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3) Performance indicators were challenging yet achievable.
4) The quarterly payment cycle was frequent enough to be motivating.

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GLOBAL HEALTH: SCIENCE AND PRACTICE
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EDITORIAL

Birthing Centers Staffed by Skilled Birth Attendants: Can They Be Effective … *at Scale*?

Peripheral-level birthing centers *may* be appropriate and effective in some circumstances *if* crucial systems requirements can be met. But promising models don't necessarily scale well, so policy makers and program managers need to consider what requirements can and cannot be met feasibly at scale. Apparently successful components of the birthing center model, such as engagement of traditional birth attendants and use of frontline staff who speak the local language, appear conducive to use in other similar settings.

See related article by Stollak.

In this issue of *Global Health: Science and Practice*, Stollak et al.[1] report a positive experience with maternal-newborn services for remote, primarily indigenous communities in Guatemala. The work was done by an NGO and included an important focus on community outreach and cultural sensitivity. Services were made more accessible by establishing birthing centers (*Casas Maternas*) in communities where such services hadn't previously been available. They were staffed by skilled birth attendants (SBAs)—locally hired auxiliary nurses—who spoke the local language. The project also cultivated relationships with traditional birth attendants, who were made welcome to support women giving birth in the *Casas Maternas*. In addition, the project facilitated reliable transfer of complicated cases to higher-level care.

This case raises 2 important issues, one specific to maternal-newborn care and the other more broadly relevant to generalizability or transferability from small scale to large.

How Effective Are SBAs in This Particular Birthing Center Model?

Well into the 1990s, to the extent that the global health community gave attention to safe motherhood, the dominant model assumed that most births would take place at home without the assistance of an appropriately skilled professional. However, by the time of the 2006 *Lancet* Maternal Survival series,[2] with the goal of ensuring as high as possible coverage of "skilled birth attendance," the model of peripheral-level, midwife-staffed birthing centers had gained currency. Over the past decade, as various countries have made efforts to implement such services, doubts have emerged about the effectiveness of the peripheral-level birthing center model in reducing risk of death. To provide effective labor and delivery care for a population, clearly certain conditions need to be met. Unfortunately, if service providers in such settings are inadequately equipped to manage complications or if robust provision for timely transfer to higher-level care is lacking (which has commonly been the case for these services), it is hardly realistic to expect significantly improved outcomes.[3]

But, alternatively, if such crucial requirements *can* be met, this model of provision of care may be an appropriate part of the mix of services in some settings. It certainly is possible to ensure important aspects of routine, preventive care at this level, e.g., use of uterotonic drugs during the third stage of labor. Also, in principle health workers at this level can provide clean delivery and good thermal care of the newborn. Certainly, auxiliary nurses/midwives can be enabled to reliably and competently manage non-breathing newborns, at least to the point of bag-and-mask resuscitation. And with good coordination with higher-level facilities (facilitated by the now-widespread use of mobile phones) and robust provision for transportation, timely referrals can be made for complications that exceed the capabilities of the SBAs, and this care can include pre-referral stabilization and initiation of treatment, e.g., for eclampsia. But for each of these functions there are corresponding systems requirements: supply chain, infrastructure, staffing, equipment, transport and communication systems, etc. In the situation described in the Stollak paper,[1] although the numbers are too small to ascertain mortality impact, it may well be that the conditions needed for effectiveness of a peripheral birthing center model have been met.

The important point here is that for *any* service delivery model, including peripheral-level birthing centers, it's not a simple matter of *whether* a model does or doesn't work; the key question is—in the particular setting—*can*

the conditions required for effectiveness of an intervention or service delivery strategy be met?

This brings us to the second important issue arising from Stollak and colleagues …

Perils of Cookie-Cutter "Evidence-Based" Models

The field of global health suffers from a tendency to search for models that can be universally recommended. As long ago as the 1970s and earlier, inspiring examples of primary health care efforts implemented in remote areas and accomplishing major reductions in mortality prompted calls for replication at scale under government health services. Such overly simplistic response to evidence from what should have been seen as no more than proofs of concept—without careful consideration of what was required for effectiveness in varying contexts—resulted in widespread uptake and large-scale implementation of community health worker programs that in many cases were eventually found to perform poorly.[4] The same pattern of concluding—on the basis of relatively intensively supported, small-scale experiences implemented by an NGO or research group—that similar impact can be reproduced at scale under government health services remains extremely widespread in global public health (e.g., Paul 2016[5]).

Drawing Out Key Lessons: Avoiding Mechanical Replication

One possible conclusion arising from an experience such as described in the paper by Stollak and colleagues[1] could be, "Based on this success, now the government should implement this model at scale." Rather, we believe another response is needed; we should be asking: "What lessons can be drawn that can be applied for broader benefit, beyond this particular setting?" As described by Stollak et al., those involved in implementing this work have been actively discussing its implications with counterparts in government and the broader NGO community in Guatemala, and certain key features of the *Casa Materna* experience have been identified that point to needed changes in how the government approaches maternal-newborn health in remote indigenous communities.

A common pattern seen in other settings is for government to put in place a pale imitation of a successful (intensively supportive demonstration) model, a dysfunctional pattern that has been characterized as "isomorphic mimicry."[6] In this particular instance, the government of Guatemala is perhaps moving along a more promising track. It has identified certain key aspects of how the *Casa Materna* service has been delivered, which seem to be both important for effectiveness and feasible for government services, notably:

- Upgrading existing health posts serving such communities to include 24/7 labor and delivery care
- Ensuring that traditional birth attendants are welcome to accompany women coming to these centers
- Ensuring availability of auxiliary nurses who speak the local language
- Setting up local committees to provide for better support and accountability

What to take home from this? First, regardless of whether or not the model we're implementing is globally recommended, we need to rigorously check to see—in the particular settings where we work—if it is actually producing its intended benefit. Are our "skilled birth attendants" actually effective in saving lives or reducing morbidity? Second, promising models can't simply be replicated at scale; drawing lessons from such early positive experiences (implemented under rather special circumstances), we are then faced with the challenge of determining how the conditions needed for effectiveness can be met within the real-world constraints of health systems operating at large scale. *–Global Health: Science and Practice*

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GLOBAL HEALTH: SCIENCE AND PRACTICE
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EDITORIAL

Abbreviating the Wealth Index to Measure Equity in Health Programs More Easily

Thomas W Pullum[a]

Efforts to simplify the construction of the DHS wealth index are encouraged (while recognizing it is constructed differently in each country), but attempts to assess equity in health programs should bear in mind that it is not sufficient to calculate the wealth index just for the participants in the program. The quintile distributions can vary dramatically within sub-populations. Assessments of equity require knowledge of the distribution of potential participants as well as actual participants.

See related articles by Chakraborty and by Ergo.

This issue of *Global Health: Science and Practice* (GHSP) includes 2 articles—one by Chakraborty and colleagues[1] and the other by Ergo and colleagues[2]—that describe how the well-known Demographic and Health Surveys (DHS) wealth index can be adapted for the purpose of assessing equity in health programs. DHS constructs the index by combining information about a large number of household assets in a principal components analysis, interpreting the first principal component as a continuous single dimension of wealth, and then identifying cut-points that break that scale into 5 segments, known as wealth quintiles.

The strategies used to adapt the DHS wealth index in the 2 GHSP articles are different from each other, but both are able to produce a good approximation to the wealth index and wealth quintiles with a much smaller number of indicators. In the article by Ergo et al., the original wealth index is trimmed by dropping the indicators with the smallest loadings in successive recalculations of the first principal component. In the article by Chakraborty et al., the indicators are trimmed by a combination of statistical criteria and judgments by a panel of experts. Realizing that the DHS wealth index is constructed differently in each country, both strategies could be applied to a country that had recently had a DHS survey (or Multiple Indicator Cluster Survey [MICS]), working with the household data files and complete information about how the wealth index was constructed in that survey, including the numerical values of the cut-points.

The authors of the 2 GHSP articles propose that the smaller set of indicators could be obtained with a much-reduced questionnaire that would be administered to the beneficiaries of an intervention, and then the simplified wealth quintiles would be constructed to determine the degree of equity in the intervention. Neither paper actually provides a summary index of equity, but both imply that an intervention would be equitable if the number of beneficiaries were the same, or nearly the same, in all 5 quintiles.

Some Caveats: Wealth Quintile Distribution Varies Across Sub-Populations and Comparisons Across Quintiles Need to Account for Both Beneficiaries and *Potential* Beneficiaries

My purpose here is not to critique these constructions of a simplified wealth index, but to set up a warning to the authors or others who may apply it to assess the equity of interventions. The distribution across wealth quintiles is uniform for a DHS survey, in the sense that there will be exactly the same number of weighted usual resident individuals in the full household sample in each of the 5 quintiles. Deviations from 20% in each quintile are negligible and are only due to possible ties at specific values of the continuous scale. For virtually any *sub-population*, however, the wealth quintiles *do not* identify 5 equally-sized categories. For example, in most DHS surveys, few urban respondents are in the bottom 2 quintiles and few rural respondents are in the top 2 quintiles. In many surveys, more than 20% of children under age 18 are in the bottom quintile and more than 20% of adults are in the top quintile, because of the

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tendency for poorer households to have more children. The distribution across quintiles can vary enormously from one region of a country to another.

Further, it is impossible to assess equity in an intervention by examining only the distribution of the *beneficiaries* across the 5 quintiles. A valid assessment of equity would also require knowledge of the distribution of the *potential* beneficiaries, so that a comparison can be made of the differences between the people who use the program and those who are eligible, or are in the catchment area, etc., but do not use the program. For a familiar analogy, it is impossible to determine whether a college admissions process has been fair with respect to ethnicity by knowing only the ethnic distribution of the acceptances. Fairness, or equity, would require knowledge of the ethnic distribution of the pool of applicants, so that a comparison could be made between those who were accepted and those who were rejected. The ethnic distribution of applicants could not safely be assumed to be the same as the ethnic distribution of the general population.

An alternative way to assess equity is to measure the *level of an attribute within quintiles* and then compare those levels. This approach is illustrated in the GHSP article by Jorge Ugaz et al.[3] One outcome of interest in that article is the percentage of users of modern methods of contraception who are using long-acting methods. This percentage is reported within each of the wealth quintiles. Data come from several DHS surveys, using the original wealth index constructed for each survey. Variations in the percentages across wealth quintiles can be interpreted as evidence of inequities in access to long-acting methods. Similarly, in the college admissions analogy, variations in acceptance rates from one ethnic group of applicants to another can be interpreted as a lack of fairness in the admissions procedure.

Improving equity in programs is a highly worthy goal. Efforts such as those by Ergo et al. and Chakraborty et al. to simplify the measurement of relative wealth and equity are commendable, but an assessment of equity in health interventions requires information about those who access the intervention and those who are eligible but do not access it. In one way or another, any application of a simplified wealth index to assess equity must confront this requirement.

Assessment of equity in health interventions requires information about those who access the intervention as well as those who are eligible but do not access it.

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GLOBAL HEALTH: SCIENCE AND PRACTICE
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COMMENTARY

Social Entrepreneurship: A Case Study From Brazil

Phil Harvey[a]

Through careful sourcing of commodities, cost-cutting efficiencies, and realistic pricing, 3 large contraceptive social marketing programs evolved into profit-making enterprises while continuing to make low-priced contraceptives available to low-income consumers on a substantial scale.

Philanthropic and humanitarian organizations are increasingly turning to business models to achieve their social objectives. "Market-based approaches," says the Acumen Fund, "have the potential to grow after charitable dollars run out, and they must be a part of the solution to the big problem of poverty."[1] Virginia-based Ashoka seeks to achieve social objectives by investing in individual entrepreneurs and "change-makers" in developing countries. An example is Fábio Rosa, an Ashoka fellow, who helped bring electricity to large parts of rural Brazil, cutting rural electrification costs substantially in the process.[2]

These organizations and many others have recognized that private business models hold important lessons for achieving social objectives and that, in the right circumstances, the profit motive can be harnessed to reduce poverty and advance human well-being. Thus, more and more nonprofits are looking to market-based techniques—techniques used by profitable businesses—to tackle nonprofit objectives.

DKT International is a nonprofit family planning organization I founded in 1989, now directed by Chris Purdy. DKT has taken an unusual approach to mixing social objectives with profitability. It hires managers in new locations, or sends expatriate managers to such locations, to start projects in the social marketing of contraceptives and, where rising incomes allow it, DKT grows those projects into profitable local enterprises that become permanent parts of the local commercial community.

This pattern has emerged only recently. When DKT began operations in 1989, most of the countries where it operated were too poor for project managers to consider profit potential, and that wasn't the fundamental purpose of these programs anyway. DKT's objective was to provide affordable contraceptives to the poor. We assumed that the contraceptives we sold through a system called social marketing would have to be subsidized indefinitely. However, this has changed over time due to the confluence of several factors:

- The economic development of low-income countries and the resulting increase in consumer income, especially in Latin America and Asia
- The declining relative prices of contraceptives due to competition among many new Asian pharmaceutical, IUD, and condom manufacturers
- The increased size of DKT's programs, which has made it possible to achieve economies of scale

Thus, it has been possible for DKT to move several of its projects toward financial self-sufficiency and, in 3 particular country programs (Brazil, Indonesia, and the Philippines), to generate significant profits that are used to subsidize DKT's programs in less affluent countries. Using the DKT program in Brazil as an example, this paper describes a new design for bringing family planning social marketing programs to financial self-sufficiency and outlines the steps needed to generate substantial program revenue while maintaining a close check on affordability of a program's contraceptives to local consumers.

SOCIAL MARKETING AND AFFORDABILITY

Social marketing itself follows a commercial design. Originally conceived and developed in 1967 in India,[3] contraceptive social marketing programs are designed to make low-cost, attractively packaged contraceptives (originally condoms and oral contraceptives; now including virtually all methods) as easily available in towns and remote villages as tea, cigarettes, or Coca Cola. The design concept is simple: with the aid of market research, a program manager creates new contraceptive brands (or, occasionally, adapts existing brands), orders a start-up inventory, hires a distribution company or companies to get the product into existing commercial channels, and

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backs the sales and distribution effort with intensive advertising in mass media (e.g., "Until You Want Another Child, Rely on Preethi Condoms," a successful slogan used in Sri Lanka) and point-of-purchase retail displays, posters, event sponsorships, T-shirts, and other promotions. The approach has worked remarkably well. In 2014, there were 82 social marketing programs operating in 62 developing countries serving just under 70 million couples,[4] which amounts to about 18% of all married couples using modern birth control in the developing world (China excluded).[5,6]

While financial self-sufficiency—or profitability—was never part of the original design of these programs, most managers of donor-supported development efforts are intrigued by the prospect of their own programs becoming self-financing. Revenue earned in the marketplace means less dependence on donors, a liberating prospect that means fewer proposals and reports to write and a psychological sense of independence and achievement. Thus, as incomes gradually moved up in Asia and Latin America, DKT's managers there began analyzing their contraceptive costs and their selling prices to see whether it might be possible, as a first step, to recover their contraceptive costs—cost of goods sold—by charging prices that were high enough to achieve this while still maintaining consumer prices within affordability guidelines.

The core guideline is, for contraceptives to be within reach of low-income consumers, a year's supply of contraceptives should cost a couple no more than 0.25% of annual per-capita gross national income (GNI) adjusted for purchasing power parity (PPP). Other yardsticks such as the price of a cup of tea, a single cigarette, or low-cost analgesics are also considered. The formula has been tested repeatedly in DKT's programs, and in some of Population Service International's (PSI's) programs, and appears to be a good yardstick, one that maximizes volume. A paper analyzing condom prices and sales volumes in social marketing programs in 1994 concluded that reasonably low prices were required for high sales volumes,[7] and those conclusions were subsequently tested in DKT's programs. The 0.25% guideline resulted. The standard means that, in a country like Brazil with a PPP-adjusted per-capita GNI of US$14,800 (2013), a year's supply of contraceptives should cost no more than $37 and, allowing 100 condoms for a year's supply,* a single condom should cost no more than 37¢. In Indonesia, the lowest-priced condom must cost no more than 22¢ and the least expensive pill less than $1.73 (allowing for 13 cycles). In Ethiopia, DKT customers pay only a bit more than 2¢ (in local currency) for a condom; thus, no profit margin is possible.

Private business models hold important lessons for achieving social objectives.

DKT PROGRAM IN BRAZIL

In 2014, there were 82 contraceptive social marketing programs operating in 62 developing countries.

The Brazil project was one of DKT's first contraceptive social marketing endeavors. It was incorporated there in 1990 as DKT do Brasil (DKT/B) (www.dkt.com.br), a commercial company wholly owned by DKT International in Washington, DC. At the time, 2 Brazilian condom manufacturers—the Brazilian arm of Johnson & Johnson (J&J) and Inal Ltda.—shared what was essentially an oligopoly there (J&J's Jontex brand in particular was dominant). Their locally manufactured condoms typically sold at retail for 60¢ to more than $1 in equivalent local currency.

As a new company, DKT/B's first task was to break the import barrier in order to bring its brands to the market at much lower prices. Fortunately, Brazil was beginning to liberalize its economic and trade policies and DKT/B was allowed to import condoms on a significant scale. Good-quality, well-packaged Asian condoms were available for around 3¢ each. Even with transport and import tariffs, this made it possible to set the consumer price at about 15¢, which meant from the outset a dramatically lower price for consumers yet still with a small margin on each sale (the all-in cost was between 4¢ and 5¢; the project sold to the trade for 6¢ to 7¢).

For contraceptives to remain affordable for low-income consumers, a year's supply of contraceptives should cost a couple no more than 0.25% of annual per-capita GNI.

Sales of DKT/B "Prudence" condoms got underway in 1991, and 400,000 were sold that year (Table 1). In 1992 the total sold was 3 million. By 1999, DKT/B was selling more than 40 million Prudence condoms annually, and the number was growing.

By 1999, DKT's Brazil project was selling more than 40 million condoms each year.

DKT's head office investment had been substantial. Between 1990 and 1995, DKT invested $3.3 million of its own private funds in Brazil; this investment was made cheerfully because the project was succeeding. During that same period, it had achieved 402,000 couple-years of protection (CYPs) for a cost of $8.20 per CYP. (One CYP is the provision of contraceptive products or services sufficient to protect 1 couple from pregnancy for 1 year.) The $8 cost was considered highly cost-effective at the time (DKT's standards have since become more rigorous), and the project was judged to be both substantial and efficient. Condom manufacturers in Brazil had begun lowering their prices in the face of

*The value of 100 condoms per year differs from the USAID factor of 120.

TABLE 1. Commercial Sales and Government Distribution of Male Condoms, Brazil, 1991–2014

Year	Volume (million pieces)			Population (millions)	Volume per Capita	DKT (million pieces)	DKT Commercial Market Share (%)
	Commercial	Government	Total				
1991	82	10	**92**	152	0.608	0.41	0.49%
1992	97	10	**107**	155	0.694	3.08	3.17%
1993	116	10	**126**	157	0.801	6.76	5.83%
1994	139	16	**155**	159	0.972	11.57	8.32%
1995	169	16	**185**	162	1.143	18.39	10.88%
1996	207	16	**223**	164	1.356	26.89	12.99%
1997	255	16	**271**	167	1.624	33.60	13.18%
1998	300	39	**339**	170	2.000	41.38	13.79%
1999	310	39	**349**	172	2.029	42.12	13.59%
2000	370	77	**447**	175	2.562	55.79	15.08%
2001	380	150	**530**	177	2.994	64.09	16.87%
2002	390	200	**590**	179	3.289	62.99	16.15%
2003	395	300	**695**	182	3.823	50.68	12.83%
2004	400	154	**554**	184	3.011	58.61	14.65%
2005	410	202	**612**	186	3.289	66.25	16.16%
2006	422	230	**652**	188	3.468	69.14	16.37%
2007	427	119	**546**	190	2.871	78.48	18.40%
2008	435	406	**841**	192	4.385	82.51	18.97%
2009	438	465	**903**	194	4.667	76.02	17.36%
2010	450	327	**777**	195	3.981	83.26	18.50%
2011	452	496	**948**	197	4.813	101.51	22.46%
2012	470	338	**808**	199	4.064	112.04	23.84%
2013	475	610	**1,085**	200	5.415	113.13	23.83%
2014	470	431	**901**	202	4.457	102.06	21.72%

Source: DKT do Brasil and Brazilian government records.

our low-priced competition and we took considerable satisfaction from having increased the availability of contraception and protection from sexually transmitted infections in Latin America's most populous country. (HIV/AIDS had become a significant threat in Brazil by then.)

And the market was growing fast. In 1991, Brazil's commercial condom market was 82 million pieces. By 2000, it had reached 370 million pieces (Table 1). Could we take credit for that? Some of it, unquestionably, was due to our role in lowering consumer prices for condoms; other parties were now importing too, and competition was heating up. On the other hand, the Brazilian government deserves much credit for the surge in overall condom sales. During this period, the government

had been heavily promoting condom use for HIV prevention with highly creative and attention-getting ads on TV, radio, and other media. They had also begun giving away free condoms, which stimulated interest in the product. Other private organizations also played a part. A complete statistical summary of DKT sales, total commercial sales, and government distribution is provided in Table 1.

DKT/B's high volume of condom sales attracted the attention of international donors, including the United States Agency for International Development (USAID). After proposal writing and negotiations, an agreement was reached and USAID invested $4.8 million in the project during 1997–2003. A private foundation also provided some support toward the end of this period.

This presented an interesting dilemma. While program managers were pleased to have the donors' funds, which made it possible to extend our reach with HIV prevention communication (and helped pay some operating overheads), the nature of the Brazilian organization began to change in ways that we did not find completely satisfactory. We had seen by then that DKT/B had the potential to become entirely self-sustaining—or even profitable—if it was properly managed. The introduction of outside donor funds required the project to take on a great many tasks that were not part of the profit-making model and, while most of those activities were valuable, they represented a considerable distraction for management, drawing attention away from the marketing and selling functions. Much of the company's effort during this period, for example, required working with local nongovernmental organizations on HIV/AIDS communication, only some of which involved condoms and all of which involved a great deal of administrative work.

In September of 2003, USAID abruptly ended its support for the program and informed DKT that funding would not be renewed. The unexpected loss of these funds was a shock, but we also recognized an opportunity. Project managers quickly streamlined the operation, reducing staff from 28 to 15, consolidating the office into a smaller space, selling some equipment, and cutting back on generic advertising. Thus began the metamorphosis of DKT/B into a lean and efficient business—a business that we were convinced could achieve full profitability and still fulfill its mission of making affordable contraceptives conveniently available to Brazilian couples. (Profitability here means coverage of all costs, including overheads and taxes, with a net profit remaining.)

CROSS-SUBSIDIZING: A WAY TO BE BOTH PROFITABLE AND AFFORDABLE

Cross-subsidization involves introducing new brands at higher prices while still maintaining at least 1 brand that meets affordability guidelines.

One way of achieving profitability without sacrificing affordability is cross-subsidization. This involves the introduction of new brands and brand variants at higher prices while still maintaining at least 1 brand that meets the affordability guidelines. For DKT do Brasil, this meant offering more and different condom brands, sold at higher prices. In 2000, for example, just 24% of DKT's Brazilian sales revenue came from premium condom products sold at higher prices; by 2011 that percentage had jumped to 68%. This has required considerable ingenuity. DKT's offerings in Brazil include condoms with colors and aromas (strawberry, chocolate, mint, tutti-frutti, banana, cola, and watermelon); condoms lubricated with mild anesthetic to delay ejaculation; extra-large, anatomically shaped condoms; and condoms lubricated to create either a cool sensation or an extra warm sensation, among others. See the Figure for a sampling of brands. The original (although now improved) Prudence brand still sells briskly at 27¢ per piece, well below the affordability guideline.

For the past decade, DKT/B has become a solid commercial operation that fulfills its basic social function but makes most of its decisions on the basis of profits. By the end of 2001, DKT had invested nearly $6 million in the operation; while we never expected to see these funds returned, it now appears that they may be. The first profit remittance to DKT's Washington office was $30,000 in 2004. Since then, a total of $3.9 million from the Brazil project has been returned to headquarters. These funds were used primarily to start new programs in Ghana and Mozambique, programs that include the social marketing of contraceptives, a small number of franchise clinics, and sale of medical abortion drugs. DKT/B's after-tax profits and remittances are shown in Table 2.

Profits from DKT country programs like Brazil's help start new programs in poorer countries like Ghana and Mozambique.

In pure business terms, these remittances would not constitute a good return on investment, even if all distributions continue on schedule. Too much money, too many years to provide an investment return. But the objective of a social marketing project is to achieve a social benefit, and that has been achieved. The project, by importing and marketing low-cost condoms, brought down the price of other brands as well as introducing a low-cost condom of its own. DKT/B had joined and helped precipitate a dramatic increase in condom sales and use throughout

FIGURE. Sample of DKT International's Prudence Condom Brand Varieties Sold in Brazil

TABLE 2. DKT do Brasil: Revenue, Profits, and Remittances to Washington, DC, Headquarters, 2000–2013 (millions, US dollars)

Year	Revenue	Profit After Tax	Remittances to DC Headquarters	Cumulative Remittances
2000	5.9	-1.9	–	–
2001	5.7	-0.7	–	–
2002	4.8	-1.7	–	–
2003	3.9	-1.6	–	–
2004	4.7	0.04	0.03	0.03
2005	6.5	0.9	0.12	0.15
2006	8.1	0.7	0.16	0.31
2007	10.8	0.7	0.26	0.57
2008	13.3	0.5	0.26	0.83
2009	11.5	0.9	0.40	1.23
2010	14.8	0.8	0.60	1.83
2011	20.0	1.3	0.60	2.43
2012	21.5	1.3	0.80	3.23
2013	22.1	0.6	0.65	3.88

Brazil. DKT's share in the commercial market grew from a very small fraction in the early 1990s to well over 20% by 2011 (Table 1). While it is not possible to calculate the health impact of these sales with precision, the impact on HIV and pregnancy prevention was significant. The 458 million DKT condoms sold during the decade between 1995 and 2004, for example, prevented an estimated 70,000 HIV infections and 1.2 million unwanted pregnancies. (HIV estimates derived from Family Health International's AVERT model[8] and estimate of unwanted pregnancies prevented from Marie Stopes International's Impact Calculator.[9])

Further, a great many family planning and HIV-prevention projects produce no financial returns at all. So DKT/B has become a different type of creature. It is a Brazilian business, part of Brazil's normal economic landscape, and, at the same time, an integral part of an international family planning organization and a contributor to that organization's charitable goals.

MORALE ISSUES?

DKT's leadership was originally concerned that its profit-making programs would be resented—or at least envied—by program directors in the lowest-income countries where financial self-sufficiency is not possible. But there has always been an important trade-off. DKT's programs in the Democratic Republic of the Congo and Mozambique, for example, are serving the clients with the greatest need because those are among the poorest populations in the world and contraceptive prevalence is extremely low. Virtually every contraceptive provided or sold in those environments makes an important difference, so everyone has something to brag about.

And, even in the poorest countries, DKT programs do not rely entirely on donor support to function and expand. Cross-subsidization always chips in. The program in Ethiopia, for example, generated $3.4 million in revenue in 2013. While this was only 18% of total program expenses that year, the contribution makes a substantial difference and helps provide a good cost-benefit ratio for DKT's donors. Worldwide, DKT programs generated $94 million in sales revenue in 2013 against total program expenses of $131 million. The balance is made up with donor funds.

AN UNINTENTIONAL DESIGN

DKT International has evolved into something its founders never anticipated: an international nonprofit family planning organization with 3 distinctly different components:

A. Contraceptive marketing programs in middle-income countries like Brazil, Egypt, Indonesia, Mexico, and the Philippines, where annual per-capita GNI exceeds $9,000. These programs have—or will—produce true operating profits from which remittances are made to DKT headquarters to support DKT's subsidized programs in low-income countries (significant remittances to date from Brazil, Indonesia, and the Philippines).

B. Subsidized social marketing and other family planning programs in low-income (PPP-adjusted GNI $<$$2,000) countries where cross-subsidization covers part of program expenses but the lion's share is paid by donors.

C. Programs in the economically in-between countries where progress toward the "A" category may well be possible as economic growth continues.

LESSONS LEARNED

While DKT's structure evolved without an originating design, there is a good deal to be learned, both from the Brazil program experience and from DKT's progression as it evolved from a traditional family planning social marketing NGO in the 1990s to the 3-tiered organization described above. Three factors were central to this process:

1. As noted, rising incomes in Asian and Latin American countries have made it possible to charge higher prices for contraceptives without exceeding affordability guidelines.
2. DKT headquarters recognized and supported sales revenue generation as a policy. We introduced a generous scale of country-director commissions that rewarded not only increases in CYPs each year, but also fund-raising revenue and, importantly, revenue from sales. Commissions continue to be paid for all three.
3. When recruiting new talent, we increasingly looked for candidates with commercial sales experience to head up DKT's overseas programs.

Because of these and related factors, DKT gradually took on an organizational culture in which steps toward profitability became positive goals recognized by everyone. Many of our new country directors, for example, found it unnatural to sell products below cost ("Why would you do

that?'') as is traditionally done in highly subsidized social marketing programs (including DKT's).

While there is a continuous discussion in DKT about whether to prioritize CYPs or income, the two are usually not in conflict. With the right pricing structure, as CYPs go up, so does revenue, although everyone understands that price increases must be gradual and carefully tested, and that at least 1 brand must remain within the affordability guidelines.

OTHER APPROACHES

There are of course other approaches for increasing social marketing program revenue. Some Latin American programs, for example, have raised revenue by selling a range of health and hygiene products,[10] and one or two programs have provided clinic and lab services at a profit as part of what they offer. While these approaches have enjoyed modest success in particular environments, they have not made a significant contribution to contraceptive social marketing revenue worldwide. That revenue, which now exceeds $150 million per year, results overwhelmingly from the sale of contraceptives.

Sales of other health and hygiene products have enjoyed modest success in certain places but none like the sale of contraceptives.

DKT's own experience bears this out. Lubricants, for example, are considered highly appropriate in DKT's and many other programs, especially in conjunction with condom sales, and pregnancy test strips are also sold in several DKT programs. But these products seldom have good margins, and they do not contribute significantly to profits. Neither do such products as sanitary napkins and razor blades, which have also been tried. Overwhelmingly it is birth control products—condoms, oral contraceptives, emergency contraceptive pills, and medical abortion drugs—that produce solid income streams and good margins.

For those who wish to try the paths towards self-sufficiency described in this paper, the basic formula is fairly simple: Create a culture where increasing sales revenue and profitability are seen as important virtues. Hire people who believe in this principle, and reward them for following it.

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GLOBAL HEALTH: SCIENCE AND PRACTICE
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COMMENTARY

Fertility Awareness Methods: Distinctive Modern Contraceptives

Shawn Malarcher,[a] Jeff Spieler,[b] Madeleine Short Fabic,[a] Sandra Jordan,[a] Ellen H Starbird,[a] Clifton Kenon[a]

Fertility awareness methods—the Lactational Amenorrhea Method, the Standard Days Method, and the Two Day Method—are safe and effective, and they have important additional benefits that appeal to women and men. Including these modern contraceptives in the method mix expands contraceptive choice and helps women and men meet their reproductive intentions.

This peer-reviewed commentary represents the technical position of the Office of Population and Reproductive Health of the United States Agency for International Development.

Fertility awareness methods (FAMs), comprising the Lactational Amenorrhea Method (LAM), the Standard Days Method (SDM), and the Two Day Method (TDM), are often left out of the basket of contraceptive options for women and couples because governments, donors, policy makers, and providers perceive them as inferior contraceptive methods. When FAMs are offered as an option, FAM users may be incorrectly lumped with traditional method users in reports and data analyses. Notably, a recent unpublished review of contraceptive method classification commissioned by the World Health Organization (WHO) found that LAM was deemed a "traditional" rather than a "modern" method in 2 of 5 major family planning publications or data-reporting sources. SDM was included as a modern method in only 3 of 6 publications, and the Two Day Method appeared in only 1 publication.

WHY DO WE CARE?

"*What gets measured gets done*." As governments and donors recommit themselves to advancing the rights of women and girls to decide—freely and for themselves—whether, when, and how many children to have, more attention is cast on the key measures of success laid out at the London Summit on Family Planning in 2012. As agreed on by committed governments and donors, key indicators of success explicitly identify *modern* method use as the outcome of interest. In this context, common misperceptions that FAMs are traditional methods mean that countries do not prioritize investments in their introduction or expanded provision. These methods may be absent from training curricula, counseling materials, logistics systems, and procurement processes. FAM users may be left out of key monitoring and data collection activities. If users of FAMs are not counted as modern contraceptive users, we as a community are failing to recognize a valid and important choice to meet client needs—*what gets counted gets supported*.

WHAT MAKES FAMS "MODERN"?

The United States Agency for International Development (USAID) supports FAMs as modern contraceptives because these methods meet the criteria for a modern contraceptive. FAMs:

- Are effective at pregnancy prevention,
- Are safe,
- Are based on a sound understanding of reproductive biology,
- Include a defined protocol for correct use, and
- Have been tested in appropriately designed studies to assess effectiveness under various conditions.

The Standard Days Method is an easy way to track the fertility cycle and fertile window for women whose menstrual cycle lengths are 26–32 days. The SDM algorithm is based on data from 7,500 cycles collected

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Fertility awareness methods are commonly misperceived as traditional methods and thus are often left out of family planning programming.

as part of a 5-country clinical trial supported by WHO. A second clinical trial of SDM followed, which documented a 95% effectiveness rate in perfect use and an 88% typical use rate; the typical use rate is commensurate with barrier methods, including male and female condoms and diaphragms.[1,2]

The Two Day Method is a modification of the Billing's Ovulation Method and relies on a woman's assessment of her cervical secretions to identify her fertile days. The algorithm is based on data from multiple, large data sets. Clinical trials following more than 400 women for 13 cycles of method use showed an efficacy rate of 96% with perfect use and over 86% with typical use, also commensurate with barrier methods.[3]

USAID supports fertility awareness methods as modern contraceptives.

The Lactational Amenorrhea Method, based on the fertility-suppressing effects of breastfeeding, requires that a woman be within 6 months postpartum, exclusively or nearly exclusively breastfeeding, and amenorrheic.[4] Multiple studies have documented an efficacy of 99% in perfect use and 98% at 6 months in typical use, commensurate with effectiveness of injectables and combined oral contraception.[5]

ADDITIONAL BENEFITS OF FAMS

Fertility awareness methods are knowledge-based, relying on women's understanding of their fertile cycle and, in the case of LAM, of how breastfeeding practices can temporarily suppress fertility. In addition to offering a safe and effective alternative to other contraceptive methods, FAMs offer several additional benefits:

Fertility awareness methods do not require clinical intervention and can be offered through a variety of service delivery channels.

- They do not require clinical intervention, such as hormones, devices, or procedures.
- They are controlled by a woman and her partner.
- They increase a woman's understanding of her fertility and biological processes.
- In the case of SDM and TDM, they provide the opportunity to facilitate pregnancy planning.
- FAMs can be offered through a wide variety of channels, including settings completely outside the health system.

Technical experts report that providers trained in FAMs appreciate their improved capacity to explain the basic concepts of fertility to their clients. This knowledge helps reassure their clients about the safety and efficacy of contraceptive methods generally, which may lead to increased acceptance of family planning. Providers who counsel on methods that require awareness and involvement of both partners, such as SDM, also develop the capacity to discuss relationship dynamics and partner communication—valuable skills regardless of the contraceptive method chosen by clients.[6]

USAID's family planning programs are guided by the principles of voluntarism and informed choice. That is, every individual has the right to choose the number, timing, and spacing of her/his children; to choose freely whether and when to use contraception; and to choose from a broad range of contraceptive methods, with ample information about use, advantages, and side effects. Evidence of USAID's commitment to these principles is its support for the development, testing, refinement, and introduction of new and improved contraceptive methods as well as its support for family planning program components that make that choice real. USAID aims to help countries meet the contraceptive needs of their people. Key to achieving this aim is expanding access to a wide and diverse method mix. USAID continues to support countries and the global family planning community in their efforts to incorporate modern methods, including FAMs, into the contraceptive method mix. The more contraceptive choice we can afford to women and men, the better equipped they will be to achieve their reproductive intentions. Key to expanding contraceptive choice is overcoming misconceptions. Let's recognize FAMs for what they are: effective, safe, modern contraception.

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GLOBAL HEALTH: SCIENCE AND PRACTICE
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ORIGINAL ARTICLE

Expanding Access to the Intrauterine Device in Public Health Facilities in Ethiopia: A Mixed-Methods Study

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Following the introduction of IUDs into the Ethiopian public health sector, use of the method increased from <1% in 2011 to 6% in 2014 in a sample of 40 health facilities. This shift occurred in the context of wide method choice, following provider training, provision of post-training supplies, and community-based awareness creation. The IUD was acceptable to a diverse range of clients, including new contraceptive users, those with little to no education, those from rural areas, and younger women, thus suggesting a strong latent demand for IUDs in Ethiopia.

ABSTRACT

In Ethiopia, modern contraceptive prevalence among currently married women nearly tripled over the last decade, but the method mix remains skewed toward short-acting methods. Since 2011, the Integrated Family Health Program (IFHP+), jointly implemented by Pathfinder International and John Snow Inc., has supported the Federal Ministry of Health to introduce intrauterine devices (IUDs) in more than 800 health centers across 4 regions to improve access to a wider range of methods. Between March and August 2014, Pathfinder conducted a mixed-methods study in 40 purposively selected health centers to assess shifts in the contraceptive method mix following introduction of IUDs using data from family planning registers; determine the characteristics of IUD users through a cross-sectional survey of 2,943 family planning clients who accepted the IUD; explore reasons for method discontinuation among 165 clients seeking IUD removal services; and identify facilitators and barriers to IUD use through focus group discussions (N=115 clients) and key informant interviews (N=36 providers, facility heads, and health office heads). Introduction of IUDs into the 40 health centers participating in the study was correlated with a statistically significant increase in the contribution of all long-acting reversible contraceptives (LARCs)—both IUDs and implants—to the method mix, from 6.9% in 2011 to 20.5% in 2014 ($P<.001$). Our study found that latent demand for the IUD was more prevalent than anticipated and that the method was acceptable to a broad cross-section of women. Of the 2,943 women who sought IUDs during the 6-month study period, 18.0% were new contraceptive users (i.e., those using a contraceptive method for the first time ever), 44.7% reported no educational attainment, 62.5% were from rural areas, and 59.3% were younger than 30 years old, with almost 3 in 10 (27.7%) under the age of 25. The most commonly cited reason for seeking IUD removal services was a desire to become pregnant (43% of women). Qualitative data indicated that while acceptability of the method is growing, limited community awareness, myths and misconceptions about the IUD, and infrastructure deficits at health centers must be addressed to further expand access to a broad range of contraceptive methods.

INTRODUCTION

In sub-Saharan Africa, approximately 1 in 4 women has unmet need for contraception.[1] Making a wide range of effective contraceptive methods available is critically important for satisfying this unmet need, for ensuring that women and couples have access to their method of choice, and for improving service quality.[2] However, the contraceptive method mix in sub-Saharan Africa is skewed toward short-acting methods (which constitute a full 82% of modern contraceptive use in the region), while permanent methods and long-acting and

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reversible contraceptives (LARCs)—comprising implants and intrauterine devices (IUDs)—remain underutilized.[1]

In recent years, governments and partner organizations in the region (most notably in Ethiopia, Malawi, Rwanda, and Tanzania) have made a concerted effort to increase access to contraceptive implants (including Jadelle, Implanon, and Sino-implant II), driven by policy commitment, dedicated manufacturers, product price reductions, and successful provider training and task shifting.[3,4] In these 4 countries, implant use has more than doubled over the last decade as women are increasingly drawn to the implant's high effectiveness, long-acting nature, and discreet method of insertion (i.e., placed under the skin of the upper arm).[3]

Despite effectiveness levels similar to that of the implant, the IUD has received less attention in sub-Saharan Africa. This is due in part to limited provider training but also to perceived lack of demand given the mode of provision (requiring a pelvic examination and insertion of the device directly into the uterus), which could potentially deter clients in more conservative settings.[5] However, recent initiatives to increase availability of IUDs in the region suggest that latent demand for this method may be more prevalent than previously thought.[5] For example, the Supporting Access to Family Planning and Post-Abortion Care project, which increased access to IUDs in crisis-affected areas in Chad, the Democratic Republic of the Congo (DRC), and Pakistan, noted a subsequent upward trend of IUD use.[6] Moreover, introduction of IUDs into the private health sector across 13 countries (including 6 located in sub-Saharan Africa) demonstrated the method's acceptability to both women and adolescents.[5] Despite this early evidence, the IUD remains largely underutilized in sub-Saharan Africa—especially in the public sector—and use has declined throughout the region from 6% in 2003 (roughly 1.2 million users) to 3% in 2012 (approximately 1.08 million users).[7]

Ethiopian Context

Ethiopia has witnessed a significant increase in modern contraceptive prevalence among currently married women in the last decade, from 13.9% in 2005 to 27.3% in 2011 and 40.4% in 2014.[8-10] Despite this substantial jump, the method mix remains skewed toward short-acting methods, as is the case in sub-Saharan Africa overall, with 84.7% of modern method users relying on pills, injectables, and male condoms for ongoing contraception.[10] LARCs account for 14.6% of total modern contraceptive use among currently married women (12.1% for implants and 2.5% for IUDs), and permanent methods constitute 0.2% of total modern method use.[10]

Reflecting the government's commitment to expanding availability of implants and mirroring the broader regional trend throughout sub-Saharan Africa, the proportion of married women using implants has increased steadily over the last decade, from 0.2% in 2005 to 3.4% in 2011 and 4.9% in 2014.[8-10] Use of IUDs, on the other hand, stagnated from 2005 to 2011 (0.2% and 0.3%, respectively), and despite a small increase to 1% in 2014, remains low.[8-10] Knowledge of the IUD also lags, with just 38.9% of Ethiopian women reporting IUD knowledge, in comparison with 73.5% who report familiarity with implants.[10]

The IUD has received little attention in sub-Saharan Africa due in part to limited provider training and perceived lack of demand among women.

Recognizing the need to further expand the range of methods available in the public sector (through which 87% of women obtain contraception),[10] the Ethiopian Federal Ministry of Health, in collaboration with partners supporting contraceptive services in the country, launched the "Ethiopia Intrauterine Contraceptive Device Scale-up Initiative (2011–2013)" in July 2010 (which has since been extended to 2017). This initiative aimed to increase access to and demand for the copper IUD—a non-hormonal, highly effective contraceptive method that can be used for up to 12 years.[11] Prior to the government's initiative, IUDs were available only through private NGO clinics located in larger, urban areas.

The Ethiopian government, with support from partners, launched an initiative in 2010 to expand access to IUDs and the range of methods available.

In December 2011, the Integrated Family Health Program (IFHP+), funded by the United States Agency for International Development (USAID)-supported Evidence to Action Project (E2A) and jointly implemented by Pathfinder International and John Snow Inc., began supporting the government's IUD initiative in public-sector health centers in its 4 program regions: Amhara, Oromia, the Southern Nations, Nationalities, and People's Region (SNNPR), and Tigray. IFHP+'s catchment area covers 300 districts and 60% of the population of these 4 regions. In this article, we describe IFHP+'s experience supporting the government to introduce IUDs into public-sector health centers in these 4 regions, subsequent shifts in the contraceptive method mix, characteristics of clients adopting IUDs, and reasons for method discontinuation.

The method mix in Ethiopia is skewed toward short-acting methods.

INTRODUCTION OF IUDS INTO PUBLIC-SECTOR HEALTH FACILITIES—THE LEARNING PHASE

From December 2011 to March 2012, IFHP+ conducted a "learning phase" that aimed to:

- Train a subset of clinical family planning providers on LARCs, including the IUD
- Initiate service provision
- Increase awareness of the IUD
- Inform future scale-up efforts

The learning phase was carried out in 128 health centers (32 per region) and their surrounding catchment areas. *Woreda* (district) health office heads selected these 128 health centers based on provision of contraceptive services; availability of at least 2 family planning providers to be trained; and availability of a supportive facility head or service provider to oversee targeted data collection. IFHP+ worked with its government counterparts to train a total of 256 providers (2 family planning providers per health center) on IUD insertion and removal, as well as all other contraceptive methods, during the learning phase. These competency-based trainings were composed of a 7-day theoretical and simulated practice component, followed by a 7-day clinical practicum at a high-volume facility.

©Pathfinder Ethiopia

An instructor in Ethiopia demonstrates how to insert an IUD using a pelvic model.

To increase the likelihood of having sufficient client numbers for each training practicum and also to reach women with unmet need for contraception at the community level, IFHP+ worked with the government to engage health extension workers—a formalized cadre of frontline health workers in Ethiopia—in informing community members about the availability of all contraceptive methods, including IUDs, during practicums. These health extension workers incorporated sensitization on IUDs into the counseling they already provided at the community level and worked to dispel myths and misconceptions about the IUD among women, their partners, and communities. Health extension workers also worked with members of Ethiopia's health development army—comprising individuals who promote health services within communities—to generate demand and convey information about IUDs at the community level. In addition, IFHP+ used vans with speakers to broadcast information about the availability of all contraceptive methods during upcoming trainings at marketplaces and other high-traffic community events. Lastly, the Federal Ministry of Health disseminated messages about IUDs through media channels (television and radio) during the scale-up initiative.

Providers counseled clients who sought services during the practicum on all short- and long-acting methods, screened them for eligibility as guided by the World Health Organization (WHO) "Medical Eligibility Criteria for Contraceptive Use" (4th edition), and provided clients with the method of their choice, including IUDs. At the end of these training sessions, IFHP+ provided post-training equipment and supplies (i.e., IUD kits and consumables) to each health facility involved in the learning phase. In this way, providers were able to immediately begin offering services at their respective health centers.

Given the sparse number of women requesting removal services during the learning phase (since IUDs were available only through private NGO clinics prior to the national scale-up initiative), IFHP+ trained providers on IUD removal using simulated models. In addition, trainees observed IUD removals among the very small number of clients who had received an IUD in NGO clinics and had sought removal services during the practical session of the learning phase.

Following the training, providers integrated IUDs into the range of services offered at their respective health centers, and health extension workers continued to create awareness of IUD service availability both at the community level

during household visits and at the health post level (i.e., the lowest level of primary health care—one level below the health center).

At least once per month, skilled providers and Pathfinder staff provided post-training follow-up and mentorship at all health centers included in the learning phase. During these visits, the mentors used a checklist to assess adequate space, equipment, infection prevention measures, and client privacy during IUD insertion and removal. Mentors also assessed the quality of provider counseling and clinical skills as well as any challenges faced during service provision; recommendations from mentors were shared with district and regional health authorities. Three months following the training, one performance review meeting was convened by each of the 4 Regional Health Bureaus (i.e., Amhara, Oromia, SNNPR, and Tigray) to assess the achievements and challenges of the learning phase, with trainees, facility heads of the participating health centers, *woreda* health managers, family planning experts, and Pathfinder staff.

Results of the Learning Phase

At the end of the learning phase (March 2012), assessments revealed that all 128 health centers routinely offered IUD insertion and removal services, and all were able to initiate the service immediately after the training. A total of 3,108 women in the 4 IFHP+ regions sought any contraceptive method at the 128 health centers during the learning phase. Among them, 992 (31.9%) accepted IUDs, of whom a remarkable 867 (87.4%) were new family planning acceptors (i.e., using contraception for the first time ever).

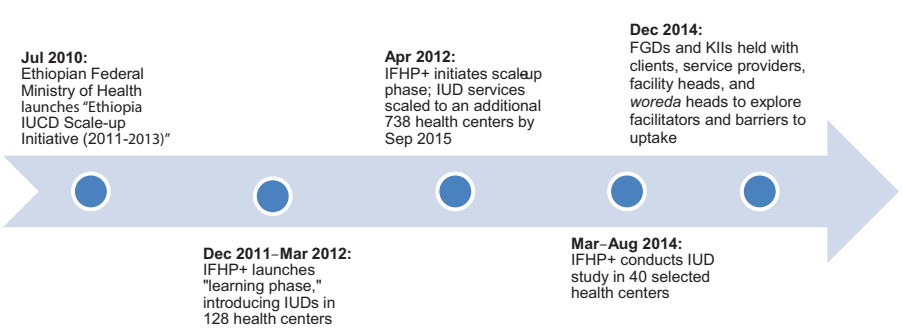
Following the successful learning phase, IFHP+ transitioned to the scale-up phase (beginning in April 2012), which aimed to capacitate all health centers and hospitals in the IFHP+ catchment area to offer a broadened method mix, including IUDs. Using the same training approach as was used during the learning phase, IFHP+ extended services to an additional 738 health facilities between April 2012 and September 2015; the scale-up phase continues to date. During both the learning and the scale-up phase, IFHP+ supported the distribution of IUDs to the health facilities through government channels.

METHODS

To better understand client characteristics and inform future programming, we conducted a study from March through August 2014 (2 years into the scale-up phase) to assess the impact of IFHP+'s support for the Ethiopian government's IUD initiative in program-supported regions (Figure). Our study had 3 specific objectives:

- Assess shifts in the contraceptive method mix following introduction of IUDs
- Identify the characteristics of clients choosing IUDs and describe the reasons for IUD discontinuation

FIGURE Timeline of Ethiopia's IUD Initiative, IFHP+'s Programmatic Support, and Pathfinder International's Study



Abbreviations: FGD, focus group discussion; IUD, intrauterine device; IFHP+, Integrated Family Health Program; KII, key informant interview.

- Identify facilitators and barriers to IUD use

We conducted a mixed-methods study composed of 3 specific components: (1) review of family planning data from health facility registers; (2) cross-sectional IUD client surveys; and (3) qualitative interviews with IUD clients and key informants.

Health Facility Register Review

To assess shifts in the contraceptive method mix following introduction of IUDs, we retrospectively extracted and reviewed data from family planning registers in 40 purposively selected health centers supported by IFHP+ (10 from each program region). Health centers were selected based on: (1) high client load; (2) continued availability of IUD services (along with other contraceptive methods) since 2012; (3) willingness of the facility head and providers to collect data; and (4) accessibility of the facility for follow-up during the data collection period. We compared the contraceptive method mix among family planning clients during the 6-month study period (March–August 2014) with the 6-month period preceding initiation of the IFHP+ learning phase (July–December 2011). Contraceptive service delivery data from the 40 facilities indicate there are no significant seasonal differences in contraceptive uptake; thus, using data from 2 different 6-month periods should not have introduced bias. Methods included in the method mix and assessed were implants, IUDs, injectables, pills, and condoms. Lactational amenorrhea, withdrawal, and the Standard Days Method are not registered in health centers' family planning service provision data, and permanent methods (i.e., vasectomy and tubal ligation) are not provided at the health center level in Ethiopia. Data from family planning registers were entered into an Excel document for data cleaning and management, and we performed chi-square pre-post statistical analyses using Epi-Info version 3.5.1.

Cross-Sectional Client Surveys

To complement the family planning register review, we conducted a cross-sectional survey of family planning clients to better understand the characteristics of IUD acceptors. All women seeking IUD insertion services at these 40 health centers during the 6-month study period (March–August 2014) were eligible to participate in our survey. Health service providers counseled women on all contraceptive methods available, and if a woman expressed interest in the IUD, the provider informed her of the study and asked her if she would like to participate. All clients were informed that they would still be eligible to receive the IUD even if they refused to participate in the study. Providers used a consent form translated into local languages to obtain consent, and participants provided written consent. Providers then used a pretested, semi-structured questionnaire to collect sociodemographic and family planning information from all clients seeking IUD insertion who consented to participate.

The sample size for IUD acceptors was calculated using single population proportion formulas for each region where the IUD scale-up had been conducted. Since no previous studies had been conducted to determine the characteristics of IUD users, we assumed a population proportion of 50% of females aged 15–49 to maximize the sample size. Taking a 5% margin of error, 95% confidence level, and a design effect of 2, the sample size was calculated at 768 IUD clients per region. Adding 5% for non-response, the required sample size was 806 per region, resulting in a total sample size of 3,224 IUD service users across the 4 regions. During the 6-month study period, a total of 2,943 clients accepted the IUD, and all these clients agreed to participate in the study (for a response rate of 100%). Thus, we were able to reach 91% of the required sample size (2,943/3,224) during the study period.

We also conducted a separate cross-sectional survey among women seeking IUD removal services at these 40 health centers during the 6-month study period to understand client characteristics and to describe the reasons for IUD discontinuation. All women seeking IUD removal services at the 40 health centers were eligible to participate. Clients were informed that they would still be eligible for IUD removal even if they refused to participate in the study. Providers used a consent form translated into local languages to obtain consent, and participants provided written consent. Providers then used a pretested, semi-structured questionnaire to collect sociodemographic and family planning information from all clients seeking IUD removal who consented to participate. Given that very few clinics offered IUD services prior to 2011, our sample size for the discontinuation cross-sectional survey was limited; we enrolled a total of 165 clients. For both the IUD acceptor and the IUD discontinuation data sets, we derived basic descriptive statistics using SPSS version 20.

Qualitative Interviews

To explore facilitating factors and barriers to IUD use, we conducted a series of focus group discussions (FGDs) and key informant interviews (KIIs) at 12 of the 40 health facilities participating in the study. These 12 facilities were purposively selected based on client volume during the 6-month period, with 1 high-, 1 medium-, and 1 low-volume facility selected from each of the 4 regions. We used semi-structured interview guides to facilitate 1 FGD at each facility with a total of 115 participants who had sought either IUD insertion or removal services. KIIs were held with 36 stakeholders from the 12 facilities (i.e., 1 service provider, 1 health facility head, and the *woreda* health office head associated with each health center). All interviews were conducted in the local language and were recorded, transcribed, and finally translated into English. A bilingual member of our team confirmed the accuracy of the English translation. Qualitative interviews were analyzed using content analysis to identify key recurring themes and to explore the nature of divergent views.

Ethics Review

Ethical clearance for this study was obtained from the ethical review committee within each of the Federal Ministry of Health Regional Health Bureaus in Amhara, Oromia, SNNPR, and Tigray. All survey participants provided written informed consent before the interviews were conducted, and all data collection and analysis were conducted according to international principles of maintaining privacy and confidentiality of personal information.

RESULTS

Shifts in the Contraceptive Method Mix Following Introduction of IUDs

Table 1 shows the contraceptive method mix in the 40 health centers during the 6 months immediately preceding IFHP+ support for the government's IUD initiative (July–December 2011) compared with the method mix during the 6-month study period (March–August 2014). The proportion of IUD users increased 14-fold, from 0.4% of total users in 2011 to 5.7% in 2014. Moreover, the overall contribution of LARCs to the total method mix increased substantially from 6.9% to 20.5%, with implant use doubling from 6.6% to 14.8%. The overall proportion of users relying on short-acting methods declined from 93.1% to 79.5%, with injectable use declining by 11.5 percentage points (from 75.8% to 64.3%) and oral contraceptive use declining by 5.9 percentage points (from 13.2% to 7.3%). The proportion of clients relying on condoms, however, nearly doubled from 4.1% to 7.9%.

The proportion of IUD users among family planning clients increased 14-fold in the study area, from <1% in 2011 to almost 6% in 2014.

Characteristics of Clients Choosing IUDs

During the 6-month study period, a total of 2,943 clients accepted IUDs at the 40 health centers included in the study. As Table 2 demonstrates, most IUD clients (62.5%) resided in rural areas, the vast majority (92.0%) were married, and just under half (44.7%) reported no educational attainment. The age distribution of users was relatively balanced among women aged 20 and older (about 20% in each 5-year age group), with the exception of a slightly higher proportion (31.6%) of women aged 25–29 accepting the IUD. While most IUD acceptors were aged 20 and older, a substantial 6.2% were younger than 20. Many acceptors had previously been pregnant 2–4 times (48.5%), most had given birth 2–4 times (52.8%), and most had 2–4 living children (53.8%). Still, those who had never been pregnant comprised a notable 7.5% of users. The majority of IUD clients (80.8%) heard about the service from a health care provider stationed at a

TABLE 1. Contraceptive Method Mix among Family Planning Clients in 40 Selected Ethiopian Health Centers Before (Jul–Dec 2011) and After (Mar–Aug 2014) the IUD Scale-Up Initiative

Contraceptive Method	Before No. (%)	After No. (%)	Percentage Point Difference	*P* Value
Long-acting reversible methods	**3,436 (6.9)**	**10,529 (20.5)**	**13.6**	**<.001**
Implants	3,260 (6.6)	7,586 (14.8)	8.2	<.001
IUDs	176 (0.4)	2,943 (5.7)	5.3	<.001
Short-acting methods	**46,242 (93.1)**	**40,713 (79.5)**	**-13.6**	**<.001**
Injectables	37,647 (75.8)	32,934 (64.3)	-11.5	<.001
Pills	6,551 (13.2)	3,733 (7.3)	-5.9	<.001
Condoms	2,044 (4.1)	4,046 (7.9)	3.8	<.001
Total	**49,678 (100.0)**	**51,242 (100.0)**		

TABLE 2. Background Characteristics of IUD Users (N = 2,943)

	No. (%)		No. (%)
Region		No. of previous pregnancies	
Oromia	926 (31.5)	0	221 (7.5)
Tigray	729 (24.8)	1	484 (16.4)
Amhara	657 (22.3)	2–4	1,426 (48.5)
SNNPR	631 (21.4)	>4	812 (27.6)
Residence		Mean (SD)	3.3 (2.3)
Rural	1,838 (62.5)	No. of births[a]	
Urban	1,104 (37.5)	0	38 (1.4)
Missing	1 (0.0)	1	477 (17.5)
Marital Status		2–4	1,436 (52.8)
Married/living together	2,709 (92.0)	>4	759 (27.9)
Never married	190 (6.5)	Missing	12 (0.4)
Divorced/separated/ widowed	42 (1.4)	Mean (SD)	3.5 (2.1)
Missing	2 (0.1)	No. of living children[b]	
Religion		0	12 (0.4)
Orthodox	1,929 (65.5)	1	500 (18.6)
Protestant	540 (18.3)	2–4	1,444 (53.8)
Muslim	393 (13.4)	>4	715 (26.6)
Catholic	74 (2.5)	Missing	13 (0.5)
Traditional	3 (0.1)	Mean (SD)	3.4 (2.0)
Missing	4 (0.1)	Sources of information about IUD service	
Educational level		Health professional[c]	2,377 (80.8)
No education	1,316 (44.7)	Health extension worker	502 (17.1)
Primary	1,114 (37.9)	Media	35 (1.2)
Secondary	356 (12.1)	Health development army	11 (0.4)
More than secondary	152 (5.2)	Relatives	5 (0.2)
Missing	5 (0.2)	Mobile van	3 (0.1)
Age		Others[d]	10 (0.3)
<20	182 (6.2)		
20–24	633 (21.5)		
25–29	930 (31.6)		
30–34	614 (20.9)		
>34	580 (19.7)		
Missing	4 (0.1)		
Mean (SD)	28.0 (6.0)		

Abbreviations: IUD, intrauterine device; SD, standard deviation; SNNPR, Southern Nations, Nationalities, and People's Region.
[a] Denominator is 2,722 women who had previously been pregnant.
[b] Denominator is 2,684 women who had ever given birth.
[c] Includes nurses, midwives, and health officers working in health centers.
[d] Includes neighbors and school.

health center (i.e., nurses, midwifes, or health officers), while 17.1% were informed about the availability of IUD services by a health extension worker.

Table 3 shows ever use of family planning and the method used (if any) at the index visit for the 2,943 women choosing the IUD during the 6-month study period. Nearly 1 in 5 (18.0%) IUD acceptors had never used a contraceptive method previously. Of the 81.3% of women who had used contraception in the past, 74.3% were shifting from a short-acting method—mostly from injectables (67.2%)—which corresponds with the overarching shift in the method mix from short-acting methods toward LARCs following introduction of IUDs (Table 1). A notable 14.8% of IUD acceptors who had previously used contraception were shifting from a contraceptive implant.

Reasons for IUD Discontinuation

Table 4 delineates the sociodemographic characteristics of the 165 clients seeking IUD removal services at the 40 health centers during the 6-month study period. The typical client seeking removal services was married (84.8%), aged 25 or older (69.7%), and had 2–4 living children (55.4%). Most clients reported either no educational attainment (37%) or primary school education (28.5%). Seven in 10 women (69.7%) seeking removal services during the study period had continued use for more than 1 year. Most of those seeking removal services (61.8%), however, reported using the IUD for 36 months or less.

Of these 165 clients discontinuing use of the IUD, 158 responded to our query about the reason for method discontinuation. As shown in Table 5, a plurality (43%) of the women discontinuing indicated they did so because of a desire to become pregnant. About one-quarter of the clients (25.9%) identified side effects or health concerns as an impetus for seeking removal services, and 20.3% indicated husband/partner disapproval as a reason for discontinuing use. A smaller proportion of women identified disapproval from another family member (7%), infrequent sex (5.7%), or method failure (2.5%) as reasons for discontinuation.

Facilitators to IUD Use

Satisfaction With the Method

For the most part, clients seeking both insertion and removal reported satisfaction with the IUD during the qualitative interviews. Clients cited the following facilitating factors to IUD uptake:

- The method is nonhormonal, long-acting, and highly effective.
- There is no need to return to the health center for method resupply (e.g., as with oral contraception and injectables).
- There is less room for human error leading to method failure.
- The IUD can be removed at any time.

18% of IUD acceptors had never used a contraceptive method in the past.

Confidence Among Service Providers

Service providers, facility heads, and *woreda* heads reported feeling comfortable providing IUD services, and they noted that the immediate provision of resources and supplies following

TABLE 3. Previous Use of Contraception Among New IUD Acceptors

	No. (%)
Ever used family planning	**2,943 (100.0)**
Yes (Method shift)	2,394 (81.3)
No (New acceptors)	531 (18.0)
Missing	18 (0.6)
Method used at index visit among those who had ever used family planning	**2,394 (100.0)**
None[a]	258 (10.8)
Long-acting reversible methods	355 (14.8)
Implanon	292 (12.2)
Jadelle	51 (2.1)
Norplant	12 (0.5)
Short-acting methods	1,780 (74.3)
Injectables	1,609 (67.2)
Combined oral contraceptives	116 (4.8)
Condoms	7 (0.3)
Breastfeeding	11 (0.5)
Natural methods (withdrawal, SDM, etc.)	37 (1.5)
Missing	1 (0.0)

Abbreviations: IUD, intrauterine device; SDM, Standard Days Method.
[a] Had used family planning in the past but were not using any method at the time of their index visit.

TABLE 4. Characteristics of Women Seeking IUD Removal Services (N=165)

	No. (%)		No. (%)
Region		No. of previous pregnancies	
Oromia	63 (38.2)	0	23 (13.9)
Tigray	30 (27.9)	1	36 (21.8)
Amhara	46 (18.2)	2–4	71 (43.0)
SNNPR	26 (15.8)	>4	27 (16.4)
Residence		Missing	8 (4.8)
Rural	87 (52.7)	Mean (SD)	2.6 (2.3)
Urban	78 (47.3)	Ever given birth[a]	
Marital status		Yes	130 (91.5)
Married/living together	140 (84.8)	No	5 (3.5)
Never married	10 (6.1)	Missing	7 (4.9)
Divorced/separated/ widowed	5 (3.0)	No. of living children[b]	
Missing	10 (6.1)	1	36 (27.7)
Religion		2–4	72 (55.4)
Orthodox	106 (64.2)	>4	22 (16.9)
Protestant	27 (16.4)	Mean (SD)	2.9 (1.9)
Muslim	22 (13.3)	Duration of IUD use, months	
Catholic	2 (1.2)	<6	32 (19.4)
Missing	8 (4.8)	6–12	18 (10.9)
Educational level		13–24	29 (17.6)
No education	61 (37.0)	25–36	23 (13.9)
Primary	47 (28.5)	37–60	22 (13.3)
Secondary	34 (20.6)	61–84	12 (7.3)
More than secondary	16 (9.7)	>84	10 (6.1)
Missing	7 (4.2)	Missing	19 (11.5)
Age		Mean (SD)	30.5 (31.3)
<20	9 (5.5)		
20–24	34 (20.6)		
25–29	49 (29.7)		
30–34	32 (19.4)		
>34	34 (20.6)		
Missing	7 (4.2)		
Mean (SD)	28.5 (6.7)		

Abbreviations: IUD, intrauterine device; SD, standard deviation; SNNPR, Southern Nations, Nationalities, and People's Region.
[a] Denominator is 142 women who had previously been pregnant.
[b] Denominator is 130 women who had ever given birth.

training, routine follow-up and mentorship, and performance review meetings contributed to their comfort with inserting and removing the IUD.

Barriers to IUD Use

Sociocultural Barriers

Clients and service providers noted challenges posed by persistent myths and misconceptions about the method (i.e., the IUD will migrate throughout the body; the IUD causes infertility, uterine cancer, or hypertension). Limited community awareness of the method and husband/partner disapproval were also mentioned as barriers to uptake. Interestingly, respondents also noted that the long period of IUD efficacy (up to 12 years) sometimes deters clients. Despite the fact that the IUD can be removed at any point in time, clients reported uncertainty about adopting a method that is effective for such an extended period of time when they want to avoid pregnancy for only a few years.

Health System Barriers

Respondents also mentioned structural barriers to IUD uptake, including insufficient space in health centers to insert/remove IUDs, leading to privacy concerns, and discomfort with a male provider inserting the IUD (i.e., clients prefer a female provider but given that there are roughly twice the number of male providers than female providers, coupled with health worker shortages more broadly, this often is not feasible). While providers and clients noted the critical importance of counseling, both groups expressed concerns about the insufficient amount of time that is available for counseling given provider workloads. Respondents also noted that a substantial proportion of women do not return for follow-up appointments.

DISCUSSION

During the 6-month study period (March–August 2014), 2,943 women sought IUDs at the 40 selected health centers in Ethiopia, constituting 5.7% of total contraceptive use. This represents a 14-fold increase from the 6-month period preceding IFHP+ support for the government's IUD initiative (July–December 2011), when just 0.4% of clients seeking services in the 40 health centers accepted the method. This increase in IUD uptake is also reflected in the nationally representative 2014 mini Demographic and Health Survey (DHS). Data for this survey were collected by the Ethiopian Central Statistics Agency from January to April 2014 (overlapping with our study period), and revealed that IUDs constituted 1% of contraceptive use in Ethiopia. Considering that IUD use remained stagnant from 2005 to 2011 (0.2% and 0.3%, respectively), the increase to 1% within a 3-year period is notable.[8–10] Knowledge of IUDs also improved over this time period, from 26.3% of women reporting familiarity with IUDs in 2011 to 37.8% in 2014.[9,10] Findings from our study—as well as from the recent DHS—suggest that latent demand for the IUD is prevalent in Ethiopia. Evidence from Kenya, Madagascar, Nigeria, Tanzania, Uganda, and Zambia (and 7 other non-sub-Saharan African countries) also demonstrates substantial demand for IUDs when they become available.[5]

TABLE 5. Reasons for Seeking IUD Removal[a] (N = 158)

	No. (%)
Want to become pregnant	68 (43.0)
Side effects/health concerns	41 (25.9)
Husband/partner disapproves	32 (20.3)
Other family member disapproves	11 (7.0)
Infrequent sex/husband away	9 (5.7)
Became pregnant while using	4 (2.5)
Don't want to give a reason	4 (2.5)
Wants more effective method	3 (1.9)
Marital dissolution/separation	3 (1.9)
Completion of effective duration of use	2 (1.3)
I don't think I can be pregnant/menopausal	1 (0.6)
Lack of access/too far for facility	1 (0.6)
Other[b]	7 (4.4)

[a] Women selected as many reasons as applied to their situation (categories are not mutually exclusive).
[b] Includes age, switched methods, and acquired a sexually transmitted infection.

The most commonly cited reason for discontinuing use of the IUD was to become pregnant.

Our study corroborates previous findings that IUDs are acceptable to a wide range of women and adolescents,[5] including new contraceptive users (18% of IUD adopters in our study were new users), those with little to no education (45% of the acceptors reported no educational attainment), those from rural areas (63% of acceptors), and younger users (59% were younger than 30,

IUDs appear to be acceptable to a wide range of women, including young women.

with 28% under the age of 25), and presumably as a means for both spacing and limiting pregnancies (given the relatively wide age and parity distribution of acceptors). Despite their acceptability, however, underlying bias often dissuades providers from offering the IUD as part of a comprehensive method mix—particularly to adolescents and nulliparous women.[12-14]

Introduction of IUDs into the 40 health centers was correlated with a significant increase in the contribution of all LARCs to the method mix.

In the 40 health centers participating in the study, introduction of IUDs into the method mix was correlated with a statistically significant reduction in reliance on short-acting methods (particularly injectables and oral contraceptives), from 93.1% to 79.5%, and increased reliance on all LARCs (both IUDs *as well as* implants), from 6.9% to 20.5%. Previous research has shown that the introduction of new contraceptive methods often results in a net benefit for *all modern* contraceptive methods.[15] However, our findings show a sizable, statistically significant shift *toward* LARCs and away from short-acting methods (with the exception of condom use) following introduction of IUDs. Worth noting, IFHP+ has also invested heavily in expanding availability of contraceptive implants (Implanon) in the country.[16] It is plausible that IFHP+'s simultaneous efforts to increase access to and uptake of both LARCs may have been mutually reinforcing, resulting in a concurrent increase in both methods.

Women liked the IUD because it is nonhormonal, long-acting, and highly effective, among other reasons.

Our study (as well as the entirety of IFHP+'s support for the government's IUD and implant initiatives) occurred in the public health sector. Given that a significant proportion of women in the region obtain contraception from the public sector, IFHP+'s experience represents an important contribution to the evidence base. Our study suggests that the IFHP+ model—composed of provider training, provision of post-training kits and consumables that enabled immediate initiation of service provision, routine provider follow-up and mentorship, and demand creation activities—is valid and can increase access to IUDs in a large public-sector program.

Due to the nature of our study design, we were unable to rigorously evaluate client follow-up; however, during FGDs and KIIs, respondents reported the perception that a substantial proportion of clients do not return for follow-up appointments. This could be attributable to lengthy distances to facilities, lack of money for transportation, and limited impetus to seek follow-up when the client experiences no problems.

Among the 165 clients seeking IUD removal services, 43% indicated that the decision to discontinue use was influenced by a desire to become pregnant. A quarter of clients (25.9%) identified health concerns/side effects as a reason for seeking removal, and 20.3% reported that husband/partner disapproval was a reason for discontinuation. The majority (61.8%) of those who discontinued had used the IUD for less than 36 months (and 30.3% for less than 1 year); however, our study design did not allow us to correlate reasons for discontinuation with duration of use for individual clients. Future research is needed to better understand the reasons for discontinuation by length of use.

Despite some debate about the cost-effectiveness of IUDs when they are used for less than their full efficacious period, recent research shows that if the IUD is used for a minimum of 2.1 years, the method is still more cost-effective than short-acting methods.[17] The mean duration of use among clients seeking removal services during the study period was 2.6 years, and 52% of clients continued IUD use for at least 2 years.

According to a review of global access to and uptake of IUDs, favorable health policy and provider training are often predictive of increased IUD access; however, the specific facilitators and barriers to uptake are complex, country-specific, and poorly documented.[18] The qualitative component of our study aimed to explore these specific facilitators and barriers in Ethiopia. Facilitators to use included the following: the method is nonhormonal, long-acting, and highly effective; there is no need to return to the health center for method resupply; there is less room for human error; and the IUD can be removed at any time. Similar to previous findings, our study found that barriers to IUD uptake included myths about the method (including misconceptions pertaining to cancer, infertility, and IUD migration), limited community awareness, partner disapproval, and infrastructure deficits at health facilities.[13,19] While provider bias is a common barrier to provision of IUDs, providers participating in our study reported that they felt comfortable inserting and removing the method—possibly attributable to IFHP+'s rigorous competency-based trainings. Finally, in settings such as Ethiopia, it is particularly important that clients are fully informed that they can have the IUD removed at any time, given that the extended period of IUD effectiveness was highlighted as a deterrent to use during FGDs.

While acceptability of the IUD is growing, limited community awareness, myths and misconceptions about the IUD, and infrastructure

deficits at health centers must be addressed to further expand availability of a comprehensive method mix. Our findings point to the need for intensified awareness creation for client cohorts and their partners (especially given that just 17.1% of women reported hearing about the IUD from a health extension worker) and mechanisms for ensuring that counseling is improved at the facility level. While health extension workers did include discussion on myths and misconceptions about the IUD in their sensitization efforts at the community level, we would recommend that more intentional, tailored messaging around specific myths and misconceptions be developed for future interventions.

Limitations

Our study had several limitations. Because of the study's cross-sectional design, we were able to collect data from clients only at one point in time and, as such, were unable to assess follow-up, client satisfaction, and potential side effects. Additionally, because IUDs were just becoming available during the study period, our sample size for clients seeking IUD removal services (n = 165) was quite small. Furthermore, we obtained data pertaining to the contraceptive method mix before and after introduction of IUDs from family planning registers within a purposively selected sample of 40 health facilities. As the selection was not random, the results presented may overestimate the increase in LARC use. The study team aimed to ensure selection of sites that provided IUD services and had high client volume; thus, these conditions may not be representative of all health facilities supported by IFHP+. In addition, while we have taken great care to ensure accurate review and management of health facility register data during data extraction, we are cognizant that there is potential for data quality issues when relying on a retrospective review of health facility data. Social desirability bias may also have been operative due to the sensitive nature of the questions asked in both the cross-sectional survey and qualitative interviews. Contraception can be a sensitive issue within conservative communities; therefore, participants may answer a question in a way that will be viewed more favorably by the research team. To limit this bias, the survey questionnaires and qualitative interview guides were pilot tested in the community prior to implementation. Finally, the cross-sectional survey and qualitative interviews were implemented among women obtaining IUD services in a health facility; therefore, there is potential for selection bias as women who come to the health facilities are likely to have better health-seeking behavior and access to health information than their peers. Thus, the results of this study may not be generalizable to Ethiopian women more broadly.

CONCLUSION

Through provider training, provision of post-training supplies, and community-based awareness creation strategies, it is possible to expand access to IUD services and thereby to increase method choice and use of IUDs, as demonstrated in our study conducted at the public health facility level in Ethiopia. During the 6-month study period, we found the IUD to be acceptable to a diverse range of Ethiopian women, including those from rural areas, those with little to no education, and younger women. Echoing programmatic experience across sub-Saharan Africa,[6,7] our study suggests that unmet need for the IUD may be more prevalent in Ethiopia than previously thought. Given that IUDs constitute such a small proportion of contraceptive use throughout sub-Saharan Africa, our study presents relevant considerations for ensuring that clients' contraceptive choice is respected and fulfilled across the region.

While acceptability of the IUD is growing, barriers such as myths and misconceptions and infrastructure deficits must be addressed to further expand availability of a broad range of contraceptive methods.

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ORIGINAL ARTICLE

Routine Immunization Consultant Program in Nigeria: A Qualitative Review of a Country-Driven Management Approach for Health Systems Strengthening

Meghan O'Connell,[a] Chizoba Wonodi[a]

Despite challenges in material and managerial support, some state-level consultants appear to have improved routine immunization programming through supportive supervision and capacity building of health facility staff as well as advocacy for timely dispersion of funds. This country-led, problem-focused model of development assistance deserves further consideration.

ABSTRACT

Background: Since 2002, the Nigerian government has deployed consultants to states to provide technical assistance for routine immunization (RI). RI consultants are expected to play a role in supportive supervision of health facility staff, capacity building, advocacy, and monitoring and evaluation.

Methods: We conducted a retrospective review of the RI consultant program's strengths and weaknesses in 7 states and at the national level from June to September 2014 using semi-structured interviews and online surveys. Participants included RI consultants, RI program leaders, and implementers purposively drawn from national, state, and local government levels. Thematic analysis was used to analyze qualitative data from the interviews, which were triangulated with results from the quantitative surveys.

Findings: At the time of data collection, 23 of 36 states and the federal capital territory had an RI consultant. Of the 7 states visited during the study, only 3 states had present and visibly working consultants. We conducted 84 interviews with 101 participants across the 7 states and conducted data analysis on 70 interviews (with 82 individuals) that had complete data. Among the full sample of interview respondents (N = 101), most (66%) were men with an average age of 49 years (± 5.6), and the majority were technical officers (63%) but a range of other roles were also represented, including consultants (22%), directors (13%), and health workers (2%). Fifteen consultants and 44 program leaders completed the online surveys. Interview data from the 3 states with active RI consultants indicated that the consultants' main contribution was supportive supervision at the local level, particularly for collecting and using RI data for decision making. They also acted as effective advocates for RI funding. In states without an RI consultant, gaps were highlighted in data management capacity and in monitoring of RI funds. Program design strengths: the broad terms of reference and autonomy of the consultants allowed work to be tailored to the local context; consultants were often integrated into state RI teams but could also work independently when necessary; and recruitment of experienced consultants with strong professional networks, familiarity with the local context, and ability to speak the local language facilitated advocacy efforts. Key programmatic challenges were related to inadequate and inconsistent inputs (salaries, transportation means, and dedicated office space) and gaps in communication between consultants and national leadership and in management of consultants, including lack of performance feedback, lack of formal orientation at inception, and no clear job performance targets.

Conclusions: While weaknesses in managerial and material inputs affect current performance of RI consultants in Nigeria, the design of the RI consultant program employs a unique problem-focused, locally led model of development assistance that could prove valuable in strengthening the capacity of the government to implement such technical assistance on its own. Despite the lack of uniform deployment and implementation of RI consultants across the country, some consultants appear to have contributed to improved RI services through supportive supervision, capacity building, and advocacy.

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INTRODUCTION

Nigeria has had a complex history of immunization dating from the 1970s/1980s. Bilateral and multilateral aid agencies were active supporters of immunization efforts during that time, but aid funding was compromised during a period of political turbulence, which led donors to cut funding in the country. Under civilian rule from 1999 onwards, the National Programme on Immunization (NPI) was established with a focus on polio. NPI was subsumed into the National Primary Health Care Development Agency (NPHCDA) in 2007 and international donors reentered the arena, but for many years routine immunization (RI) coverage performance undulated.[1]

During the last decade, there have been gradual improvements in national coverage for vaccines such as bacille Calmette-Guérin (BCG) for tuberculosis, the third dose of diphtheria-tetanus-pertussis (DTP3), polio, and hepatitis B, according to 2014 estimates from the World Health Organization (WHO) and the United Nations Children's Fund (UNICEF).[2] Strengths in Nigeria's current RI system are most apparent at higher government levels. Strong support for RI is evident from NPHCDA and the Federal Ministry of Health (FMoH), and funds for vaccine procurement have been consistently included in the federal budget. In addition, after several years of challenges, Nigeria has succeeded with interrupting polio transmission, and in October 2015 the country was certified polio free after 1 year of no polio cases. Overall, great achievements have been made in reducing mortality rates among children under 5, from 201 per 1,000 live births in 2003 to 157 in 2008, and to 128 in 2013.[3]

Despite major improvements in reducing under-5 mortality in Nigeria, vaccine-preventable diseases are still an important cause of deaths.

Despite these major improvements, vaccine-preventable diseases still constitute a significant proportion of deaths in under-5 children,[4] and recent progress occurs in the context of ongoing systemic challenges. The 2013 Demographic and Health Survey (DHS) showed staggeringly low national vaccination coverage rates, with only 38.2% of 1-year-olds vaccinated with DTP3 and 42.1% for measles.[3] Furthermore, only 25.3% of 1-year-olds received all basic vaccinations and 20.7% received no vaccinations at all.[3] A 2012 landscape analysis of the Nigerian RI system identified a number of central weaknesses that included inadequate transportation, improper cold chain management, financing barriers, stock-outs, poor accountability and performance management, poor integration of RI services with broader primary health care services, and unreliable administrative data.[4] Although program strengths and weaknesses vary across states due to the decentralized structure of governance in Nigeria, these weaknesses represent overarching challenges that must be tackled at the systems level.

As a lower middle-income country, Nigeria is quickly outgrowing its eligibility for international development assistance. Considered a frontier market economy by the World Bank,[5] in 2014 Nigeria was ranked as the largest African economy after a rebasing calculation almost doubled the gross domestic product (GDP). While as a whole this is a positive development, critical donor support for health from organizations such as Gavi, the Vaccine Alliance, is determined in part by a country's gross national income (GNI) per capita. By doubling the GDP overnight, Nigeria became eligible to move into a transition phase for Gavi funding starting in 2017, which entails a gradual phasing-out of all funds over a 5-year period. As the international community moves beyond the Millennium Development Goals to the Sustainable Development Goals and the Nigerian government becomes progressively more responsible for the cost of health programming, an emphasis must be placed on problem-driven, adaptive health programs that are designed and managed by Nigerian stakeholders and firmly rooted in country realities.[6]

This article describes and reviews an RI consultant program in Nigeria that is in many ways such a problem-driven, iterative, and adaptive approach to aid programming.[7] The program is aligned with ongoing efforts in the country to improve accountability in RI by clarifying the roles of governmental players and increasing transparency of reporting, supervision, and evaluation mechanisms across different levels of government. The specific objective of this study was to understand the implementation, strengths, and weaknesses of the RI consultant program in Nigeria to inform future strategies. The study was part of a portfolio of projects run by the Johns Hopkins International Vaccine Access Center (IVAC) in Nigeria under the Gavi-funded Vaccine Implementation Technical Advisory Consortium (VITAC). The projects aim to provide evidence and technical assistance (TA) to support the Nigerian government to introduce new vaccines and strengthen RI systems.

PROGRAM DESCRIPTION

Since 2002, the RI consultant program has been jointly funded by Gavi and NPHCDA, a parastatal

of the Nigerian FMoH. Through this program, NPHCDA is meant to deploy 1 consultant to each of the 36 states in the country as well as to the federal capital territory to serve as technical support for RI. Although there are variations, the size of the job that consultants are tasked with is quite large. Nigerian states have an average of 4.9 million people and 21 local government areas (LGAs).[8] As part of the decentralized government structure, each state has its own constitutionally designated funding and budget and operates its own health services with staff that are state employees. The overall goal of the RI consultant program is to support states to implement RI effectively and to strengthen RI systems by improving delivery, data quality, and capacity of workers at the health facility and LGA.

The design of the RI consultants program is unique in that it is not pure development assistance in the traditional sense of being fully funded by a donor government, multilateral agency, or private agency. NPHCDA and Gavi funds have had an equal share in the cost of recruiting and maintaining the RI consultants, but the proposal and design process was country driven and activities were designed by Nigerian stakeholders in response to an expressed need to better coordinate Gavi support at the state level.

Several components of the design distinguish the program's TA model:

1. Program is designed and managed by domestic actors and tailored to the local context.
2. Consultants are locally experienced staff recruited for long-term contracts.
3. Consultants are selected by domestic actors.
4. Work is primarily field based.
5. An emphasis is placed on advocacy and networking skills.[9]
6. TA is focused on resolving broader problems within the public sector (e.g., capacity building for data quality assurance).
7. Work is oriented toward outcomes that are uncertain and difficult to measure (e.g., judicious use of funds, capacity building, and advocacy).

The scope of the program has been gradually scaled-up in an iterative fashion, from 6 consultants in 2002 (1 in each geopolitical zone) to 17 consultants who coordinated between 1 and 3 states in 2008. By 2012, the program had intended on scaling-up to 37 consultants (1 per state plus 1 to the federal capital territory), but execution of the proposed 1-consultant-per-state model has not been entirely successful. At the time of data collection (September 2014), there were only 23 consultants deployed to the states.

The Nigerian RI consultant program is meant to deploy 1 consultant to each of the 36 states and to the federal capital territory to provide technical support for RI.

Recruitment of RI consultants occurs at the national level. Contracts are awarded on an annual basis and consultants are hired as state officers for a specific posting. Although their contracts are reviewed annually and subject to termination, consultants are meant to be long-term contractors of NPHCDA and are meant to reside in the state in which they are deployed. Candidates must be 35–55 years of age with a familiarity with Nigerian public-sector health systems; many consultants previously held high-level positions such as Commissioners for Health in their states and are well respected within their field.

Consultants are strategically placed as external players to the governmental health system to position them to be advocates for RI. Although they exist outside the government health system, the way in which consultants work through state and LGA structures varies by state. In some states, they work closely with the existing state RI team but are also able to work as more independent entities when necessary. Consultants are expected to spend the majority of their time in the field and to visit a minimum of 3 LGAs per month to conduct supportive supervision. Within their states, RI consultants are meant to interact primarily with the existing state RI team and LGA-level staff.

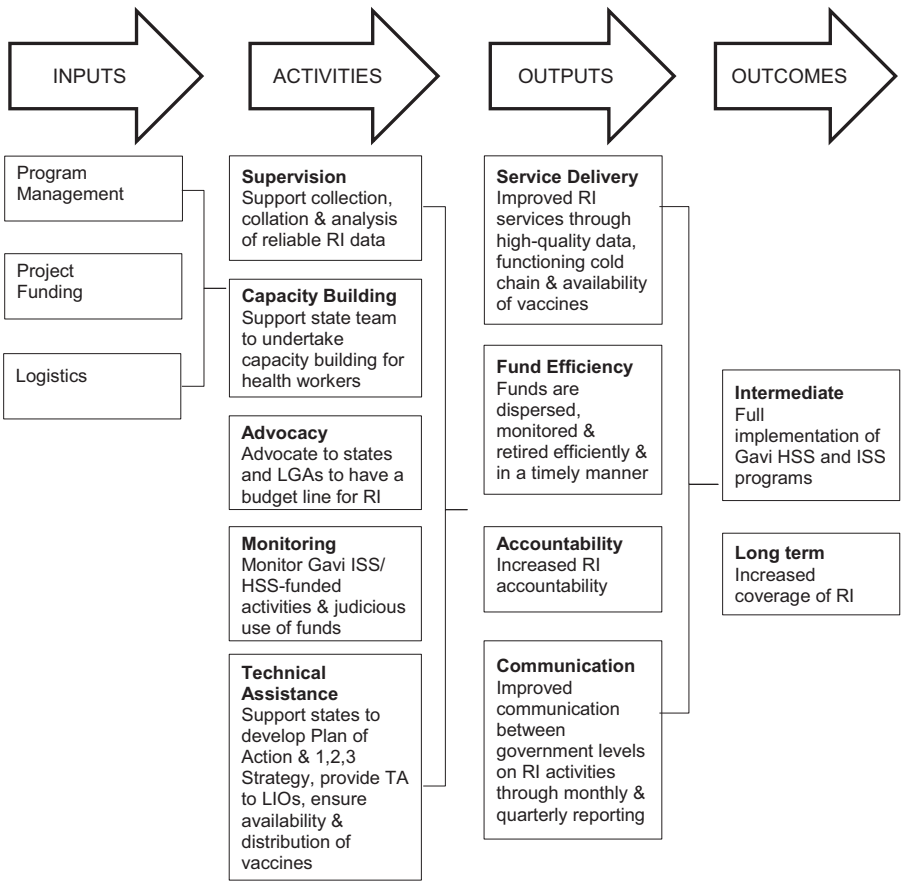
Intended Roles

According to their terms of reference (TOR), the intended role of RI consultants is to act as a liaison between national, state, and local governments to build the capacity of state-level actors to implement RI effectively. See Figure 1 for the program logic model. The consultants are meant to strengthen RI systems through:

- **Supportive supervision** of health facility staff in RI data management and quality assurance
- **Capacity building** for health workers at the LGA level
- **Advocacy** to the state for the appropriate use of Gavi funds, and to states and LGAs for a budget line for RI
- **Monitoring** the implementation of all Gavi immunization support system (ISS) and health systems strengthening (HSS) activities

The goal of the consultant program is to strengthen RI systems through supportive supervision, capacity building, advocacy, and monitoring of funds.

FIGURE 1. Logic Model of the Nigerian RI Consultant Program



Abbreviations: HSS, health systems strengthening; ISS, immunization support system; LIO, local immunization officer; LGA, local government area; RI, routine immunization; TA, technical assistance.

and the judicious use of Gavi funds within the state

- **Technical assistance** in implementation of RI activities within the state

METHODS

Study Design

We conducted a retrospective review from June to September 2014 using a mixed-methods study design consisting of semi-structured qualitative interviews and online surveys. A study advisory group comprised of international, national, and state-level experts was formed to provide guidance on the data collection and analysis approach and to determine analysis outputs most useful for NPHCDA.

State Selection

We selected 7 states (Edo, Imo, Kano, Kogi, Niger, and Oyo) from all 6 geopolitical zones to represent diverse programmatic settings while balancing security concerns (Figure 2). State selection criteria were based on RI performance (high/medium/low DTP3 coverage), urban/rural, current IVAC or consultant's partnerships, accessibility, and security (Table 1). Although the

unweighted average of the DTP3 coverage for the selected states was 58%, which was 20 percentage points higher than the national average of 38%, 2 of the selected states, Kano and Gombe, had lower than average DTP3 coverage at 19% and 36%, respectively. States with and without RI consultants were included to determine what, if any, gaps were being filled by the presence of the RI consultant.

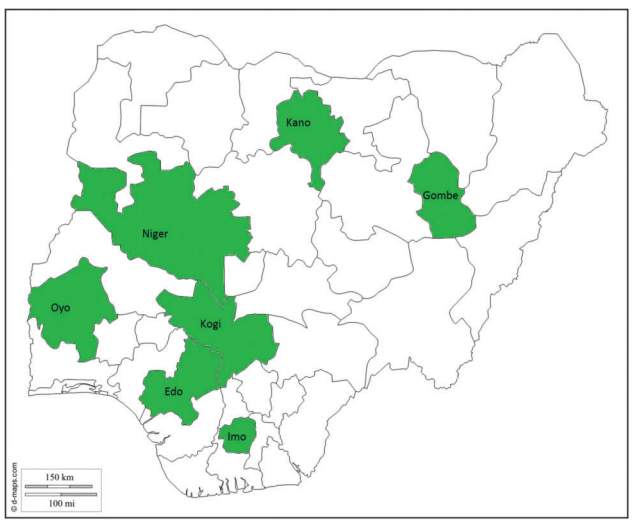
Study Procedures and Instruments

We developed the qualitative interview guides based on intended roles identified through the consultants' TOR (Box 1) and on input from key stakeholders including RI consultants and the national NPHCDA Gavi Focal Person. The discussion guides were refined iteratively throughout the data collection process to ensure gaps were filled and questions were appropriate.

Independent research consultants trained in survey administration administered the interview guide to each participant. In some cases, 2 or more participants were interviewed together using the same qualitative interview guide. Each interview took 30–60 minutes and included probing on the following domains:

- Roles and responsibilities of RI consultants
- The extent the program has been implemented as planned
- Main clients
- Monitoring and supervision
- Strengths and weaknesses
- Acceptability

FIGURE 2. Nigerian States Selected for Qualitative Data Collection



Interviews were conducted at 3 tiers of government (national, state, LGA) as well as at the facility level, with tailored interview guides for each type of respondent. All participants provided oral informed consent, and information collected from the interviewees was de-identified to maintain confidentiality.

We also conducted 2 online quantitative surveys—one of state program leaders (e.g., state immunization officers, directors of primary health care) and the other of RI consultants—to complement findings from the qualitative interviews.

TABLE 1. State Selection and Criteria

State	2013 DTP3 Coverage[a]	Urban/Rural	IVAC Relationship	Active Consultant	Airport Accessible	Security Concern
Kogi	High (75.9)	Rural	None	Yes	No	Low
Niger	Medium (67.3)	Semi-Urban	Strong	Yes	No	Low
Gombe	Low (36.0)	Rural	None	No	Yes	Medium
Kano	Low (18.9)	Urban	Strong	Yes	Yes	Medium
Imo	High (83.1)	Semi-Urban	Strong	Yes	Yes	Low
Edo	High (79.6)	Semi-Urban	None	Yes	Yes	Low
Oyo	Low (47.7)	Urban	None	No	Yes	Low

Abbreviations: DTP3, third dose of diphtheria-tetanus-pertussis; IVAC, Johns Hopkins International Vaccine Access Center.
[a] DTP3 coverage: Low: <50%, Medium: 50%–74%, High: ≥75%. Source of coverage data: 2013 Nigeria Demographic and Health Survey.

BOX 1. Terms of Reference and Key Deliverables for Gavi Routine Immunization Consultants in Nigeria

Terms of Reference

1. Advocate to states and local government areas (LGAs) to have budget line (Basket Fund) for routine immunization activities.
2. Support states and LGAs to develop Plan of Action for Routine Immunization at the state and the LGA level. The officer should, on a monthly basis, analyze the status of implementation of this plan of action, provide feedback to the state team, and report to the national level (NPHCDA).
3. Support and ensure implementation of the 1,2,3 Strategy in their state of assignment.
4. Support state team to undertake capacity building of health workers in their state of assignment.
5. Support the collection, collation, and analysis of reliable routine immunization data on a regular basis through supportive supervisory visit to health facilities and LGAs and participation in the monthly data quality checks and data quality self-assessment.
6. Provide technical support to the monthly meeting of local immunization officers (LIOs) in their state of assignment.
7. Support the state team to ensure that routine immunization vaccines are available in the state and that they are properly distributed to LGAs in a timely manner.
8. Monitor the status of implementation of all the activities in the Gavi immunization support system (ISS) and health systems strengthening (HSS) objectives and report to the national level on a quarterly basis.
9. Monitor the judicious use of Gavi funds at all levels in their state of assignment.
10. Any other activities as directed by the Director of Disease Control and Immunization at NPHCDA.

Key Deliverables

1. Monthly report on activities conducted including routine immunization performance in state of assignment, status of implementation of 1,2,3 Strategy, minutes of meeting of LIOs, funds available/released for routine immunization activities in the state, vaccine status by LGAs, and status of implementation of state plan of action.
2. Training report.
3. Report on status of utilization of Gavi funds in state of assignment.
4. Quarterly report on status of implementation of Gavi ISS/HSS activities.

Questions for both surveys covered topics on the perception of consultants' roles, visibility, and impact as well as on interactions between all state RI players, the presence of budget lines and reporting structures, and effectiveness of advocacy activities. We used Survey Monkey to send and collate survey responses from target respondents across all states in Nigeria and from the national level.

Study Participants

Participants were eligible to be included as an interviewee if they were RI consultants, had been involved in the RI consultant program design or were knowledgeable of its implementation, or had regularly interacted with RI consultants. We used purposive selection of respondents to ensure representation from different job positions and levels of government. Individuals had a minimum of 1 year of experience in their current role, unless they occupied a unique position and no other alternative existed, in which case they were not excluded if they had less experience. In general, we interviewed RI program leaders, managers, and implementers from the government and from partner organizations.

For the online survey of consultants, we sent the instrument to the 23 current consultants and to 13 former consultants for whom we had current contact information. The second survey was sent to 48 program leaders.

Analysis

All interviews were audio recorded after obtaining verbal consent from respondents. Interview tapes were transcribed verbatim, and each transcript was hand coded independently by at least 2 members of the study team to identify salient themes. Coded transcripts were entered into Atlas.ti qualitative data analysis software, which was used to query the qualitative data to examine

meaningful content and interpret the data in terms of identified themes. Codes were derived inductively from the proposed logic model (Figure 1) and grounded in the themes emerging from the data. We developed the final codebook through team discussion and consensus. For the online survey, we assessed prevalence of key opinions and perspectives on the role of RI consultants and triangulated that data with in-depth information from the interviews.

Ethical Approval

This study was approved by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board and the National Health Research Ethics Committee of Nigeria.

FINDINGS

Background Characteristics

In total, we conducted 84 qualitative interviews with 101 participants. Of the 84 interviews, 70 had complete and high-quality recorded data. Thus, we conducted qualitative data analysis on 70 in-depth interviews with a total of 82 individuals from 7 states and from national-level stakeholders based in the federal capital territory.

Among the full sample of interview participants (N = 101), the majority (66%) were men, with an average age of 49 years (± 5.6) (Table 2). Most participants had a graduate degree, and 38% had a postgraduate degree. Most participants (63%) were technical officers, but several other roles were also represented (22% consultants, 13% directors, 2% health workers). All participants were highly experienced in RI, with an average of 23 years (± 8) of work experience in health care and 17 years (± 8.5) of specialized experience in immunization.

The overall response rate for the qualitative survey was 63% (N = 59), with 42% (n = 15) for the consultants survey; of the consultants, 80% (n = 12) were current consultants. The leadership survey had a response rate of 76% (n = 44). Program leaders had worked, on average, 6 (± 4) years in their current job, and 25% of the respondents were state immunization officers, 19% classified themselves as national facilitators (n = 9), and 14% (n = 6) were national immunization officers. The low response rate for consultants was likely due to technical challenges with Internet connectivity in rural states as well as low motivation and incentive to respond among former consultants.

The level of implementation of the RI consultant program differed by state. Of 7 states visited for this study, 5 had RI consultants posted while 2 did not. Of the 5 states with a posted RI consultant, 3 states had consultants that were present and visibly working in the state while 2 states did not currently have consultants or the consultants were not generally on the ground and were not well integrated within the RI state team or RI activities.

Of the 7 states visited for the study, only 3 states had RI consultants who were present and visibly working.

Strengths and Weaknesses of the RI Consultant Program

We iteratively defined the consultants' success based on qualitative evidence that they were engaged in RI work within their state of assignment and executing their TOR to the extent possible given their individual circumstances. In

TABLE 2. Demographic Characteristics of Interview Participants

	All Interview Participants (N = 101)
Gender, No. (%)	
Male	67 (66)
Female	34 (34)
Age, mean (SD), years	49 (5.6)
Employment level, No. (%)	
National	7 (7)
State	53 (52)
LGA	41 (41)
Respondent Type, No. (%)	
Director	13 (13)
Active RI consultant	5 (5)
Other consultant (e.g., WHO consultant)	17 (17)
Technical officer	64 (63)
Health worker	2 (2)
Years in position, mean (SD)	6 (4.9)
Years in immunization, mean (SD)	17 (9.1)
Years in health care, mean (SD)	23 (8.6)
Obtained postgraduate education, No. (%)	38 (38)

Abbreviations: LGA, local government area; RI, routine immunization; SD, standard deviation; WHO, World Health Organization.

this sense, a successful consultant was one who, according to interviewees, was consistently on the ground and engaged in their expected role (advocacy, supportive supervision, capacity building, monitoring Gavi funds, TA) as it related to their states' needs.

In states with active RI consultants, these consultants were integrated well within the state RI team.

The 3 states that had RI consultants present and visibly working were distinct in that they actively engaged consultants, allowing them to be highly integrated within the state RI team through facilitated multi-stakeholder engagement.[6] In these states, implementation of activities generally aligned well with the TOR, and consultants were identified as highly respected and highly motivated individuals, capable of coordinating effectively with the state RI sector and with NGO partners.

Strengths and challenges identified by the interviewees and survey respondents are summarized below according to the key roles of the consultants defined in their TOR, followed by strengths and challenges in the overall design of the program. See Box 2 for a summary of the key findings.

Supportive Supervision and Capacity Building

Qualitative interview data from the 3 states with an active RI consultant program showed that consultants contributed to improved delivery of RI services through supportive supervision that improved the availability of high-quality data and improved functioning of the cold chain. The main activity of the RI consultants was universally expressed in these 3 states to be supportive supervision to the LGAs. This supportive supervision was intentionally focused on correction of inefficient or ineffective processes at the LGA and facility level in order to strengthen the operational system of facilities and improve delivery of RI services. Respondents at each level indicated that RI consultants played an integral role particularly with undertaking outreach services, cold-chain maintenance, and general problem solving. This supportive supervision went hand in hand with capacity building through on-the-job training (either planned or ad hoc during field visits), which was focused on the transfer of skills to LGA-level staff to build competency in providing RI services.

RI consultants reportedly provided supportive supervision for collecting and using RI data for decision making.

The most important supportive supervisory role played by consultants was identified as supervision for collecting, collating, and analyzing reliable RI data within the health facility. Interviewees indicated that, when engaged in their state, RI consultants facilitated quality assurance of RI data reported from health facilities and LGAs to the state through trainings and data quality checks. This process intentionally focused on building LGA capacity to collect and use data for decision making. Respondents indicated that consultants fed coverage data up to state leadership and that they also used these data to map unmet need, identify unsatisfactory performance, and address challenges to reaching target populations, thereby enhancing the performance of facility outreach services. Improved quality of data and increased competency and education of LGA staff were reported as the main impact from this supportive supervision.

In states without an RI consultant, the most frequently identified gap associated with the lack of supportive supervision was assistance with data management. The success in data quality improvement achieved in states with a consultant was succinctly illustrated by an LGA Cold Chain Officer:

> *The health facilities are working, but the problem we are having with them is the data. They are not producing*

BOX 2. Main Findings From Qualitative Interviews

- In states that had active and present routine immunization (RI) consultants, implementation of activities was generally well aligned with the consultants' terms of reference.
- Consultants' main role was as supportive supervisors at the local government area (LGA) level; they also acted as effective advocates for RI funding and played a key role in quality assurance of RI data.
- Program design strengths included recruiting consultants who were highly committed and motivated, familiar with the local context and language, and well respected within their field.
- Key challenges in program implementation were related to inadequate and inconsistent inputs (salaries, transportation means, dedicated office space) and gaps in management of the consultants (monitoring and supervision).
- In states without an RI consultant, capacity for data management and Gavi fund oversight were identified as the primary gaps.

data correctly, and that data speaks for the LGA. If they don't do it right, we go there and see that the coverage is low. With [the RI consultant's] presence in the state, they are going out to correct them. It improves their data … it is one of their greatest achievements.

Unfortunately, due to limited resources available to consultants, the ability to conduct supervisory visits was often constrained by lack of transportation and logistical support. Consultants often had to either use their personal vehicles or "hitch a ride" with other state RI team vehicles conducting fieldwork. This likely restricted the quantity and quality of the supportive supervision that could have occurred had consultants been provided with reliable transportation means.

Advocacy

Interview respondents from states with an active RI consultant program indicated that advocacy activities conducted by consultants were useful and were associated with fund efficiency (timely dispersion and monitoring of funds) and increased problem solving at the state and local level. The skills profile and gravitas of the RI consultants, who have many years of experience and strong professional networks, make them uniquely placed to conduct advocacy within their state for the appropriate use of Gavi funds and to state and LGA leadership for a budget line for RI. When active in their state, both qualitative and quantitative results indicate that consultants appear particularly well suited to facilitate the resolution of RI funding challenges by communicating directly to leadership within the state, such as the Commissioner, Executive Secretary, and Director of Primary Health Care, whereas other workers within the state team are not in a position to request these meetings. Importantly, the topic of advocacy was not constrained by a predetermined policy agenda but was focused on general problem solving within the consultants' state. A State Immunization Officer indicated that the RI consultant in his state had "the skill to convince the chairman or be able to stand before the chairman," while a Local Immunization Officer explained:

This year he has also done 3 advocacies to the LGA chairman to resolve problems. The last time was when there was power failure at the LGA cold store due to non-payment of bills, he advocated to the Chairman of the LGA and the problem was resolved immediately.

Additionally, having familiarity with the local context and speaking a local language were seen as assets for advocacy. One Director of Primary Health Care explained:

One of the strengths is that the [RI] consultants are from the state so they also understand the internal dynamics of the state and some challenges. They are also able to help because there are some people they can also reach to give support to the program due to their status and also they are team players; that one is a big advantage.

Limited transportation means constrained the ability of consultants to conduct supervisory visits.

Monitoring of Funds

One of the biggest challenges since the inception of Gavi funding has been timely retirement of funds in the states, specifically of ISS funds. Nigeria received ISS funds, which primarily supported routine immunization, for 4 years (in 2001, 2002, 2006, and 2007).[8] Study participants indicated that the retirement of 2007 ISS funds was still outstanding at the time of this research, which has acted as a bottleneck for disbursement of new funds.

While there were striking differences between states with and without consultants in terms of information reported on Gavi fund tracking, qualitative results indicated that some consultants could facilitate the implementation and correct use of Gavi funds, but not their retirement. On the other hand, 48% (n=21) of quantitative survey respondents said that consultants facilitated both release *and* retirement of Gavi funds (Table 3). The discordance between these results is likely due to a lack of understanding by leadership of the consultants' actual activities. Retirement of Gavi funds remains a problem and Gavi consultants seem ideally placed to facilitate this process. However, retiring funds has not been part of the consultants' TOR, and they were not granted the required signatory power to retire Gavi funds, making it unlikely that they have played any significant role in this process.

The experience and gravitas of the RI consultants made them uniquely placed to conduct advocacy activities.

On ensuring the correct use of Gavi funds, qualitative results indicated that a communication gap existed between consultants and their national-level leadership such that they could perform this task but at times did not have enough information to do so. There was no consistent mechanism in place from the national level to inform RI consultants when Gavi money was dispersed to their state, so they were not always aware of the movement of funds. Despite it being a main component of the consultants' TOR, only 18% (n=8) of survey respondents said that consultants had "a lot of influence" on use of Gavi HSS and ISS funds.

TABLE 3. Findings From Quantitative Survey of Nigerian RI Consultant Program Leaders (N = 44)

	No. (%)
How useful are your interactions with RI consultants?	
Very or somewhat useful	34 (77)
Neutral	10 (23)
Not very useful or not useful at all	0 (0)
Is the RI consultant visible and actively working on RI activities in your state?	
Yes	32 (73)
No	10 (23)
I don't know	2 (5)
To what extent is the RI consultant involved in decision making for RI at the state level?	
Very involved	17 (39)
Somewhat involved	11 (25)
Not very involved or not involved at all	12 (27)
I don't know	4 (9)
The work of the RI consultant has a large impact on improving RI services in my state	
Strongly agree or agree	31 (70)
Neutral	8 (18)
Strongly disagree or disagree	5 (11)
Does the RI consultant have influence to facilitate the release and/or retirement of Gavi HSS and ISS funds?	
Yes, release only	1 (2)
Yes, retirement only	2 (6)
Yes, both release and retirement	21 (48)
No	11 (25)
I don't know	9 (20)
How much influence does the RI consultant have on the Gavi HSS and ISS funds?	
A lot or some	20 (45)
Not much or none at all	13 (30)
I don't know	11 (25)
Are there clear performance targets for the RI consultant in your state?	
Yes	14 (32)
No	4 (9)
I don't know	26 (59)
Do you or anybody in the state evaluate performance of the RI consultant?	
Yes	9 (20)
No	30 (68)
I don't know	5 (11)

Notwithstanding the communication gap, in states where consultants were active and present, it was very clear that the consultants made an effort to track the use of Gavi funds, ensure guidelines were followed, and report misuse to state leadership for correction. Although modalities for monitoring use of funds were not structured and uniformly applied, a few consultants were able to track fund use at the LGA and health facility level and advocate for health facilities that did not receive funds. In contrast, interviews with participants in states without an RI consultant showed that this type of Gavi fund oversight was not apparent, or the interviewees specifically identified it as an area that needed attention. When asked if RI consultants made sure that Gavi funds were used for the specific programs for which they were provided, a State Deputy Director in a state without a current RI consultant (*but that had one previously*) explained:

> *They [the consultants] release the funds to local government immunization officers—these funds are for the intensification of RI, for logistics support for the smooth running of RI programs at the local government level—and they have done that well. When they were here, we felt the impact—our RI coverage increased. But when they left, it decreased. So they have done well, to my own knowledge.*

Overall Program Design

Strengths of the Design

There are several components of the program design that might have facilitated engagement of consultants in their key roles (i.e., advocacy, supportive supervision, capacity building, and monitoring of Gavi funds) within their states. First, the broad TOR and autonomy within the state allowed work to be tailored to the context, and it was clear that consultants could adapt to their states' needs. Second, the national Gavi Focal Person was a staff member of NPHCDA and facilitated the placement and integration of consultants in their respective states. This allowed consultants to work as part of the state RI teams that composed the state and LGA RI government structures. Although part of the state team, consultants could also draw on their external status to work more independently within the state when necessary. Furthermore, recruitment that prioritized advocacy and networking skills enabled a powerful player to exist within RI to act as a direct advocate for problem solving at the local level and to feed RI information up to state decision makers. In addition, we saw that selection of indigenes for long-term, field-based contracts allowed relationship building that guided progress.

Challenges to Implementation

While the consultant's independence from the state team was strategic and had benefits for advocacy, many implementation challenges were due to this external position. There was consensus among all interview participants in all states that the dominant challenge to implementation of the RI consultants program was funding—specifically, receipt of timely remuneration for consultants. Nearly all respondents regardless of role reiterated that there was a lack of timely payment; in some cases, payment had been delayed for more than a year. Lack of designated office space and, more importantly, a means of transportation, were also cited as major challenges across the board to achieving success in RI consultants' work. Although a portion of the consultants' stipend was meant to cover transportation costs, it was universally expressed that their remuneration was not sufficient and that transport without a vehicle was a key challenge. If most of their work was seen as supervisory, having no means of transportation posed a major hindrance to their effectiveness.

Timely remuneration of consultants was a major challenge of the program.

A second key challenge in implementation was related to gaps in management, specifically the monitoring and supervision of RI consultants from the national and state levels. Specific gaps in management included:

Gaps in supervision of consultants also constrained the program.

- No structured feedback on monthly consultant reports from the state or national level
- No field-based monitoring/supervision from the state or national level
- No co-management between state and national levels on consultants' activities
- No formal orientation with the state team
- No clear job performance targets

Although annual performance evaluations with real repercussions for subpar work indicated that there was no longer tolerance for poor performance, the oversight infrastructure to incentivize good performance did not exist.

DISCUSSION

Evidence for the effectiveness of the RI consultant program is limited. Many consultant posts (14 of the 37) were not filled, some consultants were inactive, and supervision of the program

Despite structural challenges, some RI consultants appear to have improved RI programming through supportive supervision and advocacy.

was weak. Despite these structural challenges, we found many positive elements in the midst of substantial difficulties. When staffed with qualified and motivated people, the RI consultants were useful in supportive supervision and advocacy for RI. A few consultants were also able to track ISS funds and report misuse to state leadership in line with their TOR.

Outsourcing critical RI program functions (supervision, cold chain maintenance, data management, monitoring of financial flows, etc.) risks creating consultant-driven dependencies, a concern underscored by our findings that continuity of the consultants is an issue in many states. However, we found that consultants have the potential and ability to be more than just a temporary helping hand for RI in their states and that their external position was a strategic positioning rather than a temporary solution. Although internal government champions are critical to the RI advocacy process, external advocates are also necessary. Many of the RI consultants were former senior health officials. This experience allowed them to navigate the government system from outside and solve problems that a more junior or less well-connected person could not. Furthermore, their professional experience brought gravitas to their role as RI advocates. Unlike typical consultancies, the program is meant to be a long-term solution. Although contracts are reviewed annually, the consultants are not placed in states as temporary or short-term staff. The risks to continuity at the time of the study were due to structural challenges in funding, not to flaws in the program design.

The RI consultant program design represents a TA model that is partially supported by an external donor and managed by a domestic partner, targeting systems strengthening through supervision and capacity building for improved service delivery in RI. In practice, we saw enthusiasm for the model for improving RI, but an inability of some consultants to overcome structural challenges to effect change. Overall, there is a lack of guidelines or models of TA implementation[10] and, until recently, a lack of case studies of programs that are locally led, problem-driven, iterative, and adaptive.[7] The absence of guidelines may work in favor of avoiding decontextualized best practices that assume one model fits all, but it may also have contributed to a plethora of TA models on the ground that may or may not be effective, are not standardized, and have not been evaluated. The findings from this qualitative study contribute to the literature on TA by synthesizing the components of the program that were well received, either by design or by default, and that were aimed at strengthening an RI system within an environment that is challenging politically, economically, and environmentally.

Recommendations

Based on our research, we put forth the following recommendations for improving the RI consultant program:

1. Improve the timeliness of payment of the consultants and consider increasing remuneration. Also consider providing the consultants with additional inputs, such as a vehicle for transportation and dedicated office space, to facilitate successful implementation of their key roles.
2. Enhance the existing monitoring and supervision system to include:
   - Joint planning with the state team and leadership on consultants' priority activities, targets, and deliverables. Targets should be based on an assessment of the gaps and the solutions that the consultant is best positioned to address.
   - A more detailed analysis of consultants' monthly reports with a structured mechanism for feedback
   - Field-based monitoring of consultants' activities within the state from the national level and/or monitoring of consultants' activities by the state leadership
   - Structured reporting by the consultants to a specified person in the state leadership
   - Appointment of an external (non-NPHCDA), national-level focal person to coordinate activities, communication, and monitoring of consultants, as well as to interface with the NPHCDA Gavi Focal Person
   - A quarterly or annual review meeting with consultants and other partners to document lessons learned and inform future strategies
3. Implement an in-person orientation with the state team at inception of the RI consultant into the state to introduce the stakeholders, align expectations within the state, and allow for joint work planning between the national and the state level.
4. Provide a structured mechanism to disseminate information on the disbursement of funding to

consultants' states to empower consultants to play a more active role in monitoring fund utilization and management.

5. Provide RI consultants with training on effective mentoring. Although the RI consultants had many mentoring relationships, training could help improve and systematize the RI consultant program across the different states.

To be more actionable, key stakeholders should discuss these recommendations, identify responsible parties for each component, and agree on the most effective method to operationalize each point.

Limitations

There are some limitations to this study. First, the study was almost exclusively qualitative, which limited the scope and ability to address important questions. Because most of the data were obtained through interviews, the information collected may be susceptible to interview bias. A more in-depth desk review that examined available meeting minutes or documentation in states, LGAs, and health facilities would have added depth to our results. Additionally, a more in-depth analysis of the political drivers of variance in the RI consultant rollout, implementation, and attrition within different states would have added to our results. Lastly, it is intuitive that a study of a larger scale, one that examined programmatic effects in more than 7 states, would have added value and insight to our analysis.

The primary limitation in the interpretation of our results is our inability to definitively link the work of consultants to system-wide effects and coverage rates within the states and hence an inability to determine the impact of the program. This information would have provided more insight into the value of the program and an ability to produce stronger recommendations for potential future directions of the program.

CONCLUSIONS

While weaknesses in managerial and material inputs affect current performance, the design of the RI consultant program in Nigeria is a unique model for development assistance that aims for transfer of resources and technical skills. Supportive supervision, capacity building, and advocacy were seen as the most valuable roles provided by the RI consultants to improve delivery of RI services; these roles seem to have facilitated collection and use of high-quality data, improved fund efficiency, and increased problem solving. If improvement in management processes occurs, consultants may be successful despite systemic challenges common in the difficult political context of Nigeria.

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ORIGINAL ARTICLE

Is Household Wealth Associated With Use of Long-Acting Reversible and Permanent Methods of Contraception? A Multi-Country Analysis

Jorge I Ugaz,[a] Minki Chatterji,[b] James N Gribble,[c] Kathryn Banke[b]

In general, across the developing world, wealthier women are more likely than poorer women to use long-acting and permanent methods of contraception instead of short-acting methods. Exceptions are Bangladesh, India, and possibly Haiti.

Abstract

As programs continue to expand access to family planning information, services, and products, it is critical that these efforts be undertaken with an equity lens, ensuring that regardless of socioeconomic status, all women and couples can use the method that meets their needs. This study explores the relationship between household wealth and the use of long-acting and permanent methods (LAPMs) versus short-acting methods of contraception among modern method users, using multivariate analyses based on Demographic Health Survey data from 30 developing countries conducted between 2006 and 2013. Overall, and controlling for relevant individual and household characteristics including age, number of living children, education, and urban/rural residence, we found that wealthier women were more likely than poorer women to use LAPMs instead of short-acting methods: 20 of the 30 countries showed a positive and statistically significant association between wealth and LAPM use. For 10 of those countries, however, LAPM use was significantly higher only for the top (1 or 2) wealthiest quintiles. Eight countries showed no broad pattern of association, while in 2 countries—Bangladesh and India—poorer women were more likely to use LAPMs than wealthier women. The positive association between wealth and LAPM use was found most consistently in the Latin American and the Caribbean countries in our sample. These findings can help program implementers respond better to women's needs for modern contraception, especially in reaching women from lower- and middle-income households.

INTRODUCTION

Although the Family Planning 2020 (FP2020) global movement has focused attention on improving access to modern contraception among the world's poorest women, evidence suggests this goal is still far from reality.[1] As programs continue to expand access to family planning information, services, and products, it is critical to undertake these efforts with an equity lens, ensuring that, regardless of socioeconomic status, all women and couples can use the method that meets their needs. In particular, for women and couples to make an informed choice, programs need to provide information about the benefits of long-acting and permanent methods (LAPMs), as well as access to those methods—either directly or through referrals. LAPMs comprise the long-acting and reversible methods of IUDs and implants as well as the permanent methods of tubal ligation and vasectomy. Benefits of LAPMs include convenience, effectiveness, cost-effectiveness, and potential health benefits,[2–4] but overall use of LAPMs is still low in developing countries. Regional LAPM contraceptive prevalence rates average 4.2% and 21.9% in sub-Saharan Africa and Latin America, respectively.[5]

Many studies have demonstrated that wealth is positively associated with modern contraceptive use.[6-9] However, it is unclear whether wealthier women are more likely than poor women to use LAPMs than short-acting methods. To our knowledge, only 3 studies have explored this issue.[7,10,11] These studies suggest that wealth and LAPM use may be positively associated in developing countries. Creanga et al.[7] conducted

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Wealth is positively associated with modern contraceptive use, but the association between wealth and use of long-acting over short-acting methods is unclear.

multivariate analysis of Demographic and Health Survey (DHS) data spanning 13 countries in sub-Saharan Africa and noted that use of long-acting contraceptive methods was more common among women in the wealthiest quintile than women in the poorest wealth quintile. However, by focusing only on the top and bottom wealth quintiles, that analysis left unanswered questions about access for the middle wealth quintiles. Using bivariate analysis, Ross and Agwanda[10] explored the use of modern methods, in particular injectables, by wealth quintiles using data from DHS and the United Nations Development Programme (UNDP) in 28 countries—14 in Eastern and Southern Africa and 14 in West and Central Africa. The study found that women from wealthier households were more likely to be using pills, injectables, condoms, or female sterilization than women from poorer households. Although the results were informative, they do not provide insights into how household wealth is associated with use of one type of method over the others. Similarly, Fotso et al.[11] analyzed DHS data from Kenya using multivariate regression and found that wealthier women were more likely to use LAPMs than poorer women, a disparity that increased from 2003 through 2008/2009.

Our analysis builds on these prior studies by conducting multivariate regression analysis in 30 countries in 3 regions to explore the relationship between household wealth and the type of contraceptive method used. Multivariate analysis allows us to correct for potential confounders (such as level of education or number of children) that are correlated with wealth and that may affect the choice between LAPMs and short-acting methods. To our knowledge, this is the first study to explore the relationship between wealth and type of method across all wealth quintiles, for many countries and different regions, using multivariate regression techniques to control for confounding factors.

Most sub-Saharan African countries have low LAPM use.

Reasons that poor women may be less likely to use LAPMs could include barriers that programs need to address, such as financial costs, geographic barriers, medical and legal restrictions,[12-15] provider bias and misinformation, social and cultural barriers,[16] or simply different preferences. This paper cannot identify the reasons for non-use of LAPMs given data limitations. Rather, the purpose of this article is to determine whether a clear relationship exists between wealth and use of long-acting versus short-acting methods of contraception. Substantiating such a relationship allows the family planning community to advocate solutions to close this gap and find ways to remove barriers to LAPM use among poor women through formative and/or intervention research. Making this information available at the country level also helps countries understand whether this is a possible equity issue that needs to be resolved. However, it should be noted that proportions of women who are in need of LAPMs may be different by country because age structures and proportions of women wanting to limit childbearing may differ across countries.

DATA AND METHODS

Our analysis used data from the DHS, which are household surveys that are nationally representative and internationally comparable, focusing primarily on reproductive health, fertility, and maternal and child health indicators. We used the most recent DHS data from 30 countries across 3 regions: 15 in sub-Saharan Africa; 9 in Asia and the Middle East; and 6 in Latin America and the Caribbean (Table 1). The surveys were conducted between 2006 and 2013.

Our final sample of countries was selected according to the following criteria. First, the most recent DHS was conducted in 2006 or later. Second, of the relevant sample of women of reproductive age (15–49 years) who were not currently pregnant and who had ever been sexually active, at least 10% reported currently using a modern contraceptive method. Third, the final sample for the country had to have at least 100 users of either LAPMs or short-acting methods among the relevant sample of women.

To assess the prevalence rates of traditional and modern contraception by type of method, we analyzed the sample of women of reproductive age who had ever been sexually active and who reported not being pregnant at the time of the interview. Table 2 displays the proportion of those women who reported using either no method, traditional methods, short-acting methods, or LAPMs for each country. Most countries in sub-Saharan Africa had low use of LAPMs, ranging from 1% in Cameroon and Nigeria to 7% in Kenya, Namibia, and Rwanda, and up to 11% in Malawi. Some countries in Asia and Latin America displayed much higher prevalence rates—from 27% in Jordan and Nepal to 39% in Egypt and the Dominican Republic to over 40% in India and Colombia.

For the multivariate analysis in this paper, we examined the subgroup of women who, in addition to being of reproductive age, sexually active, and not currently pregnant, also reported

using a modern method of contraception (short-acting methods or LAPMs) at the time of the interview. In some countries in North Africa, the Middle East, and Asia (i.e., Bangladesh, Cambodia, Egypt, Indonesia, Jordan, Nepal, and Pakistan), the questions regarding access to and use of modern contraception were asked only to married women. Table 3 presents descriptive statistics for each study sample in the 30 countries: average age, average number of children alive at time of the interview, education, urban/rural residence, and distribution of the use of modern methods by type (LAPMs vs. short-acting methods). It also displays the numbers of observations of women who have all these requisites per survey that were considered for our analysis.

Variables

Our outcome of interest was a dichotomous variable that was equal to *one* if the woman reported using a LAPM and *zero* if she reported using a short-acting method. Our main independent variable was household wealth, a variable that is included in the DHS datasets as a composite score, based on asset ownership and quality of housing; all surveyed households are ranked by index score and accordingly assigned to 1 of 5 wealth quintiles.[17] This method of categorizing households based on wealth quintiles has been shown consistent with other wealth rankings, e.g., based on consumption expenditure aggregates, especially when other socioeconomic characteristics are taken into account.[18,19] In the multivariate analysis, we represented this wealth variable as a vector of 5 dummy variables, with the poorest quintile (quintile 1) serving as the reference group.

Other control variables included:

- Age, in linear and quadratic form
- Number of living children, in linear and quadratic form
- Education, as a vector of dummy variables representing levels of education completed, including none (omitted category), elementary, secondary, and tertiary education
- A vector of dummy variables for employment status and type of occupation of the head of the household (the omitted category was for households in which the head either was unemployed or performed manual or domestic tasks for a living)
- A dummy variable for marital status equal to one for women who were married or living in

TABLE 1. Countries and Survey Years Included in the Analysis

Region/Country	Survey Year
sub-Saharan Africa	
Burundi	2010
Cameroon	2011
Ethiopia	2011
Kenya	2009
Lesotho	2009
Madagascar	2008
Malawi	2010
Namibia	2006
Nigeria	2013
Rwanda	2010
Senegal	2012
Swaziland	2006
Tanzania	2010
Zambia	2007
Zimbabwe	2010
Asia and the Middle East	
Bangladesh	2011
Cambodia	2010
Egypt	2008
India	2006
Indonesia	2007
Jordan	2009
Nepal	2011
Pakistan	2007
Philippines	2008
Latin America and the Caribbean	
Bolivia	2008
Colombia	2010
Dominican Republic	2013
Guyana	2009
Haiti	2012
Peru	2008

Source: Demographic and Health Surveys.

TABLE 2. Use of Contraception Among Women of Reproductive Age,[a] by Type of Method

Country	None	Traditional	Short-acting	LAPMs	N
sub-Saharan Africa					
Burundi	78%	4%	14%	4%	5,660
Cameroon	69%	10%	20%	1%	11,940
Ethiopia	71%	1%	23%	4%	11,280
Kenya	58%	5%	29%	7%	6,414
Lesotho	56%	1%	39%	4%	6,156
Madagascar	60%	11%	26%	3%	13,872
Malawi	54%	4%	31%	11%	17,701
Namibia	41%	1%	50%	7%	7,679
Nigeria	80%	7%	12%	1%	25,244
Rwanda	55%	6%	33%	7%	8,591
Senegal	86%	1%	11%	2%	10,761
Swaziland	51%	2%	42%	5%	3,837
Tanzania	62%	7%	25%	6%	7,403
Zambia	61%	7%	30%	2%	5,440
Zimbabwe	44%	1%	50%	4%	6,765
Asia and the Middle East					
Bangladesh	39%	9%	44%	8%	16,654
Cambodia	51%	15%	28%	6%	11,912
Egypt	38%	3%	21%	39%	14,950
India	41%	8%	9%	43%	88,075
Indonesia	39%	4%	46%	11%	30,910
Jordan	36%	19%	18%	27%	8,851
Nepal	48%	7%	18%	27%	9,228
Pakistan	62%	10%	16%	12%	12,063
Philippines	50%	17%	21%	13%	8,889
Latin America and the Caribbean					
Bolivia	44%	23%	19%	13%	12,697
Colombia	28%	5%	26%	41%	42,242
Dominican Republic	31%	3%	26%	39%	7,524
Guyana	57%	3%	30%	11%	4,008
Haiti	69%	7%	21%	3%	7,861
Peru	36%	20%	30%	13%	31,261

Abbreviation: LAPMs, long-acting and permanent methods.
[a] Unit of analysis is women of reproductive (15–49 years old) who have ever been sexually active and who were not currently pregnant.
Source: Demographic and Health Surveys (various years).

TABLE 3. Descriptive Statistics of Study Sample of Modern Contraceptive Users[a]

Country	Average Age	Average No. of Children	Education				Living in Urban Areas	Type of Modern Method Used		N
			None	Primary	High School	College or Higher		Short-Acting Methods	LAPMs	
sub-Saharan Africa										
Burundi	30.4	3.5	43%	44%	11%	2%	16%	78%	22%	1,075
Cameroon	27.3	2.0	4%	26%	58%	12%	73%	94%	6%	2,454
Ethiopia	29.5	3.1	51%	35%	7%	7%	33%	85%	15%	2,793
Kenya	31.7	3.1	3%	56%	30%	10%	30%	80%	20%	2,225
Lesotho	30.2	2.0	1%	43%	47%	9%	40%	91%	9%	2,489
Madagascar	30.7	3.2	12%	54%	32%	2%	19%	90%	10%	3,889
Malawi	30.5	3.5	15%	65%	18%	2%	21%	73%	27%	7,449
Namibia	29.7	2.0	4%	21%	66%	9%	59%	87%	13%	4,321
Nigeria	29.8	2.5	9%	20%	50%	22%	55%	90%	10%	3,117
Rwanda	31.5	3.3	16%	72%	10%	2%	14%	83%	17%	3,410
Senegal	31.9	3.5	45%	34%	18%	4%	69%	83%	17%	1,250
Swaziland	29.2	2.5	6%	28%	55%	12%	32%	89%	11%	1,837
Tanzania	30.5	3.1	14%	72%	14%	1%	33%	80%	20%	2,091
Zambia	29.5	3.3	10%	53%	30%	7%	46%	93%	7%	1,790
Zimbabwe	30.2	2.6	2%	30%	64%	5%	37%	92%	8%	3,690
Asia and the Middle East										
Bangladesh	29.8	2.4	25%	30%	36%	8%	27%	84%	16%	8,716
Cambodia	32.6	2.8	19%	57%	23%	1%	16%	83%	17%	3,993
Egypt	33.9	3.1	30%	12%	46%	12%	44%	35%	65%	8,524
India	34.2	2.9	45%	17%	32%	6%	35%	17%	83%	45,224
Indonesia	33.3	2.3	5%	48%	41%	7%	41%	81%	19%	16,963
Jordan	34.8	4.3	2%	5%	61%	32%	87%	40%	60%	3,831
Nepal	34.0	2.9	54%	18%	23%	5%	15%	40%	60%	4,194
Pakistan	34.4	4.2	51%	18%	21%	11%	41%	57%	43%	3,532
Philippines	33.7	3.1	0%	21%	46%	32%	53%	62%	38%	3,024
Latin America and the Caribbean										
Bolivia	32.0	2.8	4%	41%	34%	21%	73%	59%	41%	4,375
Colombia	32.7	2.1	2%	26%	49%	24%	79%	39%	61%	27,532
Dominican Rep.	33.1	2.5	2%	36%	36%	26%	75%	40%	60%	5,026
Guyana	32.1	2.5	1%	20%	70%	9%	32%	73%	27%	1,541
Haiti	29.7	2.5	21%	35%	38%	5%	50%	86%	14%	1,874
Peru	33.1	2.5	3%	26%	41%	30%	75%	70%	30%	13,770

Abbreviation: LAPMs, long-acting and permanent methods.

[a] Study sample is limited to women of reproductive age who have ever been sexually active, who were not pregnant at the time of the survey, and who reported current use of a modern contraceptive method.

Source: Demographic and Health Surveys (various years).

union, and zero otherwise (this variable was used as a control only for those countries where questions regarding use of contraception were asked regardless of marital status, as previously explained)

- Urban/rural residence

We included this vector of controls in order to isolate more precisely the relationship between use of LAPMs versus short-acting methods and wealth, as a proxy for disposable income. Age and education, for example, are variables that are correlated with both wealth and use of either type of method. Controlling for them is equivalent to exploring the nature of the relationship between wealth and use of LAPMs within women of the same age or same level of education. Although some of these controls are highly correlated, in order to improve the precision of our estimates and reduce the potential for omitted variable bias, all of them were included as controls simultaneously.

We hypothesized that most countries would show a positive association between wealth and use of LAPMs (versus short-acting methods). It was expected that this could occur in the form of a positive linear relationship across all wealth quintiles (meaning that women from higher quintiles would always be more likely to use LAPMs than women from lower quintiles) or in the form of a non-linear relationship, i.e., just for the highest quintiles (meaning that women from only the top 1 or 2 highest quintiles would be more likely to use LAPMs, but women from lower quintiles would be equally likely to use LAPMs than women from the lowest quintile). A negative relationship would mean that wealthier women would be less likely to use LAPMs than poorer women.

In most countries, wealthier women were more likely to use LAPMs than poorer women.

Analytical Methods

First, we examined the unadjusted relationship between our outcome of interest (use of LAPMs versus short-acting methods) and our main independent variable (wealth) separately for the 30 countries in our final sample. Second, we ran (adjusted) multivariate logistic regressions for each country, in order to control for specific individual and household characteristics that can confound the relationship between wealth and contraceptive method of choice. These control variables were age, number of living children, educational attainment, employment status and type of occupation of head of household, marital status (when applicable), and urban/rural residence.

The multivariate analysis was performed using logistic regression models to yield coefficient estimates displayed as odds ratios (ORs). These ratios represent the odds of an individual using a LAPM over the odds of using a short-acting method (thus, an odds ratio larger than one implies that the individual is more likely to use a LAPM than a short-acting method). We used the within-country weighting variables specified by each country-specific DHS. Occasionally, a country presented strata with a single sampling unit in our regressions; those strata were treated as certainty sampling units.[20]

RESULTS

Unadjusted Analysis

The unadjusted relationship between wealth and use of LAPMs (versus short-acting methods) among modern method users varied across countries (Table 4). The complement of each proportion reported in Table 4 is, by definition, the proportion of women using short-acting methods. In Burundi, for example, among the sampled women in the poorest quintile (quintile 1), 22% used LAPMs and the remaining 78% used short-acting methods.

Overall, in 17 of the 30 countries, a greater proportion of women in the wealthiest quintile used LAPMs compared with women in the poorest quintile. Conversely, of course, short-acting methods were used by a greater proportion of poorer women than wealthier women. **This positive (and linear) relationship between wealth and use of LAPMs was the dominant pattern in each region**, observed in half to two-thirds of the countries sampled: 10 of the 15 African countries, 5 of the 9 Asian/Middle Eastern countries, and 3 of the 6 Latin American/Caribbean countries.

There were many exceptions to this pattern, however. Four countries—Bangladesh, Haiti, India, and Pakistan—exhibited a clearly negative relationship: LAPM use was far more common among poorer women than among wealthier women. For another 4 countries (the Dominican Republic, Ethiopia, Nepal, and Tanzania), the relationship resembled an inverted U-shape, with LAPM use higher in the middle wealth quintiles and lower in both the poorest and the wealthiest quintiles. In Burundi and Senegal, the relationship resembled a U-shape, with LAPM use more likely in both the poorest and the wealthiest quintiles and lower in the middle quintiles; however, no large differences were observed in the proportions across all

TABLE 4. Proportion of Modern Method Users[a] Using LAPMs, by Wealth Quintile

	Wealth Quintile				
Country	**Q1 (Poorest)**	**Q2**	**Q3**	**Q4**	**Q5 (Wealthiest)**
sub-Saharan Africa					
Burundi	22%	15%	20%	23%	26%
Cameroon	7%	8%	8%	7%	5%
Ethiopia	16%	21%	16%	16%	12%
Kenya	14%	16%	21%	21%	21%
Lesotho	3%	6%	7%	10%	11%
Madagascar	8%	7%	7%	12%	13%
Malawi	24%	23%	26%	28%	32%
Namibia	5%	6%	8%	13%	22%
Nigeria	6%	8%	10%	9%	12%
Rwanda	12%	15%	15%	18%	25%
Senegal	21%	17%	14%	15%	19%
Swaziland	6%	9%	10%	9%	16%
Tanzania	17%	24%	20%	22%	18%
Zambia	2%	5%	6%	5%	13%
Zimbabwe	6%	6%	5%	7%	14%
Asia and the Middle East					
Bangladesh	21%	18%	16%	13%	10%
Cambodia	14%	14%	12%	17%	31%
Egypt	53%	61%	64%	72%	73%
India	90%	89%	88%	83%	71%
Indonesia	14%	17%	17%	19%	29%
Jordan	56%	59%	57%	60%	69%
Nepal	54%	64%	66%	64%	50%
Pakistan	50%	45%	47%	39%	40%
Philippines	33%	38%	39%	40%	41%
Latin America and the Caribbean					
Bolivia	25%	33%	39%	44%	51%
Colombia	61%	62%	61%	62%	59%
Dominican Republic	52%	58%	65%	62%	62%
Guyana	24%	27%	29%	27%	26%
Haiti	25%	18%	19%	11%	10%
Peru	18%	26%	27%	34%	34%

Abbreviations: LAPMs, long-acting and permanent methods; Q, quintile.

[a] Study sample is limited to women of reproductive age who have ever been sexually active, who were not pregnant at the time of the survey, and who reported current use of a modern contraceptive method.

Source: Demographic and Health Surveys (various years).

quintiles. Finally, in Cameroon, Colombia, and Guyana, there appeared to be no relationship between wealth and type of method used.

Multivariate Analysis

We used multivariate logistic regression to control for a vector of potentially confounding covariates: age, number of living children, education, employment/occupation, marital status, and urban/rural residence. Table 5 shows the adjusted odds ratios from the multivariate regressions, organized by region.

In Bangladesh and India (and possibly Haiti), poorer women were more likely than wealthier women to use LAPMs than short-acting methods.

The 30 countries exhibited 1 of 4 patterns:

- A consistently positive, statistically significant relationship across all 5 wealth quintiles, such that wealthier women were more likely to use LAPMs and women in the lowest wealth quintiles were more likely to use short-acting methods.
- A positive association between wealth and LAPM use, *only* when comparing the top 1 or 2 wealthiest quintiles with the poorest quintile, and no significant difference in LAPM use between the lower wealth quintiles and the poorest quintile. That is, women from the lowest 2 or 3 quintiles showed no systematic preference for LAPMs or short-acting methods, and the wealth effect was apparent only in the highest wealth quintiles.
- No significant differences in LAPM use, or a significant difference only when comparing the lower or middle quintiles with the poorest quintile. In these countries, wealth did not appear to be associated positively or negatively with LAPM use.
- A significant negative association between wealth and LAPM use, such that wealthier women were more likely to use short-acting methods and poorer women were more likely to use LAPMs.

These patterns varied by region. In **sub-Saharan Africa**, as noted in the unadjusted analysis, 10 of the 15 countries analyzed showed statistically significant and positive relationships overall between wealth and LAPM use. In 3 of these 10 countries (Lesotho, Nigeria, and Zambia), women from almost all upper quintiles were significantly more likely to use LAPMs than women in the poorest quintile. In 6 of the 10 countries (Kenya, Malawi, Namibia, Rwanda, Swaziland, and Zimbabwe), a significant relationship was found only when comparing the top 1 or 2 wealth quintiles with the poorest quintile. Tanzania showed a significant positive association only when comparing the second and fourth quintiles. In the other 5 sampled sub-Saharan African countries (Burundi, Cameroon, Ethiopia, Madagascar, and Senegal), no statistically significant relationship was found when comparing the poorest quintile with any other quintile.

In **Asia and the Middle East**, a positive and statistically significant relationship between wealth and LAPM use was noted in 5 countries: Cambodia, Egypt, Indonesia, Jordan, and Nepal. In 3 of those countries—Cambodia, Indonesia, and Jordan—the relationship was significant only for women in the wealthiest quintile. In 2 other countries—Bangladesh and India—a significant *negative* relationship was found: in those countries, as discussed below, poorer women were more likely than wealthier women to use LAPMs rather than short-acting methods. No association was found for Pakistan or the Philippines.

Finally, in **Latin America and the Caribbean**, 5 of the 6 countries showed positive and statistically significant associations between wealth and LAPM use, mostly across all wealth quintiles. Haiti was the exception—although the association was not statistically significant, the average odds ratio was around 0.54, suggesting that women from the lowest quintile may be more likely than wealthier women to use LAPMs than short-acting methods, as in Bangladesh and India

There was wide variation in the magnitude of the outcome differences. Some countries showed a markedly larger likelihood of LAPM use for women from the wealthiest quintile. Four countries—Bolivia, Lesotho, Namibia, and Zambia—had odds ratios greater than 3 when comparing outcomes between the wealthiest quintile and the poorest quintile, showing the strongest (adjusted) association between wealth and LAPM use.

DISCUSSION

Using recent data from 30 countries in 3 regions, we examined patterns of use of LAPMs and short-acting methods in relation to household wealth. Our analyses showed a general pattern of greater LAPM use by wealthier women: 20 of the 30 countries showed some pattern of positive and statistically significant association between wealth and LAPM use. However, for 10 of those 20 countries, this pattern was limited to a comparison between the wealthiest 1 or 2 quintiles and the poorest quintile; there was no significant difference

TABLE 5. Adjusted Odds Ratios for Relationship Between Wealth Quintile and Use of LAPMs vs. Short-Acting Methods Among Study Sample of Modern Method Users[a]

Country	Q1 (Poorest)	Q2	Q3	Q4	Q5 (Wealthiest)	N
sub-Saharan Africa						
Burundi	1.00	0.59	0.81	0.98	0.99	1,075
Cameroon	1.00	2.04	2.13	2.69	2.70	2,454
Ethiopia	1.00	1.47	1.07	1.04	0.81	2,793
Kenya	1.00	0.96	1.21	1.35	2.61**	2,225
Lesotho	1.00	2.53*	2.46+	5.24**	6.59**	2,489
Madagascar	1.00	0.79	0.70	1.31	1.21	3,889
Malawi	1.00	0.99	1.21	1.30+	1.74**	7,449
Namibia	1.00	1.02	1.25	2.37**	5.08**	4,318
Nigeria	1.00	1.65	2.17*	2.27*	2.28*	3,117
Rwanda	1.00	1.22	1.38+	1.57*	2.02**	3,410
Senegal	1.00	0.74	0.48*	0.56	0.83	1,250
Swaziland	1.00	1.55	1.63	1.34	1.86	1,837
Tanzania	1.00	1.62+	1.37	1.94*	1.48	2,091
Zambia	1.00	3.31*	4.51**	4.71**	11.34**	1,790
Zimbabwe	1.00	1.04	0.72	1.05	1.80+	3,690
Asia and the Middle East						
Bangladesh	1.00	0.80*	0.69**	0.59**	0.54**	8,755
Cambodia	1.00	0.96	0.78	0.99	1.76*	3,993
Egypt	1.00	1.29**	1.42**	1.97**	1.94**	8,524
India	1.00	0.87*	0.83**	0.77**	0.53**	45,224
Indonesia	1.00	1.15	1.05	1.04	1.41*	16,963
Jordan	1.00	1.09	1.04	1.12	1.58+	3,831
Nepal	1.00	1.74**	1.97**	2.33**	1.84**	4,194
Pakistan	1.00	0.85	1.05	0.88	1.06	3,532
Philippines	1.00	1.18	1.05	1.08	1.20	3,024
Latin America and the Caribbean						
Bolivia	1.00	1.80**	2.23**	2.72**	3.19**	4,375
Colombia	1.00	1.34**	1.45**	1.70**	1.68**	27,532
Dominican Republic	1.00	1.52*	1.74**	1.40+	1.84**	5,026
Guyana	1.00	1.27	1.50	1.50	1.53	1,541
Haiti	1.00	0.55+	0.58	0.52	0.54	1,874
Peru	1.00	1.42*	1.72**	2.65**	2.23**	13,770

Abbreviations: LAPMs, long-acting and permanent methods; Q, quintile.

[a] Study sample is limited to women of reproductive age who have ever been sexually active, who were not pregnant at the time of the survey, and who reported current use of a modern contraceptive method.

+ $P < .10$, * $P < .05$, ** $P < .01$

Source: Demographic and Health Surveys (various years).

between usage by women from the poorest households and women from middle-income households. **These findings suggest that in many countries the income threshold is high**—for reasons that remain to be explored.

The remaining 10 countries analyzed demonstrated 2 different patterns. No significant relationship was found between wealth and type of method used in 8 countries: Burundi, Cameroon, Ethiopia, Madagascar, and Senegal; Pakistan and the Philippines; and Haiti. The other pattern was a significant inverse (negative) relationship between wealth and LAPM use in Bangladesh and India: poorer women were more likely to use LAPMs than wealthier women, and wealthier women were more likely to use short-acting methods than poorer women. This inverse pattern may reflect a different policy environment in these countries, where supply-side and demand-side incentives, reinforced by community mobilization, contribute to high uptake of LAPMs among the poor. In Bangladesh, for example, LAPM service delivery has been prioritized by the government and is backed with a large budget, including funds for client compensation and provider fees.[21] In India, female sterilization is the leading method of contraception, accounting for two-thirds of all current contraceptive use and about three-quarters of all modern method use[22]; it is provided free of charge in the public sector[23] and has a long history of government promotion as the primary method of family planning.[24] Although the Indian government ceased to announce national sterilization targets in 1996, there is some evidence that targets and reimbursements to cover costs such as travel expenses are still used to encourage female sterilization.[25,26]

Inequity in access to LAPMs may be an issue in many developing countries.

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A medical intern in Bangladesh inserts a contraceptive implant in a client's arm under supervision while other interns watch and learn.

While our study did not analyze use of specific LAPMs (e.g., IUDs vs. female sterilization) by wealth, we can assume the patterns are generally similar to regional patterns among all contraceptive users. For example, in Latin America and the Caribbean, out of a modern contraceptive prevalence rate (mCPR) of 58.1%, almost one-third (31.4%) is from LAPMs, with a strong presence of female sterilization and, to a lesser extent, IUDs.[27] In countries from Asia, the Middle East, and North Africa, where the mCPR is 51.7%, LAPMs contribute 14.3% to that mCPR, with 8% of women using IUDs and approximately 5% using sterilization. In countries from sub-Saharan Africa, mCPR is 26.5% and overall LAPM use is low at less than 5%, with less than 2% of women using implants and less than 2% using sterilization.

The positive relationship between wealth and LAPM use is an issue of concern as it may indicate that there is inequity in access to LAPMs in many developing countries. These differentials may be due to several reasons and have different remedies. Poor women may be less likely to use LAPMs due to financial barriers, which could be addressed by voucher programs that subsidize the costs of LAPM services. Similarly, contracting-out through NGOs could improve access to these methods so that women do not have to pay full price through private providers and facilities. Geographic barriers may be an issue for poor women, which is more difficult to address. This may require more concerted efforts to provide LAPMs through high-quality, mobile outreach services in poor areas.[28] In addition, the expansion of social franchising programs can remove geographic barriers by training providers in hard-to-reach areas in the provision of LAPMs, while ensuring they have needed supplies and quality standards.[29,30] Lack of information among women and/or their spouses may lead couples to be less likely to use LAPMs. Addressing this issue would require a concerted effort by both the public and the private sectors, so that messages focus on the benefits of these methods rather than on the specific type of provider. For example, in Jordan, a private-sector health project funded by the United States Agency for International Development (USAID) supported a behavior change communication campaign that focused on the benefits of using IUDs. The project demonstrated changes in knowledge, attitudes, and intention to use IUDs without focusing on the source of the

method (public versus private sector).[31] Addressing the problem of lack of information about LAPMs also requires that community health workers who do not provide the methods be conversant in the benefits and referral systems so that women and couples can access the full range of methods that helps them achieve their reproductive goals. It also may be possible that poorer women simply have different preferences. Follow-up formative research and intervention testing is required to disentangle the reasons we find this strong association across a large number of countries.

Limitations

The analysis has several limitations. First, the DHS data do not provide specifics such as location and proximity to services, which influence access to methods. These characteristics may be correlated with both household wealth and contraceptive choice. Second, for the purposes of this analysis we have grouped all types of LAPMs together due to the issue of sample size; however, we might find differing patterns for long-acting *reversible* methods (IUDs and implants) versus *permanent* methods (male and female sterilization). Third, in a few countries, the use of any modern method was low across all wealth quintiles, but especially in the lowest wealth quintiles; in those countries (Nigeria is a good example), we found no statistical significance across the key wealth coefficients, but that may be due to small sample size of women from those quintiles using modern methods. Fourth, this analysis provides a snapshot of current behavior; it does not capture change over time. Despite its limitations, this paper demonstrates a strong, positive relationship between wealth and LAPM use in many developing countries that deserves further exploration.

CONCLUSION

In most developing countries, wealthier women are more likely than poorer women to use long-acting and permanent methods of contraception than short-acting methods. Notable exceptions are Bangladesh, India, and possibly Haiti, where poorer women are more likely to use long-acting and permanent methods than wealthier women, perhaps reflecting a different policy environment than in other countries.

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ORIGINAL ARTICLE

Role of Social Support in Improving Infant Feeding Practices in Western Kenya: A Quasi-Experimental Study

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Fathers and grandmothers who participated in separate nutrition dialogue groups supported mothers to improve infant feeding practices including dietary diversity, food consistency, and use of animal-source foods. Future studies should explore using a family-centered approach that engages mothers together with key household influencers.

ABSTRACT

Background: We designed and tested an intervention that used dialogue-based groups to engage infants' fathers and grandmothers to support optimal infant feeding practices. The study's aim was to test the effectiveness of increased social support by key household influencers on improving mothers' complementary feeding practices.

Methods: Using a quasi-experimental design, we enrolled mothers, fathers, and grandmothers from households with infants 6–9 months old in 3 rural communities (1 intervention arm with fathers, 1 intervention arm with grandmothers, and 1 comparison arm) in western Kenya. We engaged 79 grandmothers and 85 fathers in separate dialogue groups for 6 months from January to July 2012. They received information on health and nutrition and were encouraged to provide social support to mothers (defined as specific physical actions in the past 2 weeks or material support actions in the past month). We conducted a baseline household survey in December 2011 in the 3 communities and returned to the same households in July 2012 for an endline survey. We used a difference-in-difference (DiD) approach and logistic regression to evaluate the intervention.

Results: We surveyed 554 people at baseline (258 mothers, 165 grandmothers, and 131 fathers) and 509 participants at endline. The percentage of mothers who reported receiving 5 or more social support actions (of a possible 12) ranged from 58% to 66% at baseline in the 3 groups. By endline, the percentage had increased by 25.8 percentage points (P=.002) and 32.7 percentage points (P=.001) more in the father and the grandmother intervention group, respectively, than in the comparison group. As the number of social support actions increased in the 3 groups, the likelihood of a mother reporting that she had fed her infant the minimum number of meals in the past 24 hours also increased between baseline and endline (odds ratio [OR], 1.14; confidence interval [CI], 1.00 to 1.30; P=.047). When taking into account the interaction effects of intervention area and increasing social support over time, we found a significant association in the grandmother intervention area on dietary diversity (OR, 1.19; CI, 1.01 to 1.40; P=.04). No significant effects were found on minimum acceptable diet.

Conclusion: Engaging fathers and grandmothers of infants to improve their knowledge of optimal infant feeding practices and to encourage provision of social support to mothers could help improve some feeding practices. Future studies should engage all key household influencers in a family-centered approach to practice and support infant feeding recommendations.

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INTRODUCTION

Is family support as important to young child feeding as an individual mother's caregiving knowledge alone? Many behavior change approaches focus on improving knowledge gaps of mothers and pay little attention to ecological and social factors that may negatively affect a mother's infant feeding behaviors.[1]

Household members often exert social influences on a mother's adoption of optimal infant feeding practices.

Yet household members, including fathers and grandmothers, exert social influences—sometimes negative because of cultural norms—on a mother's adoption of optimal infant feeding practices.[2–5] Programs that include innovative approaches to engage these key influencers to provide positive social support could be more successful in changing behaviors to improve maternal and child nutrition than programs that focus only on improving mothers' knowledge.

Malnutrition is a contributing factor in 45% of under-5 child deaths.[6] In developing countries, more than 3.5 million children under 5 years of age die each year with undernutrition as an underlying cause. Optimal infant and young child feeding (IYCF) practices contribute greatly to child nutrition. Such optimal practices include exclusive breastfeeding for 6 months and appropriate complementary feeding from 6 months through at least 2 years of age. Some programs have focused on promoting optimal breastfeeding and have shown success, but there has been less programmatic focus on feeding young children from 6 months of age.[7] Appropriate complementary feeding includes timely initiation of solid/semisolid foods from 6 months of age; increasing the quantity, density, and variety of foods; increasing the frequency of feeding as the child gets older; responsively feeding the child; and ensuring hygienic preparation and feeding of foods. Incorporating animal-source foods in a child's diet can also help ensure adequate intake of protein, iron, and vitamin A. Appropriate complementary feeding can prevent 6% of all deaths in children 6 to 23 months of age.[8]

We used peer support groups to engage grandmothers and fathers in rural Kenya to support optimal infant feeding practices.

Kenya is one of the 36 countries that carries 90% of the global burden of stunting.

In Kenya, high rates of childhood malnutrition began to gradually fall between 2009 and 2014.[9,10] Stunting decreased from 35% to 26%, and wasting from 7% to 4%.[10] Nevertheless, Kenya is one of the 36 countries that carries 90% of the global burden of stunting.[6] Contributing to Kenya's high rates of malnutrition are poor IYCF practices. The 2008-09 Demographic and Health Survey (DHS) found that in western Kenya, only 71% of children aged 6 to 23 months were fed the recommended minimum number of times for their age and breastfeeding status, and about 50% of young children were fed adequately diverse diets.[9] More recent data from the 2014 DHS show that only 21% of children 6 to 23 months old are consuming the minimum acceptable diet in Kenya.[10] In addition, only 43% of children aged 6 to 35 months consume iron-rich foods.[11]

With high malnutrition rates in Kenya and poor infant feeding practices, community nutrition interventions, and specifically interventions to increase family support for optimal nutrition practices, could help address these problems. The influence of fathers and grandmothers on IYCF practices is well documented in the literature,[2,4,12,13] and there have been multiple calls to engage these key influencers in maternal and child health (MCH) programs globally[14] and for IYCF in East Africa.[12,15-18]

Gottlieb argued nearly 3 decades ago that social support provides a means to either diffuse information or maintain social norms.[19] Our formative research found that caregivers, fathers, and grandmothers typically lack up-to-date knowledge of optimal IYCF practices, particularly during the complementary feeding period,[20-22] which is consistent with other research in western Kenya.[18] Other researchers have shown that fathers' and grandmothers' lack of support for child feeding is negatively associated with exclusive breastfeeding, diet diversity, meal frequency, and other complementary feeding practices.[17,23,24] There is also evidence that the engagement of grandmothers through group discussion, songs, and stories and of fathers through breastfeeding education and training and men's group activities can significantly improve IYCF and health behaviors.[25-28]

Employing a socioecological model, we used peer support groups to engage grandmothers and fathers in rural Kenya to support optimal infant feeding practices (Figure 1).[29,30] The specific objective of our study was to test the effectiveness of an intervention focused on increasing social support by fathers and grandmothers to improve mothers' complementary feeding practices in rural communities in western Kenya. The hypothesis guiding this study was that families participating in activities to engage grandmothers or fathers in nutrition would be more likely to adopt better IYCF practices.

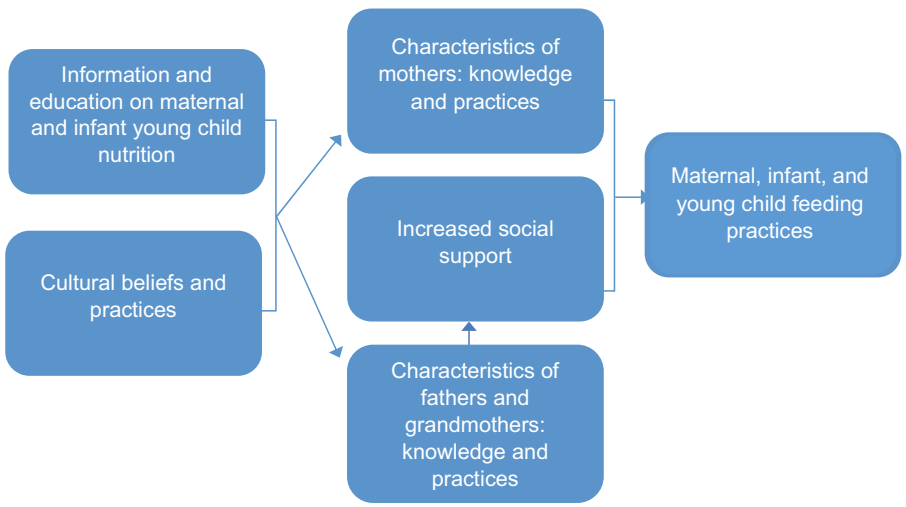
METHODS

Study Design

We conducted a multi-phased, multi-method study between June 2010 and July 2012 (Figure 2), which included the following components:

- Qualitative **formative research** to understand nutrition knowledge and practices, social and cultural relations in the community, health and nutrition-related roles and responsibilities in

FIGURE 1. Conceptual Model of Social Support Provided to Mothers Affecting Maternal, Infant, and Young Child Nutrition Practices



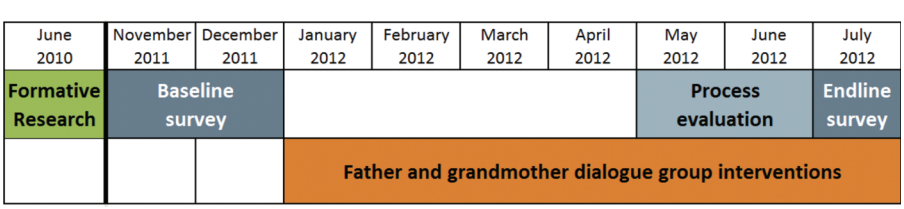
Cultural beliefs are mitigated by information and education on optimal nutrition practices. Provision of social support along with improved information and education of influencers (i.e., fathers and grandmothers) can impact maternal, infant, and young child feeding practices both indirectly by supporting mothers and directly by the influencers implementing optimal feeding practices themselves.

households, and social support. This formative research informed questionnaire development and intervention design.[20-23]

- Quantitative **baseline survey** on nutrition knowledge, practices, and social support.
- **Community-based interventions**, including dialogue groups with fathers and grandmothers, community mobilization (2 family bazaars and 5 fathers days at local clinics), and a process evaluation.
- Quantitative **endline survey** on nutrition knowledge and practices and social support.

This paper reports on the 2 quantitative surveys (baseline and endline), which constituted the impact evaluation. We used a quasi-experimental panel study design with a comparison group that included the survey of the same households. We also used pre- and post-intervention observations of fathers' and grandmothers' knowledge of infant feeding practices and provision of social support as

FIGURE 2. Study Timeline



Source: Thuita et al., 2015[31]

well as mothers' knowledge, practices, and receipt of social support.

Study Sites

Study sites were selected in 3 sub-locations in 3 districts of Vihiga County in western Kenya. Vihiga County is a densely populated rural area that produces tea and vegetables (commonly, maize and beans).[32] Interventions were implemented in 2 sub-locations: Kitagwa, Hamisi District, for fathers, and Viguru, Vihiga District, for grandmothers. Findings in these sub-locations were compared with those in Mambai, Emuhaya District, which did not receive any intervention.

The study sites were selected based on discussions with personnel from the Ministry of Health (MOH) and staff from the AIDS, Population and Health Integrated Assistance Plus (APHIA*plus*) Western Kenya Project funded by the United States Agency for International Development (USAID). Selection criteria included the presence of a functional community health unit and APHIA*plus* Western Kenya community-level activities. A functional community health unit is comprised of an employed community health extension worker (CHEW) who works out of a health center or dispensary and supervises a group of volunteer community health workers (CHWs). These CHWs form community health committees and elect their leaders. In functional units, CHWs and committees are actively providing and overseeing community health surveys.

Subsequent baseline survey findings showed that the 3 areas were similar culturally and socially, as well as in regard to residents' livelihood activities. The comparison area, Mambai, is approximately 35 km from the intervention areas and had a low likelihood of being affected by spillover from the study sites. A full description of the study design and behavior change interventions is provided elsewhere.[31,33]

Study Participants

We followed 3 different groups of study participants from the 3 sub-locations:

- Mother/father pairs (intervention group 1 in Kitagwa)
- Mother/grandmother pairs (intervention group 2 in Vigulu)
- Mother/grandmother or mother/father pairs were interviewed but with no intervention (comparison area in Mambai)

We conducted pre- and post-intervention observations of the 3 groups. We selected only households that were willing to participate and that had a child between 6 and 9 months of age. We hypothesized that the 2 intervention groups would report greater social support from the fathers and grandmothers who were engaged, resulting in greater improvements in mothers' complementary feeding practices, than in the comparison group.

Ethics Approval

The study was approved by the PATH Research Ethics Committee and the Kenyatta National Hospital/University of Nairobi Ethics and Research Committee. Research assistants reviewed informed consent protocols in the local language or in Kiswahili with the study participants and secured verbal consent before conducting interviews. The research assistants signed a standardized statement that they had followed the protocol for each interview.

Formative Assessment

Prior to the intervention, the study team conducted a literature review and a qualitative formative assessment to understand the maternal and child nutrition knowledge and practices of mothers, fathers, and grandmothers.[20,22] The formative assessment included separate focus group discussions with fathers and grandmothers of children under 2 years of age. Key informant interviews were conducted with community and religious leaders, MOH officers, CHEWs, and women's group leaders, to explore culturally relevant ways to engage fathers and grandmothers in nutrition interventions.[22]

Intervention

Using the findings from the formative research, we designed key messages for fathers and grandmothers in households in western Kenya. As per World Health Organization (WHO) and Kenya government infant feeding guidelines,[34,35] messages focused on complementary feeding practices, appropriate consistency and variety of foods to be fed to infants (6 to 23 months), age-appropriate meal frequency, and the need for animal-source foods in a child's diet. Diet diversity and frequent consumption of animal-source foods for pregnant and lactating women were also promoted. We emphasized social support actions that enabled mothers to get adequate rest and

seek health services, as well as the provision of foodstuff by fathers and grandmothers.

We used peer dialogue groups to facilitate behavior change among fathers and grandmothers by helping them gain new knowledge, share experiences and reflections, and apply communication and problem-solving skills that in turn would facilitate behavior change in mothers.[36,37] We used existing volunteer multipurpose CHWs operating in the targeted communities and community health units to support the intervention. Each CHW covers 10 to 15 households. To enhance services to the communities, the government encourages development partners to work with CHWs in their sub-location. The CHWs in the 3 study areas conducted a census of households with children 6 to 9 months of age with paternal grandmothers living nearby. Based on the census, we identified and invited mothers, grandmothers, and fathers from a random selection of households in the intervention areas to participate in separate dialogue groups of 8 to 12 participants each. To clearly demonstrate the impact of knowledge and actions of grandmothers and fathers on feeding practices, mothers of the targeted communities were not engaged in dialogue group activities. In sum, 18 dialogue groups were formed, with 79 grandmothers participating in 10 groups in the Viguru sub-location and 85 fathers participating in 8 groups in the Kitagwa sub-location.

The study team designed separate curricula for training fathers and grandmothers, protocols for training CHWs and dialogue group mentors, and dialogue group discussion guides.[38-41] Key messages were incorporated into the core intervention package.

Each dialogue group selected one of its members to serve as the group mentor. Mentors were not required to have a certain level of education, but most had at least primary school education. Volunteer CHWs assisted those mentors that were illiterate, for example, to complete monthly reports. Over a 5-day period, mentors were trained in nutrition and health, social support, intrafamilial communication, and gender norms (Box 1). During dialogue group mentor training, trainers modeled adult learning methods, including activities and techniques to encourage participation, experience sharing, and critical reflection by making connections to participant experiences, which mentors then practiced.[31] Dialogue group mentors were trained in the use of discussion guides and materials and group facilitation techniques.[38,40] The mentors received dialogue group facilitation guides with maternal and child nutrition content as well as step-by-step instructions for facilitating activities and probing questions to encourage discussion with their group members.[39,41] Before each meeting, mentors selected the discussion topic based on member interest and then facilitated discussions and activities with group members to promote their role supporting recommended nutrition practices, improving relationships and communication with mothers, and for fathers, reflecting on gender norms.[33] Group members also participated in role plays, problem solving activities, storytelling, and cooking demonstrations; grandmothers also composed songs promoting recommended practices.[32,33]

A volunteer CHW was assigned to each dialogue group to provide support and monitor group activities. Each dialogue group met twice a month for 6 months between January and June 2012. According to members' preferences, the father groups met in schools, churches, or sometimes homes, whereas the grandmother groups most often met in members' homes. A small allowance was given to each participant to cater for tea during group meetings (approximately US$1 per meeting, or $2 per month). (The government recommends giving a maximum of $20 per month as an allowance to CHWs engaged in enhanced community health activities.) The participants preferred to receive cash instead of refreshments.

Mentors facilitated dialogue groups using the discussion guides and associated materials.[39,41]

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A father in western Kenya feeds his child. Household members such as fathers and grandmothers often exert social influences on a mother's adoption of optimal infant feeding practices.

BOX 1. Training Topics

Grandmother Dialogue Groups	Father Dialogue Groups
• Role of grandmothers in infant and young child feeding and maternal nutrition • Overview of maternal and infant and young child nutrition and the local health situation • Eating during pregnancy and breastfeeding • Early initiation of breastfeeding • Exclusive breastfeeding • Complementary feeding • Preparing food safely • Responsive feeding • What to do when a child falls ill • Mother-to-child transmission of HIV • Infant feeding and HIV • Supporting mothers with HIV and their families (including referrals and promoting health seeking) • Facilitation skills • Effective family communication • Infant feeding beliefs and myths	• Understanding gender • Gender roles: behaviors and division of labor and child care in the home • Healthy and unhealthy relationships • Effective communication • Thinking about fatherhood • Family care • Poor child health "problem tree" • What your family eats • Understanding maternal and child nutrition • Supporting good infant feeding practices during the first 6 months of life • Complementary feeding • What to do when your child falls ill • Mother-to-child transmission of HIV • Infant feeding and HIV • Disclosure of HIV status (role plays) • Men, women, and caregiving • Men's role in health promotion

Grandmothers and fathers participating in dialogue groups learned about optimal maternal and young child nutrition practices and the roles they could play in supporting recommended practices.

Members learned about optimal maternal and young child nutrition practices and the role that fathers or grandmothers could play in supporting recommended nutritional practices. They learned and practiced new communication and behavioral skills to support optimal maternal, infant, and young child feeding in their homes and to improve conflict resolution within families.[39,41] Members were encouraged to share the information and provide support to mothers in appropriate ways. Dialogue groups fostered discussions in which members shared their experiences and strategies to promote improved nutrition practices in their households.[32] CHWs supported the dialogue group mentors and closely monitored the groups to assure the quality and accuracy of the information discussed. Each intervention area had 2 paid government CHEWs who oversaw the work of the CHWs and dialogue groups. To provide continual quality control, CHEWs held monthly review meetings with the CHWs and dialogue group mentors.

Other community mobilization activities were conducted in each study intervention area. These activities included 2 family bazaars (one in each intervention area) where fathers and grandmothers showcased what they were learning through songs, skits, dances, and testimonials. Representatives from the MOH in western Kenya, local leadership, religious leaders, and staff of development partners attended each bazaar along with community members. Dialogue group participants urged other community members to support the mothers to improve nutrition in their households. Mothers gave testimonials of improved familial relationships and increased provision of nutritious foods by their husbands and mothers-in-law. Food demonstration tents promoted dietary diversity coupled with a display of locally available highly nutritious foods for pregnant and lactating mothers and children under 2 years of age.

Five "Fathers Days" were held at local clinics to increase men's comfort and understanding of maternal and child health services. These Fathers Days were hosted by health facility staff and included health talks by male CHEWs. Fathers were encouraged to accompany their wives and children to the clinic and participate in growth monitoring sessions, and they were given opportunities to ask questions and receive advice from health staff.

There were no dialogue groups in the comparison area. Following the baseline survey, mothers in all 3 locations received 1 home counseling visit from a CHW on maternal and child nutrition. At the end of the visit, the CHWs gave brochures with key messages to each mother in the sample. The mothers were surveyed at baseline and endline to assess any changes in their knowledge and practices that may have been positively influenced by grandmothers or fathers (see below).

Baseline and Endline Surveys

In December 2011, the study team conducted a household interview survey (baseline) in each of the 3 communities. Using the community census completed by CHWs to identify eligible households, we randomly selected 86 households from each of the 3 communities to achieve a final sample of 69 participants in each group. (Surveyed households were the same households that were included in the intervention and comparison groups.) At endline, we returned to the same households covered at baseline and interviewed those who were available.

Findings from the formative research guided the development of survey tools.[20-23] We developed separate tools for interviewing mothers, fathers, and grandmothers. We assessed knowledge and practices of mothers, fathers, and grandmothers in relation to breastfeeding and complementary feeding. In addition, we assessed the quantity of social support provided by grandmothers and fathers in all 3 communities as well as mothers' perceptions of the social support they received from fathers and grandmothers.

For the endline survey conducted in July 2012, research team members interviewed grandmothers, fathers, and mothers in their homes. These family members were from the same eligible households that were recruited at baseline. They assessed grandmothers' and fathers' knowledge and provision of social support as well as mothers' knowledge, infant feeding practices, and receipt of social support.

Measurement

Social Support Index

Social support is a multidimensional construct. In this study we included 2 domains of social support: receipt of social support (as reported by mothers only) and provision of social support (as reported by grandmothers and fathers).

An overall social support index was generated based on responses to questions about specific social support actions over a specified period of time (Box 2). Grandmothers and fathers were asked in the baseline and endline surveys whether they had provided any support actions to mothers. Mothers were asked about the support actions they had received from the grandmothers and fathers during the past 2 weeks. Based on the formative research and on previous research by the lead author in Nairobi, Kenya,[5,22] the index was initially categorized based on the total reported number of social support actions provided to mothers and the number of each of the following types of support:

- **Accompaniment:** In the past 2 weeks, accompanied the mother of the child to a clinic, community event, church meeting, or

BOX 2. Social Support Actions

Based on previous infant feeding research conducted in Kenya,[5,22] we included a number of questions in the baseline and endline questionnaires to assess social support provided to mothers of infants by the fathers or grandmothers of the infants. The questions comprised 9 key social support actions conducted for the mother in the 2 weeks preceding the study and 3 material support actions conducted in the past month, as follows.

Past 2 weeks:

1. Going to the market
2. Collecting firewood or fetching water
3. Washing clothes
4. Cooking food or making tea
5. Taking care or playing with the child while the mother rested for an hour
6. Bathing child when the mother was busy with other duties or away
7. Going to the farm or supervising farm workers
8. Talking with the mother about how the child is fed or growing
9. Giving the mother money to buy food for the family

Past month:

1. Buying milk for child
2. Bringing or giving meat for family
3. Bringing or giving fruits for family

women's group meeting (grandmothers only for the latter).

Social support provided to mothers could range from accompanying the mother to a clinic and helping with shopping to providing money to buy food.

- **Physical support:** In the past 2 weeks, provided help with shopping/marketing, collecting firewood, washing clothes, cooking food or making tea, playing or taking care of child for at least 1 hour, bathing child, or going to the farm.
- **Advice:** In the past 2 weeks, talked with the mother of the child about how the child is being fed or growing.
- **Financial support:** In the past 2 weeks, provided money to buy food.
- **Material support:** In the past month, bought milk, bought or gave meat, or bought or gave fruits for the family (mother and child).

For this study, we focused on the material, financial, and physical support actions that were more likely to be provided by both fathers and grandmothers. These actions are more dynamic than the other measures, which showed no variability between groups.

Complementary Feeding Practices

In this study, complementary feeding practices were dependent variables. We assessed knowledge and practices of complementary feeding for infants 6 to 9 months of age (baseline) and repeated the assessment for the same households when infants were 9 to 18 months old (endline). The discrepancies in ages (not exactly 6 months after the baseline) were due to the reported age by the mothers and not actual birth dates. We assessed the following practices:

- Consistency of foods regularly consumed
- Adherence to minimum acceptable diet, including feeding frequency and dietary diversity in the past 24 hours
- Consumption of animal-source foods in the past 7 days

Socioeconomic Index

We constructed a socioeconomic status (SES) index using information collected on durable asset ownership, household possessions (such as clock, radio, television, farm animals, and mobile phones), access to a sanitation facility, and source of water. Initial descriptive analyses were carried out for all of these variables, assessing means and frequencies to help inform decisions on which variables to include in the analysis. Factor analysis was then used to generate a wealth score, which was divided into 3 categories (lowest, middle, and highest).

Analytic Methods

Sample Size

The dietary diversity indicator was used for sample size computation. At the time of the study design (in 2009), preliminary data on infant feeding practices were gathered from the Kenya Demographic and Health Survey. Among children aged 6 to 23 months in Western Province, an estimated 25% received adequately diverse diets—defined as being fed foods from 4 or more food groups per day.[9] We hypothesized that the intervention areas would demonstrate an improvement of 30 percentage points in infant feeding practices, whereas the comparison area would demonstrate an improvement of 5 percentage points. Therefore, the expected proportions of young children with adequate dietary diversity within the intervention and comparison groups would be 54.7% and 29.7%, respectively. Using this information and assuming a 5% significance level and 80% power, we calculated that a sample size of 69 individuals per group would be required to detect a 25% difference between the intervention and comparison groups for a total sample of 483 participants. The sample size computation was done using EpiInfo version 3.5.1. We recruited a total of 7 groups, including 3 groups of mothers (1 for each site; total of 207 mothers); 2 groups of fathers (2 sites only; total of 138); and 2 groups of grandmothers (2 sites only; total of 138). The sample size was subsequently adjusted to 86 for each group (total 602) to accommodate an anticipated 20% loss to follow-up.

Data Analysis

The baseline analysis included a descriptive analysis of household characteristics and mother/infant characteristics by study site. Indicators for grandmothers, fathers, and mothers/infants were generated and compared across the sites using proportions, mean, or median. Comparisons were made using chi-square tests for categorical variables, and nonparametric tests (Mann-Whitney and Kruskal-Wallis tests) were used where the median was reported as a summary measure.

The impact of the intervention was evaluated using a difference-in-difference (DiD) approach (net difference) based on a community-level analysis.

This approach considers the difference between baseline and endline in the comparison group versus the difference between baseline and endline in the intervention groups. The DiD odds ratio (OR) is obtained by assessing the difference between the 2 differences. This approach eliminates the difference that may occur over time in the absence of interventions or differences that may be due to sample selection bias.[42,43] The significance of the observed DiD was assessed using logistic regression through interaction of study location (representing intervention group) and time period (i.e., baseline or endline). A logistic regression was used to determine if the quantity of social support actions (as reported by mothers) was associated with the minimum number of meals, minimum dietary diversity, and minimum acceptable diet, after adjusting for the study site. Significance levels were set at $P<.05$.

RESULTS

Characteristics of the Study Sample

The total sample size (of intervention and comparison group participants) for the baseline survey conducted in November 2011 was 554, comprising 258 mothers, 165 grandmothers, and 131 fathers. Because 45 participants (8.1%) were lost to follow-up, the endline survey, conducted in July 2012, included only 509 participants (Table 1). Those lost to follow-up were well under the expected 20% figure that was used to calculate sample size estimates.

Baseline characteristics of the study mothers were generally similar across all 3 locations (Table 2). The 3 groups differed significantly, however, for 3 variables: marital status (100% of the mothers in the father intervention area were married compared with 88% in the grandmother intervention area and 79% in the comparison area), mother's education (a larger percentage of mothers in the comparison group had completed primary and secondary education than in the intervention groups), and spouse's education (higher in the comparison group than in the intervention groups). Although these measures are highly correlated to SES, there were no statistically significant differences between the groups based on the more direct measure of SES.

Infant Feeding Practices

This section summarizes results related to the consistency and variety of foods fed to infants, the frequency of feeding, and the consumption of animal-source foods.

Food Consistency

Although solid foods that are thick in texture can provide a high density of nutrients in a small volume, caregivers often give infants cereals and porridges that are watered down to a level that is of little nutritional value, leading to poor growth.[34] When baseline study participants were shown 2 pictures of porridge on a spoon (one showing thick consistency and one showing thin) and asked to indicate which picture represented the usual

TABLE 1. Sample Sizes at Baseline and Endline, by Type of Participant

	No. of Participants							
	Mothers		Grandmothers		Fathers		Total	
Study Areas	Baseline	Endline	Baseline	Endline	Baseline	Endline	Baseline	Endline
Father intervention area (Kitagwa)	92	70	NA	NA	85	75	177	145
Grandmother intervention area (Viguru)	77	71	79	81	NA	NA	156	152
Comparison area (Mambai)	89	76	86	73	46	63	221	212
Total	**258**	**217**	**165**	**154**	**131**	**138**	**554**	**509**
Expected sample (69 participants/group)	207		138		138		483	

TABLE 2. Baseline Characteristics of Study Sample Mothers

	Father Intervention Area (Kitagwa) n = 92	Grandmother Intervention Area (Viguru) n = 77	Comparison Area (Mambai) n = 89	*P* Value
Age of mother, mean, years	27.2	27.5	26.5	.63
Sex of child is male, %	48.9	53.2	53.9	.77
Age of child, %				
6 months	37.0	31.2	29.5	.27
7 months	15.2	18.2	22.7	
8 months	26.1	16.9	15.9	
9 months	21.7	33.8	31.8	
Parity, %				
1	25.0	15.6	33.0	.14
2–3	39.1	40.3	34.8	
4+	35.9	44.2	32.9	
Marital status, %				
Married (ever)	100.0	88.2	78.7	.001
Single/never married	0.0	11.8	21.4	
Mother's education, %				
Primary completed	38.5	48.1	55.1	.001
Secondary completed	11.0	7.8	21.4	
Mother's occupation, %				
Subsistence farmer	34.8	46.1	30.6	.32
Homemaker (no outside work)	33.7	30.3	38.8	
Outside work	31.5	23.7	30.6	
Spouse's age, mean, years	32.9	33.2	33.4	.57
Spouse's education, %				
Primary completed	31.3	47.1	48.6	.03
Secondary completed	21.7	16.2	27.1	
Spouse's occupation, %				
Subsistence farmer	18.7	30.9	16.9	.09
Employed	81.3	69.1	83.1	
Socioeconomic status, %				
Lowest quartile	31.5	36.4	32.6	.83
Middle quartile	31.5	31.2	37.1	
Highest quartile	37.0	32.5	30.3	

consistency of solid foods given to their infant, about one-third of mothers in each of the 3 study areas indicated they gave foods of the appropriate consistency (Table 3). At endline, improvements were reported in all 3 study areas but more so in the father (68.1%) and grandmother (88.7%) groups than in the comparison group (45.8%). The reported increase between baseline and endline was 21.5 percentage points higher in the father group than in the comparison group (OR, 2.4; $P=.06$) and 44.0 percentage points higher in the grandmother group than in the comparison group (OR, 0.8; $P=.001$) (Table 3). Although the age of the child had increased from baseline to endline, and thus the child was more likely to receive thicker food at endline simply because the child was older, the difference in the increase between the mothers' responses to adequate food consistency in each of the intervention areas versus the comparison area was substantial and, for the mothers in grandmother group area, statistically significant.

Minimum Acceptable Diet

International standards for optimal infant feeding practices for children 6 to 9 months old include a minimum of 2 meals per day and dietary diversity that includes consumption of at least 4 food groups (out of 7). A minimum acceptable diet dictates that a child under 2 years that is currently breastfed consumes food with the minimum frequency and dietary diversity. In the 24 hours preceding the baseline survey, in all study areas, between 64% and 78% of mothers reported that their infants had received the recommended minimum number of meals, and between 45% and 48% of mothers reported that their infants had been fed at least 4 food groups (Table 3). After the intervention, there was virtually no change from baseline in any of the study groups in the percentage of mothers who reported feeding their child the minimum number of meals; the DiD values were not statistically significant in either of the intervention areas vs. the comparison area (Table 3). Although the percentage of mothers who reported providing their infant the minimum dietary diversity almost doubled between baseline and endline in each of the 3 groups, there was no statistically significant difference in the changes between either of the intervention areas and the comparison area (Table 3). Similarly, the percentage of mothers who reported providing the minimum acceptable diet (breastfeeding plus minimum number of meals and minimum dietary diversity) increased in each of the 3 groups between baseline and endline, but there was no statistical significance in the changes between the grandmother and comparison group and between the father and comparison group (Table 3).

Animal-Source Foods

Animal-source foods are a good source of protein, iron, and vitamin A, among other nutrients. Having animal-source foods at least 3 days a week would greatly support young child nutrition. At the start of the study, a very low percentage (10% to 14%) of mothers in any of the 3 groups reported that their children had received animal-source foods on 3 or more days in the 7 days prior to the baseline survey (Table 3). After the intervention, the percentage increased in each of the intervention areas (to 41% in the father group and 42% in the grandmother group) while it remained unchanged in the comparison group. In the father group, the increase from baseline to endline was 31.0 percentage points higher than in the comparison group (OR, 6.1; $P=.005$), and in the grandmother group, the increase was 27.4 percentage points higher than in the comparison group (OR, 4.1; $P=.03$) (Table 3).

Over time, a higher percentage of mothers reported giving their infants the appropriate food consistency in the father and grandmother intervention areas than in the comparison area.

Reported provision of animal-source foods increased significantly more in each of the intervention areas than in the comparison area.

Social Support

Almost all mothers (>95%) reported receiving some social support from grandmothers or fathers in all areas at baseline and endline (Table 4). At endline, the percentage increased to 100% in each intervention area while it dropped slightly in the comparison area (from 97% to 95%). The percentage of mothers who reported receiving 5 or more social support actions (of a possible 12 actions) ranged from 58% to 66% at baseline in the 3 groups. By endline, this percentage had increased in all 3 groups, but it had increased by 25.8 percentage points more in the father intervention group than in the comparison group (OR, 13.6; $P=.002$) and by 32.7 percentage points more in the grandmother intervention group than in the comparison group (OR, 18.4; $P=.001$) (Table 4).

In both the comparison area and the grandmother intervention area, almost all grandmothers (≥86%) reported providing some social support to the mothers of the children at baseline (Table 4). By endline, the percentage had increased by 8.4 percentage points more in the grandmother area than in the comparison area, but the difference was not statistically significant (OR, 2.9; $P=.36$). However, in the grandmother intervention area, the percentage of grandmothers reporting provision of 5 or more physical support actions increased from

Mothers' receipt of 5 or more social support actions increased significantly more over time in the father and grandmother intervention areas than in the comparison area.

TABLE 3. Changes in Mothers' Reported Infant Feeding Practices, by Intervention Area: Difference-in-Difference Analysis

	Father Intervention Area (Kitagwa)	Grandmother Intervention Area (Viguru)	Comparison Area (Mambai)	Father vs. Comparison Area			Grandmother vs. Comparison Area		
				DiD	OR	*P* Value	DiD	OR	*P* Value
Adequate consistency of food consumed, No. (%)									
Baseline	92 (32.2)	77 (30.3)	89 (31.4)						
Endline	70 (68.1)	71 (88.7)	76 (45.8)	21.5	2.4	.06	44.0	9.8	.001
Minimum no. of meals provided in past 24 hours, No. (%)									
Baseline	92 (71.7)	77 (77.9)	89 (64.0)						
Endline	70 (70.0)	71 (77.5)	76 (64.5)	-2.2	1.3	.59	-0.9	1.5	.47
Dietary diversity (≥4 food groups), No. (%)									
Baseline	92 (44.6)	77 (48.1)	89 (44.9)						
Endline	70 (85.7)	71 (81.7)	76 (72.4)	13.6	2.3	.11	6.1	1.5	.42
Minimum acceptable diet, No. (%)									
Baseline	92 (39.1)	77 (40.3)	89 (31.5)						
Endline	70 (58.6)	71 (60.6)	76 (46.1)	4.9	1.2	.71	5.7	1.2	.66
Animal-source foods consumed on ≥3 days in past 7 days, No. (%)									
Baseline	92 (9.8)	77 (14.3)	89 (11.2)						
Endline	70 (41.4)	71 (42.3)	76 (11.8)	31.0	6.1	.005	27.4	4.1	.03

Abbreviations: DiD, difference-in-difference; OR, odds ratio.

baseline to endline by 36.6 percentage points more than in the comparison area (OR, 4.4; $P=.002$), and the percentage of grandmothers reporting provision of 3 or more material support actions increased by 28.4 percentage points more than in the comparison area (OR, 5.3; $P=.003$) (Table 4).

The intervention seemed to have an even greater impact on fathers' reported provision of social support. The percentage of fathers reporting provision of 5 or more social support actions in the past week increased between baseline and endline by 37.1 percentage points more in the father group than in the comparison group (OR, 46.0; $P=.001$); provision of 5 or more physical support actions increased by 54.5 percentage points more (OR, 35.9; $P=.001$); and provision of 3 or more material support actions increased by 33.0 percentage points more (OR, 13.7; $P=.001$) (Table 4).

Association Between Social Support and Infant Feeding Practices

Table 5 reports the logistic regression analysis of the quantity of social support on infant feeding practices. As the number of social support actions increased in the 3 study groups, the likelihood of a mother reporting that she had fed her infant the minimum number of meals in the past 24 hours also increased significantly (OR, 1.14; CI, 1.00 to 1.30; $P=.047$) between baseline and endline. When comparing the grandmother intervention area with the comparison area (without specifically taking into account social support), a mother in the grandmother intervention area was significantly

TABLE 4. Changes in Reported Social Support, by Intervention Area: Difference-in-Difference Analysis

	Father Intervention Area (Kitagwa)	Grandmother Intervention Area (Viguru)	Comparison Area (Mambai)	Father vs. Comparison Area			Grandmother vs. Comparison Area		
				DiD	OR	*P* Value	DiD	OR	*P* Value
Mothers' Reported Receipt of Social Support From Child's Father or Grandmother									
No. of support actions received, median									
Baseline	5.0	5.0	5.0						
Endline	10.0	10.0	6.0	4.0	–	–	4.0	–	–
Any social support received, No. (%)									
Baseline	92 (97.8)	77 (94.8)	89 (96.6)						
Endline	70 (100.0)	71 (100.0)	76 (94.7)	4.1	–	–	7.1	–	–
5+ social support actions received, No. (%)									
Baseline	92 (65.2)	77 (58.4)	89 (66.3)						
Endline	70 (97.1)	71 (97.2)	76 (72.4)	25.8	13.6	.002	32.7	18.4	.001
Fathers' Reported Provision of Social Support to Child's Mother									
Any social support provided by fathers, No. (%)									
Baseline	85 (88.2)	NA	46 (84.8)						
Endline	75 (100.0)	NA	63 (90.5)	6.1	–	–	NA	NA	NA
5+ social support actions provided by fathers, No. (%)									
Baseline	85 (63.5)	NA	46 (54.3)						
Endline	75 (98.7)	NA	63 (52.4)	37.1	46.0	.001	NA	NA	NA
5+ physical support actions provided by fathers, No. (%)									
Baseline	85 (18.8)	NA	46 (21.7)						
Endline	75 (96.0)	NA	63 (44.4)	54.5	35.9	.001	NA	NA	NA
3+ material support actions provided by fathers, No. (%)									
Baseline	85 (38.8)	NA	46 (45.7)						
Endline	75 (96.0)	NA	63 (69.8)	33.0	13.7	.001	NA	NA	NA
Grandmothers' Reported Provision of Social Support to Child's Mother									
Any social support provided by grandmothers, No. (%)									
Baseline	NA	79 (86.1)	86 (94.2)						
Endline	NA	81 (97.5)	73 (97.3)	NA	NA	NA	8.4	2.9	.36
5+ social support actions provided by grandmothers, No. (%)									
Baseline	NA	79 (60.8)	86 (67.4)						
Endline	NA	81 (90.1)	73 (86.3)	NA	NA	NA	10.4	1.9	.27

Table 4 (continued).

	Father Intervention Area (Kitagwa)	Grandmother Intervention Area (Viguru)	Comparison Area (Mambai)	Father vs. Comparison Area			Grandmother vs. Comparison Area		
				DiD	OR	*P* Value	DiD	OR	*P* Value
5+ physical support actions provided by grandmothers, No. (%)									
Baseline	NA	79 (60.8)	86 (67.4)						
Endline	NA	81 (64.2)	73 (38.4)	NA	NA	NA	36.6	4.4	.002
3+ material support actions provided by grandmothers, No. (%)									
Baseline	NA	79 (10.1)	86 (23.3)						
Endline	NA	81 (72.8)	73 (57.5)	NA	NA	NA	28.4	5.3	.003

Abbreviations: DiD, difference-in-difference; OR, odds ratio.
(–): No values reported either because the indicator is reported in terms of median or because there is 100% response; in either case, logistic regression cannot be fitted.

Increasing positive social support by key household influencers improved some of the targeted infant feeding practices of mothers.

more likely to report having provided the minimum number of meals than a mother in the comparison area (OR, 5.07; CI, 1.56 to 16.50; $P=.007$). The effect in the father intervention area was not statistically significant (OR, 2.94; CI, 0.98 to 8.83; $P=.055$). When taking into account the interaction effects of increasing total social support actions over time and place (i.e., intervention area), there was no effect on the minimum number of meals.

Dietary diversity was not significantly associated with social support in general or with overall intervention area. However, when taking into account the interaction effects of increasing social support over time and place, there was a significant association in the grandmother intervention area (OR, 1.19; CI, 1.01 to 1.40; $P=.04$) (Table 5). Trends in the father intervention area, when taking into account the interaction effects of time and intervention area, were not statistically significant (OR, 1.15; CI, 0.98 to 1.34; $P=.08$). Results for the association between social support and minimum acceptable diet also were not statistically significant in either of the intervention areas. In this analysis, we did not look separately at the quality of social support (material or physical support), which may have had an impact on behaviors more so than the quantity of social support alone. A larger sample size may have strengthened these findings, and a longer intervention period may have increased the full adoption of these practices with current and subsequent children.

DISCUSSION

In summary, the results of our study demonstrate that increasing positive social support by key influencers such as fathers and grandmothers of infants improved some, but not all, of the targeted infant feeding practices of mothers. Fathers' and grandmothers' provision of material and physical support to mothers increased significantly more in the intervention areas than in the comparison area. The quantity of social support actions that mothers received from these household influencers also increased significantly more in the intervention areas than in the comparison area. The effect of increasing social support appears to be influenced by the quality of the social support (material or physical actions) not just the quantity (number of social support actions) provided to mothers.

We found a greater increase between baseline and endline in the percentage of mothers who reported feeding thicker and more diverse foods to their infants in the grandmother intervention area than in the comparison area, and greater improvements in reported feeding of animal-source foods in both the grandmother and father intervention areas. This highlights the difference between what mothers can practice based solely on education and information provided to them versus what they can practice when key influencers are encouraged to provide specific material and physical support actions to the mothers.

If major factors influencing women to adopt recommended IYCF practices are largely related to attitudes of and motivation from family members,[44-47] then it behooves us to engage grandmothers and fathers effectively. Although our study examined how engaging fathers and grandmothers separately could influence mothers' infant feeding

TABLE 5. Influence of Reported Social Support Received by Mothers on Infant Feeding Practices

	Min. No. of Meals		Min. Dietary Diversity		Min. Acceptable Diet	
	OR (CI)	*P* Value	OR	*P* Value	OR (CI)	*P* Value
No. of social support actions	1.14 (1.00, 1.30)	.047	1.07 (0.95, 1.21)	.24	1.06 (0.94, 1.20)	.32
Study site; ref: comparison area (Mambai)						
Father intervention area (Kitagwa)	2.94 (0.98, 8.83)	.055	0.4 (0.14, 1.15)	.09	0.95 (0.33, 2.71)	.92
Grandmother intervention area (Viguru)	5.07 (1.56, 16.50)	.007	0.38 (0.13, 1.13)	.08	1.00 (0.35, 2.90)	.99
Support * Father intervention area	0.85 (0.73, 1.00)	.045	1.15 (0.98, 1.34)	.08	1.04 (0.90, 1.21)	.58
Support * Grandmother intervention area	0.82 (0.70, 0.97)	.02	1.19 (1.01, 1.40)	.04	1.06 (0.91, 1.23)	.48

Abbreviation: OR, odds ratio.
The first row (number of social support actions) indicates the effect of increasing social support in all 3 study groups on the selected infant feeding practices. The second row (study site) compares the effect on infant feeding practices of the father intervention area vs. the comparison area and the grandmother intervention area vs. the comparison area, without specifically taking into account social support. The last set of rows (support * father intervention area; support * grandmother intervention area) takes into account the interaction effects of both intervention area *and* social support on infant feeding practices.

practices, designing programs that use a family-centered approach with behavior change interventions for mothers, fathers, *and* grandmothers will likely have a greater impact. Formative research findings should be used to identify contextually appropriate activities and messages. Moving from a woman-centered approach to a family-centered or household-based approach may help to reduce barriers and increase uptake and sustainability of optimal nutrition practices. A previous study from western Kenya found that familial relationships affected how women cared for their children and that infant feeding was part of the social context of the family.[48] Our formative research also confirmed the importance of fathers and grandmothers for key decision making related to child nutrition and their willingness to be better informed and engaged in nutrition-related activities at home.

Engaging grandmothers and fathers in public health programs is of growing interest to program managers and public health researchers,[2,12,49] yet this approach is not practiced widely, and how to do it effectively is rarely discussed in print. The dialogue approach goes beyond transmitting information to individuals to engaging participants in a discussion group that enables reflection, learning by doing, and resolving conflicts through improved communication techniques.[13] An intergenerational dialogue approach previously proved effective for improving child feeding practices in Malawi.[50] In Bolivia and Madagascar, using doable actions proved important for changing behaviors.[51] Our results suggest that a dialogue process can instigate key social support actions by fathers and grandmothers that are valuable to mothers. As support from fathers and grandmothers increased in our study groups, so did improvements in some infant feeding practices. We believe this is a promising intervention pathway for improving infant and child nutrition.

Our process evaluation data indicated that father and grandmother dialogue groups were well received and contributed to active engagement with mothers, especially by the fathers.[32] Successful engagement requires careful planning and collaboration with community leaders, local health authorities, and professionals so that communities and households have the institutional support needed to increase their control over their children's health. The community health unit structure can feasibly provide such institutional support.[33] Dialogue group mentors

reported that the dialogue approach promoted intra-household discussions about child nutrition among grandmothers, fathers, and mothers.[33] This process enabled these key influencers to give mothers physical and material support in an empathetic way that did not disempower women.[31,33] Richards et al. describe this social interaction as "intra-household bargaining," which they argue is an effective social determinant of health.[52]

In addition to specifying and measuring key social support actions, we specified and measured key infant feeding knowledge and actions that we wanted to change. This included frequency of feeding, diversity of feeding, minimum acceptable diets, and frequency of consuming animal-source foods. Reviews of complementary feeding interventions found that interventions that promoted animal-source foods showed a positive effect on nutritional status.[53,54] Although our intervention showed effectiveness in changing some infant feeding practices, it may need to also incorporate other activities where food security is a chronic issues, such as food production activities and support for establishment of kitchen gardens.

Strengths and Limitations

A clear strength of this study was the level of specificity, which enabled the researchers to more accurately measure the association between reported social support and certain infant feeding practices. However, the intervention time was short (6 months), and additional related topics covered during the dialogue groups may have diluted the impact on key infant feeding practices. The dialogue sessions covered many aspects of optimal infant feeding, maternal dietary practices, and HIV and nutrition over a short period of time. More time was spent on topics of great interest to the participants, such as HIV and nutrition.[31] It is quite likely that participants varied in their ability to remember details to enable them to encourage mothers to adopt new practices.

Our study has other limitations. First, including grandmothers and fathers in separate intervention arms may have weakened the impact on mothers. If we had a fully family-centered approach and engaged both grandmothers and fathers in the same intervention areas but in separate groups, the impact may have been greater. Findings from our process evaluation, however, suggest that this gender separation was a chief contributor to successful father engagement. Second, when measuring the association between social support and infant feeding practices, the aspects of both quality and quantity need to be examined. Third, the intervention and comparison groups were not completely comparable, and the differences may have diluted the impact of the intervention or confounded measures of the effect size. Due to data limitations, the differences between groups could not be factored into the logistic regressions for evaluating the impact of the intervention. Fourth, although we met the threshold for our sample size criteria, the size of the difference between the intervention and comparison groups was smaller than predicted. If we had a larger sample size, we may have been able to document an even greater impact. We may have been able to enroll a larger number of people in each household and community if we included both grandmothers and fathers in 1 intervention area instead of focusing on 1 group in 2 areas. Finally, the intervention ran for only 6 months. If more time were available, we may have had a greater impact on mothers' practices of feeding their next child. Infant feeding practices rapidly change within the first year of life. Attempting to affect these practices in a short period may require more intensive education and actions involving the entire family. After the initial intervention, there may be a greater impact on a mother's next child.

CONCLUSION

This proof-of-concept study has shown it is possible to move beyond a woman-centered approach to engaging key household influencers by providing education and encouraging "doable" actions to improve infant feeding practices. Engaging fathers and grandmothers who are key influencers of mothers' infant feeding practices can increase not only the quantity but the quality of support for recommended practices. It is premature, however, to recommend scaling-up this intervention at this time. Future studies should use a family-centered approach that engages all key family members (i.e., mothers, fathers, and grandmothers) in tailored activities to practice and support infant feeding recommendations.

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ORIGINAL ARTICLE

Meeting Postpartum Women's Family Planning Needs Through Integrated Family Planning and Immunization Services: Results of a Cluster-Randomized Controlled Trial in Rwanda

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Integrating contraceptive services into infant immunization services was effective, acceptable, and feasible without negatively affecting immunization uptake. Yet unmet need for contraception remained high, including among a substantial number of women who were waiting for menses to return even though, at 6 months or more postpartum, they were at risk of an unintended pregnancy. More effort is needed to educate women about postpartum return to fertility and to encourage those desiring to space or limit pregnancy to use effective contraception.

ABSTRACT

Objective: The primary objective of this study was to test the effectiveness of integrating family planning service components into infant immunization services to increase modern contraceptive method use among postpartum women.

Methods: The study was a separate sample, parallel, cluster-randomized controlled trial. Fourteen randomly selected primary health facilities were equally allocated to intervention (integrated family planning and immunization services at the same time and location) and control groups (standard immunization services only). At baseline (May–June 2010), we interviewed postpartum women attending immunization services for their infant aged 6 to 12 months using a structured questionnaire. A separate sample of postpartum women was interviewed 16 months later after implementation of the experimental health service intervention. We used linear mixed regression models to test the study hypothesis that postpartum women attending immunization services for their infants aged 6–12 months in the intervention facilities will be more likely to use a modern contraceptive method than postpartum women attending immunization services for their infants aged 6–12 months in control group facilities.

Results: We interviewed and analyzed data for 825 women from the intervention group and 829 women from the control group. Results showed the intervention had a statistically significant, positive effect on modern contraceptive method use among intervention group participants compared with control group participants (regression coefficient, 0.15; 90% confidence interval [CI], 0.04 to 0.26). Although we conducted a 1-sided significance test, this effect was also significant at the 2-sided test with alpha = .05. Among those women who did not initiate a contraceptive method, awaiting the return of menses was the most common reason cited for non-use of a method. Women in both study groups overwhelmingly supported the concept of integrating family planning service components into infant immunization services (97.9% in each group), and service data collected during the intervention period did not indicate that the intervention had any negative effect on infant immunization service uptake.

Conclusion: Integrating family planning service components into infant immunization services can be an acceptable and effective strategy to increase contraceptive use among postpartum women. Additional research is needed to examine the extent to which this integration strategy can be replicated in other health care settings. Future research should also explore persistent misconceptions regarding the relationship between return of menses and return to fertility during the postpartum period.

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INTRODUCTION

Healthy timing and spacing of pregnancies (HTSP) improves the health of both mothers and their children.[1-9] Risks of miscarriage, abortion, and maternal death are much greater when births are spaced less than 2 years apart.[2-5,8] Preterm birth, low birth weight, stillbirth, and newborn death are also more likely when births are spaced too closely together.[2,7-10]

Many postpartum women have unmet need for contraception.

Unmet contraceptive need is high for many postpartum women in sub-Saharan Africa; across 21 low- and middle-income countries, an estimated 61% of postpartum women had unmet contraceptive need.[11] The extended postpartum period, 12 months after childbirth, can be a time of particularly elevated risk for an unplanned pregnancy. Research indicates as many as 40% of women who state they intend to use a contraceptive method 0–12 months postpartum do not do so.[12]

To reduce unmet contraceptive need, postpartum women need access to family planning information and services, yet reaching these women in Africa is often difficult because many do not deliver within health facilities and even fewer attend routine postpartum visits. Most postpartum women do, however, seek routine health services for their infants, including for immunizations. Given their timing, infant immunization services provide an important opportunity to reach postpartum women repeatedly throughout the postpartum period.

Infant immunization services can be an effective contact point for reaching postpartum women with family planning services.

Health service integration has become an important topic of discussion in global health. Intuitively, moving from vertically administered services to an integrated platform has the potential to improve service delivery efficiency, access, and uptake. Infant immunization services, with their worldwide success, have been an important focus for many integration efforts.[14] A variety of maternal and child health services has been integrated into immunization services, including vitamin A supplementation, deworming, malaria prevention, nutrition, and HIV services, and there have been some efforts to integrate family planning with infant immunization.[14]

Although integrated family planning and infant immunization services are not new, limited evidence exists to support its effectiveness. One study in Togo (1994) demonstrated that a simple family planning referral message delivered during immunization services increased the number of family planning clients by over 50% without decreasing immunization service use.[15] A second study in rural Bangladesh (2001) showed that introducing integrated family planning and child immunization services increased contraceptive prevalence from 28% to 53%.[16] However, a more recent (2009–2010) cluster-randomized controlled trial in Ghana and Zambia that used screening and referral to family planning services demonstrated no increase in contraceptive method use among postpartum women attending infant immunization.[17] The remaining evidence to support the strategy is largely derived from observational studies or programmatic experiences.[18,19]

The situation in Rwanda reflects that of many other countries in the region. Despite improvements in health care access and use in the past decade, facility-based deliveries and postpartum care remain underutilized. Nearly one-third of women in Rwanda deliver their babies at home, and only one-fifth receive any postpartum care.[20] However, Rwanda has one of the most successful infant immunization programs in Africa.[21] According to 2010 Demographic and Health Survey estimates, 86% of children under 2 in Rwanda received all recommended vaccinations within their first year.[20]

With high immunization attendance levels, immunization services could be an effective contact point for reaching postpartum women with family planning services in Rwanda. As such, we developed an intervention, using the Health Belief Model (HBM), to integrate elements of family planning services into infant immunization. The HBM model is one of the most widely used conceptual frameworks guiding the design of health behavior interventions and has been applied to sexual risk behaviors and contraceptive behaviors in a variety of populations including populations in sub-Saharan Africa.[22] Given the dearth of existing evidence, this study was designed to test the effectiveness of this enhanced offering of family planning services during infant immunization visits to increase contraceptive method use among postpartum women.

METHODS

Study Design

The study was a separate sample, parallel, cluster-randomized controlled trial of a health services intervention designed to improve family planning use, thus reducing unmet contraceptive need among postpartum women attending public health care facilities in Rwanda. A cluster-randomized design was selected due to the design of the experimental intervention, which was delivered to both individuals and in group educational settings. Fourteen public

primary health care facilities were randomly selected from a national sampling frame then randomly allocated to intervention or control groups of equal size (7 intervention facilities and 7 control facilities). A structured questionnaire was administered to postpartum women attending immunization services for their infant ages 6 to 12 months in all 14 study facilities during the baseline period (May–June 2010), immediately followed by intervention implementation in intervention group facilities (beginning in July 2010).

After baseline data were collected, intervention group immunization and family planning providers attended a 3-day training on postpartum family planning and the use of a screening tool to assess pregnancy risk among postpartum women. Providers in the control facilities received no training and continued to deliver services as usual. The endline questionnaire was administered to a separate sample of postpartum women 16 months after the beginning of intervention implementation.

Cost data were extracted from financial reports and confirmed with project personnel. To ensure intervention implementation fidelity, a study staff and a district Ministry of Health officer carried out quarterly supportive supervision visits.

Intervention Description

The primary goal of the intervention was to increase uptake of family planning methods among postpartum women, thus reducing unmet contraceptive need. This goal was to be accomplished through enhanced components of family planning services delivered during infant immunization services designed to improve access to family planning services and to improve knowledge with regard to postpartum family planning. The intervention included 4 distinct yet interrelated components that were delivered to women attending all infant immunization services (i.e., at 6, 10, and 14 weeks and 9 months post-delivery).

1. **Concise messages delivered during group education sessions.** Immunization service providers routinely provide education to women attending immunization services on a variety of health topics. The delivery of such information did not change in intervention facilities, but the content on family planning was strengthened and delivered at each session, in addition to any other information being delivered. In intervention facilities, providers included the following information in all pre-immunization group education talks in the facility:
   - The risk of becoming pregnant after delivery of a baby if a woman is sexually active and not using a modern contraceptive method (which included the Lactational Amenorrhea Method [LAM] for women less than 6 months postpartum), even if she is breastfeeding or if her menses had not returned
   - The benefits of family planning to help women and their families time and adequately space their pregnancies for the health of the mother and her baby
   - Safe and effective contraceptive options for women to use during the postpartum period, even if breastfeeding
2. **A simple brochure in the local language (Kinyarwanda) distributed during group education.** The brochure contained messages about LAM, return to fertility and pregnancy risk during the postpartum period, the benefits of spacing pregnancies by at least 2 years, and contraceptive options for postpartum women. Brochures (Supplementary Material 1) were provided to women so they could share the information with their husbands.
3. **Individual screening of all women attending infant immunization services by the immunization provider.** An immunization provider met one-on-one with each mother, during which the provider asked the mother about the 3 LAM criteria to screen her for current risk of becoming pregnant. The provider also offered a brief counseling message

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A woman attending infant immunization services in Rwanda also receives screening for family planning services.

depending upon risk classification and referral to family planning services for those currently or soon-to-be at risk of pregnancy. Providers were trained on a job aid (Supplementary Material 2) to assist the screening and counseling process. The screening questions were asked either as the baby received his/her immunization or by a separate provider while women were waiting for their baby's immunization.

4. **Convenient offer of family planning services to women attending immunization at the same facility and on the same day as immunization services**. A family planning provider was available to receive clients as they were referred from immunization for family planning information/counseling and to initiate the woman's method of choice, per the facility's family planning service standard. No changes were made to the way in which family planning services were delivered with the exception of timing of availability; however, family planning service providers did receive reinforcement on the safety and appropriate timing of modern contraceptive methods for use by postpartum women for both those who did breastfeed and for those who did not.

The brochure and key messages delivered through group education were adapted from the Extending Health Service Delivery (ESD) project and the Access to Clinical and Community Maternal, Neonatal and Women's Health Services (ACCESS-FP) project, both funded by the United States Agency for International Development (USAID).[23-25] In addition to improving basic knowledge about postpartum family planning, the materials were also informed by the Health Belief Model. Specifically, the intervention was designed to act on women's perceptions, including perceived severity of an unplanned pregnancy, perceived susceptibility to an unplanned pregnancy if sexually active and not using a contraceptive method, perceived benefits of contraception to prevent an unplanned pregnancy, and perceived barriers to accessing family planning services (Figure 1).

To accommodate the differing staffing and physical structure of health centers, each facility was asked to determine the most appropriate way to structure their integrated service delivery. We considered this ability to structure the service delivery according to the local context as an important element for sustainability. All facilities opted to offer family planning services concurrently with immunization so that once a woman was finished with her infant's immunization she could see the family planning provider directly.

In addition to these 4 main intervention components, District Health Managers (DHMs), who already conducted routine supervision visits to health care facilities, were accompanied by a study staff member to observe the integrated service delivery on a quarterly basis. The DHM and study staff used a checklist designed by the study to assess the quality of the services being offered and to reinforce activities when necessary. This information was also used by the study to ensure the intervention was being delivered as intended and to take corrective action if necessary.

To put the intervention in place, immunization service providers, family planning services providers, and facility supervisors from intervention group facilities participated in a 3-day training session. This training covered essential postpartum family planning topics and the intervention components, in addition to a general refresher on family planning methods that the Ministry of Health opted to add. Training materials were also adapted from the ESD and ACCESS-FP materials. During the course of the study, it was observed that several trained providers had been transferred out of some of the intervention facilities leaving few or no providers who had undergone the initial training, so a 1-day refresher training on the intervention was carried out in each of the 7 intervention facilities. Health care providers and facilities in

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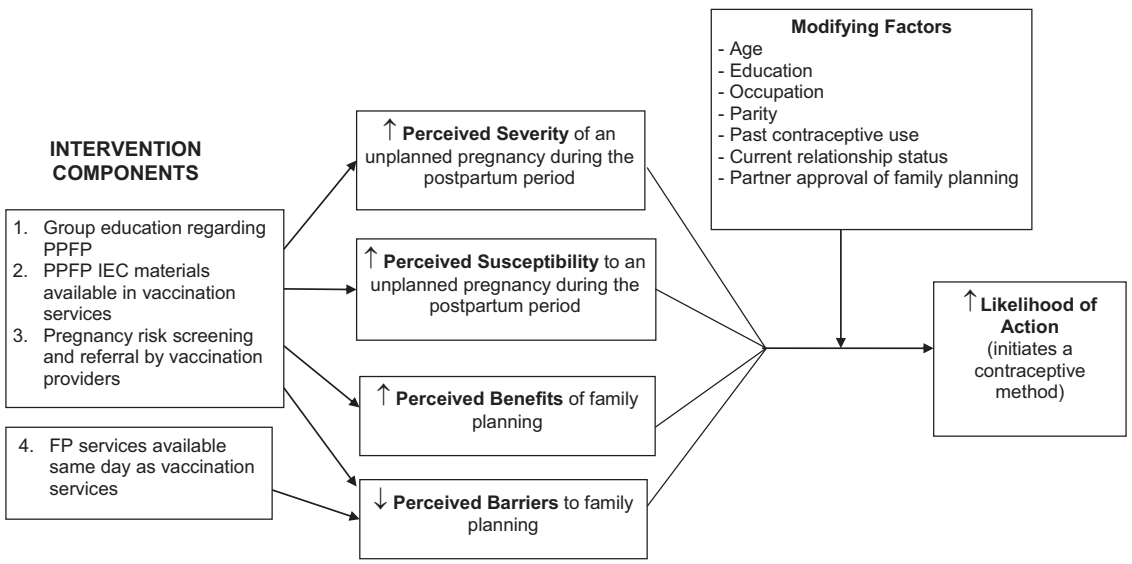
In Rwanda, clients review the integration project's brochure about family planning while awaiting immunization for their infants.

FIGURE 1. Conceptual Framework of Anticipated Intervention Effects Based on the Health Belief Model



Abbreviations: FP, family planning; IEC, information, education, and communication; PPFP, postpartum family planning.

the control group received no additional training or support.

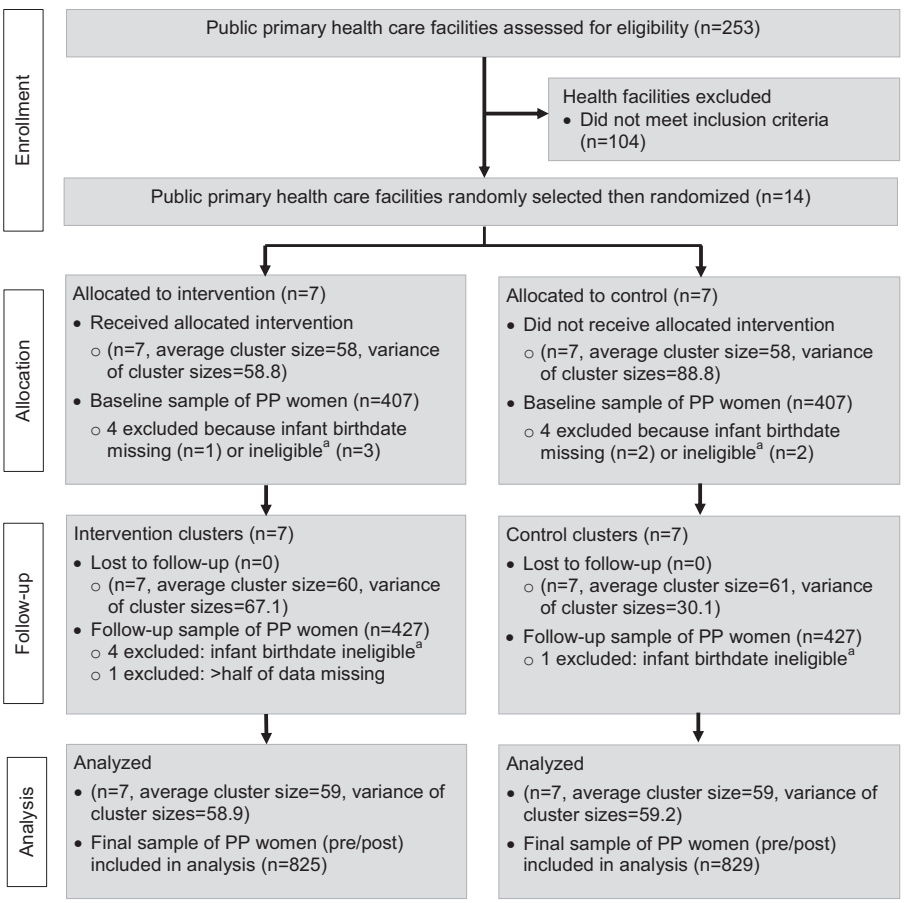
Study Sample

The sample size of postpartum women was calculated to be able to detect a 12 percentage point difference in current modern contraceptive method use from baseline to endline between the intervention and the control groups (difference of differences), assuming a baseline contraceptive prevalence of 27% based on DHS data available at the time.[26] Our primary sampling unit (PSU) was public primary health care facilities, and our secondary sampling unit included postpartum women who brought their infants for immunization. Adjusting for clustering at the facility level and assuming an intra-class correlation of 0.023 based on similar work in Madagascar,[27] we estimated that a sample of 55 women interviewed at each time point in each of 14 health facilities, for a total of 770 women (385 participants per study arm) at both baseline and endline, would have 80% power to detect an intervention effect for a 1-sided test at the .05 significance level.

At the time of the study, there were 253 public primary health care centers in Rwanda (Figure 2). The sampling frame was restricted to public primary health care facilities with an average monthly client volume of at least 50 infant measles immunizations (n = 149) to ensure data collection could be completed within a reasonable time frame. Because health care is decentralized to the district level and district health managers supervise all facilities monthly, there was concern that if more than one facility was selected from a district and if the facilities were randomized to different treatment groups, there could be contamination across facilities. Therefore, we stratified the sampling frame by districts and then selected a random sample such that no more than one facility was sampled in any district, using the "Surveyselect" procedure in SAS System for Windows, version 9.3.[28] Random allocation of facilities to treatment arms was also carried out using SAS/STAT software, version 9.3.[28]

Within the health centers, women were enrolled to participate in the study in the order they arrived during data collection until the sample size was achieved in each facility. Eligible participants included adult women, 21 years or older, or women 18 to 20 who had achieved legal majority status by emancipation due to marriage, who brought their own infants between 6 and

FIGURE 2. CONSORT Flow Diagram for Rwanda Postpartum Family Planning–Immunization Integration Study



Abbreviation: PP, postpartum.

[a] Women were recruited if their babies were between 6 months to 1 year old (180–365 days), as calculated by their birthdate. In a handful of cases, mothers of infants who were near but outside the range of 180–365 days completed interviews because they reported their infants as being of eligible age, but the age differed slightly once calculated in days and were thus excluded from analyses.

12 months of age to immunization services. We sampled women who were 6 to 12 months postpartum so that all women in the sample who desired to initiate a modern contraceptive method to delay or limit a new pregnancy should have done so by that point, if they followed the information and counseling being offered through the intervention. Prior to 6 months, some women may have been actively, or passively, protected by LAM; however, the intervention messaging clearly indicated to women that by 6 months postpartum, they should initiate a contraceptive method besides LAM if they wished to use family planning.

Data Collection and Measures

Trained data collectors obtained written informed consent from all study participants and then interviewed study participants using structured

questionnaires during exit interviews conducted in a private setting within the health facility. Data were collected on: (1) participant demographics; (2) reproductive and family planning history; (3) current pregnancy risk (infant age, breastfeeding status, status of menses, return to sexual activity); (4) postpartum family planning knowledge; and (5) perceptions toward postpartum family planning, including perceived susceptibility to and severity of an unplanned pregnancy, perceived benefits of family planning, perceived barriers to using family planning, and self-efficacy for using family planning. Participants in both groups were asked about the acceptability of integrating family planning services into infant immunization services and on satisfaction with their immunization service visit that day.

The primary outcome variable was self-reported current modern contraceptive method use. Modern methods comprised oral contraceptive pills, injectable contraceptives, contraceptive implants, female or male sterilization, intrauterine devices, male or female condoms, spermicides, or the Standard Days Method. For this study, emergency contraception was not counted as a modern method. LAM was not included because all participants were more than 6 months postpartum. Because population-level data demonstrate that family planning use increases with woman's age, parity, and education and is associated with relationship status and partner approval, we included these as control variables.[20,26] Occupation, which is related to education, was also included as a control variable.

Immunization service data, including the monthly number of immunization clients by immunization type (e.g., measles, polio, etc.), were collected for the duration of the intervention beginning July 2010. Data on costs associated with carrying out the intervention were also recorded, including material development and reproduction, staff training, and quarterly supportive supervisory visits.

Data Analysis and Hypotheses

The main hypothesis tested in this study was that postpartum women who attend immunization clinic services for their infants ages 6–12 months in the intervention facilities will be more likely to use a modern contraceptive method than postpartum women who attend immunization clinic services for their infants, ages 6–12 months, in control group facilities. We tested this hypothesis with a linear mixed regression model using a 1-sided test at the .05 significance level with 12 degrees of freedom. The model controlled for age, parity, education, occupation, current relationship status, and perceived partner family planning approval, and it accounted for clustering by facility and time.

We also used linear mixed regression models to examine differences between groups and time for all descriptive variables separately and for bivariate analyses between individual characteristics and current modern contraceptive method use. The same approach was used to test differences between study groups and HBM variables. All models accounted for cluster effects. Analyses were carried out with the SAS System for Windows, version 9.3.[28]

Costing analyses were carried out using Microsoft Excel. We calculated the cost of the intervention per facility and estimated both the cost per full exposure, assuming 4 immunization visits over the 12-month extended postpartum period, and cost of the intervention per new acceptor. We used the number of babies who received measles vaccines from January–September 2011 (N = 5,036) in the intervention facilities as a proxy for the number of women who received the full 4-visit exposure. Because this was a 2-group, separate sample study, we did not have the actual number of new family planning acceptors. Instead, the number of family planning acceptors was calculated based on the number of women estimated to have been exposed to the intervention multiplied by the effect of the intervention shown in the study. We then divided the total incremental cost of the intervention by that number.

Ethics Approval

This study was approved by the Rwanda National Ethics Committee and FHI 360's Protection of Human Subjects Committee, and it is registered on the US National Institutes of Health ClinicalTrials.gov database, registry #NCT01115361.

RESULTS

Participant Characteristics

The final sample included in the analysis comprised 825 women from the intervention group and 829 women from the control group. Study participants were demographically similar in intervention and control groups at baseline and endline (Table 1). Average age among participants was 27–28 years, and nearly all were Christian—fairly evenly divided between Protestantism and Catholicism. Most women had at least a primary school education, and more than three-fourths

Modern contraceptive use was relatively high among all study participants, but unmet need was also high.

The integrated intervention had a significant and positive effect on modern method use.

were literate. Just over half of all women reported working outside the home.

Contraceptive Use and Unmet Need

Modern contraceptive method use was relatively high among study participants; roughly half of women across study groups at both time points were using a modern contraceptive method (Table 2). Unmet contraceptive need was also high (45.6% in the control group and 39.2% in the intervention group at endline); nearly all women not currently using a modern method desired to space or limit their births (Table 2). Just under half of respondents reported desiring no more children; among those who desired additional children, nearly all wanted to wait at least 2 years before their next pregnancy. Most respondents in both groups at both time points had returned to sexual activity since childbirth.

Intervention Effect

To assess the effectiveness of the intervention to increase modern contraceptive method use, we examined the change in modern method use between intervention and control groups across time points (Table 3). Results showed that the intervention had a statistically significant and positive effect on modern method use among intervention group participants compared with control group participants (regression coefficient, 0.15; 90% confidence interval [CI], 0.04 to 0.26). In other words, we observed an 8% increase in the intervention group and a 7% decrease in the control, resulting in a 15 percentage point difference between the intervention and control groups when comparing baseline to follow-up results. Although we conducted a 1-sided significance test, this effect was also significant at the 2-sided test with an alpha = .05 (95% CI, 0.01 to 0.29).

TABLE 1. Background Characteristics of Study Participants by Intervention Group and Time

	Baseline		Endline	
Characteristic	Control (n = 403)	Intervention (n = 403)	Control (n = 422)	Intervention (n = 426)
Age of mother, years, mean	27.9	28.4	27.4	28.5
No. of months postpartum, mean	9.4	9.4	9.4	9.4
Married/living with partner, %	96.5	97.5†	93.8	93.4†
Currently works outside the home, %	64.3	68.7	60.0	51.6
Literate, %	77.2	80.0	78.4	79.8
Education, %				
None	14.9	12.9	18.5	14.8
Primary	69.2	74.0	67.5	73.7
Secondary or more	15.9	12.7	14.0	11.5
Religion, %				
Catholic	40.7	49.1	35.8	46.5
Protestant	33.0	35.0	41.7	39.0
7th Day Adventist	15.6	10.7	15.6	8.9
Muslim	5.7	2.0	1.4	2.1
Other	4.0	2.7	5.4	3.5
No. of living children, mean	2.5	2.6	2.4	2.7

† Statistically significant difference between baseline and endline within group at P=.05.

TABLE 2. Modern Contraceptive Use and Unmet Need for Contraception by Intervention Group and Time

	Baseline		Endline	
	Control (n = 403)	Intervention (n = 403)	Control (n = 422)	Intervention (n = 426)
Currently using a modern method, %	57.5	49.0†	50.7¥	57.0†¥
Injectables	38.6	28.4	29.2	31.0
Pills	8.2	12.4	6.9	10.6
Male condoms	5.0	3.4	7.1	7.5
Implants	3.2	2.5	4.7	4.2
Standard Days Method	1.5	1.7	1.0	1.0
IUD	0.5	0.0	1.0	1.1
Female sterilization	0.3	0.5	0.5	0.2
Male sterilization	0.3	0.0	0.0	0.0
Female condoms	0.0	0.0	0.0	0.5
Sexually active, %	92.8	91.5	94.1	92.7
Desires pregnancy in <2 years, %	4.3	2.6	4.0	3.8
Unmet need for contraception, %	38.2	48.4	45.3	39.2
Unmet need to space	16.4	24.8	19.9	19.2
Unmet need to limit	21.8	23.6	25.4	20.0

† Statistically significant difference between baseline and endline within group at $P = .05$.
¥ Statistically significant difference between groups at $P = .05$.

Health Belief Model Effects

Concerning the HBM concepts and contraceptive method use, women with a higher perceived susceptibility to an unplanned pregnancy were more likely than those with a lower perceived susceptibility to use a modern contraceptive method at both baseline and follow-up (linear mixed model regression estimate, 0.24; $P = .05$) (Table 4). Greater perceived severity of an unplanned pregnancy and perceived benefits of family planning were also significantly and positively associated with greater family planning use (regression estimates, 0.04 and 0.06, respectively). Greater perceived barriers to family planning use was associated with lower family planning use (regression estimate, -0.14); however, this finding was not statistically significant.

We found a small but statistically significant change in perceived susceptibility to an unplanned pregnancy between intervention and control groups from baseline to follow-up; perceived susceptibility increased from baseline to endline in intervention facilities and decreased in control facilities. However, no other significant changes were observed among HBM concepts because perceptions of severity of an unplanned pregnancy and benefits of family planning were already very high in both groups, and perceived barriers to family planning were relatively low (data not shown).

Reasons for Non-Use

At endline, we asked those not currently using a modern method (non-users) their reasons for non-use (data not shown). Responses were similar in both groups; the most common reason reported was that participants were awaiting menses to return to

TABLE 3. Three Linear Mixed Models of Modern Contraceptive Use Over Time, for Intervention Group Alone, Control Group Alone, and Comparing Intervention With Control Group

(Outcome is current method use)	Regression Estimate	95% CI	90% CI
Intervention only (Endline–Baseline)	0.09†	-0.004, 0.19	0.01, 0.17
Control only (Endline–Baseline)	-0.01	-0.16, 0.04	-0.14, 0.02
Difference of differences	0.15††	0.01, 0.29	0.04, 0.26

† $P=.10$; †† $P=.05$.
Model adjusted for mother's age, parity, marital status, education, and religion and accounts for clustering by facility and facility*time.

Most non-users said they were waiting for menses to return before initiating a method.

initiate a method (46.1% in the control group, 50.3% in the intervention group). Other important reasons for not using a contraceptive method included fear of side effects or health problems associated with family planning (19.4% in the control group, 13.4% in the intervention group), as well as currently breastfeeding (8.2% in the control group, 11.2% in the intervention group).

Postpartum Women's Perspectives on Family Planning and Immunization Service Integration

There were no downward trends in the number of infants immunized for measles in the integrated intervention facilities.

At endline, women in both study groups were asked about their perspectives on integrating family planning services components into infant immunization services (Table 5). Women in both groups nearly universally (98%) agreed that infant immunization services were a good time to receive information on family planning options. Approximately three-quarters of all women also stated that they preferred to get family planning services on the same day when they bring their infants for immunizations. Fewer than 20% overall stated they did not think the immunization service visit was the appropriate time to receive family planning information; most of these women stated they preferred to come when they did not have their babies with them (data not shown).

Women in both groups were very satisfied with the services they received (Table 5). There was no difference between study groups in overall satisfaction, satisfaction with the wait time, or in the proportion of women who stated that providers treated them with respect. However, more women in the intervention group reported that they were given the opportunity to ask health-related questions and that the provider was able to give them the information they needed.

TABLE 4. Bivariate Analyses of Health Belief Model (HBM) Concepts and Contraceptive Method Use Using Linear Mixed Models

HBM Concept	Regression Estimate
Perceived susceptibility to unplanned pregnancy	0.24†
Perceived severity of unplanned pregnancy	0.04†
Perceived benefits of FP	0.06†
Perceived barriers to receiving FP service	-0.14

† $P=.05$.
Model accounts for clustering by facility and facility*time.

Immunization Service Statistics

Given the possibility that integrating family planning education, pregnancy risk screening, and family planning services could have a negative effect on immunization uptake, we collected service data on measles immunization (scheduled between 9 and 12 months of age) at all facilities (Figure 3). There was considerable monthly variation in the numbers of infants immunized at all facilities. Observed peaks are likely due to periodic community outreach efforts (such as Mother and Child Health Weeks, which occur in March and November each year) during immunization campaigns to reach unimmunized children. We observed no downward trend in the numbers of infants immunized for measles in the intervention facilities over the course of the study period, indicating that once family planning services were integrated into immunization services within intervention facilities, immunization uptake did not decrease. Although we present data only for the measles vaccine in Figure 3, trends were similar

TABLE 5. Postpartum Women's Perspectives on Integration of Family Planning and Immunization Services and Satisfaction With Immunization Services at Endline, % Who Agreed With Statements

	Intervention (n = 427)	Control (n = 426)
Perspectives on integration		
It is good to get information about family planning options when I bring my baby for immunization.	97.9	97.9
I prefer to get both baby immunization and family planning on the same day rather than to come to the health facility on different days.	73.3	75.4
If my husband knew I received family planning information during immunization service, he would be unhappy.	9.1	10.8
Satisfaction with immunization services		
Immunization provider treated me respectfully.	98.6	98.1
Immunization provider gave me an opportunity to ask any health-related questions.	28.6	16.7
Immunization provider helped me get needed health information.	36.3	22.5
Wait time to see the provider who provided my child's immunization was acceptable.	85.7	86.9
Overall satisfaction with the service received during visit		
Not satisfied at all	1.2	2.1
Somewhat unsatisfied	2.8	1.4
Somewhat satisfied	21.8	18.8
Very satisfied	74.2	77.7

for all recorded vaccines, including the first 3 doses of diphtheria, tetanus, and pertussis vaccine (DTP).

Costs of the Intervention

Intervention costs included:

- Document development and reproduction (job aid and brochures)
- Preparation visits to the intervention sites
- Training providers and supervisors
- Launching activities in intervention sites
- Quarterly supervisions to the intervention sites during implementation
- One-day refresher training for all intervention sites

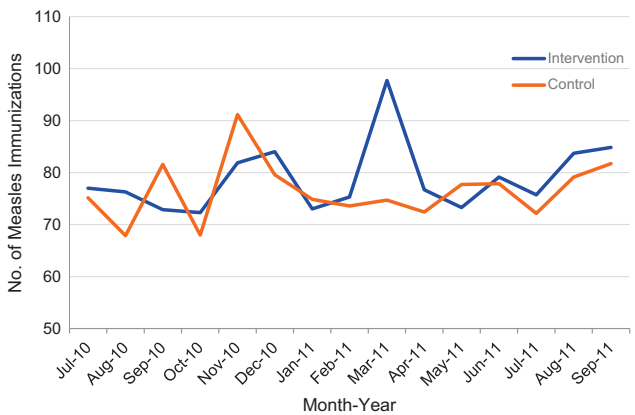
After subtracting costs not relevant to scale-up (e.g., staff time to develop training materials), the total cost was US$24,203. This resulted in a cost of US$4.81 per woman for full exposure to the intervention (at 6, 10, and 14-week and at 6-month immunization visits). Assuming that 15% of women would accept a new contraceptive method, based on the 15 percentage point difference observed between the intervention and control groups, the intervention cost was US$32.06 per new family planning acceptor.

DISCUSSION

This study contributes to the small global body of evidence on the effectiveness of integrated health service delivery and supports previous findings that integrating family planning service components into infant immunization services can be an effective, acceptable, and feasible strategy for increasing family planning service uptake among postpartum women. Clients were overall very positive about receiving family planning information and services during infant immunization, and integration did not adversely affect reported service satisfaction. We also demonstrated that adding family planning service components did not negatively affect immunization service uptake,

Integrating family planning services into immunization programs can be effective, acceptable, and feasible.

FIGURE 3. Average Number of Measles Immunizations per Month, by Study Group, During the Service Integration Intervention Period, From August 2010 to September 2011



which has been a concern among some public health professionals.[13,29]

The intervention sought not only to increase modern contraceptive method uptake but also to improve postpartum family planning knowledge among women. Given that half of non-users at endline stated that they were awaiting menses to return to initiate a method despite being 6 or more months postpartum, it appears that the intervention was not completely successful at dispelling this misconception. Our findings are consistent with several other investigations that have explored the relationship between postpartum amenorrhea and initiation of a family planning method, which found that many women await the return of menses before initiating a family planning method, potentially placing them at risk for an unintended pregnancy.[30-32] More efforts are needed to ensure women and their providers understand that postpartum women can become pregnant before their menses return, even while breastfeeding, and that sexually active women who desire to space or limit their pregnancies should initiate an effective modern contraceptive method as early as possible. Additional research is needed to better understand the persistence of these misperceptions and to test strategies to address them.

More efforts are needed to ensure women understand that they can become pregnant before their menses return in the postpartum period.

The integration approach employed in this study permitted a degree of flexibility within health facilities with regard to how the family planning and immunization services were co-delivered, which we believe is important to successful implementation and sustainability. However, several systemic challenges affected integrated service implementation. We selected public primary health centers where both immunization and family planning services are offered. In Rwanda, family planning services are offered every day of the week, although not necessarily at the same time as immunization services. In settings where family planning services are not offered daily, this intervention may require significant changes to service delivery, which may or may not be feasible. We also found that a single training session for providers was insufficient to successful implementation and that supportive supervision was key to successful, ongoing implementation. Until providers are experienced in the new service delivery strategy, maintaining the level of supportive supervision provided in the study intervention could prove a challenge to some district health personnel.

We also found that, despite a conducive service delivery setting, provider attrition through transfers caused trained providers to be replaced with untrained providers, affecting service delivery. The most permanent comprehensive solution to this problem would be to include training on integrated family planning and immunization service delivery in preservice education for all providers and to systematically train all current primary care providers on the strategy through new or existing training opportunities.

At US$32.06 per new acceptor, this strategy could be considered relatively expensive; however, many expenses can be reduced or eliminated by incorporating the work into existing activities. Two of the largest expenses were provider training and quarterly supervision visits, both of which could be integrated into existing training and supervision activities.

Limitations

This study used a rigorous study design; however, it is not without limitations. We used a separate sample approach to measure intervention effects. The primary reason for enrolling separate samples of postpartum women was to enroll women who could be fully exposed to the intervention. Although most women in Rwanda bring their babies to health facilities to receive immunizations, only about half of women delivered in health facilities at the time of the study.[26] Sampling women at the time of delivery and following them during the postpartum period would have limited our sampling frame to only women who delivered in a facility as opposed to all women who bring their infants to immunization services. We believe the information gained through this sampling strategy outweighs its limitations. A

second limitation was the relatively small number of facilities included in the study sample. Having only 7 PSU per study arm decreased the likelihood that randomization led to completely comparable study groups. In response, we chose to examine the difference in modern contraceptive method use from baseline to endline between study groups (difference of differences), reducing the study's power to detect statistically significant differences. Despite this limitation, we observed a statistically significant and positive intervention effect.

Study Implications

This rigorous trial demonstrated that integrating family planning service components into infant immunization services can be an effective, acceptable, and feasible strategy for increasing modern contraceptive use among postpartum women without negatively affecting immunization services. The study addressed some of the limitations previously noted in the literature on this topic by including a control group, collecting extensive process data to understand implementation fidelity, and collecting costing data.

Further research is needed to test this approach in other settings. Given that this is one of only a handful of research studies directly examining the effectiveness of integrated family planning and infant immunization services and that the study enrolled a relatively small number of health care facilities within one country setting, attempting to replicate these results elsewhere is important. Additionally, a strong policy environment aiming to improve maternal and child health, extensive engagement of the Ministry of Health in the planning and implementation of the intervention, as well as intensive efforts to strengthen the country's health system likely played important roles in the success of the intervention. Replicating this work in settings where political or health system support is not as strong may not generate the same results.

In March 2013, the Rwanda Ministry of Health held a national meeting to discuss results of this and other studies focused on improving family planning services and contraceptive uptake. Participants recommended national scale-up of the intervention and initiated discussions on changes to service delivery guidelines, supervision requirements, training curricula, and data collection systems to support scale-up. Recommendations were sent to the national Maternal and Child Health Technical Working Group for incorporation into Ministry of Health and partner organization work plans.

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In Rwanda, a nurse provides information on postpartum family planning during a group education session while the women wait for immunization services.

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ORIGINAL ARTICLE

The Single-Visit Approach as a Cervical Cancer Prevention Strategy Among Women With HIV in Ethiopia: Successes and Lessons Learned

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With the single-visit approach for cervical cancer prevention, women with positive ''visual inspection of the cervix with acetic acid wash'' (VIA) test results receive immediate treatment of the precancerous lesion with cryotherapy. The approach worked successfully for women with HIV in Ethiopia in secondary and tertiary health facilities, with high screening and cryotherapy treatment rates. Sustainability and appropriate scale-up of such programs must address wider health system challenges including human resource constraints and shortage of essential supplies.

ABSTRACT

Introduction: Cervical cancer is the second most common form of cancer for women in Ethiopia. Using a single-visit approach to prevent cervical cancer, the *Addis Tesfa* (New Hope) project in Ethiopia tested women with HIV through visual inspection of the cervix with acetic acid wash (VIA) and, if tests results were positive, offered immediate cryotherapy of the precancerous lesion or referral for loop electrosurgical excision procedure (LEEP). The objective of this article is to review screening and treatment outcomes over nearly 4 years of project implementation and to identify lessons learned to improve cervical cancer prevention programs in Ethiopia and other resource-constrained settings.

Methods: We analyzed aggregate client data from August 2010 to March 2014 to obtain the number of women with HIV who were counseled, screened, and treated, as well as the number of annual follow-up visits made, from the 14 tertiary- and secondary-level health facilities implementing the single-visit approach. A health facility assessment (HFA) was also implemented from August to December 2013 to examine the effects of the single-visit approach on client flow, staff workload, and facility infrastructure 3 years after initiating the approach.

Results: Almost all (99%) of the 16,632 women with HIV counseled about the single-visit approach were screened with VIA during the study period; 1,656 (10%) of them tested VIA positive (VIA+) for precancerous lesions. Among those who tested VIA+ and were thus eligible for cryotherapy, 1,481 (97%) received cryotherapy treatment, but only 80 (63%) women eligible for LEEP actually received the treatment. The HFA results showed frequent staff turnover, some shortage of essential supplies, and rooms that were judged by providers to be too small for delivery of cervical cancer prevention services.

Conclusion: The high proportions of VIA screening and cryotherapy treatment in the *Addis Tesfa* project suggest high acceptance of such services by women with HIV and feasibility of implementation in secondary- and tertiary-level health facilities. However, success of cervical cancer prevention programming must address wider health system challenges to ensure sustainability and appropriate scale-up to the general population of Ethiopia and other resource-constrained settings.

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INTRODUCTION

Cancer of the uterine cervix is an important public health challenge in low- and middle-income countries (LMICs). In 2012, almost 270,000 women died from cervical cancer, 86% of them in less developed

With early detection and effective management, cervical cancer is one of the most preventable and treatable forms of cancer.

regions of the world.[1] The majority of women who die from cervical cancer in LMICs are in the prime of their life, resulting in social and economic repercussions for both their families and their communities.[2] With early detection and effective management, cervical cancer is one of the most preventable and treatable forms of cancer.[3] Unfortunately, the majority of women with cervical cancer in LMICs are diagnosed at late stages of the disease and do not have access to lifesaving treatment or prevention options.[3] A series of seminal studies have proven the safety, acceptability, and effectiveness of the single-visit approach for cervical cancer prevention in low-income countries.[4–7] With the single-visit approach, women are tested through visual inspection of the cervix with acetic acid wash (VIA) and, if they test positive, receive immediate treatment of the precancerous lesion with cryotherapy, a procedure that freezes and destroys diseased tissue.

Cervical cancer screening with visual inspection of the cervix with acetic acid wash (VIA) is simple and affordable.

Screening is considered optimal when the smallest amounts of resources are used to achieve the greatest benefit. Cervical cancer screening with VIA is a simple and affordable alternative to cytology-based screening with accuracy to detect precancerous lesions at a rate comparable with or better than cytology.[8,9] Furthermore, nurses, midwives, and other non-physician health care providers can be trained in VIA and cryotherapy, which can greatly improve access to cervical cancer prevention services.[10–12] In contrast, the sensitivity rate of HPV DNA testing (94%) is much higher than VIA (80%)[9,13]; however, the high cost and health system requirements of HPV DNA testing would be challenging for large-scale implementation in LMICs. The addition of loop electrosurgical excision procedure (LEEP) services offers women with positive VIA results and larger lesions a good alternative to hysterectomy, the only previously available treatment option in Ethiopia and most other LMICs. With the "global call to action" for cancer control in low-income countries,[14] various multi-stakeholder cervical cancer prevention initiatives have been implemented in LMICs.

The *Addis Tesfa* project, launched in 2009, introduced cervical cancer prevention services in 14 sites in Ethiopia.

This article describes the *Addis Tesfa* (New Hope) project, the first cervical cancer prevention program in Ethiopia that uses the single-visit approach. Ethiopia is a low-income country located in the horn of Africa. In 2012, the country had a gross domestic product (GDP) per capita of US$472 and spent 3.8% of GDP on total health expenditure—about half (48%) of this expenditure was made by the public sector.[15] Lower respiratory infections, cancer, diarrheal diseases, malaria, tuberculosis, and HIV remain important public health challenges in the country. In 2012, cervical cancer in Ethiopia was reported to be the second leading cancer diagnosis (after breast cancer) among adult women with an estimated 7,095 new cases and 4,732 deaths.[1] Routine access to cervical cancer screening was not available and treatment for precancerous cervical lesions did not exist in Ethiopia until implementation of the *Addis Tesfa* project in 2009. The objective of this paper is to review screening and treatment outcomes of the *Addis Tesfa* project from August 2010 through March 2014 using routine monitoring data and to identify lessons learned from this project in order to increase access to cervical cancer prevention programs in Ethiopia and other resource-constrained settings.

METHODOLOGY

Context and Project Sites

Funded by the US Centers for Disease Control and Prevention (CDC), Pathfinder International's *Addis Tesfa* (New Hope) project was launched in 2009, in collaboration with the Ethiopian Federal Ministry of Health (FMOH) and the Stanford University Program for International Reproductive Education and Services, to introduce cervical cancer prevention services in Ethiopia for women with HIV. Although the Ethiopian adult HIV prevalence of 1.3% is much lower than the sub-Saharan African regional average of 4.7%,[16] the rationale to offer the single-visit approach to women with HIV was based on global evidence that such women have higher rates of cervical dysplasia and lesions than women without HIV.[17–20] In addition, targeting women with HIV was an ideal entry point to assess the single-visit approach in Ethiopia prior to national scale-up and integration into routine health services.

Fourteen sites, which represented tertiary- and secondary-level health facilities in Ethiopia, were selected based on client volume, access to HIV services, geographic location, and readiness of the Regional Health Bureaus and hospital managers to participate. The 14 sites were located in 4 of the 9 geographical regions of Ethiopia in addition to the administrative capital, Addis Ababa. One facility, often a regional referral center or a university-based teaching hospital, was selected to be a Center of Excellence in each of the selected regions to provide cervical cancer

prevention training; later these centers offered LEEP treatment as an alternative for women ineligible for cryotherapy. The majority of women with HIV attending the HIV/AIDS care and treatment service units at these 14 sites were on antiretroviral therapy (ART).

Provider Training

A total of 77 health care providers (51 nurses/midwives and 26 physicians) were trained for VIA and cryotherapy in the selected sites from July 2010 to July 2013. Each site trained teams of 1–2 physicians and 3–5 nurses/midwives to provide cervical cancer prevention services through the single-visit approach. Trained physicians working in the 5 Centers of Excellence and who were certified in VIA and cryotherapy were also trained on LEEP.

To facilitate the training, the *Addis Tesfa* project developed basic clinical and counseling guides, client consent forms, SVA standard operating procedures, and quality management toolkits (http://www.pathfinder.org/publications-tools/cervical-cancer-prevention.html). The competency-based training program combined didactic sessions with practical skill development modules; the training programs lasted 10 days for nurses/midwives and 5 days for obstetricians and gynecologists.

To ensure clinical competence, semiannual refresher trainings and quarterly quality control visits were conducted jointly with several Regional Health Bureau staff members. During these visits, supervisors used checklists developed by the project to verify health care providers' skills in interpersonal communication and counseling, VIA, cryotherapy, LEEP, and adherence to infection prevention guidelines.

Single-Visit Approach

The clinical protocol for the single-visit approach was based on World Health Organization guidelines for screening and treatment of precancerous lesions for cervical cancer prevention[21] but was modified and adapted to the Ethiopian context through expert consultation. Women with HIV aged 30–45 years received pre-procedure counseling on cervical cancer screening and treatment; written client consent was required prior to treatment of precancerous lesions. Women were screened using VIA and categorized as VIA negative (VIA-), VIA positive (VIA+), VIA inconclusive, or suspected of having cancer based on visual examination. All results were carefully explained to the women and documented on facility records.

Women with VIA- test results were counseled to come back for subsequent screening 5 years later. Women with VIA+ results who were eligible for cryotherapy were offered immediate treatment and counseled to return 1 year later for follow-up screening. Those not eligible for cryotherapy due to large lesion size (precancerous lesion >75% of cervix and lesion extending >2 mm beyond the diameter of the cryosurgical tip) were referred for LEEP at one of the 5 Centers of Excellence and also counseled to return in 1 year for follow-up screening (Box). Women with suspected cancer

BOX. Cryotherapy and LEEP Procedures Employed by the *Addis Tesfa* Project in Ethiopia

Cryotherapy

- A standard double-freeze cryotherapy technique was employed (freeze for 3 minutes, thaw for 5 minutes, freeze for another 3 minutes) in order to create an ice-ball that extended 4–5 mm beyond the cryotherapy tip edge.
- Post-cryotherapy counseling was given, which included self-care and guidance for any potential complications. Women were counseled for subsequent screening 1 year later, which was documented on the client card with the rescreening date highlighted.

Loop Electrosurgical Excision Procedure (LEEP)

- LEEP excisional biopsy and conization (using a loop or triangular electrode to excise a cervical cone) are procedures performed in an outpatient setting under local anesthesia.
- LEEP was postponed for 4 weeks if cervicitis was present; antibiotics were prescribed based on national guidelines for women with HIV.
- Post-LEEP counseling was given, which included self-care and guidance for any adverse effects. Women were counseled for subsequent screening at 6 weeks and at 1 year.

through visual examination or with inconclusive VIA screening results were referred for further diagnosis and management.

Health Facility and Community Demand Creation

The project invested early efforts in educating health professionals, policy makers, and local leaders about cervical cancer prevention. The project held a series of sensitization and orientation workshops to build key partnerships and to garner support for services, and to ultimately promote the sustainability of services. To create awareness of the new cervical cancer prevention services, the project developed information, education, and communication materials tailored for the Ethiopian context. Information on cervical cancer prevention was disseminated at health facilities to people living with HIV/AIDS (PLHIV). In addition, sensitization and orientation to cervical cancer prevention services were provided to health professionals, policy makers, and local HIV associations through group workshops. Community awareness was also delivered through various media channels including radio, newspaper, and television announcements starting in November 2011.

Timeline of Project Rollout

The *Addis Tesfa* project began offering cervical cancer prevention services to women with HIV in the 5 regional Centers of Excellence in August 2010. An additional 4 sites provided the single-visit approach to cervical cancer prevention by September 2011, and the remaining 5 sites began providing the services by August 2012 (14 sites total).

Data Collection and Analysis

Screening and treatment services were documented in facility records. Each facility aggregated counseling, screening, and treatment results from the single-visit approach into monthly summary forms, which were entered into an electronic database for analysis by the *Addis Tesfa* project. Routine monitoring data that were collected from all 14 sites included the number of women with HIV who:

- Were counseled about the single-visit approach
- Were screened with VIA (stratified by VIA screening results)
- Tested VIA+ and who received treatment
- Tested VIA+ and who received treatment and returned for follow-up

More than 16,000 women with HIV were counseled about the single-visit approach, and nearly all agreed to be screened with VIA.

Quality control of monitoring data was conducted through monthly data checks by health facility and *Addis Tesfa*'s regional project staff members at each site, augmented by additional data review by the project data manager once monthly data were submitted to the *Addis Tesfa* project.

Basic descriptive statistics and trend analysis were conducted retrospectively on project data from August 2010 to March 2014 using SPSS v. 20. In addition, global chi-square test of independence at $\alpha = .05$ significance level was performed to assess regional variability on key single-visit approach results.

A health facility assessment (HFA) was conducted by Pathfinder International and respective hospital management teams from August to December 2013 to assess the effects of introduction of the single-visit approach on the health systems of individual facilities. To examine the site's client flow, staff workload, and facility infrastructure, equipment, and supplies 3 years after initiation of the single-visit approach, an HFA tool was developed for this project that recorded observations and staff feedback at all 14 single-visit approach sites.

Ethical Considerations

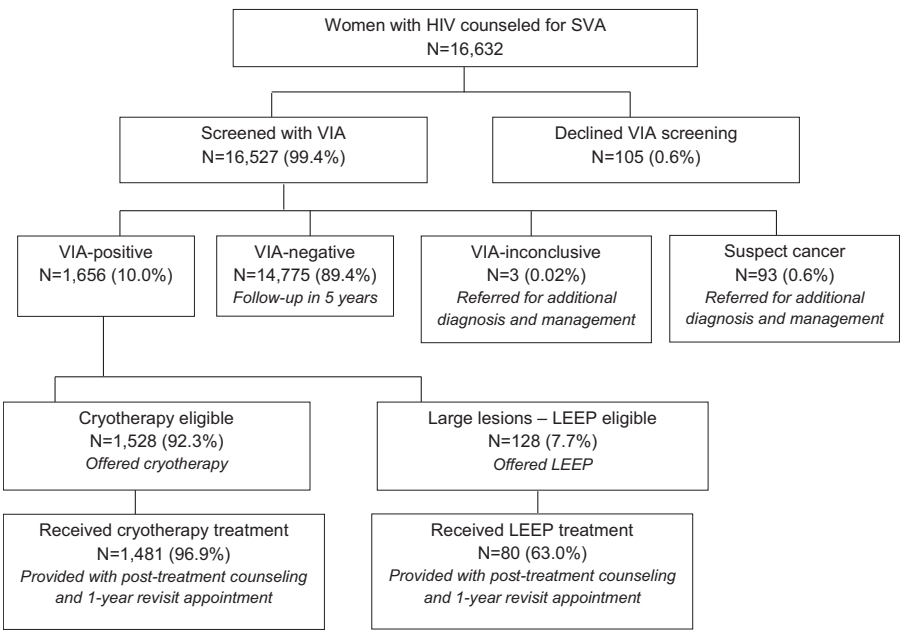
In addition to ensuring clinical competence, health care provider training and refresher courses reinforced the importance of client consent and privacy during service provision. Ethical clearance was obtained from the US Centers for Disease Control and Prevention (CDC) who determined that data collection and analysis conducted as part of this programmatic review was not considered human subjects research.

RESULTS

Screening and Treatment Coverage

Between August 2010 and March 2014, the project counseled 16,632 women with HIV about the single-visit approach (Figure 1). Nearly all of these women (99.4%) agreed to be screened with VIA, and of those screened, 10.0% (n = 1,656) had positive VIA test results (Figure 1). The number of women with HIV screened with VIA increased from 290 in the first period of service delivery (August–September 2010) to 1,596 in the tenth quarter (October–December 2012) as the number of facilities providing the single-visit approach services increased, but decreased to 708 in the final quarter (January–March 2014) of this project as a result of the declining pool of eligible

FIGURE 1. Single-Visit Approach Flow Chart for Cervical Cancer Prevention Services Provided to Women With HIV, August 2010 to March 2014



Abbreviations: LEEP, loop electrosurgical excision procedure; SVA, single-visit approach; VIA, visual inspection of the cervix with acetic acid wash.

women with HIV seeking the services (Figure 2). The overall treatment rate—the percentage of women with HIV who had positive VIA test results and were treated with either cryotherapy or LEEP—averaged 94.3% from August 2010 to March 2014, and it remained at this relatively high proportion throughout the project period (range, 87.4% to 99.1%).

Initial VIA Screening by Region

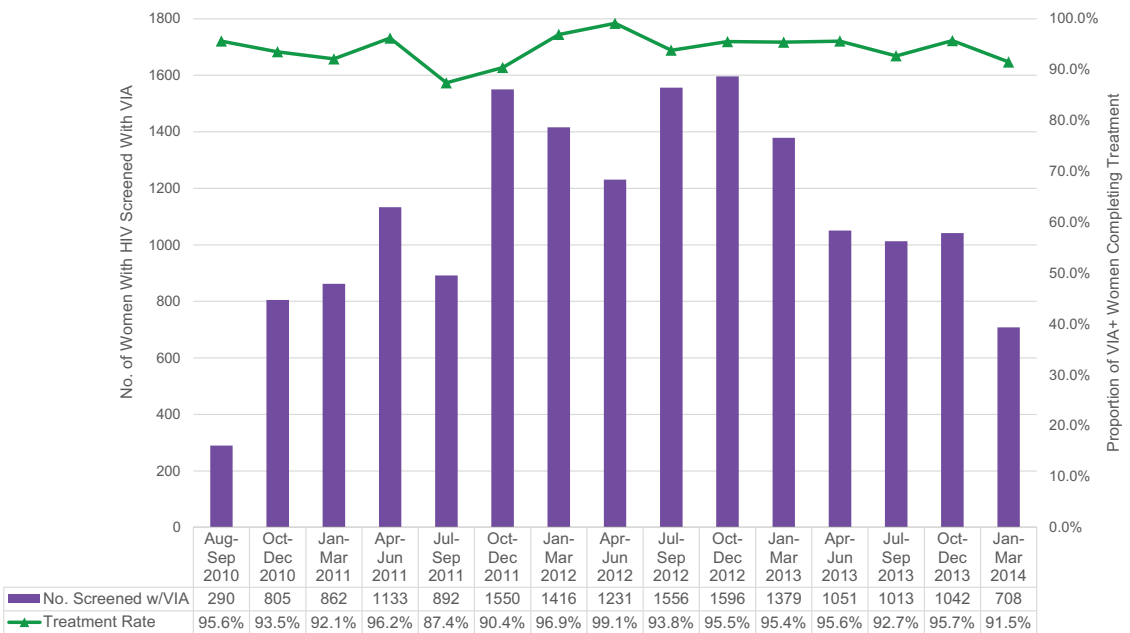
There was regional variability in the results of the initial VIA screening ($\chi^2=103.4$; df=8; $P<.001$). In regards to VIA positivity, the Southern Nations, Nationalities, and People's Region (SNNPR) showed the highest rates of precancerous lesions (13.1%) while Amhara had the lowest rate (7.3%) (Table 1). There were also significant differences between regions in eligibility for cryotherapy and LEEP ($\chi^2=25.5$; df=4; $P<.001$). Among women who tested VIA+, 1,529 (92.3%) women with HIV were eligible for cryotherapy (range, 88.6% in Addis Ababa to 97.3% in Oromia). Only 128 (7.7%) women with HIV who tested VIA+ were referred for LEEP (range, 2.7% in Oromia to 11.4% in Addis Ababa). Few women with HIV (n=93, or 0.6%) were suspected to have cancer based on visual inspection and were referred for additional testing and clinical management (range, 0.1% in Tigray to 0.8% in Amhara).

The overall treatment rate among women with VIA+ test results averaged 94% during the project period.

Treatment Acceptance

Among women with HIV who tested VIA+ and were eligible for cryotherapy during the life of the project, 1,481 (96.9%) received cryotherapy treatment with almost all (98%) women receiving treatment on the same day of screening (Table 2). There were regional differences with VIA+ women who received cryotherapy ($\chi^2=43.6$; df=4; $P<.001$). The proportion of women treated with cryotherapy was as low as 93.1% (Addis Ababa) to as high as

FIGURE 2. Number of Women With HIV Screened With VIA and Treatment Rate With Cryotherapy or LEEP Across All Project Sites, August 2010 to March 2014



	Aug-Sep 2010	Oct-Dec 2010	Jan-Mar 2011	Apr-Jun 2011	Jul-Sep 2011	Oct-Dec 2011	Jan-Mar 2012	Apr-Jun 2012	Jul-Sep 2012	Oct-Dec 2012	Jan-Mar 2013	Apr-Jun 2013	Jul-Sep 2013	Oct-Dec 2013	Jan-Mar 2014
No. Screened w/VIA	290	805	862	1133	892	1550	1416	1231	1556	1596	1379	1051	1013	1042	708
Treatment Rate	95.6%	93.5%	92.1%	96.2%	87.4%	90.4%	96.9%	99.1%	93.8%	95.5%	95.4%	95.6%	92.7%	95.7%	91.5%

Abbreviations: LEEP, loop electrosurgical excision procedure; VIA, visual inspection of the cervix with acetic acid wash.

100% (Tigray). Although regional differences were detected, the great majority of women who were eligible received cryotherapy throughout the different regions.

The treatment rate for LEEP (63%) was considerably lower than for cryotherapy (97%).

The percentage of women who were referred for LEEP and received treatment was considerably lower than for cryotherapy; only 80 (63.0%) women eligible for LEEP actually received the treatment. Regional variability was observed in the percentage of women with HIV receiving LEEP treatment ($\chi^2 = 45.9$; df = 4; $P < .001$), from only 1 client (4.8%) receiving LEEP in Amhara to 39 clients (86.7%) in Tigray.

Follow-Up Screening

About half of the women counseled to return for rescreening 1 year later actually returned.

Women with HIV who were VIA+ and received treatment with cryotherapy or LEEP were expected to be rescreened 1 year later. From August 2010 to March 2014, about half (51.1%) of the 1,201 women expected to come for follow-up actually returned for screening 1 year later and were screened (Table 3).

One-year follow-up rates differed greatly between regions ($\chi^2 = 167.8$; df = 4; $P < .001$); the proportion of women returning for screening was as low as 29.8% in Addis Ababa to as high as 81.1% in Tigray. Results from the 1-year follow-up VIA rescreening indicated that 90% of women with HIV who were VIA+ 1 year prior were VIA- at rescreening and potentially cured from the precancerous lesion that was detected from the original VIA screening; 0.2% of women were suspected to have cancer. Differences in the 1-year follow-up VIA screening results were detected between the various regions ($\chi^2 = 19.7$; df = 8; $P = .01$). The 2-year follow-up rates were much lower with only 36.8% (14 of 38) of women with HIV expected to be rescreened actually returning for the single-visit approach services; however, screening results among the 14 women who returned at 2 years indicated they were all VIA-.

TABLE 1. Results of VIA Screening in Ethiopia by Region, August 2010 to March 2014

	Addis Ababa (2 sites)	Amhara (3 sites)	Oromia (3 sites)	SNNPR (3 sites)	Tigray (3 sites)	Total (14 sites)
Screening[a]	n = 2,066	n = 5,688	n = 2,574	n = 2,619	n = 3,577	n = 16,524
VIA +	245 (11.9%)	416 (7.3%)	258 (10.0%)	343 (13.1%)	394 (11.0%)	1,656 (10.0%)
VIA-	1,806 (87.4%)	5,229 (91.9%)	2,303 (89.5%)	2,258 (86.2%)	3,179 (88.9%)	14,775 (89.4%)
Suspect cancer	15 (0.7%)	43 (0.8%)	13 (0.5%)	18 (0.7%)	4 (0.1%)	93 (0.6%)
Eligibility among VIA +	n = 245	n = 416	n = 258	n = 343	n = 394	n = 1,656
Cryotherapy eligible	217 (88.6%)	395 (95.0%)	251 (97.3%)	316 (92.1%)	349 (88.8%)	1,528 (92.3%)
LEEP eligible	28 (11.4%)	21 (5.0%)	7 (2.7%)	27 (7.9%)	45 (11.2%)	128 (7.7%)

Abbreviations: LEEP, loop electrosurgical excision procedure; SNNPR, Southern Nations, Nationalities, and People's Region; VIA, visual inspection of the cervix with acetic acid wash.
[a] Three inconclusive VIA test results are excluded from this table.

Health Facility Assessment

The results from the HFA can be found in Table 4. Interruption in clean water supply and electricity was detected in the majority of sites. Although all sites provided private rooms for the single-visit approach, a small number of facilities was judged by providers to have rooms that were not wide enough for cervical cancer prevention equipment to comfortably conduct patient counseling, screening, treatment, and infection prevention procedures. In addition, HFA findings indicated that a number of facilities faced difficulties with their cryotherapy units, especially with the freezing and de-freezing components of the instruments. Shortage of supplies such as speculums, forceps, and hemostatic agents (Monsel's solution) was occasionally experienced at some sites. Finally, staff turnover was identified as an important challenge; only three-quarters of health workers trained in the single-visit approach were still working at their respective sites and 4 sites did not have a gynecologist trained in the single-visit approach during the HFA. Among health workers providing the single-visit approach services, there were complaints associated with their work load as they were assigned to multiple services, such as coverage for the single-visit approach and HIV services during the same shift.

Several health system challenges were identified including inconsistent water and electricity supply and staff turnover.

TABLE 2. Treatment Results of the Single-Visit Approach in Ethiopia by Region, August 2010 to March 2014

	Addis Ababa (2 sites)	Amhara (3 sites)	Oromia (3 sites)	SNNPR (3 sites)	Tigray (3 sites)	Total (14 sites)
Cryotherapy eligible	n = 217	n = 395	n = 251	n = 316	n = 349	n = 1,528
Received cryotherapy	202 (93.1%)	394 (99.7%)	236 (94.0%)	300 (94.9%)	349 (100.0%)	1,481 (96.9%)
Did not receive cryotherapy	15 (6.9%)	1 (0.3%)	15 (6.0%)	16 (5.1%)	0 (0.0%)	47 (3.1%)
LEEP eligible	n = 28	n = 21	n = 7	n = 27	n = 45	n = 128
Received LEEP	22 (78.6%)	1 (4.8%)	3 (42.9%)	15 (55.6%)	39 (86.7%)	80 (62.5%)
Did not receive LEEP	6 (21.4%)	20 (95.2%)	4 (57.1%)	12 (44.4%)	6 (13.3%)	48 (37.5%)

Abbreviations: LEEP, loop electrosurgical excision procedure; SNNPR, Southern Nations, Nationalities, and People's Region.

TABLE 3. One-Year Follow-Up Results of the Single-Visit Approach in Ethiopia by Region, August 2010 to March 2014

	Addis Ababa (2 sites)	Amhara (3 sites)	Oromia (3 sites)	SNNPR (3 sites)	Tigray (3 sites)	Total (14 sites)
Women expected for the rescreening	n = 178	n = 277	n = 188	n = 272	n = 286	n = 1,201
Returned for rescreening	53 (29.8%)	153 (55.2%)	71 (37.8%)	105 (38.6%)	232 (81.1%)	614 (51.1%)
Did not return for rescreening	125 (70.2%)	124 (44.8%)	117 (62.2%)	167 (61.4%)	54 (18.9%)	587 (48.9%)
Follow-up screening test results	n = 52	n = 153	n = 71	n = 105	n = 232	n = 613
VIA-	40 (76.9%)	143 (93.5%)	63 (88.7%)	96 (91.4%)	208 (89.7%)	550 (89.6%)
VIA+	12 (23.1%)	10 (6.5%)	7 (9.9%)	9 (8.6%)	24 (10.3%)	62 (10.1%)
Suspect cancer	0 (0.0%)	0 (0.0%)	1 (1.4%)	0 (0.0%)	0 (0.0%)	1 (0.2%)

Abbreviations: SNNPR, Southern Nations, Nationalities, and People's Region; VIA, visual inspection of the cervix with acetic acid wash.

DISCUSSION

Results from the *Addis Tesfa* single-visit approach project are consistent with published literature of cervical cancer prevention programs using VIA and treatment with cryotherapy and LEEP in low-resource settings.[5,6,10,22–24] The increasing trend in the total number of women with HIV screened with VIA from 2010 to 2012 was associated with the increasing number of sites providing the single-visit approach (all 14 selected sites were providing such services by August 2012) and the ongoing community awareness and demand creation activities. The decline in the total number of women with HIV screened with VIA from 2012 to 2014 can most likely be attributed to the decreasing pool of eligible women with HIV seeking single-visit approach services in the 14 project-supported sites. Programmatic data suggest that approximately 85% to 90% of eligible women with HIV in the project catchment area received the single-visit approach service.[25]

The relatively low VIA+ rate of 10% in the project setting may be because most women were on ART and thus may not have been immunocompromised.

The project's overall VIA+ rate of 10.0% is relatively low compared with other studies using VIA for women with HIV; for example, the VIA+ rate among women with HIV in Guyana[24] and Tanzania[26] was 16% and 27%, respectively. The reason for the low VIA+ prevalence in this project could be partially attributed to the fact that the women in our study may not have been severely immunocompromised. Women in the *Addis Tesfa* project were recruited from HIV care and treatment centers in secondary and tertiary health facilities and may have already been taking ART, which could have improved their immune system. Unfortunately, this study was not designed to capture individual women's characteristics associated with HIV status and treatment history. Anecdotal data indicate that approximately three-fourths of women with HIV in the study population were on ART.[25] Another possible explanation for the low VIA+ rate may be due to under-diagnosis by service providers. Providers at all project-supported facilities received competency-based training, which was complemented by routine self-learning using different educational materials (training materials, flash cards, educational videos, etc.) and onsite mentoring by gynecologists. In addition, all single-visit approach service providers were given refresher trainings and regular mentoring visits by *Addis Tesfa* project personnel. However, despite the project's quality improvement measures, it is possible that variability in the skills and competency of service providers could have resulted in under-diagnosis that led to the project's low prevalence of VIA+.

The project's overall cryotherapy treatment rate was high with 96.9% of women eligible for cryotherapy receiving treatment. In other single-visit approach studies, the cryotherapy treatment rate was 94% in Guyana,[24] 92% in Thailand,[6] 91% in Ghana,[5] 84% in Laos,[22] and 61% in the demonstration project in Malawi, Madagascar, Nigeria, Tanzania, Uganda, and Zambia.[23] Our project's high cryotherapy rate is most likely a result of this procedure being truly offered in a single visit. In addition, the rights-based approach to training health care providers that emphasized comprehensive client counseling, respect for confidentiality and privacy, and informed consent may also have facilitated the high cryotherapy rate.

TABLE 4. Key Single-Visit Approach Findings From the Health Facility Assessment, Ethiopia, 2013

Health System Areas	Key Observations
Infrastructure	
Electricity	Interruption in power supply was noted at all 14 sites.
Back-up generator	All 14 sites had back-up generators; however, 1 site did not have back-up system connected to the CCP room.
Water supply	10 of 14 sites noted frequent interruption to water supply.
Examination rooms	All 14 sites had a private room for CCP services; however, about one-quarter (4 of 14) of the sites had rooms that were of insufficient size.
Equipment and Supplies	
Cryo-machine	Over one-quarter (4 of 14) of the sites reported a problem with the cryo-machine.
Spare parts	Majority of sites (12 of 14) had an extra O-ring available.
CCP supplies	About three-quarters (10 of 14) of the sites had all the necessary CCP supplies available with no shortages detected.
Other equipment	A few sites (2 of 14) noted that the examination lamp was not functional and required maintenance.
Staff	
Retention	Three-quarters (57 of 77) of health workers that were trained in SVA were still working at the same site.
Workload	Majority of SVA providers at all 14 sites complained of the workload as they were also assigned to a different service unit on the same working day.

Abbreviations: CCP, cervical cancer prevention; SVA, single-visit approach.

The low LEEP eligibility rate of 7.7% is most likely due to the late introduction of LEEP, which was introduced into the *Addis Tesfa* project starting in November 2011—15 months after the start of the project, in the 5 Centers of Excellence. As LEEP was only offered in these 5 centers, the low LEEP treatment rate of 63% is most likely a result of women who were referred for LEEP but were unable or unwilling to travel to one of the Centers of Excellence to obtain LEEP services. To reach a Center of Excellence health facility, a client may need to travel 40–500 kilometers and spend anywhere from US$5–50 for round-trip transportation costs. Cervical cancer prevention services that require additional procedures or services at other sites are no longer "single-visit approaches" and will inevitably reduce overall treatment rates. LEEP treatment rates for clients at Centers of Excellence were relatively high (>78%); however, challenges were observed in some project-supported health facilities. In the Amhara center, the 1-year delay in the installation of the LEEP machine could have resulted in lower treatment rates in this region. In addition, the Center of Excellence in Oromia region did not offer LEEP regularly as there was high turnover of a LEEP-trained gynecologist in the region, contributing to lower referral and treatment rates for LEEP.

A little over half (51%) of women with HIV in the *Addis Tesfa* project returned for follow-up and rescreening 1 year later. In other single-visit approach programs in low-resource settings, 1-year follow-up rates were 53% in Ghana,[5] 50% in Guyana,[24] and 50% in the demonstration project in 6 African countries.[23] The Ethiopian experience in regards to 1-year follow-up for the single-visit approach is almost identical to the findings in Guyana and in the African countries. This is in contrast to the Southeast Asian demonstration studies, which provided single-visit approach services in rural settings through primary health centers. These demonstration

studies showed impressively high 1-year follow-up rates of 94% in Thailand[6] and 68% in Laos.[22] The 2-year follow-up rates showed that approximately one-third (37%) of women expected to be rescreened actually returned for follow-up, highlighting the challenges of long-term follow-up in this program. It can be assumed that the proportion of follow-up and rescreening in the subsequent years will continue to decline. To ensure the effectiveness of the single-visit approach, programs need to develop systems and processes to encourage women to return for follow-up and rescreening. To optimize access and follow-up of single-visit approach services, the appropriate cervical cancer prevention approach—whether to provide single-visit approach services at primary health centers versus secondary and tertiary facilities and the strategy and types of providers used for client follow-up—must also be carefully considered in each country setting.

The VIA follow-up results in this project indicate that the great majority (90%) of women who were initially tested as VIA+ were VIA- 1 year later. This very high potential cure rate of 90% seen in women rescreened 1 year later was also seen during the 2-year follow-up, in which all (100%) women who returned for screening were VIA-. The high potential cure rate shows the benefit of the single-visit approach and suggests that women with HIV in this population were not severely immunocompromised or were on ART.

Regional variation in treatment and follow-up rates with the single-visit approach can partially be attributed to the health facility's ability to coordinate efforts across different stakeholders, developing systems to ensure success in implementing the single-visit approach, and variability in clinical competency. For example, health facilities in the region of Tigray were able to provide comprehensive client counseling in the local language; provide coordination between single-visit approach service providers, staff from the HIV/AIDS care unit, and PLHIV associations; and allocate resources for client follow-up and rescreening. Variability in the skills and competency of health care providers, either through differences in quality improvement measures or availability of specialized health care providers (i.e., gynecologists) within a health facility, could also result in regional variability of VIA+ diagnosis and treatment rates.

Training multiple health workers at each project site helped ensure consistent and sustainable services in face of high staff turnover.

No major concerns were noted from single-visit approach beneficiaries; however, several women with HIV would ask why this service was being offered only to them. Due to resource constraints in the country and the fact that this was a pilot implemented in a few health facilitates, trained health care providers would carefully explain to those that were concerned that people with weakened immune systems, such as individuals with HIV, were at higher risk of cervical cancer compared with the general population and that the single-visit approach was currently offered only to women with HIV.

Lessons Learned

The results of the HFA conducted as part of the *Addis Tesfa* project highlighted some of the health systems challenges that need to be considered and addressed to ensure successful cervical cancer prevention and control programs in resource-constrained settings:

- Private rooms with sufficient space and lighting are needed for counseling and delivery of the single-visit approach.
- Back-up systems for clean water supply must be devised accordingly.
- Cryotherapy machines must be fully functional with supplies and spare parts readily available.
- Coordination and forecasting systems for regular maintenance, back-up machines, and monitoring of essential supplies are important components that need to be integrated into the operational management of health facilities.
- The human resources necessary to implement the single-visit approach for cervical cancer prevention must also be appropriately managed. With health care provider turnover experienced in the majority of single-visit approach sites in Ethiopia, training multiple health care providers at each site, especially groups of nurses and midwives, was an important strategy employed by the project in ensuring consistent and sustainable single-visit approach services for cervical cancer prevention. To maximize the public health impact of cervical cancer prevention, rigorous training and support of health care providers must be an integral component of any single-visit approach program.

Addis Tesfa Experience and Future of Cervical Cancer Prevention in Ethiopia

The strong partnership between implementers, government representatives, and technical experts

led to a collaborative endeavor that supported the first cervical cancer prevention program in Ethiopia to implement the single-visit approach. Despite health facility challenges described in some project-supported sites, the overall results of the project suggest that the single-visit approach for cervical cancer prevention services for women with HIV can be implemented in secondary and tertiary health facilities in resource-constrained settings.

Several important outcomes have resulted from the *Addis Tesfa* project. First, the project was able to work with the FMOH and key stakeholders to develop the "Guidelines for Cervical Cancer Prevention and Control in Ethiopia" that integrates the single-visit approach into the national reproductive health strategy. In addition, the project has expanded cervical cancer prevention services beyond women with HIV to include all eligible women who are in need of VIA screening. Despite the health system constraints, the project laid the groundwork and generated interest for phased scale-up of cervical cancer prevention services in Ethiopia, an initiative spearheaded by the first lady of Ethiopia, Roman Tesfaye Abneh, now working toward offering the single-visit approach in more than 100 facilities in 2015. As part of the national commitment to address cervical cancer and phased scale-up of single-visit approach services, a strong cervical cancer prevention network of implementers, government representatives, and technical experts must continue to monitor and provide technical guidance to the prevention strategy in Ethiopia. In addition, continued investments to increase availability and functionality of cryotherapy machines, while supporting ongoing training and capacity building of health care providers in key single-visit approach services (VIA, cryotherapy, and LEEP), are critical components of the national cervical cancer prevention agenda.

Limitations

This study was designed to describe and learn about the implementation of the *Addis Tesfa* project using routine client data and health facility assessments. Performance monitoring data may identify statistically significant differences in single-visit approach results among the different regions; however, the study was not designed to explore and evaluate regional variability in great detail. In addition, client data were analyzed at the aggregate level and did not contain adequate individual-level variables, which prevented regression and correlation analysis of single-visit approach outcomes against client characteristics (i.e., ART status, CD4 count, etc.).

CONCLUSIONS

The high rates of VIA screening and cryotherapy treatment in the *Addis Tesfa* project suggest that cervical cancer prevention services among women with HIV can be implemented in secondary- and tertiary-level health facilities using the single-visit approach in Ethiopia. However, success of prevention programming must also consider the health system challenges to ensure sustainability and appropriate scale-up of single-visit approach services in Ethiopia and other resource-constrained settings. To optimize access and follow-up of such services, the appropriate cervical cancer prevention approach—identifying the optimal types of facilities, service providers, and entry points for single-visit approach services—must be carefully considered in each country setting.

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ORIGINAL ARTICLE

Mapping the Prevalence and Sociodemographic Characteristics of Women Who Deliver Alone: Evidence From Demographic and Health Surveys From 80 Countries

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An estimated 2.2 million women surveyed in low- and middle-income countries between 2005 and 2015 gave birth alone. This practice was concentrated in West and Central Africa and parts of East Africa. Women who delivered with no one present were very poor, uneducated, older, and of higher parity. Experience from northern Nigeria suggests the practice can be reduced markedly by mobilizing religious and civil society leaders to improve community awareness about the critical importance of having an attendant present.

ABSTRACT

Evidence has shown that quality skilled care during labor and delivery is essential to improve maternal and newborn health outcomes. Unfortunately, analyses of Demographic and Health Survey (DHS) data show that there are a substantial number of women around the world that not only do not have access to skilled care but also deliver alone with no one present (NOP). Among the 80 countries with data, we found the practice of delivering with NOP was concentrated in West and Central Africa and parts of East Africa. Across these countries, the prevalence of giving birth with NOP was higher among women who were poor, older, of higher parity, living in rural areas, and uneducated than among their counterparts. As women increased use of antenatal care services, the proportion giving birth with NOP declined. Using census data for each country from the US Census Bureau's International Database and data on prevalence of delivering with NOP from the DHS among countries with surveys from 2005 onwards (n = 59), we estimated the number of women who gave birth alone in each country, as well as each country's contribution to the total burden. Our analysis indicates that between 2005 and 2015, an estimated 2.2 million women, who had given birth in the 3 years preceding each country survey, delivered with NOP. Nigeria, alone, accounted for 44% (nearly 1 million) of these deliveries. As countries work on reducing inequalities in access to health care, wealth, education, and family planning, concurrent efforts to change community norms that condone and facilitate the practice of women giving birth alone must also be implemented. Programmatic experience from Sokoto State in northern Nigeria suggests that the practice can be reduced markedly through grassroots community advocacy and education, even in poor and low-resource areas. It is time for leaders to act now to eradicate the practice of giving birth alone—one of many important steps needed to ensure no mother or newborn dies of a preventable death.

INTRODUCTION

The United Nations Sustainable Development Goals (SDGs), endorsed in September 2015, provide a framework for improving population health outcomes for billions of people globally. The SDGs cover many topics from poverty eradication to climate change and represent a global consensus on an agenda to reduce inequalities.[1] Of the 17 SDGs, the third one (ensure healthy lives and promote well-being for all at all ages) explicitly pertains to health outcomes. The first target under SDG 3 (target 3.1) calls for a reduction in the global maternal mortality ratio to fewer than 70 per 100,000 live births by 2030. The second target under SDG 3 (target 3.2) aims to reduce newborn mortality to fewer than 12 deaths per 1,000 live births.[2]

Evidence has shown that quality, skilled care during labor and delivery is a required and key intervention to improve maternal and newborn health outcomes.[3,4] Unless every mother and newborn has access to such services, preventable maternal and newborn deaths are likely to continue and will jeopardize the attainment of

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SDG targets 3.1 and 3.2. Too many women and newborns, particularly in countries with weak health systems, social inequalities, and few available services, cannot access or afford high-quality maternity care.[5]

There is an additional subpopulation of women, embedded among those who do not have access to quality skilled care, who deliver absolutely alone.

More alarmingly, there is an additional subpopulation of women and their newborns, embedded among those who do not have access to quality skilled care, who deliver absolutely alone with "no one present" (NOP). Delivery with NOP has recently become a focus of interest in Nigeria, although it has been neglected in most global policy and practice discussions.[6-8] Published work on women giving birth with NOP in other countries and regions of the world is scant. We believe that this is an omission; women who give birth alone are denied the social support of companionship during birth and have no one to act on their behalf as a timely conduit to the health system in the event of maternal or newborn complications. Under such a scenario, this subset of women is likely to contribute disproportionately to the burden of maternal and neonatal mortality. This paper identifies differentials in the prevalence and socioeconomic characteristics of women who delivered with NOP among the 80 countries with available DHS data. This is an important first step in developing interventions to eradicate the practice, and ultimately in achieving SDG targets 3.1 and 3.2.

DATA AND METHODS

Since 1984, the Demographic and Health Surveys (DHS) have been conducted in at least 85 countries.[9] DHS data have documented the association between skilled assistance at delivery and lower rates of mortality and morbidity among mothers and their newborns.[10,11] In addition to quantifying the prevalence of skilled birth attendance, the DHS also explicitly collects data on women who gave birth with NOP.

An estimated 2.2 million deliveries with no one present occurred in 59 countries, with Nigeria accounting for 44%.

For our analysis, we used publicly available data from the DHS program's STATcompiler database to profile the distribution of delivery with NOP across countries, as well as to identify which subpopulations within countries were most likely to engage in this risky practice.[12] Data on women giving birth alone were available for 80 countries. The STATcompiler database also enabled us to stratify all live births that occurred with NOP in the 3 years preceding the most recent country DHS survey on several indicators. The variables available were urban/rural residence, wealth quintile, mother's age, number of antenatal care (ANC) visits, birth order, and mother's level of education. Although most countries had full data on these stratification variables, some disaggregated data were missing for Botswana, Ecuador, El Salvador, Mexico, Sri Lanka, Sudan, Thailand, and Trinidad and Tobago.

We also sought to estimate each country's contribution to the total burden of women who gave birth alone among surveyed countries. In doing this, we used the mid-year population of women between the ages of 15–49, as calculated by the US Census Bureau's International Database, during the same year as each DHS, adjusted for the general fertility rates (as presented in STATcompiler) for the 3 years preceding each survey year. For these analyses, we found census data for the same year as the DHS data for 77 countries. (Census data were missing for Ecuador, Sudan, and Thailand and were excluded from the analysis because they did not have recent DHS surveys conducted after 2004; see below.)[13]

These numbers were used to calculate a rough estimate of the number of women who would have given birth alone, given the prevalence rates of delivery with NOP at the time of the most recent DHS survey after 2004. We excluded 18 countries in the final analyses (besides Ecuador, Sudan, and Thailand mentioned above) as they had no data available after 2004. These countries were Botswana, Brazil, Central African Republic, Chad, Eritrea, Guatemala, Mauritania, Mexico, Morocco, Nicaragua, Paraguay, South Africa, Sri Lanka, Trinidad and Tobago, Turkey, Turkmenistan, Uzbekistan, and Vietnam. This yielded a total of 59 countries with recent data that were used to assess the number of women giving birth alone.

Data from the DHS and the US Census Bureau are both open access and publicly available. Additionally, as standard protocol, each DHS survey received in-country ethical clearance. As both of these data sources are anonymized, we did not seek any additional ethical approval for this work.

RESULTS

Estimated Magnitude of Delivery With NOP

For the 59 countries with data since 2005, we estimated there were 2.2 million deliveries with NOP in the 3 years preceding the most recent country survey (Table 1). On a country-by-country basis, the number of women who gave birth alone in 7 countries (Nigeria, India, Niger, Tanzania, Ethiopia, Uganda, and Kenya) made up 78% of the total number of women who gave birth alone. Although the proportion of women who gave birth

TABLE 1. Estimated Number of Women Who Gave Birth With No One Present (NOP) and Percent Contribution of Each Country to the Total Number of Births With NOP, Selected Countries With DHS Data Between 2005 and 2015[a]

Country & Survey Year	Population of Women Aged 15–49	General Fertility Rate/1,000 Women Aged 15–44[b]	Percentage of Live Births With NOP	Estimated Number of Women Giving Birth With NOP	Estimated Percent Contribution to the Total Number of Births With NOP Among All Surveyed Countries
Nigeria 2013	39,466,768	0.190	13.00%	974,829	44.22%
India 2005	279,621,419	0.101	0.50%	141,209	6.41%
Niger 2012	3,423,589	0.269	14.50%	133,537	6.06%
Tanzania 2011	10,465,797	0.188	6.70%	131,827	5.98%
Ethiopia 2011	20,405,177	0.161	3.80%	124,839	5.66%
Uganda 2011	7,234,128	0.217	6.80%	106,747	4.84%
Kenya 2008	9,361,636	0.161	6.50%	97,970	4.44%
Angola 2006	3,385,034	0.198	8.40%	56,300	2.55%
Mali 2012	3,524,985	0.214	5.80%	43,752	1.98%
DRC 2013	18,043,728	0.225	0.80%	32,479	1.47%
Guinea 2012	2,518,996	0.176	7.10%	31,477	1.43%
Rwanda 2010	2,650,841	0.151	7.30%	29,220	1.33%
Cameroon 2011	4,993,439	0.180	3.10%	27,863	1.26%
Nepal 2011	7,986,822	0.096	2.90%	22,235	1.01%
Côte d'Ivoire 2011	5,293,915	0.174	2.40%	22,107	1.00%
Ghana 2008	5,654,518	0.136	2.70%	20,763	0.94%
Zambia 2013	3,274,651	0.184	3.10%	18,679	0.85%
Malawi 2010	3,388,791	0.202	2.70%	18,482	0.84%
Yemen 2013	6,040,827	0.206	1.40%	17,422	0.79%
Bangladesh 2011	43,392,926	0.092	0.40%	15,969	0.72%
Burundi 2010	2,068,122	0.203	3.60%	15,114	0.69%
Senegal 2014	3,435,961	0.172	2.50%	14,775	0.67%
Pakistan 2012	48,212,804	0.131	0.20%	12,632	0.57%
Mozambique 2011	5,453,352	0.206	1.10%	12,357	0.56%
Zimbabwe 2010	2,894,645	0.150	2.80%	12,158	0.55%
Indonesia 2012	65,894,656	0.088	0.20%	11,597	0.53%
Burkina Faso 2010	3,688,866	0.206	1.40%	10,639	0.48%
Togo 2013	1,755,425	0.163	3.10%	8,870	0.40%
Madagascar 2008	4,668,384	0.168	0.80%	6,274	0.28%

Table 1 (continued).

Country & Survey Year	Population of Women Aged 15–49	General Fertility Rate/1,000 Women Aged 15–44[b]	Percentage of Live Births With NOP	Estimated Number of Women Giving Birth With NOP	Estimated Percent Contribution to the Total Number of Births With NOP Among All Surveyed Countries
Haiti 2012	2,576,070	0.117	1.90%	5,727	0.26%
Benin 2011	2,144,241	0.175	1.10%	4,128	0.19%
Egypt 2014	22,030,793	0.127	0.10%	2,798	0.13%
Bolivia 2008	2,478,335	0.121	0.90%	2,699	0.12%
Philippines 2013	24,814,911	0.101	0.10%	2,506	0.11%
Peru 2012	8,124,085	0.086	0.30%	2,096	0.10%
Swaziland 2006	320,632	0.137	4.40%	1,933	0.09%
Colombia 2010	12,024,552	0.074	0.20%	1,780	0.08%
Honduras 2011	2,084,188	0.107	0.60%	1,338	0.06%
Timor-Leste 2009	242,026	0.175	3.00%	1,271	0.06%
Congo 2011	1,084,812	0.182	0.50%	987	0.04%
Gambia 2013	486,629	0.085	1.90%	786	0.04%
Namibia 2013	583,375	0.125	0.90%	656	0.03%
Lesotho 2009	523,654	0.119	1.00%	623	0.03%
Azerbaijan 2006	2,637,985	0.066	0.30%	522	0.02%
Sierra Leone 2013	1,391,263	0.169	0.20%	470	0.02%
Jordan 2012	1,722,911	0.112	0.20%	386	0.02%
Liberia 2013	928,619	0.168	0.20%	312	0.01%
Tajikistan 2012	2,128,742	0.134	0.10%	285	0.01%
Dominican Rep. 2013	2,629,898	0.089	0.10%	234	0.01%
Comoros 2012	181,215	0.142	0.90%	232	0.01%
Gabon 2012	376,360	0.144	0.40%	217	0.01%
Kyrgyzstan 2013	1,487,207	0.125	0.10%	186	0.01%
Moldova 2005	1,083,166	0.055	0.20%	119	0.01%
Guyana 2009	185,875	0.094	0.60%	105	<0.01%
Albania 2008	798,442	0.046	0.10%	37	<0.01%
Armenia 2010	849,511	0.061	0.00%	0	<0.01%
Cambodia 2010	4,088,903	0.105	0.00%	0	<0.01%

Table 1 (continued).

Country & Survey Year	Population of Women Aged 15–49	General Fertility Rate/1,000 Women Aged 15–44[b]	Percentage of Live Births With NOP	Estimated Number of Women Giving Birth With NOP	Estimated Percent Contribution to the Total Number of Births With NOP Among All Surveyed Countries
Sao Tome and Principe 2008	39,078	0.164	0.00%	0	<0.01%
Ukraine 2007	12,201,772	0.039	0.00%	0	<0.01%
Total				**2,204,554**	

[a] We excluded the following 18 countries because they did not have DHS data since 2005: Botswana, Brazil, Central African Republic, Chad, Eritrea, Guatemala, Mauritania, Mexico, Morocco, Nicaragua, Paraguay, South Africa, Sri Lanka, Trinidad and Tobago, Turkey, Turkmenistan, Uzbekistan, and Vietnam. We also excluded Ecuador 1987, Sudan 1989, and Thailand 1987 both because they did not have recent DHS data and because census data were missing for these countries.
[b] Number of live births in the 3 years preceding each survey year per woman aged 15–44.
Source of data: Population data from the US Census Bureau; general fertility rate and percentage of live births with NOP from STATcompiler.

with NOP was highest in Niger (at 14.5%), the sheer number of women giving birth alone in Nigeria, estimated at almost 1 million in 2013, conferred Nigeria with a problem of greater absolute magnitude. We estimated that Nigeria alone contributed 44% of the total estimated number of women giving birth alone.[9] It is also noteworthy that although only 0.5% of women in India gave birth alone in 2005, due to its large population, India contributed 6% of the total number of women giving birth alone.

Regional Variations

In Latin America and the Caribbean, the prevalence of women who gave birth alone was less than 3% in each country with survey data, with the exception of El Salvador where it was estimated at 7.6% in 1985 (Table 2). In South and Southeast Asia, Timor-Leste (3% in 2009) and Nepal (2.9% in 2011) had the highest prevalence of women who gave birth alone. Central Asia had a very low prevalence of delivery with NOP, with all countries reporting a prevalence of less than 0.5%, as did most North African, East European, and West Asian countries. Yemen was the main outlier in West Asia, reported at 4.4% of women who gave birth alone in 1997. In general, the highest prevalence of delivery with NOP was found in sub-Saharan Africa, where in 10 of 41 countries with data the prevalence was 5% or higher. The highest levels were in Nigeria at 13% and Niger at 14.5% (Table 2). A mapping of available data that included the 80 countries revealed that delivery with NOP was concentrated in West and Central Africa and parts of East Africa (Figure 1).

Sociodemographic Correlates

Prevalence of delivering alone was higher among women who were poor, uneducated, and living in rural areas than among their counterparts.

Table 2 shows that delivery with NOP is overwhelmingly a rural phenomenon in all the countries with available data. Additionally, we observed a clear association between wealth and delivery with NOP, with the poorest bearing the brunt of the burden in all countries with data. Finally, we found a clear age gradient; the prevalence of delivery with NOP rose as mothers got older in all countries. Furthermore, in 8 sub-Saharan African countries (and El Salvador), the prevalence of delivery with NOP among women over the age of 35 years ranged from 10% to 20%.

When delivery with NOP was disaggregated by residence, wealth, and maternal age, Nigeria emerged as an outlier in terms of the large magnitude of the difference between urban and rural populations that gave birth alone. Nigeria had the highest percentage of both urban (6.4%) and rural women (17%) who gave birth alone. Nigeria also had the largest disparity between wealth categories, wherein 26% of women in the poorest quintile gave birth alone in 2013 in contrast to 2% in the wealthiest quintile. Furthermore, although there was a discernible linear trend showing that as mothers aged, they were more likely to have given birth alone, in Nigeria, as well as in Niger, nearly 10% of mothers under the age of 20 also reported they gave birth alone.

TABLE 2. Percentage of Women Whose Most Recent Birth[a] Occurred With No One Present, Stratified by Residence, Wealth Quintile, and Maternal Age

		Residence		Household Wealth Index					Maternal Age at Birth		
Country & Survey Year	**Total**	**Urban**	**Rural**	**Lowest**	**Second**	**Middle**	**Fourth**	**Highest**	**<20**	**20–34**	**≥35**
sub-Saharan Africa											
Angola 2006-07	8.4	3.5	13.7	15.5	13.0	5.8	3.9	0.6	5.8	9.2	17.3
Benin 2011-12	1.1	0.9	1.3	2.6	1.3	1.0	0.5	0.2	0.7	1.2	1.3
Botswana 1988	1.4	0.2	1.7	NA	NA	NA	NA	NA	0.0	1.6	2.5
Burkina Faso 2010	1.4	0.5	1.5	1.8	2.0	1.2	1.2	0.3	0.3	1.4	1.8
Burundi 2010	3.6	1.6	3.8	5.4	3.7	3.0	4.6	1.3	0.5	3.0	7.4
Cameroon 2011	3.1	1.3	4.4	8.1	3.6	1.6	0.6	0.3	2.2	3.1	4.3
Central African Republic 1994-95	1.8	1.4	2.1	1.5	2.7	2.7	1.4	0.7	0.2	1.9	4.2
Chad 2004	4.0	2.9	4.3	3.6	6.6	4.0	2.7	3.0	2.1	4.5	5.2
Comoros	0.9	0.8	0.9	2.2	0.8	0.2	0.5	0.2	0.0	1.0	1.2
Congo (Brazzaville) 2011-12	0.5	0.1	1.1	1.5	0.4	0.1	0.2	0.0	0.3	0.5	0.7
Congo Democratic Republic 2013-14	0.8	0.5	1.0	1.4	0.9	1.0	0.4	0.3	0.3	0.8	1.4
Côte d'Ivoire 2011-12	2.4	0.7	3.4	3.5	2.6	2.6	2.0	0.6	0.7	2.6	3.4
Eritrea 2002	0.3	0.2	0.3	0.2	0.3	0.4	0.3	0.0	0.5	0.1	0.5
Ethiopia 2011	3.8	1.6	4.2	3.4	4.8	3.8	3.9	2.9	2.8	3.6	6.0
Gabon 2012	0.4	0.3	0.8	0.9	0.2	0.3	0.0	0.5	0.2	0.5	0.3
Gambia 2013	1.9	1.9	1.9	1.9	2.1	2.8	1.7	0.9	0.4	2.0	2.7
Ghana 2008	2.7	1.1	3.8	4.8	3.7	1.7	1.6	0.5	1.1	2.3	5.7
Guinea 2012	7.1	1.9	9.0	11.5	6.5	9.1	5.8	0.5	3.8	6.2	15.8
Kenya 2008-09	6.5	1.8	7.6	8.2	8.4	7.4	5.8	2.1	2.4	5.8	16.4
Lesotho 2009	1.0	0.6	1.1	1.4	0.7	2.0	0.5	0.3	0.5	1.2	0.7
Liberia 2013	0.2	0.0	0.4	0.6	0.1	0.1	0.0	0.1	0.1	0.2	0.3
Madagascar 2008-09	0.8	0.2	0.8	1.7	0.6	0.4	0.5	0.1	0.2	0.7	2.0
Malawi 2010	2.7	2.2	2.8	3.9	3.1	2.4	2.4	1.5	0.5	2.5	6.7
Mali 2012-13	5.8	2.0	6.7	7.7	6.7	8.0	4.5	1.1	3.9	5.8	8.1
Mauritania 2000-01	6.9	1.6	10.9	7.4	10.4	10.0	4.8	1.1	6.6	6.6	8.4
Mozambique 2011	1.1	1.2	1.1	0.5	1.4	0.9	1.2	1.8	0.9	0.9	2.6
Namibia 2013	0.9	0.2	1.5	2.3	0.8	0.4	0.5	0.0	0.0	0.9	1.6
Niger 2012	14.5	3.6	16.2	16.4	17.7	18.1	12.6	7.3	8.8	15.0	19.1
Nigeria	13.0	6.4	16.7	25.7	17.4	10.5	5.1	1.6	9.1	12.8	17.8

Table 2 (continued).

Country & Survey Year	Total	Residence		Household Wealth Index					Maternal Age at Birth		
		Urban	Rural	Lowest	Second	Middle	Fourth	Highest	<20	20–34	≥35
Rwanda 2013	7.3	5.2	7.6	9.8	8.9	7.7	5.5	3.1	2.0	6.3	13.7
Sao Tome and Principe 2008-09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Senegal 2012-13	5.1	1.5	7.0	11.3	6.7	2.9	2.1	0.2	2.4	4.7	8.7
Sierra Leone 2013	0.2	0.1	0.2	0.3	0.2	0.1	0.2	0.0	0.0	0.2	0.2
South Africa 1998	2.1	0.6	3.5	5.4	2.3	0.5	0.5	0.0	1.1	2.1	3.0
Sudan 1989-90	4.3	2.1	5.5	NA	NA	NA	NA	NA	7.5	3.7	4.5
Swaziland 2006-07	4.4	1.5	5.3	11.3	4.8	1.8	2.1	1.2	2.1	3.7	14.2
Tanzania 2010	3.5	1.1	4.1	4.3	4.5	3.9	3.2	0.0	1.3	3.4	5.5
Togo 2013-14	3.1	0.8	4.4	5.2	5.1	3.4	1.0	0.3	1.5	2.8	5.4
Uganda 2011	6.8	1.0	7.7	8.8	8.7	9.0	5.2	1.1	1.4	6.5	14.2
Zambia	3.1	1.1	4.1	4.5	4.6	3.2	1.2	0.4	0.4	2.5	9.4
Zimbabwe 2013-14	2.8	1.4	3.4	5.1	3.1	3.0	1.2	1.3	1.2	2.5	8.3
North Africa/West Asia and Eastern Europe											
Albania 2008-09	0.1	0.2	0.0	0.3	0.0	0.0	0.0	0.0	0.9	0.0	0.0
Armenia 2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Azerbaijan 2006	0.3	0.5	0.1	0.0	0.3	1.2	0.0	0.0	0.0	0.4	0.0
Egypt 2014	0.1	0.0	0.1	0.1	0.3	0.0	0.0	0.0	0.2	0.1	0.2
Jordan 2012	0.2	0.2	0.1	0.2	0.0	0.0	0.7	0.0	0.0	0.2	0.2
Moldova 2005	0.2	0.2	0.2	0.4	0.6	0.0	0.0	0.0	0.0	0.2	0.0
Morocco 2003-04	1.1	0.4	1.8	2.5	1.4	0.4	0.3	0.3	0.0	0.7	3.2
Turkey 1998	0.7	0.3	1.4	2.1	0.7	0.0	0.4	0.0	0.0	0.6	3.3
Ukraine 2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yemen 1997	4.4	2.7	4.9	3.6	4.1	5.8	5.2	3.5	2.0	4.2	7.7
Central Asia											
Kyrgyz Republic 2012	0.1	0.0	0.2	0.0	0.0	0.6	0.0	0.0	0.0	0.2	0.0
Tajikistan 2012	0.1	0.1	0.1	0.5	0.0	0.1	0.0	0.0	0.0	0.1	0.8
Turkmenistan 2000	0.2	0.2	0.1	0.3	0.0	0.0	0.0	0.6	0.0	0.2	0.0
Uzbekistan 1996	0.4	0.0	0.6	0.8	0.0	1.0	0.0	0.0	0.0	0.4	1.9
South and Southeast Asia											
Bangladesh 2011	0.4	0.2	0.5	0.7	0.9	0.4	0.1	0.0	0.2	0.6	0.0
Cambodia 2010	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0

Table 2 (continued).

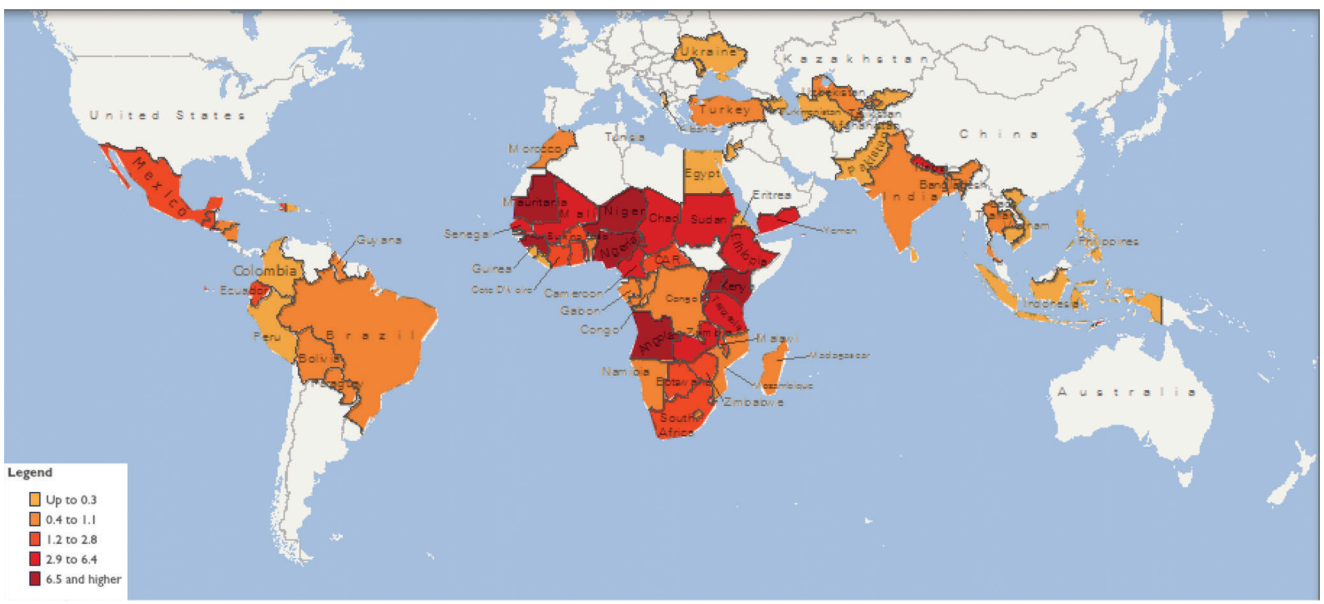
Country & Survey Year	Total	Residence		Household Wealth Index					Maternal Age at Birth		
		Urban	Rural	Lowest	Second	Middle	Fourth	Highest	<20	20–34	≥35
India 2005-06	0.5	0.3	0.6	1.1	0.5	0.4	0.1	0.1	0.2	0.5	1.4
Indonesia 2012	0.2	0.1	0.4	0.8	0.2	0.1	0.0	0.0	0.4	0.2	0.4
Nepal 2011	2.9	1.4	3.0	7.7	2.6	1.0	0.8	0.3	0.8	3.0	7.2
Pakistan 2012-13	0.2	0.0	0.2	0.1	0.5	0.2	0.0	0.0	0.0	0.2	0.2
Philippines 2013	0.1	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.1	0.1
Sri Lanka 1987	0.2	0.0	0.3	NA	NA	NA	NA	NA	0.0	0.3	0.0
Thailand 1987	1.0	0.2	1.1	NA	NA	NA	NA	NA	0.4	0.6	5.0
Timor-Leste 2009-10	3.0	1.6	3.4	4.5	3.5	3.7	2.4	0.6	1.8	2.2	5.6
Vietnam 2002	0.1	0.0	0.1	0.2	0.2	0.0	0.0	0.0	0.0	0.1	0.0
Latin America and the Caribbean											
Bolivia 2008	0.9	0.4	1.5	2.0	0.9	0.7	0.0	0.1	0.6	0.9	1.5
Brazil 1996	0.6	0.4	1.0	1.0	0.9	0.3	0.0	0.0	0.2	0.6	0.8
Colombia 2010	0.2	0.1	0.4	0.6	0.2	0.0	0.0	0.0	0.0	0.3	0.2
Dominican Republic 2013	0.1	0.1	0.0	0.1	0.1	0.2	0.0	0.0	0.0	0.1	0.0
Ecuador 1987	2.2	0.6	3.8	NA	NA	NA	NA	NA	0.4	2.0	5.7
El Salvador 1985	7.6	3.0	11.3	NA	NA	NA	NA	NA	4.5	7.8	13.5
Guatemala 1998-99	1.2	0.0	2.0	3.6	1.3	0.3	0.0	0.0	1.0	1.0	2.7
Guyana 2009	0.6	0.3	0.7	0.8	0.0	1.3	0.6	0.0	0.0	0.6	1.8
Haiti 2012	1.9	1.4	2.1	2.3	2.0	1.5	1.4	2.3	0.8	1.5	4.2
Honduras 2011-12	0.6	0.3	1.0	1.5	0.8	0.5	0.0	0.0	0.2	0.7	1.0
Mexico 1987	2.6	0.8	5.6	NA	NA	NA	NA	NA	0.5	2.7	4.9
Nicaragua 2001	1.1	0.5	1.7	2.6	1.2	0.4	0.3	0.1	0.3	1.0	3.8
Paraguay 1990	0.5	0.2	0.8	0.4	1.5	0.0	0.6	0.0	0.0	0.6	0.5
Peru 2012	0.3	0.2	0.7	1.0	0.3	0.0	0.2	0.0	0.0	0.3	0.8
Trinidad and Tobago 1987	0.1	0.0	0.2	NA	NA	NA	NA	NA	0.0	0.1	0.0

[a] Data were restricted to the most recent live birth in the 3 years preceding each survey.

As women increased use of ANC, the proportion of women giving birth alone declined.

Table 3 presents the distribution of women who gave birth with NOP by number of ANC visits, the birth order of the index child, and maternal education. Across all countries, we observed that as women increased use of ANC, the proportion of women that gave birth with NOP declined. This is most clearly evident in Rwanda, where 36% of the women who reported they had given birth with NOP had not accessed any ANC compared with 9% of women who had made 1–3 ANC visits and 4% of women with 4 or more ANC visits (Table 3). Of equal importance are those factors that enabled women to seek ANC as well as those that removed barriers to accessing ANC. We found that in all countries, women with higher-order births were more likely

FIGURE 1. Prevalence of Women Giving Birth With No One Present Among the 80 Countries With Available DHS Data



Source of data: STATcompiler.

to have given birth alone. Improvements in mothers' level of education were associated with reductions in the prevalence of women who gave birth alone across the 80 countries studied.

DISCUSSION

These analyses have shown that far too many women—roughly 2.2 million based on recent data from 59 countries—delivered alone, with no one present. This practice is taking place predominantly in parts of the world with the worst maternal and newborn health indicators such as West and Central Africa and parts of East Africa. Complications during pregnancy and childbirth are a leading cause of death and disability among women in developing countries. Women who deliver alone are particularly vulnerable, as they do not even have access to the marginal support *any* attendance at birth confers. While we are not calling for anything less than for all mothers and newborns to have access to quality skilled care, ensuring that no mother delivers alone is an urgent moral and human rights imperative.

Recent research publications examined the issue of Nigerian women who gave birth with NOP.[6–8] They found that the highest risk factors were poverty, rural residence, and rising maternal age. Our analysis confirms these findings both within Nigeria and across all countries studied. Nigeria, in particular, had severe wealth disparities in terms of women delivering alone (26% of the poorest women deliver alone compared with 2% of the wealthiest women). This finding suggests that the severity of inequity linked to delivering alone in Nigeria is exceptionally high in contrast to other countries included in this study. We also found a high proportion of urban women in Nigeria who gave birth alone (6%) in addition to a high proportion in rural areas (17%). This may be emblematic of the fact that Nigeria, as Matthews et al. have documented, is a country with large urban inequalities and a substantial urban rich advantage.[14] In rural areas of Nigeria, the exceptionally large proportion of women who gave birth alone may be a direct result of a fewer number of facilities in rural areas.[15] In terms of maternal age, there was a clear pattern across the

Giving birth alone takes place predominantly in West and Central Africa and parts of East Africa.

TABLE 3. Percentage of Women Whose Most Recent Birth[a] Occurred With No One Present, Stratified by Antenatal Care (ANC) Visits, Birth Order of the Index Child, and Maternal Educational Levels

		No. of ANC Visits for Recent Birth			Birth Order of the Index Child				Mother's Highest Educational Level		
Country & Survey Year	Total	None	1–3	≥4	1	2–3	4–5	≥6	None	Primary	Secondary or higher
sub-Saharan Africa											
Angola 2006-07	8.4	NA	NA	NA	NA	NA	NA	NA	13.3	7.9	0.0
Benin 2011-12	1.1	4.2	2.0	0.2	0.9	0.9	1.4	1.5	1.5	0.4	0.1
Botswana 1988	1.4	NA	NA	NA	0.3	1.7	1.8	1.9	4.0	0.4	0.0
Burkina Faso 2010	1.4	4.3	1.6	0.5	0.0	1.4	1.7	1.8	1.6	0.3	0.1
Burundi 2010	3.6	16.7	4.0	2.5	0.8	2.3	5.6	6.5	4.6	2.9	0.3
Cameroon 2011	3.1	9.6	3.1	1.5	0.6	2.0	3.2	7.6	8.1	2.0	0.4
Central African Republic 1994-95	1.8	3.7	1.3	1.2	0.2	1.7	2.4	2.9	2.4	1.2	1.0
Chad 2004	4.0	5.1	2.8	2.7	0.9	3.7	4.1	6.3	3.8	5.5	1.4
Comoros	0.9	5.6	0.5	0.3	0.2	0.8	1.1	1.6	1.6	0.6	0.1
Congo (Brazzaville) 2011-12	0.5	3.4	0.6	0.2	0.1	0.4	0.6	1.3	1.7	0.8	0.2
Congo Democratic Republic 2013-14	0.8	2.0	0.6	0.8	0.2	0.4	1.3	1.3	1.2	1.1	0.4
Côte d'Ivoire 2011-12	2.4	8.7	2.7	0.9	0.5	1.8	3.3	4.8	3.0	1.8	0.5
Eritrea 2002	0.3	0.5	0.1	0.2	0.0	0.2	0.0	0.8	0.3	0.3	0.0
Ethiopia 2011	3.8	4.5	2.6	3.4	2.1	3.5	3.1	6.0	4.2	3.3	1.3
Gabon 2012	0.4	2.4	0.3	0.3	0.3	0.2	0.6	0.6	0.2	0.7	0.3
Gambia 2013	1.9	23.9	2.7	1.4	0.6	1.6	1.6	4.1	2.1	1.5	1.9
Ghana 2008	2.7	8.6	4.4	2.1	0.4	0.9	5.8	6.5	4.3	2.8	1.5
Guinea 2012	7.1	20.5	5.6	4.9	2.7	4.9	9.5	12.1	8.7	2.4	1.1
Kenya 2008-09	6.5	17.2	6.7	4.5	0.5	3.7	9.4	16.2	8.0	7.6	3.0
Lesotho 2009	1.0	3.5	1.1	0.6	0.4	0.7	2.7	2.4	3.1	1.3	0.5
Liberia 2013	0.2	1.0	0.6	0.1	0.0	0.1	0.4	0.4	0.2	0.3	0.0
Madagascar 2008-09	0.8	3.6	0.6	0.3	0.0	0.6	0.6	2.1	1.0	0.9	0.2
Malawi 2010	2.7	15.1	2.7	2.3	0.6	1.6	3.2	6.4	4.2	2.7	1.2
Mali 2012-13	5.8	11.8	4.7	3.0	3.6	4.5	6.1	8.9	6.3	4.8	1.5
Mauritania 2000-01	6.9	11.0	5.6	3.0	4.4	7.2	6.3	9.1	9.2	3.3	1.5
Mozambique 2011	1.1	0.4	1.2	1.3	0.7	0.8	1.3	1.9	1.2	1.1	1.1

Table 3 (continued).

Country & Survey Year	Total	No. of ANC Visits for Recent Birth			Birth Order of the Index Child				Mother's Highest Educational Level		
		None	1–3	≥4	1	2–3	4–5	≥6	None	Primary	Secondary or higher
Namibia 2013	0.9	5.9	2.1	0.5	0.1	0.8	1.8	2.4	4.0	1.9	0.3
Niger 2012	14.5	15.0	15.0	13.7	6.4	11.2	16.7	19.1	15.7	10.1	3.6
Nigeria	13.0	21.5	17.1	6.8	4.3	9.9	14.6	22.6	21.7	9.7	2.6
Rwanda 2013	7.3	36.4	8.7	3.7	1.0	6.2	10.1	15.3	11.7	6.7	2.9
Sao Tome and Principe 2008-09	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Senegal 2012-13	5.1	23.6	5.8	2.7	1.4	3.2	7.5	9.5	6.3	3.5	0.8
Sierra Leone 2013	0.2	0.0	0.4	0.1	0.0	0.1	0.2	0.3	0.2	0.0	0.0
South Africa 1998	2.1	6.5	2.3	1.7	0.4	1.5	3.5	7.8	7.6	3.1	0.9
Sudan 1989-90	4.3	NA	NA	NA	4.1	4.2	3.8	4.8	7.4	0.4	0.5
Swaziland 2006-07	4.4	15.2	4.6	3.8	0.9	3.1	8.3	12.3	10.6	6.1	2.4
Tanzania 2010	3.5	6.5	4.2	2.2	0.2	2.6	3.6	7.9	3.7	3.7	0.7
Togo 2013-14	3.1	13.5	3.4	1.5	0.5	2.7	2.6	8.4	5.0	2.4	0.9
Uganda 2011	6.8	14.1	8.6	4.3	1.2	3.3	7.4	13.7	12.5	7.2	2.2
Zambia	3.1	7.0	3.5	2.6	0.1	1.1	3.0	9.2	8.0	3.5	0.9
Zimbabwe 2013-14	2.8	5.0	2.9	2.3	0.5	2.0	6.2	10.4	10.7	4.2	2.1
North Africa/West Asia and Eastern Europe											
Albania 2008-09	0.1	4.1	0.0	0.0	0.2	0.0	0.0	0.0	6.1	0.0	0.0
Armenia 2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Azerbaijan 2006	0.3	1.6	0.0	0.0	0.0	0.7	0.0	0.0	0.0	0.0	0.3
Egypt 2014	0.1	0.7	0.1	0.0	0.0	0.1	0.2	0.2	0.2	0.1	0.1
Jordan 2012	0.2	1.3	2.3	0.0	0.0	0.3	0.1	0.1	0.0	0.1	0.2
Moldova 2005	0.2	0.0	0.0	0.2	0.0	0.4	0.0	0.0	0.0	0.0	0.2
Morocco 2003-04	1.1	1.8	0.7	0.8	0.0	0.4	1.9	4.6	1.7	0.0	0.1
Turkey 1998	0.7	1.8	0.8	0.0	0.1	0.5	0.7	4.0	1.5	0.7	0.0
Ukraine 2007	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Yemen 1997	4.4	5.1	3.1	3.5	1.7	3.1	4.3	6.5	4.8	2.9	3.1
Central Asia											
Kyrgyz Republic 2012	0.1	0.0	0.0	0.2	0.4	0.0	0.0	0.0	0.0	0.0	0.0
Tajikistan 2012	0.1	0.3	0.3	0.0	0.1	0.1	0.4	0.0	2.5	0.0	0.1
Turkmenistan 2000	0.2	17.0	0.0	0.0	0.2	0.2	0.0	0.0	0.0	0.0	0.2

Table 3 (continued).

Country & Survey Year	Total	No. of ANC Visits for Recent Birth			Birth Order of the Index Child				Mother's Highest Educational Level		
		None	1–3	≥4	1	2–3	4–5	≥6	None	Primary	Secondary or higher
Uzbekistan 1996	0.4	2.0	0.0	0.3	0.0	0.0	0.0	1.9	0.0	0.0	0.4
South and Southeast Asia											
Bangladesh 2011	0.4	0.6	0.5	0.2	0.0	0.4	1.9	0.0	0.7	0.6	0.3
Cambodia 2010	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
India 2005-06	0.5	1.1	0.5	0.2	0.1	0.5	0.9	1.5	0.9	0.3	0.1
Indonesia 2012	0.2	2.4	1.3	0.1	0.2	0.1	0.9	1.4	1.3	0.5	0.1
Nepal 2011	2.9	9.5	2.4	1.3	0.6	2.0	6.5	12.0	4.5	2.7	1.0
Pakistan 2012-13	0.2	0.4	0.1	0.1	0.0	0.2	0.2	0.2	0.3	0.0	0.0
Philippines 2013	0.1	0.4	0.2	0.1	0.0	0.1	0.0	0.4	1.4	0.4	0.0
Sri Lanka 1987	0.2	NA	NA	NA	0.0	0.1	0.9	0.7	0.7	0.3	0.2
Thailand 1987	1.0	NA	NA	NA	0.2	1.0	1.8	4.2	0.3	1.0	1.2
Timor-Leste 2009-10	3.0	5.4	3.5	2.2	1.1	2.2	2.6	5.4	4.9	3.2	1.3
Vietnam 2002	0.1	0.3	0.1	0.0	0.0	0.0	0.6	2.0	1.1	0.0	0.0
Latin America and the Caribbean											
Bolivia 2008	0.9	2.9	1.4	0.5	0.2	0.7	1.3	2.2	3.3	1.2	0.2
Brazil 1996	0.6	1.7	1.2	0.3	0.2	0.3	1.6	1.9	0.3	1.0	0.3
Colombia 2010	0.2	1.1	0.8	0.1	0.0	0.2	0.4	1.1	1.0	0.5	0.1
Dominican Republic 2013	0.1	3.2	0.0	0.1	0.0	0.1	0.4	0.5	1.0	0.0	0.1
Ecuador 1987	2.2	NA	NA	NA	0.8	1.6	2.5	4.9	9.5	2.0	0.2
El Salvador 1985	7.6	NA	NA	NA	2.9	5.6	9.8	16.1	17.4	4.8	0.0
Guatemala 1998-99	1.2	2.7	3.2	0.4	0.3	0.7	1.2	2.9	2.3	1.0	0.0
Guyana 2009	0.6	0.0	0.0	0.7	0.0	0.8	1.1	0.6	0.0	0.2	0.7
Haiti 2012	1.9	2.7	2.1	1.7	0.5	2.1	3.3	2.9	3.6	1.7	1.1
Honduras 2011-12	0.6	3.3	1.0	0.5	0.1	0.7	1.2	1.8	3.2	0.8	0.1
Mexico 1987	2.6	NA	NA	NA	0.6	0.8	3.8	7.3	8.6	2.2	0.3
Nicaragua 2001	1.1	3.0	1.5	0.6	0.0	0.4	1.6	4.3	3.5	0.6	0.2
Paraguay 1990	0.5	2.7	0.2	0.4	0.0	0.1	1.4	1.2	0.0	0.7	0.0
Peru 2012	0.3	2.1	0.0	0.3	0.0	0.2	0.9	1.7	0.5	1.0	0.1
Trinidad and Tobago 1987	0.1	NA	NA	NA	0.0	0.0	0.5	0.0	0.0	0.2	0.0

[a] Data were restricted to the most recent live birth in the 3 years preceding each survey.

countries included in our analysis that prevalence of giving birth alone increased with increasing maternal age. Given the constellation of extant risks for advanced maternal age, older mothers who deliver alone are particularly vulnerable to complications.[16] However, in Nigeria and Niger, there was also a high proportion of young mothers who delivered alone; these young, often nulliparous, adolescent mothers who deliver alone are at significantly higher risk of developing obstetric fistula.[17]

Our analysis suggests that the drivers of delivery with NOP are of a structural nature, and not presumptively cultural. Across all 80 countries studies, the pattern was strikingly consistent, showing that women who gave birth alone were poor, had little education, and lived in rural areas. As the global community works to reduce inequalities in socioeconomic and health indicators, it will also likely have impact on eradicating delivery with NOP.

At the same time, evidence from Sokoto State, in northern Nigeria, suggests that the prevalence of delivery with NOP can be eliminated almost entirely through targeted actions by key stakeholders, along with education and advocacy, even in a population where poverty is pervasive, resources are scarce, and women are poorly educated. In 2008, the DHS reported that the prevalence of delivery with NOP in Sokoto State was 25%; by 2013, the prevalence had dropped to less than 1%.[18,19]

Sokoto State is situated in the northwest corner of Nigeria, with an estimated population of just over 4.6 million in 2013, 80% of whom live in poverty.[20,21] Data show that use of maternal health services in health facility settings is very low and has not improved in recent years; in both 2008 and 2013, 95% of married women in Sokoto State reported having delivered their most recent child at home.[18,19] Furthermore, more than 80% of women in the state in 2013 reported that they had not accessed any antenatal care during their most recent pregnancy.[18,19] The low uptake of maternal health services may be a direct result of few services available. There have been investments in increasing access to and the availability of health services in Sokoto State, resulting in a 26% increase in the number of government-run health facilities between 2009 and 2015, from 600 facilities to 756 facilities.[22,23] Although efforts to increase the number of facilities have yielded results, the majority of women in Sokoto State, as noted above, still give birth at home.

The decline in delivery with NOP in Sokoto State coincided with multilevel discussions between government and civil society beginning in 2012 after the problem was first reported by JSI Research and Training Institute, Inc. (JSI) researchers.[7] JSI researchers, working in Sokoto State with the Targeted State High Impact Project (TSHIP) funded by the United States Agency for International Development (USAID), shared their findings with government officials and civil society leaders. Whereas government officials in Sokoto State were surprised by the magnitude of the problem, community leaders were not. All parties agreed the status quo was not acceptable.

In addition to ongoing efforts to improve access to and use of quality maternal and newborn health services across Sokoto State, JSI/TSHIP began working with state-level leaders of Jama'atu Nasril Islam (JNI), Nigeria's largest, most-networked, Muslim nonprofit aid group, to address the issue of women delivering alone. JNI leadership took charge of sounding an alarm and raising awareness among government and civil society leaders in Sokoto State. JNI also issued a call to eliminate the practice of delivery with NOP. Throughout all 244 wards in Sokoto State, JNI mobilized its local leaders and briefed them on the dangers associated with giving birth with NOP. Additionally, JNI called for local leaders to publicly discourage giving birth alone in homes. In 2012, JNI leaders trained Muslim clerics throughout the state to use appropriate verses from the Koran and *hadith* (collections of sayings or traditions of the Prophet Muhammad) to highlight the dangers of giving birth with NOP in relation to maternal and newborn mortality. Muslim clerics, with support from JNI, started to preach in favor of delivery with skilled assistance during Friday congregational prayers, wedding *fatihas* (religious ceremonies), and naming ceremonies. These efforts were successful in educating communities in Sokoto State on the dangers associated with giving birth alone, and ultimately changing the societal norms that had, in the past, condoned and facilitated the practice of delivering with NOP.

Programmatic experience in northern Nigeria suggests that the practice of giving birth alone can be reduced markedly through community education and advocacy.

As a complement to these efforts, JSI/TSHIP also worked with the state government officials and communities to launch a 2,440-strong female community-based health volunteer (CBHV) team in 2012. These 2,440 CBHVs, representing 10 CBHVs per ward, were trained to counsel mothers on delivery with skilled attendance; the CBHVs made a total of 389,000 documented household visits in 2013 alone.[23,24]

The case of Sokoto State suggests that a process of community education and awareness has the potential to create ideation around norms in the short to medium term and can realistically

accelerate the replacement of NOP-type deliveries with some type of attendance. This encouraging development is worth the attention of policy and civil society members across countries with relatively higher prevalence of deliveries with NOP. In itself, it is a call to action for leaders to act now alongside the broader implementation of SDG-related initiatives. The eradication of the practice of giving birth with NOP is only one step in ensuring that no mother or newborn dies of a preventable death. Ultimately, until every woman has safe, affordable, acceptable, and available maternal health services, there will remain barriers to achieving SDG targets 3.1 and 3.2.

Study Limitations

Several limitations to our analysis should be noted. First, the DHS methodology collects information on women giving birth alone only through self-report.

Second, as the DHS is conducted in many countries, with multiple language groups, it is possible that women may not have understood the question correctly and thus that they incorrectly reported that their most recent birth occurred with "no one" present, despite efforts undertaken by the DHS to mitigate complications that may arise due to translation. The protocol for the standard DHS questionnaire not only asked women directly about who assisted with their most recent delivery but also probed those respondents who said "no one" assisted to determine whether any adults were present at the time of delivery.[25]

Another issue that must be noted, particularly in the Sokoto State context where the practice of giving birth with NOP has been so publicly and widely discouraged, is that DHS respondents may be reluctant to share that they have delivered alone. If women, due to social pressure and/or stigma associated with giving birth alone, are unwilling to report giving birth alone, it would be impossible to detect that, given the DHS methodology. Research on whether or not covert delivery with NOP occurs would be best informed through other study designs.

In Table 2 and Table 3, we were unable to include the number of women who gave birth. Unfortunately, the STATcompiler database neither provided specific sample sizes nor numerators and denominators for the percentages presented.

Also, many of the countries have not had a recent DHS survey, precluding determination of current *global* burden of delivering with NOP.

Furthermore, in our analyses of the burden of women who gave birth alone, there are some disagreements between the age parameters from the US Census Bureau (population of women aged 15–49) and the general fertility rate, as calculated by the DHS, which includes only women between the age of 15–44. According to the DHS, "The General Fertility Rate (GFR) is for the three years preceding the survey expressed per 1,000 women age 15–44. Note however that births to all women 15–49 are included in the numerator. In practice, there are very few births to women age 45–49 so the difference compared to restricting to births to women age 15–44 would be very small."[26]

Finally, data available via STATcompiler could only be analyzed by using broad categories. Further research should use country-specific data to further explore the interactions between these predictive variables. Despite these data limitations, this analysis has shown that too many women are giving birth alone, and that grassroots advocacy and programmatic efforts are able to reduce the phenomena considerably, including in contexts where other socioeconomic determinants of health remain unchanged.

CONCLUSION

Giving birth alone is a problem of important magnitude in many low- and middle-income countries, particularly in those countries with the worst maternal and newborn health indicators such as in West and Central Africa and parts of East Africa. Community education and awareness has the potential to change cultural norms in the short and medium term, accelerating the replacement of deliveries with no one present with some type of attendance. Ensuring that no mother delivers alone is an urgent moral and human rights imperative to prevent avoidable maternal and newborn deaths.

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ORIGINAL ARTICLE

Casas Maternas in the Rural Highlands of Guatemala: A Mixed-Methods Case Study of the Introduction and Utilization of Birthing Facilities by an Indigenous Population

Ira Stollak,[a] Mario Valdez,[b] Karin Rivas,[c] Henry Perry[d]

In an isolated mountainous area of Guatemala with high maternal mortality, an NGO-sponsored approach engaged communities to operate local, culturally appropriate birthing facilities and is achieving high and equitable utilization. Likely success factors:

- **Community engagement and ownership**
- **Close location of facilities**
- **Perceived high quality of services**
- **Engagement of traditional birth attendants in the birthing process and as advocates for facility use**

ABSTRACT

Background: An international NGO, with financial and managerial support from "partner" communities, established *Casas Maternas* (birthing facilities) in 3 municipalities in the isolated northwestern highlands of the department of Huehuetenango in Guatemala—an area with high maternal mortality ratio (338 maternal deaths per 100,000 live births). Traditional birth attendants are encouraged to bring patients for delivery at the *Casas Maternas*, where trained staff are present and access to referral care is facilitated.

Methods: We conducted a mixed-methods study in San Sebastian Coatán municipality to assess the contribution of 2 *Casas Maternas* to health facility deliveries among partner and non-partner communities, with particular emphasis on equity in access. We surveyed all women who delivered in the study area between April 2013 and March 2014, the first full year in which both *Casas Maternas* in the study area were operating. In addition, using purposive sampling, we conducted in-depth interviews with 22 women who delivered and 6 focus group discussions with 42 community leaders, traditional birth attendants, and *Casas Maternas* staff members. We analyzed the quantitative data using descriptive statstics and the qualitative data with descriptive content analysis.

Results: Of the 321 women eligible for inclusion in the study, we surveyed 275 women (14.3% could not be located or refused to participate). Between April 2013 and March 2014, 70% of women living in partner communities delivered in a health facility (54% in a *Casa Materna*) compared with 30% of women living in non-partner communities (17% in a *Casa Materna*). There was no statistically significant difference in uptake of the *Casa Materna* by maternal education and only a weak effect by household wealth. In contrast, distance from the *Casa Materna* had a pronounced effect. Traditional birth attendants were strong advocates for utilization of the *Casa Materna* and played an important role in the decision regarding where the birth would take place. In addition, the program's outreach component, in which peer volunteers visit homes to promote healthy behaviors and appropriate use of health facilities, was identified as a key factor in encouraging mothers to deliver in facilities.

Discussion: The *Casa Materna* approach to strengthening maternity care as developed by Curamericas has potential to increase health facility utilization in isolated mountainous areas inhabited by an indigenous population where access to government services is limited and where maternal mortality is high. The approach shows promise for broader application in Guatemala and beyond.

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INTRODUCTION

Although Guatemala has made strong national progress in reducing its maternal mortality ratio (MMR) to 88 maternal deaths per 100,000 live births,[1]

this national average hides marked regional and ethnic disparities. The MMR for indigenous women (163 per 100,000) is twice that of non-indigenous women (78 per 100,000), and indigenous women account for 71% of the country's maternal deaths compared with 54% of the country's births.[2] Furthermore, the national percentage of deliveries that take place in facilities is 29% for indigenous women and 70% for non-indigenous women.[2]

Guatemala's National Study of Maternal Mortality describes the problem of disparities in maternal health outcomes as follows[2]:

> *The departments most affected by maternal mortality are those that have the highest levels of poverty, rurality, and indigenous population, principally Mayan, as well as the lowest levels of education and highest levels of fertility … This convergence of factors is no coincidence but … is caused by inequitable access to health and human development resources, which is rooted in a history of exclusion and social, economic, and ethnic discrimination that persists.*

Key factors accounting for these disparities are culture and language, geographic barriers to accessing services, shortage of rural health personnel, and poverty. Mayan women are less inclined to use Ministry of Health (MOH) facilities because the staff members rarely speak their language, and their cultural practices are prohibited and even scorned. They complain of poor treatment by the Ladino/mestizo (non-indigenous) staff and cite this as a reason for not using the facilities. The MOH facilities are too far away, and dangerous mountainous roads often must be traversed in order to reach them. There is no local or community accountability of the MOH services. There are frequent shortages of staff, and services are frequently unavailable. Furthermore, there is high turnover of MOH staff members who are from a non-indigenous culture and are eager to relocate to an area closer to their home of origin and families.

The government has made various efforts to address this problem including: (1) "indigenizing" its health staff serving Mayan populations and making services more culturally acceptable, (2) developing a cadre of women authorized to verify and report on the quality of maternity services provided in indigenous areas, and (3) providing training and support to traditional birth attendants (known as *comadronas*) along with formal registration with the government. Special projects have also been implemented over the years, including MotherCare's government-managed *Casas Maternas*[3] in the 1990s and Project Concern's *Casas Maternas* around Lake Atitlan.[4,5] These *Casas Maternas* are comprehensive centers for managing high-risk pregnancies referred from outlying areas. Limited in scope, these approaches have not been able to comprehensively address the more complex issue of establishing "community-friendly" facilities for routine delivery with high-quality, nearby, around-the-clock medical care for mothers and newborns and support during childbirth from *comadronas*.

Guatemala's Northwest Region and the department of Huehuetenango, which are predominantly Mayan, have among the highest maternal mortality ratios (MMRs) in Guatemala (226 per 100,000 live births).[6] Through its program of routine systematic home visitation and registration of vital events, Curamericas documented over a 10-year period in the municipalities covered by its programs 104 maternal deaths among 30,780 births.[7] This represents an MMR of 338 per 100,000 live births, one of the highest reported in the Western hemisphere.

To address these disparities, Curamericas/Guatemala, in collaboration with Curamericas Global (an international NGO), began a project in 2011 to expand equitable access to and use of maternal and newborn health services. The project worked in a catchment area comprising 28,000 women of reproductive age in 3 isolated municipalities in the department of Huehuetenango (Figure 1).

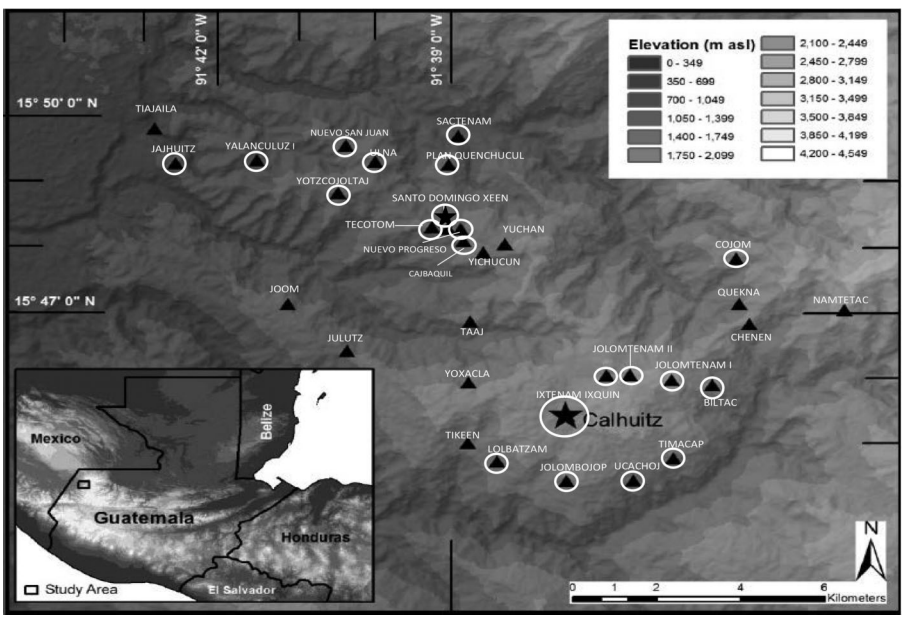
Guatemala's pronounced ethnic disparities in maternal health are a result of cultural, language, and geographic barriers to accessing services as well as a shortage of rural health personnel.

Curamericas had been working in this isolated part of the department of Huehuetenango since 2002 to reduce the mortality of mothers and children through community-based primary health care services and community engagement. A 2011 survey in the area revealed that 89% of deliveries were still occurring in the homes and 81% were attended by *comadronas*.[7] The extreme geographic isolation of the communities, lack of transport, and cultural traditions contributed to this situation.

Beginning in 2011, Curamericas built on its engagement in the 3 municipalities where it had been working previously to initiate activities in 89 communities with a combined population of 42,755 (Phase 1). In Phase 2, which began in 2013, the project extended its activities to 94 additional communities with a combined population of 54,867. The project integrates 3 key methodologies:

- A census-based, impact-oriented (CBIO) methodology to mobilize communities and ensure equitable coverage of services[8]
- A Care Group methodology,[9] which uses volunteer female community peer educators

FIGURE 1. Location of Study Communities in the San Sabastian Coatán Municipality of the Northwestern Highlands of Guatemala



Partner communities with a *Casa Materna in operation (Calhuitz and Santo Domingo).*

Partner communities in close geographic proximity to a *Casa Materna.*

▲ Non-partner communities.

to motivate behavior change and generate demand for maternal/newborn services

- The *Casas Maternas* of Curamericas/Guatemala,[10] which provide local access to community-based, culturally appropriate maternal services for routine deliveries, in contrast to MotherCare's and Project Concern's *Casas Maternas* model, described above, which focus on high-risk pregnancies

Curamericas recognizes traditional birth attendants as essential partners for improving maternal and newborn care.

In brief, after working in partnership with communities to identify all households, the project recruited 1 woman volunteer for every 10–12 households with a mother and young children to serve as a volunteer peer educator. The volunteers shared key maternal and child health messages with the mothers every 2 weeks through home visits or during meetings with a few neighbors. A group of 10–12 volunteer peer educators met every 2 weeks as a Care Group with a paid facilitator to learn a new message to share with their neighbors, to discuss their activities during the previous 2 weeks, and to report any new vital events.

From the outset of its work in 2002, Curamericas has developed a relationship of respect and collaboration with *comadronas*. Being careful not to interfere in the relationship between families and *comadronas*, Curamericas recognized that *comadronas* are inextricably embedded in the local culture and are thus essential partners for improving maternal and newborn care. Since the work of Curamericas extends down to each household, the program has been able to develop and maintain contact with the *comadronas.* The Box provides further details about the program.

A key component of the current program is the *Casa Materna*, which translated literally from Spanish means maternal house. The *Casas Maternas* developed by Curamericas/Guatemala are a response to the lack of readily available around-the-clock delivery care. In the 3 municipalities of the Curamericas program, there was only 1 facility that attended deliveries prior to the

operation of the *Casas Maternas*, and it was open only on Mondays through Fridays during the day. This facility was operated by the government and was difficult to access because of the terrain, lack of transportation, and costs involved. Furthermore, staff members were frequently not present and spoke only Spanish, and *comadronas* were not allowed to assist with the delivery.

To examine whether the *Casas Maternas* have contributed to increasing health facility deliveries, we conducted a mixed-methods study in San Sebastian Coatán, a municipality with 32 communities, which was part of the 2011 Phase 1 activities. The specific objectives of the study were to examine the degree to which use of *Casas Maternas* has been equitable in terms of family income, educational level of the mother, and distance from the *Casa Materna,* as well as the factors that influenced use of the *Casas Maternas* by women in the communities.

METHODS

Study Setting

The study was conducted in the municipality of San Sebastian Coatán, which has 32 scattered mountainous communities, most of which are located at elevations of 2,000–3,800 meters. These communities belong to the *Chuj* ethnic group, which has strong ancestral customs, and they are relatively homogeneous culturally and socioeconomically. Most women speak only the local Mayan dialect (*Chuj*) and only a small proportion speak Spanish.

Until the last decade, most of the communities were inaccessible to vehicles and could be reached only on foot. Still, many of the communities remain accessible only by foot or motorcycle. Levels of education and socioeconomic status are quite low. The area is commonly referred to as the "triangle of death" because of its high mortality rates and because of the oppression it suffered during the Guatemalan civil war from 1960–1996.

There are 2 *Casas Maternas* operating in the study area: one in the small town of Calhuitz, which began operation in 2009, and the other in the town of Santo Domingo, which opened in early 2013. There are 9 and 12 partner communities for the *Casas Maternas* in Calhuitz and Santo Domingo, respectively. The other 11 communities in the study area are non-partner communities. Partner communities were self-selected: (1) they are in close geographic proximity to the *Casa Materna*, (2) the community leaders took on the responsibility of participating in a management committee for the *Casa Materna*, and (3) the community contributed to the construction of the *Casa Materna.* As shown in Figure 1, most but not all, communities surrounding these 2 *Casas Maternas* are partner communities. *Casa Materna* services were available to anyone regardless of community of residence.

Casas Maternas, or birthing facilities, were established to provide readily accesible, around-the-clock delivery care to women living in remote areas of Guatemala.

Study Design

A mixed-methods design was chosen to document the extent to which the project's *Casas Maternas* were used by the surrounding population and to understand how women addressed the complex issues surrounding the decision of where to give birth. Study participants were all of the women who had given birth in the study area during the 12-month period between April 1, 2013, and March 31, 2014, the first full year in which both *Casas Maternas* in the study area were operating, as recorded in the vital events register maintained by the program. The study area consisted of 32 communities of the municipality of San Sebastian Coatán.

Three types of data were collected from the study participants: (1) household survey data from all mothers eligible to be included in the study, (2) in-depth interviews with selected mothers, and (3) focus group discussions with selected key informants, including Micro-Regional Committee members, *comadronas*, and *Casa Materna* staff. The household survey provided the primary data for the socioeconomic status of the household and distance from the *Casa Materna*. These data were complemented by in-depth interviews with individuals and focus group discussions that provided additional insights into what factors were considered in the decision-making process related to birth location, as well as information about the delivery experience and perspectives on the *Casas Maternas*.

Data Collection

Quantitative data were collected in September 2014 by a survey team of 12 trained women professionals (teachers and health educators) who were fluent both in the local language (*Chuj*) and in Spanish. A structured household questionnaire was administered to all mothers living in the 32 Phase 1 communities in the municipality of San Sebastian Coatán who had given birth during the period from April 1, 2013, until March 31, 2014. The questionnaire included questions about sociodemographic characteristics, including ownership of 22 household assets, as well as information on the location of maternal and newborn health services received. The survey questionnaire was written in Spanish, but the interviews were conducted in *Chuj*.

BOX. What is a *Casa Materna*?

Casas Maternas provide an alternative response to the challenges that Ministry of Health (MOH) services present. These maternity centers provide: (1) scientifically validated medical care with cultural and linguistic adaptation; (2) physical proximity to the patient's home; (3) community ownership and accountability; and (4) use of lower-level health staff who are willing to live in the area and are usually from a local community. In contrast to MOH facilities generally, at all the *Casas Maternas* the staff members speak the local Mayan dialect, and traditional cultural practices—including the presence of family—are respected.

Casas Maternas, as developed and implemented by Curamericas in collaboration with local communities, consist of a simple physical facility, a small number of trained staff, some basic supplies and equipment, and a management and financial support structure embedded in the community. At the time of writing of this article, in the Curamericas program area of almost 100,000 people, there were 4 operating *Casas Maternas*.

Community Engagement

Curamericas engages with communities when planning and operating *Casas Maternas*, responding to their interests and needs. In all cases, there is a "micro-region" of communities formed that want to support the development and management of the *Casa Materna* because of their high maternal mortality and distance from MOH facilities. All communities sign a formal agreement. A committee of community members works with the Curamericas program leadership. The community provides the land and labor to construct the facility, while Curamericas provides the materials and the equipment needed to operate it. The managing committee takes responsibility for providing the *Casa Materna* with food and for keeping the facility clean and maintained. The committee also manages emergency referral transport and the transport insurance program (described further below).

The Physical Infrastructure

Each *Casa Materna* has a reception area, a traditional Mayan kitchen with a wood-burning stove, potable filtered drinking water, and a bathroom with indoor plumbing (including a toilet, sink, and shower). There is an examination room, a birthing room, a recovery/postpartum room with 2 beds, and an adjacent *chuj* (traditional sweat lodge). There is also a small pharmacy. Outside, there is a patio with a faucet for washing dishes and clothes. The mother and her family can use the kitchen to prepare traditional meals, and the patio to wash and clean dishes.

The Staff and Their Capabilities

Each *Casa Materna* is staffed by an auxiliary nurse and 2 support women. The auxiliary nurse performs most deliveries, but the support women are trained to do deliveries in the auxiliary nurse's absence. The auxiliary nurse is Mayan, from the local municipality, and speaks the local Mayan dialect. Auxiliary nurses receive a 12-month course from the MOH. After then being hired by Curamericas, they receive a 2-month internship at the Calhuitz *Casa Materna*, where a highly experienced obstetric nurse supervisor is stationed along with a readily available physician with training in obstetrics. In addition, there are 2 obstetric registered nurses (RNs), who serve as teachers and supervisors for 2 *Casas Maternas*.

The deliveries occur in a clean and safe environment; there is a dedicated delivery room in the *Casa Materna*, where the staff use the 3 "essential newborn actions" (clean cord care, thermal care, and immediate breastfeeding with colostrum) and active management of the third stage of labor (AMTSL), including routine administration of oxytocin postpartum, controlled umbilical cord traction, and uterine massage. The staff members are also skilled in "home-based life saving skills" (HBLSS), which includes management of retained placenta (and prompt referral if not effective), emergency care of hemorrhage, and resuscitation of the newborn if needed.

This training is provided by the Curamericas nurse supervisor, an obstetric RN (who provides regular monthly trainings to the *Casa Materna* staff members as well as continuous quality control monitoring of their work using a *Casa Materna* staff training guide). She and the *Casa Materna* staff have been trained in HBLSS by nurse-midwives from the American College of Nurse Midwives. The staff received this training in the summer of 2012 and again in the fall of 2013. The staff is also trained in behavior change communication (BCC) concerning antenatal care, the importance of health facility births, postpartum care, and recognition of and prompt response to danger signs during pregnancy, delivery, and the

BOX (continued).

postpartum period, as well as the importance of exclusive breastfeeding and how to do it. They deliver these lessons to support groups of pregnant and lactating women that meet at the *Casa Materna*. They are also trained by the nurse supervisor to provide family planning, carry out antenatal and postpartum care checks, perform Papanicolaou tests to screen for uterine cancer, and provide maternal nutritional counseling.

The auxiliary nurses have taken the American College of Nurse Midwives course in safe delivery. They perform AMTSL by using a partogram, uterine massage, controlled umbilical cord traction, and intramuscular injection of oxytocin. They have available for their use intravenous fluids, blood pressure cuffs, thermometers, antibiotics, and obstetrical tools for clamping the umbilical cord and for repairing perineal tears.

Delivery Care and Referral

During the period of labor and delivery, the mothers are allowed to assume whatever position is most comfortable for them. Many like to lean against a large plastic ball about 3 feet in diameter. After the delivery, women stay at the *Casa Materna* for a minimum of 8 hours prior to discharge.

In most cases, a *comadrona* selected by the mother is also present and participates in the care of the mother during labor and delivery and afterwards. Local *comadronas* have been integrated into the *Casa Materna* operations—they look after pregnant women for their usual fee, but encourage women to deliver in the *Casa Materna* and accompany them there, where they assist in the delivery. They are trained by *Casa Materna* staff to detect danger signs during pregnancy and the postpartum period and to promptly refer women with complications to the *Casa Materna* if they are delivering at home.

Each *Casa Materna* is equipped with a satellite telephone to communicate if needed with a volunteer ambulance crew based 1–2 hours away (depending on the *Casa Materna*) at a town at the foot of the mountain range. Each *Casa Materna* has drivers and vehicles on call to take a patient in need of referral to meet the ambulance at the foot of the mountain. Transport to the hospital in the city of Huehuetenango (the only referral facility available) for patients costs US$125 to $150, a very large sum of money for the families living in the area. An insurance scheme has been developed by the communities with facilitation by Curamericas, in which families can pay into for about $13. If transport is needed, the insurance covers half the transportation cost.

During the 12-month study period, the 2 *Casas Maternas* had 118 deliveries and 19 referrals to the hospital in Huehuetenango (16.1% of deliveries were referred). The reasons for referral of these 19 patients were: hemorrhage (5, including 3 with placenta previa); prolonged labor (4); transverse lie (4); premature rupture of membranes and premature labor (3); pre-eclampsia (2, including 1 with associated hemorrhage); and other complicating medical problems (1). All patients who were referred accepted the referral. Of these referrals, there were no maternal deaths, 3 stillbirths, and 1 death of a newborn while the mother and newborn were still at the hospital. Thirteen of the 19 referred women underwent cesarean delivery, 4 delivered vaginally, and 2 underwent dilation and curettage (D&C). The cesarean delivery rate among the women coming to the *Casa Materna* during the 12-month study period was 11.0% (13/118). Complications managed at the *Casa Materna* without the need for referral were 6 women with completed abortions (treated with rehydration and antibiotics) and 7 women with footling presentations.

Availability of Services and Cost to Patients

Services at the *Casa Materna* are free and available to any woman, whether or not she comes from a partnering community in the "micro-region." In practice, however, women prefer not to go very far from their home to deliver. The population of the partner communities in the "micro-regions" that is responsible for a *Casa Materna* is about 3,000 people. The family can bring its own food or pay $5 for food provided at the *Casa Materna*. The family can clean the linens used by the patient there or pay $5 to have them cleaned after the delivery.

Other Services and Programs at the *Casa Materna*

In addition to delivery care, *Casa Materna* staff provide other services, including prenatal care and facilitation of various education and support groups (e.g., for pregnant women, lactating mothers, adolescent groups). In addition, the staff members provide home visits, meet with local women's group in the communities (Care Groups and local

BOX (continued).

women's groups), provide training for community health committees and the micro-regional committees responsible for the *Casas Maternas*, and meet with community assemblies. Discussions are now underway in Guatemala on a broader scale for the MOH to implement this model in hard-to-reach areas inhabited by indigenous populations.

The *Casa Materna* program is linked with a strong outreach delivery system using volunteers to reach every household every 2 weeks to give educational messages and to register vital events. This outreach program follows the census-based, impact-oriented (CBIO) and Care Group methodologies of identifying all homes, visiting all homes on a regular basis with early identification of pregnant women, promotion of healthy behaviors and appropriate health facility utilization (including prenatal care and childbirth at facilities), and registration of vital events.[21,22]

Management, Sustainability, and Finances

The budget of a *Casa Materna* is approximately 20,000 Guatemalan Quetzales (GTQ) per month (about US$2,600, with 7.7 GTQ currently equivalent to US$1). At present, 1 of the 4 *Casas Maternas* has an auxiliary nurse whose salary is paid by the MOH. One of the municipalities is beginning to pay the support workers who work at 1 of the *Casas Maternas*. There are indications that the MOH and the municipalities will gradually support the salaries of the staff at each *Casa Materna*.

The cost of the entire program (including the *Casas Maternas* and the outreach program) is $5.60 per capita per year for the entire project area.

For the qualitative data collection, key informant interviews and focus group discussions were carried out in 6 purposively selected communities: 2 from non-partner communities (Yoxacla and Chenen) and 4 from partner communities (Calhuitz and Santo Domingo, each of which had a *Casa Materna* in operation, as well as Ulna and Lolbatzan, which did not have a *Casa Materna*). In 5 of the 6 communities, 4 women were purposively selected and interviewed; 2 of the women had used a *Casa Materna* and 2 had not. In the sixth community (Yoxacla), there were no women who had used the *Casa Materna*, so only 2 women were interviewed, both of whom delivered at home. The 22 in-depth interviews were performed by 3 teams of 2 interviewers in the respondents' homes. The interview covered 3 main topics: (1) how the decision about birth place for the most recent birth was made, (2) the birth experience, and (3) assessment of quality of care and recommendations for improvement of *Casa Materna* services. The interviews were recorded. Prior to beginning the interview or survey, the interviewer obtained informed consent verified by either a signature or a thumbprint.

Six focus group discussions were conducted with 42 key informants: 2 focus groups were conducted with members of Micro-Regional Committees, 2 with groups of *comadronas*, and 2 with staff of the *Casas Maternas* in the study area. The focus groups were conducted in *Chuj* by 3 teams of 2 trained bilingual women at the Calhuitz and Santo Domingo *Casas Maternas*.

Data Management

Two field supervisors as well as the data entry supervisor reviewed each completed survey questionnaire to ensure that all questions were clearly and appropriately completed. To de-identify each interview, each questionnaire was labeled with a unique code number. The data were entered into Epi Info version 7.1 by a team of 4 data entry staff trained in Epi Info data entry, quality control, and confidentiality assurance.

For the qualitative data management, one field supervisor as well as the transcription supervisor reviewed each recording and transcription to ensure the quality of both the translation and the transcription. Each recorded session and its corresponding transcription were labeled with a unique code number for quality control and confidentiality.

Data Analysis

The survey data were analyzed using Epi Info 7.1 and Stata 13. Quantitative data were analyzed using descriptive statistics. Principal components analysis (PCA) was used to create an asset score for each household using 22 household assets according to standard techniques.[11,12] For the equity analyses, frequency distributions of the number of years of education of the mother and the distance of the mother's community from the nearest *Casa Materna* were used to establish terciles. The distribution of the family's PCA asset scores was used to develop

quintiles. For education, the terciles were defined as follows: 0 years of education, 1–3 years, and 4 or more years (30%, 33%, and 37% of the respondents, respectively). Distance terciles were also defined: 0 to <4 km, 4 to <8 km, and 8–15 km (34%, 33%, and 33% of the respondents, respectively). The percentage falling in each wealth quintile ranged from 19% in the first quintile to 21% in the third.

Equity of health facility utilization was assessed by calculating the number of women in each equity tercile (or quintile) who gave birth in a facility divided by number of women in that group who had given birth during the year of the study.

Although all women giving birth between April 1, 2013, and March 31, 2014, in the study population were included in the 2014 household survey (i.e., no sampling was carried out), conservative estimates of confidence intervals were calculated using WIN-PEPI and Epi Info 7.1.

The qualitative data were manually reviewed and inductively grouped and coded into categories as shown in Table 1. This process is referred to as descriptive content analysis, which involves identifying themes among the responses and locating the specific responses with these themes. The research team then checked the coding and interpretation collaboratively and found them to be consistent.

The quantitative and qualitative data were integrated at the interpretation stage and triangulated for congruence and complementarity.

Ethical Clearance

The study protocol was approved by the National Committee for Ethics in Health of the Ministry of Public Health and Social Welfare of Guatemala. All research participants provided written or verbal informed consent.

RESULTS

Quantitative Results

Demographic Characteristics of Study Respondents

Of the 321 women identified from the vital events system as giving birth during the study period, 46 (14.3%) had moved out of the community, could not be located, or refused to be interviewed. A total of 275 women were interviewed. The participation rate of these women from the partner communities (86%) was virtually identical as that from women in the non-partner communities (85%).

The demographic characteristics of the survey respondents are presented in Table 2. In brief, nearly all (99%) respondents were of *Chuj* ethnicity, with a mean age of 25 years and an average of 3 children. The mean level of education was 2.7 years. Only 15% of their families owned a vehicle or motorcycle; most depended on local private minibus and bus services.

The characteristics of the population in the partner communities were similar to those in the non-partner communities except that non-partner communities were considerably further away from a *Casa Materna* (Table 2). The mean distance of a respondent's community to the nearest *Casa Materna* was 4 km for those living in partner communities compared with 8 km for those living in non-partner communities ($P<.01$). This was expected as the *Casas Maternas* are strategically located to be in proximity to their partner communities. In the non-partner communities, no women lived in the closest tercile (0 to <4 km from the nearest *Casa Materna*), while 68% of the women lived in the farthest tercile (8–15 km).

Utilization of Health Facilities for Deliveries

Among the 189 women in our study who resided in partner communities, 69.8% reported that they delivered their child in a health facility (54.4% in a *Casa Materna*) during the period from April 2013 through March 2014 (Table 3). In contrast, only 30.2% of the study participants from non-partner communities reported delivering in a health facility (17.4% in a *Casa Materna*) during the same time period.

70% of women from partner communities reported delivering in a facility compared with 30% of women from non-partner communities.

We do not have comparable baseline data from 2011 (when the project began), but we do have data from 2 household knowledge, practice, and coverage (KPC) surveys carried out in January 2012. (Although the Calhuitz *Casa Materna* had been in operation since 2009, utilization of the Calhuitz *Casa Materna* during its first 2 years of operation was quite low, picking up substantially in 2011; thus, one can assume 2011 as the baseline for the Calhuitz location as well.) The 2012 KPC data indicate that only 16% of women with a child younger than 2 years of age in the Phase 1 project area (comprising 89 communities in 3 municipalities) reported that their most recent birth occurred in a facility; in the Phase 2 project area (comprising 94 communities in 3 municipalities), the percentage was only 7%. In addition, of the 50 women living in partner communities who participated in the January 2012 baseline KPC survey, 32.0% reported a facility delivery at the time of their most recent delivery. Although none of these data are directly comparable, they do suggest that the percentage of facility births taking place in partner communities increased substantially in a

TABLE 1. Framework for Qualitative Data Analysis

Theme	Description
Decision about birth place	Comments about how the location of birth was selected **Sub-codes:** • Influence of others on delivery location • Cultural traditions • Previous birth experiences • Perception of distance to the facility and availability of transportation • Influence of costs on birth location
Birth experience	Comments related to the actual experience of giving birth **Sub-codes:** • Cultural traditions • Opinions about the care received at home or at a facility
Recommendations	Suggestions for improving labor and delivery services at the *Casa Materna*

TABLE 2. Demographic Characteristics of Survey Respondents (N = 275), by Type of Community

Demographic Characteristic	All Respondents (N = 275)	Partner Communities (n = 189)	Non-Partner Communities (n = 86)	*P* Value[a]
Age of mother, mean, years	25.2	25.3	25.0	.93
No. of persons in household, mean	6.8	6.9	6.6	.76
No. of children in household, mean	3.2	3.4	3.0	.12
Living with spouse/partner, %	87.3	89.9	81.4	**.049**
Speak *Chuj*, %	98.9	98.9	98.8	.94
Speak Spanish, %	24.7	27.0	19.8	.20
Principally housewives, %	95.3	95.2	95.3	.71
Family received remittances in past 3 months, %	20.4	20.6	19.8	.87
Reported food insecurity in past 6 months, %	21.8	21.7	22.1	.94
Family owns a vehicle or motorcycle, %	14.5	14.3	15.1	.72
No. of years of education of mother, mean	2.7	2.8	2.6	.66
PCA asset score of household, mean	0.97	0.96	1.00	.55
Distance of mother's community from nearest *Casa Materna*, mean, km	5.4	4.1	8.3	**<.01**

Abbreviation: PCA, principal components analysis.
[a] Comparing partner communities with non-partner communities. Values shown in boldface are statistically significant at $P < .05$.

short period of time, from January 2012 to the study period (April 2013 through March 2014).

Equity of Health Facility Utilization

Figure 2 shows the percentage of women delivering in a facility by level of education of the mother for partner and non-partner communities. In neither the partner communities nor the non-partner communities was there a statistically significant difference in the percentage of health facility births by educational level for women, suggesting that those with the lowest level of education were as likely to obtain a facility birth as those with higher levels of education. However, in the non-partner communities, there was a suggestion of increasing health facility utilization among those with more education, increasing, for example, from 18.5% among the bottom education tercile to 40.7% in the middle education tercile.

Similar patterns were observed by wealth quintile (Figure 3), although in the partner communities there was a suggestion of a modest effect of increased utilization among women in only one of the 4 wealthier quintiles, with the difference between the lowest and the fourth quintile reaching statistical significance ($P<.01$). In the non-partner communities, the lowest wealth quintile had lower utilization of health facilities (18.8%) than the other wealth quintiles (range, 30.8% to 35.7%), but the difference was not statistically significant.

The effect of distance from the *Casa Materna* on birth location present a more complex picture (Figure 4). For all the partner communities, the greater the distance, the lower the facility delivery coverage rate. Among the non-partner communities, none of the women giving birth in a facility lived within 3 km of a *Casa Materna* (i.e., the closest tercile). For the intermediate and most distant tercile groups, delivery rates were actually higher among the most distant group (39.0%) than among the intermediate group (11.1%). Almost one-quarter of the births in the most distant tercile of the non-partner communities occurred at the Calhuitz *Casa Materna*.

Qualitative Results

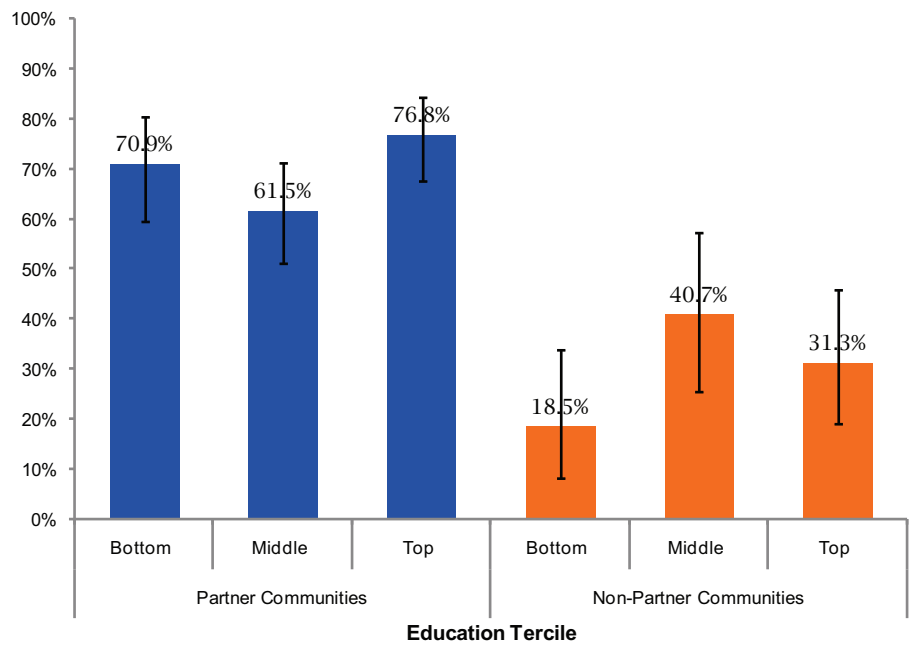
For qualitative data from in-depth interviews and focus groups, first-order descriptive themes and second- and third-order analytic themes are

TABLE 3. Location of Deliveries During the Study Period (April 1, 2013–March 30, 2014) in the San Sebastian Coatán Municipality, by Type of Community

Location of Delivery	All Respondents (N = 275)	Partner Communities (n = 189)	Non-Partner Communities (n = 86)
Non-health facility deliveries	**117 (42.5)**	**57 (28.1)**	**60 (69.8)**
Home of interviewee or of another person	116 (42.1)	56 (29.6)	60 (69.8)
En route in ambulance	1 (0.4)	1 (0.5)	0 (0.0)
Health facility deliveries	**158 (57.5)**	**132 (69.8)**	**26 (30.2)**
Hospital	18 (6.5)	13 (6.9)	5 (5.8)
MPHSW health center	20 (7.3)	14 (7.4)	6 (7.0)
Private clinic	2 (0.7)	2 (1.1)	0 (0.0)
Casa Materna Calhuitz	74 (26.9)	59 (31.1)	15 (17.4)
Casa Materna Santo Domingo	44 (16.1)	44 (23.3)	0 (0.0)

All data shown as No. (%).
Abbreviation: MPHSW, Ministry of Public Health and Social Welfare.

FIGURE 2. Percentage of Health Facility Deliveries by Women's Education Tercile[a] and by Type of Community



95% confidence intervals shown.
[a] Bottom education tercile, no education; middle tercile, 1–3 years of education; top tercile, 4+ years.

summarized in Table 4. The findings for the main topics are described in the following sections.

Decision About Birth Place

Comadronas and husbands were identified as playing key decision-making roles about where a woman would deliver.

Many people were identified as being involved in the process of decision making about the birthing place, and the woman herself was generally not the final decision maker. The *comadrona* and the husband were identified as playing key decision-making roles. The *comadrona* was found to be one of the best supporters of the *Casa Materna* and a strong motivator for women to have their deliveries there. A woman living in a partner community explained:

> *When I knew I was pregnant I told the comadrona, and she advised me to go to the Casa Materna and the entire family accepted my decision.*

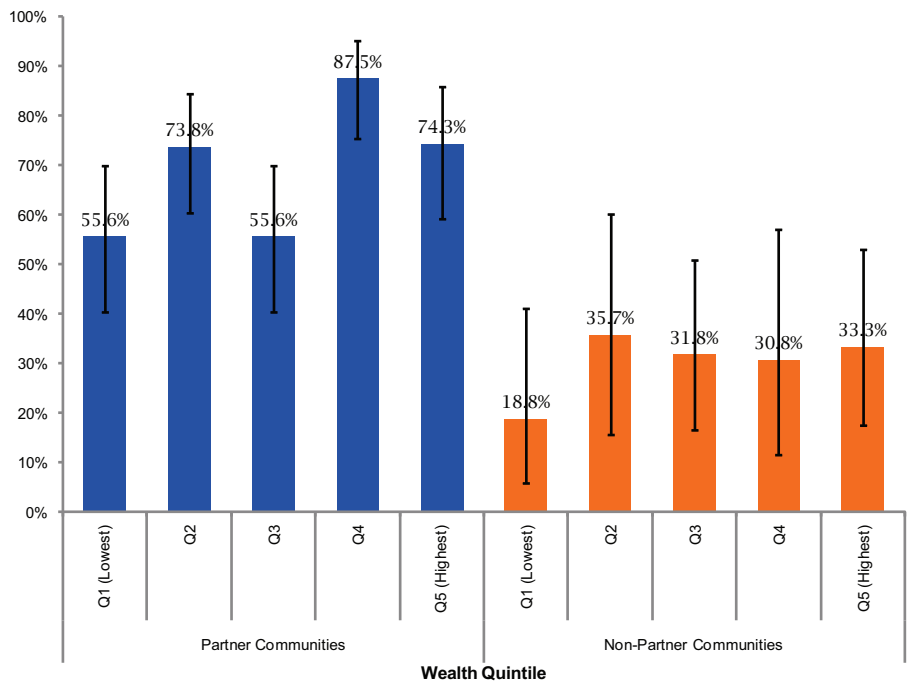
A *comadrona* living in a partner community described the rationale she gave to women to deliver at the *Casa Materna*:

> *Before I accepted the management of the pregnancy, I advised the woman and her family that she must go to the Casa Materna because there could be complications in childbirth.*

In some settings, the husband acted as a facilitator by supporting his wife in her decision to use the *Casa Materna*, while in others, the husband prohibited a facility delivery due to cultural traditions such as *machismo* (a cultural tradition that embraces the subjugation of women by men that is expressed in attitudes, behaviors, and decisions). In still other settings, the husband played a more neutral role and placed the decision making in someone else's hands, such as an elder female family member. A woman from a non-partner community explained that the final decision was in her husband's hands:

> *My husband made the decision that I give birth at home and said that I should not go elsewhere.*

FIGURE 3. Percentage of Health Facility Deliveries by Women's Household Wealth Quintile and by Type of Community



95% confidence intervals shown.

Other factors such as cultural traditions and previous experience play an important role in discouraging use of the *Casa Materna.* For example:

> *I decided to give birth at home because I have 3 children and have experience. It is the custom to give birth at home.* –Woman living in a non-partner community

Geographic distance to the *Casa Materna* was also found to be an influential factor affecting delivery location. The perceived far distance, as well as the lack of or high cost of transportation, influenced the decision for some women. Some women reported that the *Casa Materna* was too far to travel to during labor, and travel at night or during the rainy season was also considered particularly difficult. Perception of distance in some cases was more important than actual distance: some perceived that the *Casa Materna* was close to their community even when the community was more than 8 km from the *Casa Materna*.

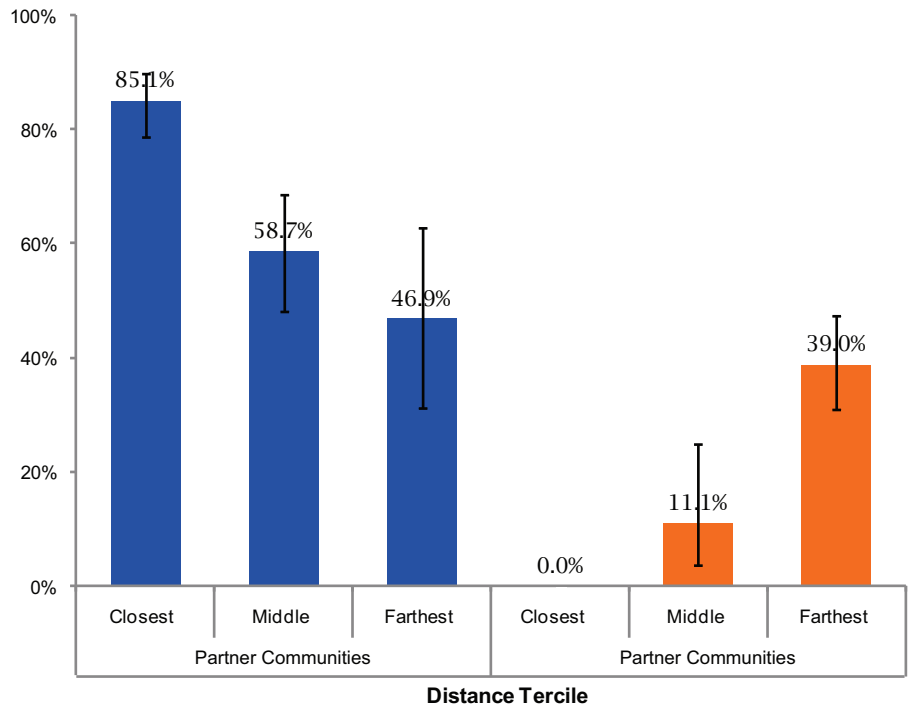
> *I have no possibility to go to the Casa Materna because I have no money; it is far and transportation is expensive.* –Woman living in a partner community

> *I went to the Casa Materna since not much money is spent because it is near my community.* –Woman living in a non-partner community

Assessment of the Childbirth Experience

Key informants reported that when a woman goes into labor, the *comadrona* is contacted and then comes to the home. She then either attends the woman's birth at home or accompanies her to the *Casa Materna* with her husband and family members,

FIGURE 4. Percentage of Health Facility Deliveries by Distance of Women's Household to the Nearest *Casa Materna* and by Type of Community



95% confidence intervals shown.

Closest tercile is <4 km from the *Casa Materna*; middle tercile is 4 to <8 km; farthest tercile is ≥8 km away.

depending on the family's decision. In the partner communities, the *comadrona* is considered as part of the team but is not formally a member of the staff of the *Casa Materna*.

> *When the labor pains started I told my husband and he called my comadrona. My husband looked for transportation and we went to the Casa Materna.* –Woman living in a partner community

> *The Casa Materna cares for us well since the staff understand our culture, which is not the case in the government hospital.* –Comadrona living in a partner community

Women who perceived that the *Casas Maternas* provide high-quality care reported feeling more comfortable giving birth at a *Casa Materna*. Community leaders and *comadronas* also reported feeling comfortable working with *Casa Materna* staff members because of the quality of care that they provide. Staff of the *Casa Materna* reported that the participation of the *comadronas* during the delivery process was helpful and contributed to good outcomes.

> *I chose the Casa Materna to have a safe delivery and avoid any complications during delivery.* –Woman living in a non-partner community

> *Our communities have benefited from the Casa Materna because now our women have a clean, safe place to give birth to our children.* –Leader in a partner community

> *The Casa Materna has the necessary medicines to attend births as well as good attention from the nurses, and they allow me to be with her [my patient] during the labor.* –Comadrona in a partner community

TABLE 4. Thematic Analysis of Factors Affecting Decision About Birth Place

First-Order Themes	Second-Order Themes	Third-Order Themes
Barrier: Too many people involved in the decision-making process **Facilitator:** The role of *comadronas* **Facilitator/barrier:** The role of husbands	Influence of others on delivery location	Decision about birth place
Barrier: Tradition supports giving birth at home **Facilitator:** The role of the *comadrona*	Cultural traditions	
Facilitator/barrier: Effects of previous birth experiences on subsequent delivery location	Previous birth experience	
Barrier: *Casa Materna* perceived as being located far away by some **Facilitator:** *Casa Materna* perceived as being nearby by others	Perception of distance	
Barrier: Perceived high cost of facility birth compared with home birth **Facilitator:** Perceived low cost of *Casa Materna* for facility birth compared with private facilities	Cost of childbirth	
Facilitator: *Comadrona* is part of the team during delivery process **Facilitator:** Woman is attended to in her own language and with respect for long-standing traditions	Cultural traditions	Assessment of birth experience
Barrier: Home perceived as safe place to give birth **Facilitator:** Home perceived as an unsafe place to give birth. **Facilitator:** *Casa Materna* perceived as providing high-quality care	Perceived quality of care	
Facilitator: To have more equipment	Suggestion	Recommendations for improving care at the *Casa Materna*

> *In the past our children were born into garbage, but now they are born into cleanliness.* –Member of the Santo Domingo Micro-Regional Committee

Recommendations for Improvement

Respondents from both in-depth interviews and focus groups agreed that the *Casas Maternas* provide good-quality care. However, some of the respondents did recommend that the *Casas Maternas* should provide sonography.

DISCUSSION

The purpose of the present study was to examine whether *Casas Maternas* have contributed to increasing health facility deliveries in an equitable manner in 32 communities of the municipality of San Sebastian Coatán and what factors have influenced use of the *Casas Maternas* by women in the communities. Our findings clearly indicate that there is a relatively high rate of utilization of the *Casas Maternas*. By 2014, 54% of women living in the Calhuitz and Santo Domingo partner communities were giving birth at the respective *Casas Maternas*.

These findings are particularly impressive in light of the low percentage of births (21%) taking place at facilities in the overwhelmingly indigenous department of Huehuetenango and the low percentage of facility births (29%) among indigenous women in the country as a whole.[6] *Casas Maternas* are clearly increasing the percentage of facility births occurring among indigenous women in a rural isolated area in the Western highlands of the department of Huehuetenango and therefore are beginning to contribute to reducing the national inequities that exist in this regard.

The data also show that within this context of poverty and limited education, local equity in the provision of health facility deliveries with respect to relative wealth and education was achieved. Although the study population is relatively homogenous in terms of education (but less so

***Casas Maternas* have achieved local equity in provision of facility deliveries in terms of wealth and education of mothers.**

in terms of income), our findings indicate that utilization of health facilities for delivery is similar across education terciles and wealth quintiles in both partner and non-partner communities. However, *Casa Materna* utilization is more equitable (in terms of education and wealth) than utilization of non-*Casa Materna* health facilities (data not shown).

Distance matters: women in partner communities who lived close to a *Casa Materna* had higher facility delivery rates than women living farther away.

But the data also clearly demonstrate that in this extreme geography, distance matters. Living in a partner community within 3 km of a *Casa Materna* greatly increased the likelihood that a woman would deliver in the *Casa Materna* and benefit from a clean and safe health facility delivery. The qualitative data support this finding, as women who did not use the *Casa Materna* often cited the perceived or real distance and cost of transportation as barriers. Our findings echo that of other studies that have highlighted the importance of close-to-home birthing facilities to expand facility deliveries.[13,14]

Although our study did not explore quality of care directly, it is important to point out that there were no maternal deaths among the 189 participants who gave birth during the study period (April 1, 2013, through March 31, 2014) who were living in the partner communities that support the 2 *Casas Maternas*. In contrast, there were 3 maternal deaths among the 86 study participants in the non-partner communities ($P = .03$). Furthermore, there were no maternal deaths among the 206 deliveries that specifically took place in the 2 *Casas Maternas* during the study period. These findings add credence to the *Casa Materna* model described in this paper. Forthcoming publications will review specific issues related to the quality of care and overall impact of the 4 *Casas Maternas* in the project area following their introduction, including more recent data through 2015.

The government of Guatemala is beginning to incorporate *Casa Materna* principles into the ministry system.

Community engagment and ownership are important success factors to the *Casas Maternas* program.

The literature on *Casas Maternas* in the Americas is limited, but there are 2 recent examples in which similar approaches have been tried unsuccessfully.[15,16] In both, community engagement and community ownership were absent, suggesting that these factors—which were critical for establishing the operation of the *Casas Maternas* (construction and management of the facility)—are particularly important for explaining the success of the *Casas Maternas* in the Curamericas program area of Huehuetenango. In addition, anecdotal evidence provided by project staff suggests that the outreach component of the Curamericas program (visiting all homes for promotion of healthy behaviors and appropriate utilization of health facilities) has encouraged mothers to deliver in facilities. Other contributory success factors include the close location of services to families compared with those provided at government facilities and the community's perception of high-quality services provided in the *Casas Maternas*—that women are treated with respect, that the care is culturally appropriate, and that the care is of good medical quality. Finally, the *comadronas* appear to have played an important role in influencing women to give birth in a *Casa Materna,* with the qualitative data from our study demonstrating that the strong encouragement of health facility deliveries by the *comadronas* was decisive for many women.

Comadronas seem to be enthusiastic in supporting the use of the *Casa Materna* for 4 reasons: (1) they are not losing any income by promoting use of the *Casa Materna*, (2) they continue to play an important role in providing support to the mother and her family and in participating in the delivery itself, (3) they do not suffer the risk of being blamed for any complication that might arise, and (4) they are beginning to realize that delivery in a *Casa Materna* is in the best interest of the mother and her child.

Opportunities for Incorporating *Casa Materna* Principles Into the MOH System

Although it is not easy to address all of the many and complex factors contributing to disparities in maternal mortality in Guatemala within the government system, the MOH is beginning to take steps to incorporate some of the principles of *Casas Maternas* within the department of Huehuetango by converting peripheral health posts (each serving 3,000–5,000 people) in 2 municipalities of the Western highlands of the department into *Casas Maternas.* These facilities, staffed by auxiliary nurses who are from the area and speak the local language, will now be open continuously (24 hours a day, 7 days a week), and *comadronas* will be welcome to accompany their patients for delivery there. The MOH is now setting up for the first time community committees to provide oversight into the functioning of these health posts. Finally, these health posts are intended to become a type of local "emergency room," where patients with acute illnesses can be seen and treated or referred. Access to referral through telephone communication and prearranged transport is also being developed. If successful, this approach could be scaled-up more broadly at the national level.

Relevance of the Findings for Guatemala and Beyond

The issues faced by the women of the project area are not uncommon throughout Latin American countries with indigenous populations that have been marginalized over the centuries following the Spanish conquest, particularly those living in more isolated mountainous communities. Moreover, many of these same issues are faced by other poor women in low- and middle-income countries around the world, especially those living in isolated rural locations.

Globally, one-third of births still occur in the home. In sub-Saharan Africa, South Asia, and in the least-developed countries, the percentages are 46%, 45%, and 44%, respectively.[17] In spite of major pushes by governments to promote facility-based deliveries, progress has been slow. One of the reasons for this has been the lack of readily accessible, locally accountable, and "community-friendly" facilities staffed by local people where local traditions and norms are respected.

A recent review synthesizing the qualitative evidence regarding facilitating factors and barriers to facility-based deliveries in low- and middle-income countries concluded that women and their families in many settings have come to believe that "childbirth has become medicalized and dehumanized" and that families avoid facilities for childbirth because of a fear of undesirable procedures as well as fear of disrespectful and abusive care.[18] Evidence of mistreatment of women during childbirth in health facilities is abundant according to a recent systematic review.[19] In 2014, the World Health Organization released a statement on the prevention and elimination of disrespect and abuse during facility-based childbirth that has been endorsed by leading organizations around the world involved in women's health, recognizing the right of every woman to dignified, respectful health care.[20] The statement recognized that those at greatest risk of disrespectful treatment and abuse are adolescents, unmarried women, women from ethnic minorities, migrant women, and women living with HIV.

One recent review[21] of a similar approach to the *Casas Maternas* in rural Nepal that uses skilled birth attendants in birthing centers identified 2 major drawbacks of the approach from the standpoint of the providers: the skilled birth attendants worked alone and access to referrals was lacking. The *Casa Materna* approach overcomes these 2 drawbacks since a team of providers is always available along with prompt referral.

The approach developed by Curamericas in the rural highlands of Guatemala to expanding access to respectful, culturally appropriate facility-based childbirth is now gaining attention in other similar areas of the country, and plans are underway to develop *Casas Maternas* there. The approach has relevance not only for Guatemala and Latin America but also for areas of sub-Saharan Africa and South Asia where home deliveries still predominate. The *Casa Materna* model developed by Curamericas in Guatemala offers an important example of how communities can engage with health systems to establish "community-friendly" spaces for delivery by more highly trained personnel than traditional birth attendants while at the same time honoring the role of traditional birth attendants.

The *Casa Materna* model offers an example of how to engage communities to establish community-friendly spaces for high-quality facility deliveries while honoring the role of traditional birth attendants.

Whether or not the increased availability and utilization of "community-friendly" birthing centers reduces maternal and neonatal mortality in the Curamericas project area, in Guatemala or elsewhere, remains an open question. The answer will depend on the capacity of the *Casas Maternas* to prevent infection, manage complications, and facilitate referral to the next level of care—issues that will be addressed further in subsequent publications along with questions related to costs and sustainability.

Study Limitations

Our study has several limitations. First, it would have benefited from direcly comparable baseline data on the characteristics of women using health facilities prior to introduction of the *Casas Maternas* to better assess whether improvements in equity as well as coverage had occurred. Second, because the number of surveyed respondents was limited (N = 275), the ability to detect statistically significant differences among variables influencing *Casa Materna* utilization was limited. Third, in the translation of interview questions and answers from Spanish to *Chuj,* back to Spanish, and ultimately to English, some important meanings could have been lost, despite having bilingual Spanish/*Chuj* and Spanish/English staff performing the translations. Finally, stronger evidence on the quality of maternity and newborn care provided in the *Casas Maternas* and health outcomes of patients receiving care there (including maternal and perinatal mortality) would have

enabled us to make a stronger case for the applicability of the *Casa Materna* model on a broader scale. Ongoing services provided at *Casas Maternas* are being monitored, and future reports will address in greater detail the quality of care provided there. As indicated elsewhere, the number of *Casas Maternas* in the project area is growing and the Ministry of Health is beginning to convert some of its health posts in the project area into quasi-*Casas Maternas*. Plans are also underway to convert health posts in another department (San Marcos) into quasi-*Casas Maternas*, and several other NGOs are in the process of establishing *Casas Maternas* based on the Curamericas model. Thus, these experiences will help to shape the evidence regarding the advisability of scaling-up the *Casa Materna* approach more broadly.

CONCLUSION

Working with communities to establish *Casas Maternas* that provide high-quality, culturally appropriate, and readily accessible maternity care in an isolated mountainous area of Guatemala, where most births are still attended at home by traditional birth attendants (*comadronas*), provides a promising approach to increasing facility-based deliveries at low cost. Uptake of these services was equitable in terms of maternal education and family income but was not able to fully overcome geographic barriers for those who live at greater distances. *Casas Maternas* also provide opportunities for *comadronas* to continue in their traditional role of supporting mothers at the time of childbirth while also serving as champions of facility delivery. Linking strong, frequent outreach to all households by volunteers through the CBIO+ Care Group approach[22,23] with *Casas Maternas* also warrants consideration for broader application in Guatemala and beyond.

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ORIGINAL ARTICLE

A Dedicated Postpartum Intrauterine Device Inserter: Pilot Experience and Proof of Concept

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Use of the inserter was found to be safe, with high fundal placement in 82% of cases. Complete expulsion occurred in 7.5% of cases and partial expulsion was detected in 10%, comparable with rates in other studies using standard IUD insertion techniques. Further study and use of the dedicated inserter may reveal increased convenience and reduced risk of infection among users and could improve acceptability of postpartum IUD provision among providers.

ABSTRACT

Objective: To assess the feasibility, acceptability, and safety of a dedicated postpartum intrauterine device (PPIUD) inserter specifically designed for the post-delivery setting. Primary objectives of fundal placement and expulsion rates were assessed. Secondary objectives were participant satisfaction and IUD retention.

Methods: In this pilot proof of concept, we enrolled 80 women who presented for PPIUD insertion at 2 government hospitals in Delhi and Lucknow, India, between March and July 2015. PPIUD insertion was completed with the dedicated inserter in all cases, by trained providers with no prior experience in PPIUD insertion, followed immediately by ultrasound to assess location and fundal placement of the IUD. Follow-up took place at 6 to 8 weeks post-insertion, and ultrasound was used to assess IUD location. Providers and participants also completed satisfaction surveys.

Results: High fundal placement (≤10 mm from uterine fundus) was achieved with the dedicated PPIUD inserter in 82% of cases (n = 65). There were no perforations or infections among the participants and no other complications associated with use of the dedicated inserter. The mean distance between the IUD and the endometrial verge immediately post-insertion was 5.8 mm (range, 0–31; N = 80); this distance at follow-up was also 5.8 mm (range, 0–25; n = 50). Complete expulsion was observed in 6 cases (7.5%), and asymptomatic partial expulsion in 8 cases (10%). Providers reported the majority (93%, n = 74) of insertions to be easy. The majority (74%, n = 59) of participants reported the same level of pain before and after insertion.

Conclusions: This dedicated PPIUD inserter performed as intended and was found to be safe, with high acceptability among the participants and providers. Further study and use of the dedicated inserter may reveal reduced risk of infection among PPIUD users as well as increased convenience compared with standard PPIUD insertion techniques, and could improve acceptability of postpartum IUD provision among providers. The success of this study has led to the initiation of a formal randomized controlled trial in India to further investigate the acceptability of the dedicated inserter.

INTRODUCTION

In the immediate postpartum time period, there is an opportunity to provide women with contraception they may not otherwise obtain. Data demonstrate a global disparity in family planning services among women in the first year following delivery, with little improvement between 2001 and 2015.[1,2] Improving access to long-acting reversible contraceptives (LARCs) immediately postpartum has the potential to improve this gap. Short birth-to-pregnancy intervals (≤18 months) are associated with poor perinatal and maternal health outcomes,[3-6] so women and their children may benefit from improved access to immediate postpartum contraception, particularly to LARCs such as intrauterine devices (IUDs).

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Post-placental (performed within 10 minutes of placental delivery or while the woman is still in the delivery room) and immediate postpartum (within 48 hours post-delivery) insertions of the IUD are associated with more participant benefits than interval insertion (performed at 6 weeks or more postpartum). Participants report less discomfort and fewer side effects with postpartum IUD (PPIUD) insertion.[7] In addition, PPIUD insertions are convenient for the participant, provider, and health care system, as they reduce the need for an additional post-discharge family planning visit.

The literature documents higher expulsion rates associated with PPIUD insertions than with interval insertions, but high fundal IUD placement reduces the expulsion rate.[8] PPIUD expulsion rates appear to be dependent on the skill of the provider in ensuring that the IUD is placed as close to the fundus as possible.[10] Studies have documented overall low rates of pain, bleeding, infection, and perforation with PPIUD insertion regardless of the timing or insertion technique.[7,9]

Until recently, no instrument was specifically designed for IUD insertion in the post-placental or immediate postpartum period. Rather, 2 methods of insertion have emerged for PPIUD insertions: (1) manual insertions, in which the provider removes the IUD from the package and places it on his/her fingers, before manually placing the IUD at the uterine fundus; and (2) forceps insertions, in which the provider removes the IUD from the package, grasps it with forceps, and then places the IUD at the uterine fundus. Each of these approaches requires the IUD to be manipulated by hand, providing opportunity for contamination, possible subsequent infection, and damage to the IUD. In addition, the IUD string of most copper-containing IUDs is not long enough to be visible after PPIUD insertion, which can create uncertainty about IUD location when the woman presents for care later.[11]

PPIUD insertions are associated with higher expulsion rates than interval insertions, but high fundal IUD placement reduces the expulsion rate.

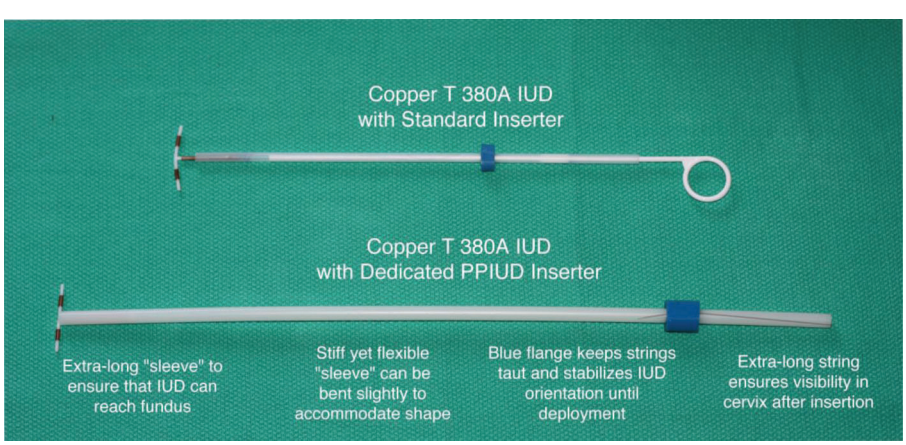
Manual insertions have largely been abandoned for reasons related to participant discomfort, possible HIV exposure to the provider, and difficulty of use in morning-after-delivery insertions. Forceps insertions have also become confusing and potentially frustrating to providers, because some types of forceps recommended in global training curricula are not easily available in many countries. The use of forceps also requires special training that can be time consuming and expensive for an insertion technique that is not particularly intuitive.

A dedicated inserter could conceivably increase PPIUD acceptability among both providers and patients if it was convenient and expeditious to use. In addition, preliminary unpublished evidence suggests that the availability of PPIUDs could increase institutional deliveries in rural areas, where maternal mortality is highest and access to contraception the lowest.[12]

Standard PPIUD insertion techniques require providers to manipulate the IUD by hand, providing opportunity for contamination and possible subsequent infection.

To address this, a dedicated PPIUD inserter was designed jointly by Population Services International (PSI), The Stanford Program for International Reproductive Education and Services (SPIRES), and Pregna International Ltd. (Figure 1).

FIGURE 1. Postpartum Intrauterine Device (PPIUD) Inserter



The dedicated PPIUD inserter:

- Eliminates the need for specialized instruments such as forceps and allows for a standardized, easy-to-learn technique that mimics interval insertion
- Is made from stiff yet still flexible Silastic that can accommodate the shape of the postpartum uterus
- Comes preloaded in the insertion sleeve—ready to insert—eliminating the need for manipulation and reducing the opportunity for contamination and infection
- Does not require the provider to put his/her hand in the woman's vagina to insert the IUD, further reducing risk of infection and discomfort
- Has a longer insertion sleeve than the standard IUD inserter to ensure the IUD reaches the fundus easily, further reducing the risk of expulsion and facilitating insertion
- Has a longer string than the standard IUD that is visible following postpartum insertion
- As a dedicated product, could improve acceptability among providers of postpartum IUD provision

A dedicated PPIUD inserter comes preloaded in the insertion sleeve, eliminating the need for manipulation.

A proof-of-concept study was conducted to determine if this new PPIUD inserter, specifically designed for the post-delivery setting, achieves the primary objectives of fundal placement and acceptable expulsion rates, provider and participant acceptability, and feasibility. Secondary objectives of participant satisfaction and IUD retention were also studied.

METHODS

Between March 2015 and July 2015, we enrolled a convenience sample of women 18 years or older requesting a post-placental or immediate postpartum IUD during prenatal care, at time of delivery, or before 48 hours postpartum at 2 public-sector, government hospitals in Delhi and Lucknow, India. All participants received counseling that included the full range of safe contraceptive methods for postpartum women and the health benefits of spacing pregnancies. Eligible participants met World Health Organization (WHO) medical eligibility criteria for initiating an IUD.[13] Participants with ruptured membranes more than 18 hours prior to delivery, diagnosis of chorioamnionitis at the time of delivery, unresolved postpartum hemorrhage, or non-vaginal delivery were excluded from the study.

To reduce bias due to possible previous PPIUD insertion experience, health care providers included in the study had a Bachelor of Medicine and Bachelor of Surgery (MBBS) and/or postgraduate degree in obstetrics and gynecology with no prior experience in PPIUD insertion. Study personnel then trained these providers on insertion with the dedicated PPIUD inserter. Training involved a combination of didactic learning, model-based training (with the Mama-U postpartum uterus model developed by Laerdal Global based in Stavanger, Norway, and the specially adapted Noelle maternal and neonatal birthing simulator developed by Gaumard based in Miami, Florida, USA), and supervised clinical practice, lasting a total of no more than 3 days. To view a video demonstrating the models and the PPPIUD insertion technique, see https://www.youtube.com/watch?v = uMcTsuf8XxQ.

Following delivery, participants were assessed for exclusion criteria and if not eligible were withdrawn from the study. Excluded participants were counseled about appropriate family planning methods and were provided with their chosen method by their health care provider.

Data Collection

Prior to PPIUD insertion, participants were asked to report their perceived pain on a 3-point scale of "no pain," "bearable," and "unbearable." The participant's IUD was placed using the dedicated PPIUD inserter up to 48 hours post-delivery, but as close to delivery as possible. The timing of insertion with respect to delivery was recorded. An abdominal ultrasound was performed immediately post-insertion to assess fundal placement of the IUD. The distance between the endometrial verge (the fundal termination of the endometrium) and the uppermost (leading) aspect of the IUD was measured. In addition, the distance between the external cervical os and the uterine fundus was assessed with the inserter itself, which had markings to indicated uterine depth.

Immediately post-insertion, participants were asked to report their perceived pain on the same 3-point scale of "no pain," "bearable," and "unbearable." Prior to discharge, participants completed a questionnaire with a counselor that was designed to capture participant satisfaction, pain experienced, counseling provided, experience at hospital, and if they would recommend PPIUD insertion to a friend or family member. Additionally, the health care provider inserting the IUD using the

dedicated inserter completed a satisfaction questionnaire. This questionnaire assessed the ease of insertion on a 3-point scale ("easy," "slightly difficult," "difficult"), reinsertions (if any), and location of the IUD on ultrasound.

TABLE 1. Baseline Characteristics of Study Participants in India (N = 80)

	No. (%)
Age, years	
18–20	8 (10)
21–30	65 (81)
>30	7 (9)
No. of living children	
1	23 (29)
2	35 (44)
≥3	22 (27)
Gestation at delivery, weeks	
32–37	20 (25)
>37	60 (75)
Timing of contraceptive counseling	
Prenatal	8 (10)
Early labor	47 (59)
Postpartum (up to 48 hours post-delivery)	25 (31)
Duration of membrane rupture, hours	
<6	66 (83)
6–12	13 (16)
>12	1 (1)
Type of delivery	
Normal vaginal	31 (39)
Normal vaginal with episiotomy	47 (59)
Assisted vaginal (vacuum, forceps)	2 (2)
Time interval between delivery and PPIUD insertion, hours	
<1	49 (61)
1–6	26 (33)
>6	5 (6)

Participants were contacted by telephone every week after PPIUD insertion for health-related information and to remind the participant of the importance of attending the follow-up visit 6 to 8 weeks post-insertion. In case of any complaint of discomfort or expulsion, the participant was encouraged to visit the hospital immediately.

At the follow-up visit, up to 8 weeks post-insertion, an ultrasound was performed to assess the position of the IUD with the same IUD-endometrial verge distance being recorded. If a complete expulsion (complete spontaneous expulsion of the IUD from the uterus) or a partial expulsion (asymptomatic descent of the IUD such that it could be seen in the cervix at examination) was noted, this was recorded in the case reporting form. Follow-up visits were performed at the 2 hospitals where insertions took place as well as at additional, secondary clinical sites. Participants were also asked at the follow-up visit to indicate their satisfaction with their experience and whether they would recommend PPIUD insertion to a friend or family member.

Data Analysis

Data were collected on paper forms and entered into Excel spreadsheets. Statistical analyses were performed with SPSS version 23 and SYSTAT version 13. Sociodemographic characteristics of the participants were analyzed using descriptive statistics. Student's *t* test was used to compare means, and non-parametric tests were used to compare medians.

Ethics Approval

Study approval was obtained from the Drug Controller General of India (DCGI) as well as the Ethics Committees of the relevant hospitals. The study was registered with the Clinical Trial Registry of India (CTRI). All participants provided informed consent.

RESULTS

Background Characteristics

Study personnel trained 11 health care providers on how to use the dedicated PPIUD inserter. During the study period, 80 participants provided consent and were enrolled (Table 1). Women ranged from 18 years of age to 37 years. All participants had at least 1 living child, and parity ranged from 1 to 6. The majority (75%) of participants delivered at or after 37 weeks

TABLE 2. Key Performance Results of Dedicated PPIUD Inserter Among Postpartum Women in India (N = 80)

	No. (%)
Distance from fundus to IUD on ultrasound (immediately post-insertion), mm	
<6	58 (72.5)
6–10	7 (8.8)
11–20	10 (12.5)
>20	5 (6.3)
Change in participant pain status after insertion	
Same	59 (73.8)
Increased	7 (8.8)
Decreased	14 (17.5)
Provider reported ease of PPIUD insertion	
Easy	74 (92.5)
Slightly difficult	2 (2.5)
Difficult	4 (5.0)
IUD location at follow-up	
Retention	61 (76.3)
Partial expulsion	8 (10.0)
Complete expulsion	6[a] (7.5)
Removal	5[a] (6.3)

[a] One case occurred during an episode of delayed postpartum hemorrhage.

gestation. Nearly all women had either a normal vaginal delivery with episiotomy (59%, n = 47) or a normal vaginal delivery without episiotomy (39%, n = 31); 2 participants (2%) had an assisted vaginal delivery with either vacuum or forceps.

Fundal placement with the PPIUD inserter was achieved in 82% of the cases.

Complete expulsion occurred in 6 cases (7.5%).

Timing of PPIUD Insertion

The majority of participants in the study received contraceptive counseling for their PPIUD while in early or prodromal labor (59%); no counseling took place during active labor. Most (61%, n = 49) participants received their PPIUD insertion less than 1 hour after vaginal delivery, while 33% (n = 26) received their PPIUD insertion between 1 and 6 hours after vaginal delivery and 6% (n = 5) more than 6 hours after vaginal delivery (Table 1). The overall median time difference between the time of delivery and the time of insertion was 42 minutes, and the mode was 15 minutes.

Fundal Placement of IUD

Fundal placement (≤10 mm from the fundus) with the PPIUD inserter was achieved in 82% of cases (n = 65) (Table 2). Average fundo-cervical length was 17.5 cm, meaning that over 80% of the participants had their IUD inserted within 10 mm of the fundus or approximately 95% of the distance to the fundus from the cervix. Removal and reinsertion was performed in 3 participants, as the provider was initially not sure of fundal placement. No perforations were reported or observed on ultrasound, and no infections occurred among the participants. In addition, there were no other complications associated with use of the dedicated PPIUD inserter.

Women's Reports of Pain and Providers' Reports of Ease of Insertion

The participant satisfaction questionnaire revealed that 74% of participants (n = 59) experienced the same level of pain before and after PPIUD insertion, 17% (n = 14) reported a decrease in pain compared with just before insertion, and only 9% (n = 7) reported an increase of pain. Health care providers reported the vast majority (93%, n = 74) of insertions to be easy (Table 2).

Expulsion Rates

All 80 participants completed follow-up, defined as a clinical visit in which the presence or expulsion of the IUD was verified. Of the 50 participants who had ultrasound at follow-up, the mean distance measured with ultrasound from the endometrial verge to the IUD was 5.8 mm (standard deviation, 6; range, 0–25) (Table 3).

Among all 80 participants, by the follow-up visit, the IUD was completely expelled in only 6 cases (7.5%), partially expelled in 8 cases (10.0%), and removed in 5 cases (6.3%) for social and clinical reasons (Table 2). The mean distance of the IUD from the fundus (on immediate post-insertion ultrasound) among those cases with an expelled IUD at the follow-up visit was 12.2 mm compared with 5.3 mm among women whose IUD was retained at the follow-up visit ($P = .08$) (Figure 2). The median time from delivery to insertion was 49 minutes among women with an expelled IUD compared with 40 minutes among

women who retained their IUDs ($P=.32$) (Figure 3).

Of the 4 insertions reported by providers to be difficult, 3 resulted in complete expulsion and 1 in a partial expulsion. Interestingly, the mean distance from the endometrial verge to the IUD (on immediate post-insertion ultrasound) among the cases reported as difficult was 16 mm (range, 5–31) compared with 5.8 mm for the total group ($P=.16$). Among difficult insertions, the median time from delivery to insertion was 65 minutes compared with 41 minutes among insertions assessed as easy or slightly difficult.

In the 6 cases of complete IUD expulsion, 2 were expelled on the same day as insertion (1 of which occurred during an episode of delayed postpartum hemorrhage). In the 5 reported cases of IUD removal, 2 participants removed the IUD themselves by pulling the strings and 2 participants had their IUD removed by a private health care provider (speculatively due to psychosocial motivations). The reasons for removal in the remaining case are uncertain.

Client Satisfaction

After insertion, 100% of the participants stated that their provider met or exceeded their expectations, and 99% of participants reported the overall experience met or exceeded their expectations. Participants' experience at the hospital was reported as better than expected in 38% of cases and the same as expected in 61%. Almost all participants said they were satisfied with counseling and the decision to get a PPIUD and would recommend this method of contraception to their friends and family members.

DISCUSSION

In this proof-of-concept study, the dedicated PPIUD inserter functioned well and very much as anticipated, with over 80% of IUDs being placed high (≤10mm from the IUD to the fundus internally) in the uterine fundus. In this very carefully followed group, complete IUD expulsion at up to 8 weeks post-insertion was observed in 6 (7.5%) of the 80 participants and partial expulsions reported in 8 (10.0%). These rates are consonant with the published literature,[7,9] especially in studies with high rates of clinical follow-up.[14,15]

Evidence suggests that placement of the IUD at the fundus and the skill of the provider are important factors for effective PPIUD service delivery.[16] Data have also indicated that PPIUD insertions done within 10 minutes (post-placental) of delivery result in lower expulsion rates than those done after 2 hours.[7,10,17] However, in many of these studies, high fundal placement was not mentioned or documented as a primary insertion objective. The lower uterine segment contracts and assumes its non-gravid curvature starting within 24 hours post-delivery. Thus, unless a concerted effort was made to achieve fundal placement, it may have been potentially less likely and expulsion rates possibly higher when insertions were done later rather than immediately

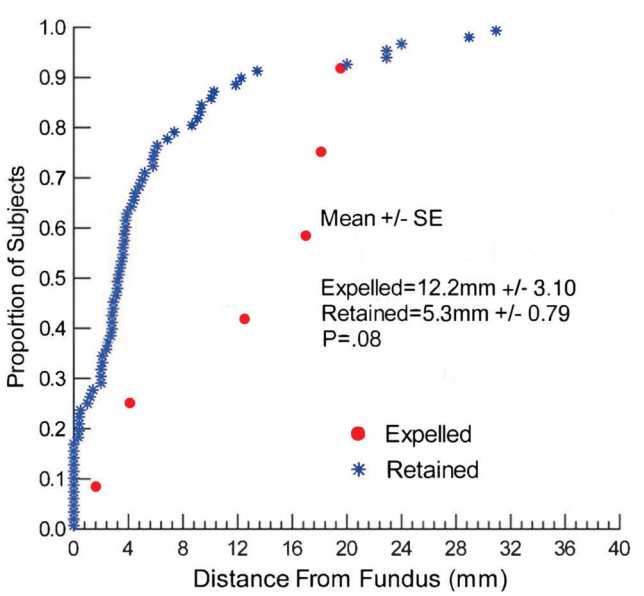
Expulsion rates with the dedicated PPIUD inserter were comparable with rates in other studies using standard IUD insertion techniques.

TABLE 3. Distance (mm) From Fundus to IUD Immediately Post-Insertion and at Follow-Up

	Mean (SD; Range)
Immediately post-insertion (N = 80)	5.8 (7; 0-31)
At follow-up (n = 50)	5.8 (6; 0-25)

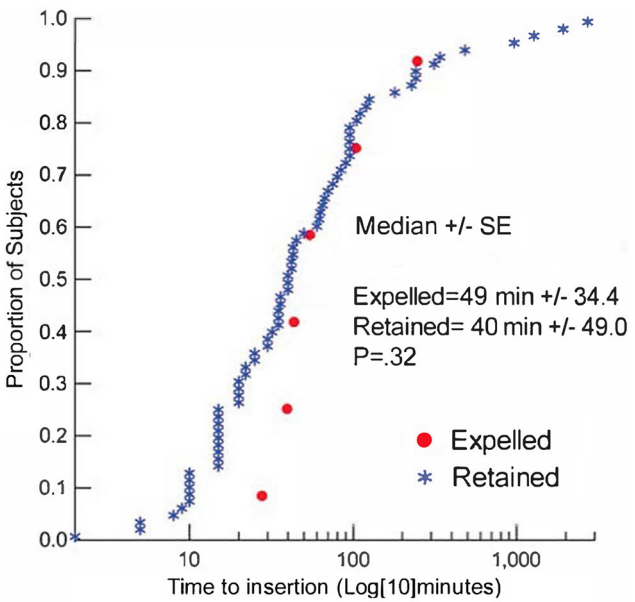
Abbreviation: SD, standard deviation.

FIGURE 2. IUD Distance From Fundus by Expulsion Status (N=80)



Abbreviation: SE, standard error.

FIGURE 3. Time to PPIUD Insertion After Delivery by Expulsion Status (N=80)



Abbreviation: SE, standard error.

PPIUD expulsion rates seem to be dependent on both the timing of the insertion and the skill of the provider in ensuring proper fundal placement.

post-delivery.[10] Our data, albeit limited, but derived from a study in which fundal placement was a definite objective, do not show an effect of timing on subsequent expulsion. Thus, PPIUD expulsion rates appear to be mainly dependent on the skill of the provider in ensuring that the IUD is placed as high as possible to the fundus.

Since fundal placement is held to be an important factor for increasing IUD retention, techniques that can realize such placement may reduce the expulsion rate and enhance overall service delivery. Again, with respect to this criterion, the inserter being assessed here functioned well. Given the reduced diameter of the dedicated inserter, compared with forceps, and the fewer intrauterine manipulations involved, the dedicated inserter may be both more convenient and comfortable than forceps insertions for women having an insertion after they have left the delivery room.

There were no unrecognized expulsions in this study.

Provider experience also affects the rate of expulsion, most likely as a function of proper IUD placement. In the study by Chi et al. (1989), providers with experience in vaginal PPIUD insertion had a 6.9% expulsion rate whereas inexperienced providers had a 12% rate of expulsion.[17] In the data reported here, when the provider reported the insertion to be "difficult" (a subgroup that contained 3 of the 6 expulsions in the study), there was a trend toward later insertion and a greater distance from the fundus after insertion.

Importantly, our study documented 100% follow-up up to 8 weeks post-insertion, and it is noteworthy that there were no unrecognized expulsions during that time. A study by Bednarek et al. (2011) reported follow-up rates of 73%, which may have resulted in an underestimate of rates of expulsion, unintended pregnancy, and infection.[18] In an upcoming planned randomized controlled trial (RCT), with a larger number of participants, we hope to establish associations between fundal placement and expulsion rates and between expulsion and time between delivery and IUD placement.

As the literature on IUD expulsion rates matures, a pattern of expected "market rates" of expulsions may be emerging:

- 0%–5% after interval insertions[19-21]
- 3%–5% after 1st trimester abortions[18]
- 4%–8% after 2nd trimester abortions[22]
- 8% after cesarean delivery[23]
- 5%–25% after a term vaginal delivery[7,9]

Such rates make sense in terms of the physiologic and pathologic states relating to uterine size, propulsive forces in the uterus acting on the IUD, cervical dilation, and blood flow. This study's 7.5% rate for complete, spontaneous expulsion is very consistent with the published peer-reviewed literature on this topic. With high rates of follow-up in this study compared with many other studies in this topic area, the "partial expulsions" might not have been captured in other, less rigorous studies. It is important to note that almost 90% of women in this study continued to have an IUD that was conveniently obtained, and a method that studies indicate might not have been provided to the woman at all had it not been provided immediately postpartum.[23,24] As Blumenthal and Goldthwaite state, "a woman simply cannot continue to use an IUD that she never got."[24]

As stated above, there were no unrecognized expulsions in this study. Expulsions are neither dangerous nor painful for women; when expulsion

is noted, another IUD can easily be inserted or another contraceptive method obtained. *It is unrecognized expulsions that leave the woman exposed to unintended pregnancy, and none of those occurred in this study.* Finally, Salcedo et al. (2013) indicate that, depending on the cost of the IUD and the service provided, expulsion rates can be as high as 30% and the IUD still remains a cost-effective approach.[25]

Limitations

This study was not without limitations. Counseling and enrolling women in the prenatal period for the study was difficult or not possible; some women who were counseled in prenatal care were excluded because of cesarean delivery or because of delivery at other birthing centers. The majority of participants enrolled for the study were counseled during the early labor and postpartum periods. Ensuring follow-up was also not without challenge in India, as many women traditionally visit a maternity home post-delivery. Due to this tradition, many women were unable to come to their respective study site (i.e., where the woman delivered and the IUD was inserted) for follow-up, so the study protocol allowed the woman to visit a secondary study site for follow-up. At these secondary sites, data on retention or expulsion were obtained, but ultrasound was not always possible. We also acknowledge the limitation of the small sample size in this study and plan to address this in future studies.

In addition, although price of the inserter was not considered in this pilot, the manufacturer indicates that when used in programs, the total cost of the inserter (which includes the IUD itself) would be less than US$1, thus making this a very cost-effective device, and one that compares well with other methods in common use. As always, the cost of actually getting an IUD at the time of the delivery (given that no other instruments are necessary for insertion) must be considered in comparison with the *intended* use of forceps insertion but which may not occur due to the absence of the required instrument.

The inclusion criteria for health care providers to be naïve to PPIUD insertion was an additional limitation of the study. The current guidelines of the state government in India are for doctors to be trained in PPIUD insertion immediately upon joining a government hospital. Thus, it was difficult to find doctors truly inexperienced in PPIUD insertion. In addition, due to the multiple responsibilities imposed on doctors at an early stage of training, it was not always possible for them to be present in the labor and delivery area when an insertion needed to be performed. As a result, the majority of insertions at 1 study site were done by 1 provider (31 of 50 insertions).

CONCLUSION

Overall, this dedicated PPIUD inserter was found to be safe and effective with high acceptability among the participants and providers. The inserter performed well and as anticipated, and there were no adverse events or complications associated with its use. Complete IUD expulsion up to 8 weeks post-insertion was observed in 7.5% of cases. As a proof-of-concept study, it was not powered to perform inferential statistics for analyzing associations between variables. The success of this study has led to the initiation of a formal RCT in India to further investigate the acceptability of the dedicated PPIUD inserter.

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METHODOLOGY

Simplified Asset Indices to Measure Wealth and Equity in Health Programs: A Reliability and Validity Analysis Using Survey Data From 16 Countries

Nirali M Chakraborty,[a] Kenzo Fry,[b] Rasika Behl,[c] Kim Longfield[a]

Many program implementers have difficulty collecting and analyzing data on program beneficiaries' wealth because a large number of survey questions are required to construct the standard wealth index. We created country-specific measures of household wealth with as few as 6 questions that are highly reliable and valid in both urban and rural contexts.

ABSTRACT

Background: Social franchising programs in low- and middle-income countries have tried using the standard wealth index, based on the Demographic and Health Survey (DHS) questionnaire, in client exit interviews to assess clients' relative wealth compared with the national wealth distribution to ensure equity in service delivery. The large number of survey questions required to capture the wealth index variables have proved cumbersome for programs.

Methods: Using an adaptation of the Delphi method, we developed shortened wealth indices and in February 2015 consulted 15 stakeholders in equity measurement. Together, we selected the best of 5 alternative indices, accompanied by 2 measures of agreement (percent agreement and Cohen's kappa statistic) comparing wealth quintile assignment in the new indices to the full DHS index. The panel agreed that reducing the number of assets was more important than standardization across countries because a short index would provide strong indication of client wealth and be easier to collect and use in the field. Additionally, the panel agreed that the simplified index should be highly correlated with the DHS for each country (kappa $\geq$ 0.75) for both national and urban-specific samples. We then revised indices for 16 countries and selected the minimum number of questions and question options required to achieve a kappa statistic $\geq$ 0.75 for both national and urban populations.

Findings: After combining the 5 wealth quintiles into 3 groups, which the expert panel deemed more programmatically meaningful, reliability between the standard DHS wealth index and each of 3 simplified indices was high (median kappa = 0.81, 086, and 0.77, respectively, for index B that included only the common questions from the DHS VI questionnaire, index D that included the common questions plus country-specific questions, and index E that found the shortest list of common and country-specific questions that met the minimum reliability criteria of kappa $\geq$ 0.75). Index E was the simplified index of choice because it was reliable in national and urban contexts while requiring the fewest number of survey questions—6 to 18 per country compared with 25 to 47 in the original DHS wealth index (a 66% average reduction).

Conclusion: Social franchise clinics and other types of service delivery programs that want to assess client wealth in relation to a national or urban population can do so with high reliability using a short questionnaire. Future uses of the simplified asset questionnaire include a mobile application for rapid data collection and analysis.

INTRODUCTION

The 2012 unanimous adoption of a United Nations resolution to promote universal health coverage has prioritized a global movement to ensure that all people obtain health services they need without suffering financial hardship.[1] Despite the emphasis on

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government responsibility to provide primary health care, the private sector is still extensively used for health services in low- and middle-income countries (LMICs).[2,3] Health expenditure in the private sector has been shown to account for 61% of the total health expenditure in low-income countries, and the majority of these costs are out of pocket, which can prove especially difficult for the poor.[4–6] In spite of the financial hardship associated with accessing private-sector health services, particularly high-quality health services, clients often indicate a preference for the private sector because of perceived availability and customer service orientation.[2,6–8] Interventions that harness the power of the private sector to increase the poor's access to necessary, high-quality services without causing undue hardship have the potential to move countries closer to universal health coverage.

As a measure of wealth, income is extremely difficult to capture accurately.

While working with the private sector offers great opportunity, it also comes with challenges. In most LMICs, there is no unified oversight of the private sector. Quality standards for private-sector service delivery are often lacking and when they do exist, there is little to no enforcement.[3,9]

In the mid-1990s, concerns over the quality of private-sector care led to the creation of social franchising—the application of commercial franchising concepts to deliver socially beneficial products and services in underserved communities worldwide.[10] When applied to clinical care, social franchising connects a network of health care providers through formal agreements to deliver health services under a common franchise brand and to improve overall quality.[11]

The social franchising industry has grown from just a few clinical franchises in the mid-1990s to more than 90 franchises in 40 countries around the globe.[12] Costs associated with starting and maintaining social franchises have historically been covered through large donor grants, and while social franchise programs can differ in their scale and scope of services offered, most have the common goal of serving the poor.[10,13]

To best reach the poor, social franchisors must first accurately capture the socioeconomic profile of the people they serve.

To implement strategies that best reach the poor, social franchisors must first accurately capture the socioeconomic profile of the people they serve. This information allows them to understand if the right clients are benefiting from subsidized services and to subsequently make decisions about where to scale-up or modify programs to reach those most in need. This paper first describes the different approaches to measuring wealth and the way many social franchisors have tried to understand the wealth profile of their clients, and then proposes a simplified but robust methodology to improve programmatic understanding and use of wealth measurement.

APPROACHES TO MEASURING WEALTH

Although income may appear to be the most obvious indicator of wealth and is commonly used as a measure of economic status, it has been found to be extremely difficult to capture accurately. Economists have realized that income tends to fluctuate a great deal according to factors such as seasonality and migration, and it does not account for informal earnings, such as payments made in-kind. Furthermore, individuals are often reluctant to share information about their income openly, which makes it difficult to measure during household surveys.[14,15] Thus, it is not the best practical measure of wealth to support programmatic decisions.

One alternative has been to measure consumption instead of income. Economists believe that consumption data, representing the total value of household monetary expenditure and items received as gifts or produced by the household, can be both representative of longer-term wealth and less sensitive to fluctuations in income. This method is used extensively in the World Bank's Living Standards Measurement Study surveys and national Household Income and Expenditure Surveys. However, the surveys are extremely lengthy and are impractical when the primary objective for health program implementers is to collect other information besides consumption data.[14]

In the late 1990s, Filmer and Pritchett discovered that household characteristics and material assets were much easier to capture and could be used as a proxy for consumption and, consequently, for economic status.[16] This led to the creation of the wealth index. Data for the wealth index are usually collected through Demographic and Health Surveys (DHS) or other national surveys and cover household ownership of selected assets and quality of living standards, such as housing structure and access to utilities. The raw data are converted into a weighted index using principal components analysis, and populations are divided into quintiles of wealth, each representing 20% of the population.[15] Quintile 1 represents the poorest segment of the population and quintile 5, the wealthiest. Other population-level indicators are then stratified by wealth,

allowing for an understanding of equity. Equity refers to an absence of differences (in health indicators) that are avoidable, unfair, and unjust; in this paper, we focus on differences specifically related to socioeconomic status.[17–19] The inclusion of these questions in all DHS and similar surveys has made the wealth index one of the most common measures of equity in health.[20,21] All references to DHS in this article constitute a reference to any party engaged in the collection, analysis, and reporting of the publicly available DHS data and reports.

CONVENTIONAL WAYS OF MEASURING EQUITY IN SOCIAL FRANCHISING

As a community of practice, social franchisors have identified several goals for social franchising and are working together to identify uniform metrics for each goal.[22] One goal, equity, requires an understanding of the socioeconomic status of franchise clients. To identify a practical measure of equity that could be used to inform scale-up of social franchising or modifications to existing strategies, the Social Franchising Metrics Working Group—comprised of franchisors and their donors—has worked together to pilot and choose an appropriate measure. The working group started with a rigorous testing process in which both absolute and relative measures of wealth were piloted. Results from the pilot revealed that the wealth index most closely aligned with the needs of franchisors by providing results that were easier to interpret than other measures. To facilitate a common application of this procedure, the working group created data collection and analysis resources.

Data for the wealth index among social franchising clients are typically gathered through client exit surveys and then compared with the national wealth index generated from DHS data. The analytic methods, described elsewhere, have also been automated in a toolkit that franchisors can use.[21,23] Despite the availability of data collection and analysis resources, large social franchising organizations such as Population Services International (PSI) have found it difficult to systematically and accurately collect wealth index data across its franchises, which in the case of PSI spans 27 countries. Reasons for difficulty are related both to survey implementation as well as replicability of analytic methods.

Gathering wealth index data is simpler than implementing traditional consumption surveys. However, the number of questions needed to capture the variables required for the wealth index, using DHS country-specific questionnaires, range from 25–50. This adds to survey length, particularly in an exit interview context, and can make data collection time consuming. Additionally, several required questions are difficult for data collectors to ask and for clients to answer, especially since exit interviews take place away from the household. Specifically, the following challenges have been identified as being too complicated for client surveys:

The wealth index, constructed by collecting data on asset ownership, is one of the most common measures of equity in health.

To capture the variables required for the wealth index, DHS surveys need to ask 25–50 questions.

- Respondents have difficulty estimating with confidence the number of hectares of agricultural land their household owns while away from the household.
- Respondents living in peri-urban or partially built-up rural areas are unable to confidently say whether their household is in an urban or a rural area. This is also difficult for data analysts to determine given that definitions of urban and rural residence vary by country.
- Questions on household characteristics are intended to be completed by trained interviewers observing the household. However, in a clinic setting, clients often find it difficult to correctly answer questions with long and detailed response-option lists. For example, the standard DHS question on the type of toilet in a household has 13 response options, some of which may seem similar to the respondent (e.g., ventilated improved pit latrines and pit latrines with slabs).

To improve transparency for data analysis and make the method accessible to all types of programs, a toolkit with standard syntax was created. The syntax mimicked the process used by the DHS Program in creating its country indices. Given variability in the DHS procedure, the toolkit's syntax varies from country to country, including in response options, country-specific assets, and differences in treatment of livestock variables.

The challenges discovered in trying to apply a complex analytic method to data intended for program monitoring and improvement raised the question of whether a simpler index could be created. Simplifications, however, may result in less accurate wealth quintile assignment. In this article, we consider the practical advantages of various alternatives to the standard wealth index and assess the extent to which each alternative's wealth quintile assignment agrees with that of the

standard wealth index. As program implementers, our primary concern is that our proposed methods pass muster within a larger community engaged in the measurement and use of equity data.

METHODS

Preliminary Analyses

To arrive at an alternative, simplified measurement approach, we adapted the Delphi method.[24,25] We prepared preliminary analyses, described below, and presented them to an invited group of experts, who assembled in Washington, DC, in February 2015 for a panel meeting. The panel was comprised of 15 collaborators (6 men, 9 women), representing a variety of stakeholders including donors, franchise program implementers, developers of the original wealth index methodology, and others working in public health programs actively engaged in the measurement of equity. Members of the panel were not considered human subjects but collaborators in the analysis. Data used in the analyses, described below, are publicly available and de-identified.

We used national survey data from 16 countries to assess the validity of simplified asset indices against the standard DHS wealth index.

We used the most recent DHS, MIS (Malaria Indicator Survey), or AIS (AIDS Indicator Survey) data from 16 countries to assess the validity of each alternative wealth measure. MIS and AIS surveys are nationally representative, as are the DHS, and related resources are publicly available.[26] The 16 countries were selected based on 2 main criteria:

- Implementation of a DHS VI survey, in which the original wealth index factor weights had been published on the DHS website[27] by July 2015
- The presence of a known social franchise in operation.

The 16 countries were: Bangladesh, Benin, Cambodia, Cameroon, Ethiopia, Malawi, Mozambique, Nepal, Nigeria, Pakistan, the Philippines, Rwanda, Senegal, Tanzania, Uganda, and Zimbabwe.

For each country, we compared 4 alternative wealth indices (described as A–D below) against the original DHS-calculated wealth index. The alternative indices had fewer variables than the original wealth index for each country. In these comparisons, the DHS wealth index was conceptualized as the "gold standard," and we aimed to determine how reliable each alternative was against this standard.

Two quantitative measures were used:

- Percent agreement, to determine what percent of individuals were assigned to the same quintile in the alternative measure as they would have been assigned to in the original
- Cohen's kappa statistic (k), to take into account agreement that could have happened by chance alone.

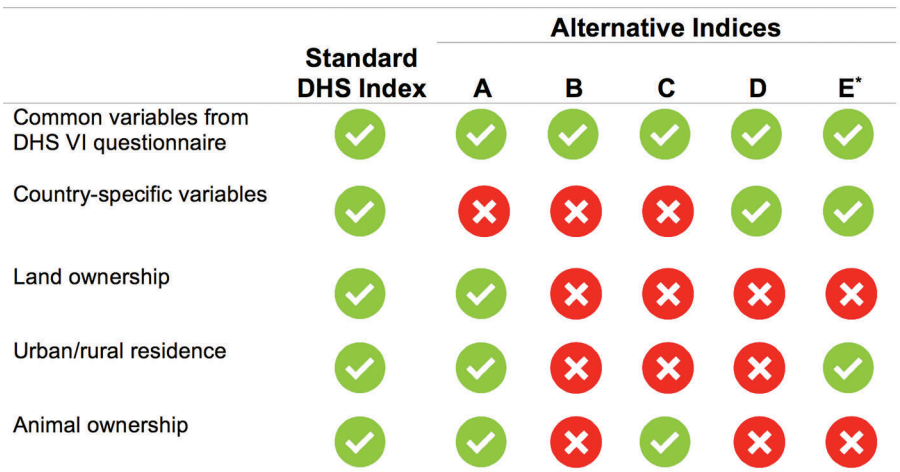
Percent agreement can range from 0 to 100, while kappa ranges from -1 to 1, where 0 indicates that all agreement is due to chance alone. Researchers have proposed 2 alternative interpretations of kappa as follows: $k<0$ = no agreement; 0–0.20 = poor; 0.21–0.40 = fair; 0.41–0.60 = moderate; 0.61–0.80 = substantial; 0.81–1.0 = almost perfect.[28] The second alternative interpretation is that $k>0.75$ is considered excellent, as per Fleiss.[29]

The original DHS wealth index for each country includes a set of common variables found in the DHS VI questionnaire, as well as country-specific variables.[30] The original index routinely includes a measure of land size (number of hectares of land owned), whether the household is urban or rural, and number of animals owned, by animal type (cow, goat, chicken, etc.). Wealth indices are created for urban and rural respondents separately and then combined.[31]

To create each alternative index, we used a standardized process, beginning with the common variables in the DHS VI questionnaire.[23] First, we recoded all categorical variables to binary variables. For questions with multiple response options (such as type of floor), we recoded each response option as a binary variable (none were merged together). Animal ownership was not recoded to a binary variable if it was entered as a continuous variable for each type of animal owned. We manually removed response options with zero cases, as well as those common variables that were not included in the country-specific questionnaire. We manually included country-specific variables. We then conducted a principal component analysis on all variables, with responses weighted at the individual level, and created a score from the factor weights of the first principal component. Scores were ordered and respondents were divided into 5 equal quintiles. Analyses were conducted using SPSS version 23. Figure 1 indicates which variables are present in each alternative asset index:

- Alternative A included all common variables that should be present in all DHS VI datasets, including land area and animal ownership. Wealth indices were created for urban and rural respondents separately and then combined. Country-specific assets were excluded.

FIGURE 1. Question Types Included in the Standard DHS Wealth Index and in Each Alternative Simplified Index



Abbreviation: DHS, Demographic and Health Survey.

* Alternative E may contain some common questions from the DHS VI questionnaire and/or some country-specific variables. See main body of the article for further details.

- Alternative B included all common variables in the DHS VI questionnaire, except land area and animal ownership. It excluded country-specific assets, and a separate urban/rural analysis was not conducted.
- Alternative C excluded country-specific assets, land area, and the urban/rural analysis, but included animal ownership.
- Alternative D included country-specific assets. It excluded land area, animal ownership, and the urban/rural analysis.

Consultation With Expert Panel

We presented the 4 alternatives to our panel. Panel members agreed that a shortened index is needed and that achieving the simplest and most practical questionnaires possible in each country was more important than standardizing questions across countries. All panel participants felt that a simplified approach would allow more programs to measure equity, resulting in better decision making and more equitable service delivery. It would also reduce the burden on clients being interviewed.

The panel made several recommendations, which necessitated the creation of another alternative (alternative E). First, the panel advised us to group the respondents into 3 groups. These groups, in order to be relevant to program decision making, were not terciles but rather the lowest 2 quintiles, the middle quintile, and the highest 2 quintiles, representing the relatively poor, middle, and rich. The panel felt that these 3 groupings would have greater face validity than the distinction between clients in the highest and second highest quintile, or between the lowest and second lowest quintiles. The panel also felt that presenting national quintiles alone would provide insufficient information for franchisors located primarily or solely in urban areas. They advised that the simplified set of questions should allow for sub-analyses on residence to determine the distribution of clients across urban wealth quintiles, with sufficient reliability. Further details about the variables included in alternative E are presented in the next section.

The best index of the 5 alternative options would be based upon 2 measures of agreement (percent agreement and Cohen's kappa statistic

of at least 0.75) and by comparing wealth quintile assignment in the new index to the full DHS wealth index. The same agreement rule applied to the urban sub-analysis: the simplified wealth index calculated among the urban respondents of the DHS survey should agree with the original wealth index in the urban stratum with a kappa statistic of at least 0.75.

Revised Analyses for the Panel-Recommended Approach

To create the simplified wealth index for the new alternative E, we used an iterative process. We began by removing the variables related to land size (hectares) and animal ownership. Then, for each remaining variable, we created a measure of its importance to the overall wealth index by multiplying the absolute value of the factor weight of the first principal component (drawn from DHS documentation) by the standard deviation of that variable. Variables that have larger absolute factor weights explain a greater proportion of the variation in the construct. Multiplying the factor weight by the standard deviation captures variation in ownership within the population, and the overall procedure values variables with high variation. All included variables were binary, so the standard deviations were comparable in their units. To further simplify the index, we looked at each response option within a categorical variable independently. The goal was to create one list of variables that was sufficiently reliable in both the overall population and the urban population.

Specifically, we followed these steps to create the asset index for alternative E:

- Binary variables, including those constructed from categorical variables, from the original DHS wealth index were listed. These variables were ranked in order of their importance to national wealth index scores and separately ranked in order of importance to the urban wealth index.
- New wealth index scores were calculated for respondents in the DHS using the 5 most important variables in the overall and urban listings. Thus, up to 10 variables were included in the new wealth index calculation.
- Respondents were separated into wealth quintiles using the new scores. Respondents in urban areas were also assigned to urban-specific wealth quintiles.
- A cross-tabulation of the bottom 2 quintiles, middle quintile, and top 2 quintiles according to the original wealth index and according to the simplified wealth index was conducted. This allowed the calculation of the percentage of clients assigned to the same quintiles by the original DHS wealth index and the reduced set of variables, along with calculation of the kappa statistic. This was done for both the national wealth quintiles and for the urban wealth quintiles.
- Steps 2–4 were repeated until the smallest number of variables were found that met the reliability criteria of kappa $\geq$ 0.75 for both the national and the urban samples.
    - In cases where the kappa statistic for either the urban or national index or both were below 0.75, the next variable in the list from the distribution with the lower agreement was added, and steps 2–4 were repeated. This process was repeated until both the urban and national indices had kappa statistics of 0.75 or greater.
    - In cases where both urban and national indices had a kappa statistic above 0.75, the smallest list of variables was generated. Variables were removed in ascending order of importance, from the distribution with the lower kappa statistic. Steps 2–4 were repeated, until removing further variables resulted in a kappa statistic below 0.75.

The average number of questions required to construct the simplified index E was reduced by 66% from the original DHS wealth index.

RESULTS

Table 1 presents the number of survey questions required to calculate the standard DHS wealth index as well as each of the 5 alternative indices presented to the expert panel. Note that the number of survey questions required to calculate the original wealth index for each country is not equal to the number of variables required in analysis, as categorical responses are converted into binary variables. Each alternative index contained fewer questions than the original DHS survey. The number of questions required for alternative E was fewer than for any of the other alternatives, for all countries presented. The average reduction in questions for index E from the original DHS survey was 66%, ranging from an 85% decrease in Benin (41 to 6 questions) to a 32% decrease in Malawi (25 to 17 questions).

TABLE 1. Number of Survey Questions Required for the Standard DHS Wealth Index and for Each Alternative Simplified Index

Country, Survey Type and Year	Variables Included[a]	Number of Survey Questions					
	Standard DHS Index	Standard DHS Index	Alternative A	Alternative B	Alternative C	Alternative D	Alternative E
Bangladesh, DHS 2011	CS, U/R, H, A	33	25	17	22	30	8
Benin, DHS 2011–12	CS, U/R, H, A	41	31	21	28	30	6
Cambodia, DHS 2010	CS, H	30	29	21	26	26	14
Cameroon, DHS 2011	CS, U/R, H, A	47	31	21	28	30	9
Ethiopia, DHS 2011	CS, U/R, H, A	36	29	20	26	25	14
Malawi, MIS 2012	U/R, H, A	25	26	19	23	19	17
Mozambique, DHS 2011	U/R, H, A	33	29	21	26	21	10
Nepal, DHS 2011	CS, U/R, H, A	44	30	20	27	29	10
Nigeria, DHS 2013	CS, U/R, H, A	26	30	21	27	28	11
Pakistan, DHS 2012–13	CS, U/R, H, A	47	29	21	26	34	14
Philippines, DHS 2013	CS, U/R	30	19	19	19	25	9
Rwanda, MIS 2013	CS, U/R, H, A	38	28	19	25	19	15
Senegal, DHS 2012-13	CS, U/R, H, A	41	28	19	25	28	18
Tanzania, AIS 2012–13	CS, U/R, H, A	37	31	21	28	24	8
Uganda, DHS 2011	CS, U/R, H, A	41	30	20	27	28	10
Zimbabwe, DHS 2010–11	CS, U/R, H, A	38	28	21	25	26	16

Abbreviations: AIS, AIDS Indicator Survey; DHS, Demographic and Health Survey; MIS, Malaria Indicator Survey.
[a] Variables included in the original DHS analysis, beyond the core variables from the DHS VI questionnaire. CS, country-specific; U/R, urban and rural areas analyzed separately before combining; H, Hectares or land area; A, animals.

In Table 2, we present 2 measures of reliability, the percent agreement and kappa statistic, between the original wealth index and each alternative index A–D. The reliability calculated here compares respondent movement between each of the 5 quintiles. The percent agreement and kappa statistic were highest overall for alternative D (median agreement, 83.26%; median kappa, 0.79). Although alternative B had fewer question types than alternative C, it produced a higher median agreement and kappa statistic (median agreement, 77.90% vs. 76.10%, respectively; median kappa, 0.72 vs. 0.70, respectively).

The subsequent analyses conducted as per panel group recommendations are presented in Table 3 (national) and Table 4 (urban only). The panel wished to compare alternatives B and D to the newly created alternative E, having decided that alternatives A and C were overly prone to respondent error due to the inclusion of questions on the number of animals owned. The comparisons are presented after combining the 5 wealth quintiles into 3 groups, which may be more programmatically meaningful. Consequently, the agreement and kappa statistics for alternatives B and D are greater in Table 3 than in Table 2, where respondent movement between quintile 1 and 2 would indicate error.

Index E was the simplified index of choice because it required the fewest number of survey questions while maintaining reliability in national and urban contexts.

The 6 questions chosen for Benin in alternative E, for example, produced a wealth distribution that agrees with the original wealth index 85% of the time among the national population, when the population was grouped into 3 meaningful divisions (Table 3). Despite having fewer questions, alternative E produced a higher kappa statistic in the national distribution than alternative B (including only the DHS core questions) for Bangladesh, Cambodia, Ethiopia, Malawi, Pakistan, and Uganda. Alternative E also produced a higher kappa statistic in the national distribution than alternative D (also including country-specific assets and animal ownership) for Ethiopia and Malawi. Similarly, when looking at the urban-specific distributions (Table 4), alternative E fared better than B in Bangladesh, Cameroon, Malawi, Pakistan, the Philippines, Senegal, Uganda, and Zimbabwe, and better than D in Malawi and Zimbabwe. In Zimbabwe, the effect of choosing variables that are strong predictors of wealth for the urban population was very evident—alternative E was the only one that produced a highly reliable result ($k = 0.75$ for alternative E; $k < 0.75$ for alternatives B and D).

Figure 2 shows the shortened alternative E questionnaires for Bangladesh and Benin (in English). In Benin, it is obvious, even without seeing the factor scores, that some questions are geared toward assessing wealth (e.g., having a DVD player) while others would be strong indicators of poverty (e.g., not having any toilet facility).

DISCUSSION

This paper describes a methodological innovation that simplifies the collection of data to create relative measures of wealth within program populations. The premise behind the simplification process is that the DHS wealth index (both the construction and the resulting distribution) represents the "gold standard" for program implementers who need to understand the socioeconomic profile of their clients and beneficiaries. Thus, each alternative was judged against the gold standard, to determine if a sufficiently reliable alternative was possible.

Alternative E, presented here as the chosen, simplified approach because it required the fewest number of survey questions while maintaining a high enough reliability score, is a promising start for program implementers. Rather than advocating for a reduction in the DHS surveys, we acknowledge that quintiles from the standard DHS wealth index are a popular way to stratify populations, and program beneficiaries should be similarly categorized. The shorter questionnaires, however, are faster to use and therefore may improve the use of equity as a metric for internal decision making, as well as further its use as one for external accountability—a vision of the Social Franchising Metrics Working Group.

Other concise approaches to assessing poverty status exist. The Grameen Foundation's Progress out of Poverty Index (PPI) is limited to 10 questions for all available countries and is derived from a household income and expenditure survey.[32] Thus, it is using the 10 easily answerable questions as a proxy of expenditure. It offers the user a probability that the respondent is above or below various poverty lines, thus measuring absolute poverty. A primary selling point of the PPI is the ability to compute the outcome by hand, as all of the scores are whole numbers. As with the approach we present, the questions for each country differ. The absolute measure from the PPI was previously piloted by franchise organizations, but it did not

TABLE 2. Reliability Between the Standard DHS Wealth Index and Each Alternative Index Included in the Preliminary Analysis

	Alternative A		Alternative B		Alternative C		Alternative D	
Country	**Agreement**	**Kappa**	**Agreement**	**Kappa**	**Agreement**	**Kappa**	**Agreement**	**Kappa**
Bangladesh	73.20%	0.665	68.10%	0.601	60.00%	0.500	83.22%	0.790
Benin	85.40%	0.818	83.30%	0.791	83.90%	0.799	83.30%	0.791
Cambodia	73.20%	0.665	78.90%	0.736	75.20%	0.690	85.26%	0.816
Cameroon	81.10%	0.764	78.60%	0.733	79.10%	0.738	84.40%	0.805
Ethiopia	65.90%	0.574	62.10%	0.526	62.60%	0.533	69.30%	0.616
Malawi	88.60%	0.857	73.10%	0.664	64.80%	0.560	73.10%	0.664
Mozambique	87.90%	0.848	78.70%	0.734	74.50%	0.681	78.70%	0.734
Nepal	74.60%	0.682	77.60%	0.720	77.20%	0.714	87.55%	0.844
Nigeria	76.40%	0.705	72.20%	0.652	77.00%	0.712	74.86%	0.686
Pakistan	74.20%	0.678	73.50%	0.669	71.80%	0.648	89.22%	0.865
Philippines	79.20%	0.740	78.40%	0.730	78.40%	0.730	88.17%	0.854
Rwanda	88.80%	0.860	78.20%	0.728	71.40%	0.642	78.20%	0.728
Senegal	80.90%	0.761	76.40%	0.705	80.50%	0.754	77.45%	0.718
Tanzania	81.50%	0.769	80.30%	0.753	75.10%	0.689	85.34%	0.817
Uganda	76.50%	0.708	72.60%	0.657	69.00%	0.612	86.92%	0.837
Zimbabwe	86.50%	0.832	81.70%	0.772	78.70%	0.734	80.73%	0.759
Median	**80.05%**	**0.751**	**77.90%**	**0.724**	**76.10%**	**0.701**	**83.26%**	**0.791**
Range	**65.90% to 88.80%**	**0.574 to 0.860**	**62.10% to 83.30%**	**0.526 to 0.791**	**60.00% to 71.80%**	**0.500 to 0.648**	**69.30% to 89.20%**	**0.616 to 0.865**

Abbreviation: DHS, Demographic and Health Survey.

TABLE 3. Reliability[a] of the National Wealth Distribution Between the Standard DHS Wealth Index and Each of 3 Alternative Indices Recommended by the Expert Panel Group

	Alternative B		Alternative D		Alternative E	
Country	**Agreement**	**Kappa**	**Agreement**	**Kappa**	**Agreement**	**Kappa**
Bangladesh	82.50%	0.727	90.74%	0.855	84.17%	0.753
Benin	91.02%	0.860	91.02%	0.860	84.91%	0.764
Cambodia	87.66%	0.807	92.23%	0.879	88.36%	0.818
Cameroon	88.20%	0.816	90.99%	0.859	85.26%	0.770
Ethiopia	75.97%	0.624	80.95%	0.702	84.73%	0.761
Malawi	83.44%	0.741	83.44%	0.741	84.30%	0.755
Mozambique	89.75%	0.840	89.75%	0.840	86.09%	0.783
Nepal	87.13%	0.799	94.08%	0.907	86.44%	0.788
Nigeria	87.52%	0.805	89.21%	0.831	85.22%	0.768
Pakistan	85.99%	0.781	94.47%	0.914	86.29%	0.786
Philippines	87.55%	0.805	93.09%	0.892	85.09%	0.766
Rwanda	86.83%	0.794	86.83%	0.794	84.13%	0.752
Senegal	87.92%	0.811	88.22%	0.816	86.22%	0.785
Tanzania	88.93%	0.827	92.12%	0.877	84.65%	0.756
Uganda	83.84%	0.748	92.88%	0.889	85.70%	0.777
Zimbabwe	91.48%	0.867	90.79%	0.856	85.46%	0.773
Median	**87.53%**	**0.805**	**90.89%**	**0.856**	**85.24%**	**0.769**
Range	**75.97% to 91.48%**	**0.624 to 0.867**	**80.95% to 94.47%**	**0.702 to 0.914**	**84.13% to 88.36%**	**0.752 to 0.818**

[a] Reliability assessed after grouping the 5 wealth quintiles into 3 groups: the lowest 40% (Q1 + Q2), middle 20% (Q3), and richest 40% (Q4 + Q5).

meet their diversity of needs and it was found to be more difficult for program decision makers to interpret than the wealth index.

Rutstein and Staveteig created one unique comparative wealth index, in which all countries with DHS data are benchmarked against Vietnam in 2002.[33] In this measure, the items used to calculate the index are identical across countries, and while the measure is not relative within the country, it is still a measure of wealth relative to Vietnam. The comparative wealth index, however, was not considered to be a viable alternative by members of the expert group, including by the comparative index creators themselves.

We find it an advantage that our method is reliable for both national and urban populations. Previous pilot testing of wealth, benchmarked to the national population, as a metric of equity has indicated that franchised programs are not always able to act upon the results. Many franchise programs are primarily urban and peri-urban. When results have indicated that their clients are from the wealthiest 40% of the population, they have questioned the specificity of the measure and indicated they would like to see how their clients compared with others in the immediate area covered by the franchise network.[34,35] Using the same short list of questions to compute equity in an urban sub-population will allow them this increased contextual information.

It is possible to include further sub-groups beyond the urban population in one of two ways. First, our iterative approach could be replicated to explore whether a shortened list of questions

TABLE 4. Reliability[a] of the Urban Wealth Distribution Between the Standard DHS Wealth Index and Each of 3 Alternative Indices Recommended by the Expert Panel Group

	Urban B		Urban D		Urban E	
Country	**Agreement**	**Kappa**	**Agreement**	**Kappa**	**Agreement**	**Kappa**
Bangladesh	83.69%	0.745	91.75%	0.871	85.00%	0.766
Benin	90.18%	0.847	91.91%	0.874	85.11%	0.768
Cambodia	86.34%	0.787	90.76%	0.856	85.37%	0.771
Cameroon	82.82%	0.732	86.15%	0.827	85.69%	0.776
Ethiopia	86.93%	0.796	88.10%	0.814	85.39%	0.771
Malawi	87.42%	0.803	87.42%	0.803	93.96%	0.906
Mozambique	94.54%	0.915	94.54%	0.915	89.01%	0.828
Nepal	87.26%	0.801	92.95%	0.890	84.26%	0.754
Nigeria	84.57%	0.759	89.43%	0.835	84.26%	0.754
Pakistan	78.41%	0.663	94.17%	0.909	84.27%	0.754
Philippines	84.39%	0.756	92.51%	0.883	85.24%	0.769
Rwanda	94.86%	0.920	94.86%	0.920	93.62%	0.900
Senegal	81.86%	0.717	86.79%	0.794	85.30%	0.770
Tanzania	91.01%	0.860	92.33%	0.880	83.95%	0.750
Uganda	81.55%	0.712	93.22%	0.894	84.12%	0.752
Zimbabwe	42.14%	0.593	75.02%	0.610	83.96%	0.750
Median	**85.46%**	**0.773**	**91.83%**	**0.873**	**85.17%**	**0.769**
Range	**42.14% to 94.54%**	**0.593 to 0.920**	**75.02% to 94.86%**	**0.610 to 0.920**	**83.95% to 94.00%**	**0.750 to 0.906**

[a] Reliability assessed after grouping the 5 wealth quintiles into 3 groups: the lowest 40% (Q1 + Q2), middle 20% (Q3), and richest 40% (Q4 + Q5).

could be found that accurately divides members of the sub-group. A different set of questions than those described here may result. Second, the same short list of questions could be used, but the reference population changed when producing results. In this case, the results may not be as valid (kappa may not be greater than 0.75), but the results would be tailored to the sub-group of interest. One can imagine a large number of different short questionnaires or sub-group analyses that are possible. However, limiting the reference populations to the national and urban populations ensures practicality and comparability. With different evaluations using the same reference population, the level of poverty indicated by wealth quintiles is kept standard. These results are also comparable with data presented in DHS reports using national and urban quintiles. Interpretation of results should keep in mind that national or urban quintiles may not accurately represent quintiles specific to the sub-group eligible for the intervention in question.

Limitations

We identify 3 primary limitations of our approach. First, the DHS surveys, a publicly available data source, are not available in all countries, nor do the surveys occur very frequently. The effect of the age of the source data on the inference to a current population remains to be assessed. Ownership of some assets, such as mobile phones, has rapidly increased in low-income countries. This can bias the results from a

FIGURE 2. Example Simplified Wealth Asset Questionnaires for Alternative E for Bangladesh and Benin

Bangladesh				
Does your household have:				
1	a television?	Yes	No	
2	an electric fan?	Yes	No	
3	electricity?	Yes	No	
4	an almirah/wardrobe?	Yes	No	
5	a refrigerator?	Yes	No	
6	Does any member of this household have a bank account?	Yes	No	
7	What is the main material of the floor in your household?	Cement floor	Earth or sand floor	Other
8	What is the main material of the walls in your household?	Cement walls	Other	

Benin				
Does your household have:				
1	electricity?	Yes	No	
2	a television?	Yes	No	
3	a VCD or DVD player	Yes	No	
4	What is the main material of the walls in your household?	Cement walls	Bamboo, Cane, Palm or Trunk	Other
5	What is the main fuel used by your household for cooking?	Wood	Other	
6	What type of toilet do the members of your household usually use?	No toilet/ nature	Other	

current survey, if, in an older reference population such as Cambodia in 2010, mobile phones were still indicative of being relatively wealthy but are now more pervasive. Second, following the DHS methodology, analysis is weighted to be generalizable to the whole population. However, in practice, exit surveys would be applied to a more narrow target group, such as women of reproductive age. If the target population is not evenly distributed across the 5 quintiles, this may introduce error into the results. Lastly, in shortening the questionnaires, we may have reduced our ability to distinguish between 2 adjacent quintiles. With fewer questions, it may not be possible to easily distinguish between quintiles 1 and 2, as the distribution is "lumpier." For this reason, we grouped the respondents into 3 groups, which seemed more programmatically relevant, when assessing the reliability of the reduced survey. Piloting reduced questionnaires in varied settings may provide insight into whether less variability affects the utility of the findings.

CONCLUSION

It is possible to use a shorter questionnaire to assess relative wealth within a sample that is benchmarked to the national population, and the resultant measure remains highly correlated to the original DHS wealth index. Through the engagement of an expert panel, this research has galvanized a great deal of interest among a variety of franchising programs, many of which are asking for shorter questionnaires to include within other surveys they conduct, such as for client satisfaction, as well as interest from the International Finance Corporation to assess the wealth of their project beneficiaries. The simplified asset questionnaires will also be embedded into a mobile application to make the collection and analysis of these data easier. (The shortened form of all questionnaires can be found online at www.equitytool.org.) The agreement of our expert panel—a seasoned group of methodologists, program implementers and donors—adds

validity to the proposed methodology. Their conclusion that a simplified approach to assessing wealth is acceptable for programmatic decision making will benefit the use of this measure.

As current and former researchers within organizations implementing social franchising, the authors are keenly aware that the measurement of equity, in whatever form, is both desired by, and loathed by, their colleagues. International development organizations exist to serve the underserved, and this measure of socioeconomic status is only one way to define and measure underserved individuals. In many of the countries in which we work, most people are poor in absolute terms. A wealth index, as we have proposed, is relative, and compares those in the same country or subpopulation with each other. The interpretation of results from this simplified method is context-specific and dependent upon program goals and needs of the eligible population. Future refinements should concentrate on providing both absolute and relative poverty information, in order to improve the understanding of the measure (for example, someone in the wealthiest quintile in Madagascar may still live on less than US$1.25/day) and the justification for providing subsidized services to individuals who appear wealthy on a relative scale.

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Competing Interests: Kenzo Fry has been employed specifically to develop resources, using the methodology proposed in this article, for a mobile data collection tool. No other authors have any competing interests.

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METHODOLOGY

Measurement of Health Program Equity Made Easier: Validation of a Simplified Asset Index Using Program Data From Honduras and Senegal

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Piggy-backing on an existing representative household survey that includes an asset index, it is possible to assess the socioeconomic distribution of program beneficiaries at low cost. The typically large number of questions used to construct the asset index, however, deters many implementers from adopting this approach. This study demonstrates that the number of questions can be significantly reduced to a subset that takes only a few minutes to administer without substantially altering findings or policy recommendations. The relevant subset is country-specific and thus necessitates tailored country questionnaires.

ABSTRACT

Equitable access to programs and health services is essential to achieving national and international health goals, but it is rarely assessed because of perceived measurement challenges. One of these challenges concerns the complexities of collecting the data needed to construct asset or wealth indices, which can involve asking as many as 40 survey questions, many with multiple responses. To determine whether the number of variables and questions could be reduced to a level low enough for more routine inclusion in evaluations and research without compromising programmatic conclusions, we used data from a program evaluation in Honduras that compared a pro-poor intervention with government clinic performance as well as data from a results-based financing project in Senegal. In both, the full Demographic and Health Survey (DHS) asset questionnaires had been used as part of the evaluations. Using the full DHS results as the "gold standard," we examined the effect of retaining successively smaller numbers of variables on the classification of the program clients in wealth quintiles. Principal components analysis was used to identify those variables in each country that demonstrated minimal absolute factor loading values for 8 different thresholds, ranging from 0.05 to 0.70. Cohen's kappa statistic was used to assess correlation. We found that the 111 asset variables and 41 questions in the Honduras DHS could be reduced to 9 variables, captured by only 8 survey questions (kappa statistic, 0.634), without substantially altering the wealth quintile distributions for either the pro-poor program or the government clinics or changing the resulting policy conclusions. In Senegal, the 103 asset variables and 36 questions could be reduced to 32 variables and 20 questions (kappa statistic, 0.882) while maintaining a consistent mix of users in each of the 2 lowest quintiles. Less than 60% of the asset variables in the 2 countries' full DHS asset indices overlapped, and in none of the 8 simplified asset index iterations did this proportion exceed 50%. We conclude that substantially reducing the number of variables and questions used to assess equity is feasible, producing valid results and providing a less burdensome way for program implementers or researchers to evaluate whether their interventions are pro-poor. Developing a standardized, simplified asset questionnaire that could be used across countries may prove difficult, however, given that the variables that contribute the most to the asset index are largely country-specific.

INTRODUCTION

Considerable efforts have been made over the past 2 decades to raise awareness among public health professionals of the importance of incorporating an equity perspective into health-related policies and interventions in low- and middle-income countries

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(LMICs). A number of publications have greatly contributed to these efforts by documenting prevailing socioeconomic inequalities in health,[1] showing what works and what does not to improve equity,[2] and providing useful tools and methods for assessing equity.[3-5]

These efforts have been accompanied by an increased interest in the use of a so-called asset index (or wealth index) to measure socioeconomic position in LMICs. An asset index combines responses to survey questions regarding household asset ownership, housing characteristics, and access to basic services such as water and sanitation. Principal components analysis (PCA) is commonly used to calculate a weight for each variable generated from the responses to those questions.[6] An index is then calculated for each household by adding up the weighted responses. Each household is thus given an asset index value. All the households in the survey are subsequently sorted based on the value of their asset index and the sample is divided into socioeconomic groups of equal size. Most commonly, 5 groups are created, which are known as asset quintiles or wealth quintiles.[7] The use of an asset index is particularly attractive for the analysis of data from household surveys such as the Demographic and Health Surveys (DHS), the Multiple Indicator Cluster Surveys (MICS), or the Reproductive Health Surveys (RHS) because of difficulties in many LMICs in obtaining accurate information regarding household income or consumption expenditure.

Construction of the standard asset index can involve as many as 40 survey questions, making it burdensome for program implementers to use.

An asset index can be used for a wide range of equity analyses. It can, for example, be used to assess the socioeconomic profile of users of a specific health service[8] by asking a small random sample of service users the same questions as those used for the construction of an asset index in an existing reference survey such as the DHS. The asset index is then constructed for each service user, using the same weights as those used to construct the asset index in the reference survey. The asset indices of service users can then be compared with those of people in the country as a whole, i.e., those in the reference survey, which permits estimation of the proportion of service users falling into each of the national asset quintiles. Patterns can then be examined to assess whether users are evenly spread across quintiles; whether they are more represented in the lower quintiles, in which case the program or intervention is pro-poor; or conversely whether relatively more service users fall into the higher quintiles, indicating that the program or intervention favors the better-off.

This method of assessing equity in use of health services is attractive for 2 reasons: it is relatively low cost and it is easy to apply. More particularly, it has the following advantages:

- The socioeconomic profile of service users can be compared with national asset indices that are already calculated, thus considerably simplifying the calculations needed to analyze the survey of intervention beneficiaries.
- Country-specific asset questions developed by those who conducted the reference survey can simply be added to a planned survey, including household surveys or exit surveys of facility users.
- The sample size required is relatively small since there is no need to *create* new asset quintiles from the sample of service users. The analysis in essence *borrows* information from an existing household survey, in which a representative sample of the national population was already divided into national wealth quintiles.

Despite these advantages, many implementers who wish to assess whether their interventions have reached the poor may still perceive the approach as being too burdensome, especially since the construction of the asset index in a typical reference survey, such as a DHS, can involve as many as 40 questions, many with multiple responses. They may be reluctant to add that many extra questions to a survey that is primarily designed to monitor overall progress or achievements relating to the service or intervention of interest.

Using data from previously conducted studies in Honduras and Senegal, this paper examines the extent to which a reduction in the number of variables used to construct the asset index, and consequently in the number of questions to be asked of service users, affects the results of such equity analysis. Most importantly, the paper assesses the extent to which such reduction alters the resulting socioeconomic profile of service users and the policy recommendations derived from the findings.

METHODS

Our analysis was based on data from 2 countries: Honduras and Senegal. In each of these countries, a suitable example of the full equity analysis

described in the preceding section was available. Both examples used a DHS as reference survey.

Project Implemented by Child Fund International in Honduras

From October 1, 2009, to September 30, 2013, Child Fund International (CFI) implemented a community-based maternal, neonatal, and child health project in Francisco Morazán Sur, Honduras. The goal of the project was to decrease maternal, neonatal, infant, and under-5 child mortality in the project area through 3 community-based health interventions:

1. Standardizing the role of communities in increasing institutional deliveries and strengthening community-based obstetric and neonatal care within a national decentralization strategy.
2. Creating self-sustaining community-based health units (UCOS), which integrate vertical Ministry of Health (MOH) maternal, neonatal and child health programs and various cadres of community volunteers. UCOS are small, freestanding structures located in selected communities, equipped with essential drugs, basic equipment, and health education materials. Community volunteers offer care, attention, and education to persons in need, with an emphasis on women, infants, and children. They are self-sustaining financially, managed by the community, supervised by the MOH, and given technical and logistical support by Child Fund Honduras. UCOS sustainability depends upon a functioning revolving drug fund.
3. Adapting and implementing community-based continuous quality improvement systems for the UCOS.

The UCOS strategy was developed to better reach the most underserved populations, which tend to be families of low socioeconomic status. To determine whether the UCOS were reaching a poorer population than MOH facilities (referred to as CESAMO), CFI conducted exit surveys of 334 UCOS clients and 143 clients of CESAMO facilities, after obtaining written informed consent. The full set of questions used to construct an asset index in the 2011–2012 Honduras DHS was added to the CFI questionnaire, and asset indices were calculated for all respondents using the DHS weights. Respondents were then assigned to a national asset quintile based on the value of their asset index, and a socioeconomic profile of service users was constructed for the 2 types of facilities. The exit surveys complemented assessments of health coverage and costs. The MOH was interested in reviewing information from all 3 assessments to determine if the UCOS strategy should be adopted as national policy.

Project Implemented by the Ministry of Health and Social Action in Senegal

In 2012, the Ministry of Health and Social Action (MoHSA) of Senegal implemented a results-based financing (RBF) pilot project in 2 regions of the country: Kaffrine and Kolda. In this pilot, financial incentives were provided to health centers, district hospitals, and district health management teams, conditional on meeting predefined targets on a set of key health service utilization indicators. Financial incentives also reflected quality of care, which was assessed using a quality checklist.

Equity was not explicitly taken into consideration in the design of the pilot. MoHSA was well aware, however, of the risk that RBF might encourage health facilities to focus on populations that are easier to reach—which tend to be better off—in order to meet the targets and that this would lead to increased socioeconomic inequalities in health. It was therefore important to monitor the equity effect of the pilot. This monitoring was incorporated into the verification function of the RBF model.

As part of the verification process, facility registers were reviewed, and during the review process the verification team also extracted information on a random sample of patients. A contracted community-based organization was then tasked with visiting the households of the selected patients and, after obtaining informed consent, to verify the data extracted from the facility's registers. Interviewed service users from Kaffrine and Kolda districts (N = 1,423) were also asked about expenses engendered and perceived quality. In addition, the questionnaire included all the questions and response options used in the 2010–2011 Senegal DHS to construct an asset index. The weights applied by DHS were then used to calculate a comparable asset index value for each respondent's household, which could then be used to construct the socioeconomic profile of service users.

Simplified asset indices were validated against program data from Honduras and Senegal, with the standard DHS wealth index in each country serving as the reference.

Development of a "Simplified" Asset Index

Both country studies relied on the "full" asset index, as constructed in the reference DHS, constituting the ideal starting point for our analysis. Results obtained in each of these

applications became the "gold standard" with which we compared results from analyses based on simplified asset indices—that is, asset indices constructed using a shorter list of variables.

In both Honduras and Senegal, DHS produces separate asset indices for urban and rural households, using PCA. The urban and rural household asset indices are then combined into a national asset index, using a third common PCA coupled with a regression procedure developed by the DHS secretariat.[9,10] The resulting national asset index is used to construct the national asset quintiles. In our study, we followed the same procedure to develop a national asset index for each study country that is identical to that included in the DHS dataset.

We then examined the individual variables contained in each country's index. To begin, we sorted the variables in ascending order of their relative importance, as captured by the absolute value of factor loadings.

After sorting the variables, we identified and dropped those that contributed least to the DHS asset index's total value, i.e., those at the top of the sorted lists. Rather than dropping variables one by one, we dropped the variables in groups by gradually increasing the threshold for the minimum acceptable factor loading. More precisely, we first narrowed down the list of variables by only accepting variables with an absolute value of factor loading greater than 0.05; we subsequently increased the threshold to 0.10, 0.20, and so forth up to 0.70, resulting in a total of 8 iterations. We stopped at a threshold of 0.70 because in both countries the correlation to the original asset index at that threshold was visibly far off and neither country had more than 3 variables that would meet a higher threshold. Variables needed to meet the threshold for the absolute value of factor loading in at least one of the PCAs (urban, rural, or common) in order to be retained within each respective iteration. To maintain consistency, we based variable selection in each iteration on the same sorted list derived from the full asset index. The asset index calculation procedure described above, however, was repeated on each shortened list of variables to generate new weights and quintile cut-off points. PCA was conducted using SPSS factor analysis procedure (SPSS Statistics Version 22), extracting only one factor.

Socioeconomic Profile of Honduras and Senegal Service Users

To construct the socioeconomic profile of service users in the Honduras and Senegal studies, we used the procedure described earlier for the original DHS asset index to calculate a national asset index value for each participant. We then applied the original DHS asset quintile cut-off points to classify the participants in the 2 Honduras programs and the single Senegalese program into national asset index quintiles. These steps were then repeated for each of the 8 simplified asset index iterations. Results obtained for each of the iterations were compared against the results based on the original DHS asset index, which was considered to be the gold standard for these analyses.

Evaluation of the "Parsimonious" Asset Index Iterations

We used Cohen's kappa statistic for 2 different purposes. First, we used it to compare the composition of the DHS asset quintiles, which represent the general population: in comparison with the quintiles based on the "full" asset index, how did the composition change in each iteration, i.e., what proportion of households moved in and out of each quintile? Second, we used Cohen's kappa statistic to compare the socioeconomic profiles of service users: in comparison with the socioeconomic profile obtained in the original analysis, how did the profile change in each of the 8 iterations based on a simplified asset index? This test, which is considered to be a more robust measure than a simple percent agreement calculation since it takes into account the agreement occurring by chance, produces values ranging from -1 to 1. Correlations <0 are considered to have poor strength of agreement, with 0–0.20 considered as slight, 0.21–0.40 as fair, 0.41–0.60 as moderate, 0.61–0.80 as substantial, and 0.81–1.0 as almost perfect agreement.[11]

In order to assess changes in the socioeconomic profile of service users, we also calculated the difference in the percentage of respondents in each asset quintile compared with that obtained in the analysis based on the original DHS asset index. For summary purposes, we present the highest percentage point change across the 5 quintiles for each of the iterations.

To examine the extent to which the use of a simplified asset index would result in similar conclusions from a policy standpoint, we used the Honduras data in which the purpose of the evaluation had been to compare the ability of the UCOS service delivery model to enroll a higher percentage of the poor than the CESAMO

model. We compared, for each iteration, the percentage of clients in each asset quintile for the 2 delivery models to determine if the patterns observed in the original analysis, which was based on the full DHS asset index, persisted as the number of variables included in the asset index was decreased. For purposes of this analysis, we used 4 iterations (numbers 1, 2, 4, and 7 described fully in the Results section), which involve 111 (full asset index), 74, 36, and 9 variables, respectively.

While assessing the agreement between asset quintile assignments is essential in any attempts to reduce the number of asset variables, a second essential component in developing a more parsimonious asset index is evaluating the extent to which it simplifies and shortens data collection. In the asset index calculations used by DHS and others, multiple choice responses to questions relating to the source of drinking water, the type of fuel used for cooking, or the material used for wall, roofing, or floors, are each coded as binary variables, such that a single question may generate many variables. For this reason, we examined not only the variables in the simplified indices but also the number of questions that would need to be asked on a questionnaire to generate the retained variables.

Our final analysis consisted of a comparison of the lists of asset variables retained in each iteration between the 2 countries. The purpose was to assess the extent to which a single set of asset variables could be used across the 2 countries.

RESULTS

Table 1 presents the principal results for Honduras, for each of 8 iterations, while Table 2 presents the results for Senegal. As shown in columns (c) and (d) of the tables, the number of required questions and variables for each country declined as the factor loading cut-offs were raised, although the number of questions that would need to be retained did not decline as rapidly as the number of variables.

The kappa statistics in column (e) show the level of agreement in the DHS data between asset quintiles based on the original DHS asset index

TABLE 1. Honduras Results for Full Asset Index and 8 Simplified Iterations

					Changes in Socioeconomic Profile		
					Max. Absolute Percentage Point Change *(in which quintile)*	Kappa Statistic	
Iteration	Inclusion Criteria (absolute value of the factor loading)	No. of Questions	No. of Variables	Changes in DHS Quintile Composition Kappa Statistic (N = 21,362)		UCOS (n = 334)	CESAMO (n = 143)
(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)
Full asset index (reference)	All variables included	41	111	1.000	NA	1.000	1.000
1	>0.05	35	86	0.993	3% *(CESAMO Q2&3)*	0.972	0.957
2	>0.10	33	74	0.986	2% *(CESAMO Q3)*	0.966	0.936
3	>0.20	25	48	0.927	6% *(CESAMO Q3)*	0.898	0.780
4	>0.30	19	36	0.877	4% *(CESAMO Q2)*	0.829	0.734
5	>0.40	15	24	0.799	8% *(CESAMO Q2)*	0.778	0.652
6	>0.50	13	17	0.724	11% *(CESAMO Q4)*	0.683	0.471
7	>0.60	8	9	0.634	8% *(CESAMO Q2)*	0.476	0.422
8	>0.70	2	2	0.209	91% *(UCOS Q3)*	-0.023	0.019

Abbreviations: CESAMO, Centro de Salud con Médico y Odontólogo (Ministry of Health clinics); DHS, Demographic and Health Survey; UCOS, Unidades Comunitarios (community-based health units).

The number of asset variables in the wealth index could potentially be reduced from 111 to 9 in Honduras, and from 103 to 10 in Senegal, while maintaining substantial agreement with the standard wealth index.

The socioeconomic profile of users generally was not dramatically affected by simplification of the asset index.

and those based on each simplified asset index iteration. For Honduras, there was *almost perfect* agreement all the way down to iteration 4 (and almost to iteration 5; 36 to 24 variables) (Table 1), and for Senegal, to iteration 5 (21 variables) (Table 2). Thus, for these first 4 to 5 iterations, changes in the quintile composition were relatively minor, and reducing the number of asset variables, from 111 to 36 in the case of Honduras and from 103 to 21 in the case of Senegal, had limited effect on the DHS asset quintile composition. For both countries, the level of agreement remained *substantial* (i.e., with a kappa value greater than 0.61) in all but the last iteration, suggesting that the number of asset variables could potentially be further reduced down to 9 for Honduras and to 10 for Senegal.

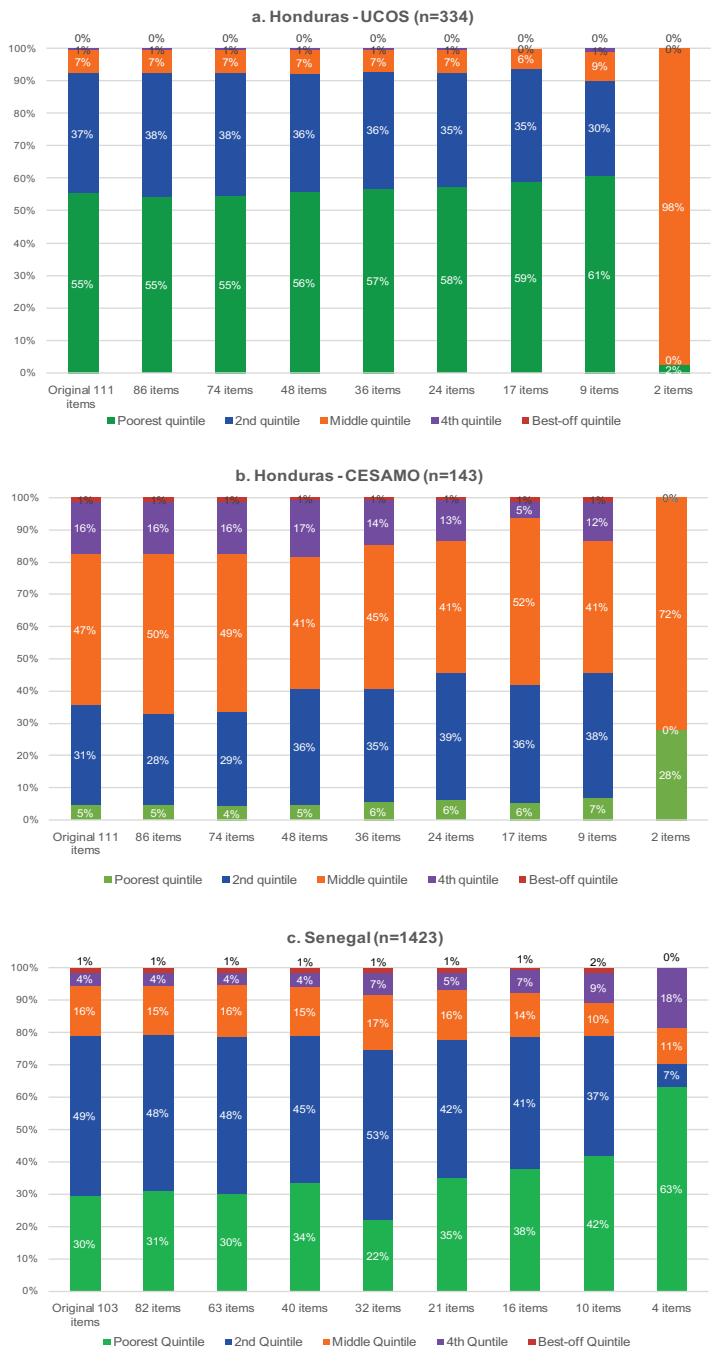
Columns (f), (g), and (h) in Table 1, and columns (f) and (g) in Table 2, summarize the findings relating to changes in the socioeconomic profile of the service users in each country's project. Column (f) in both tables indicates in which quintile(s) the largest change was observed, and for Honduras (Table 1), in which study group (UCOS or CESAMO). The maximum change remained below 10 percentage points for iterations 1 to 5 in Honduras (111 to 24 variables) and for iterations 1 to 6 in Senegal (103 to 16 variables). In Honduras, the largest changes tended to occur in the socioeconomic profile of CESAMO users. In neither of the countries did the maximum change exceed 12 percentage points until the very last iteration. The kappa statistics displayed in the remaining column(s) were systematically lower than those relating to the DHS asset quintile composition in column (e), although the correlations remained in the "substantial" or higher category until the fifth iteration in Honduras (24 variables) and the sixth iteration in Senegal (16 variables).

Figure 1 shows changes in the socioeconomic profile of service users as the number of variables used to construct the asset index decreases for Honduras (1a and 1b) and for Senegal (1c). In each graph, the socioeconomic profile obtained in the original study, which used the full asset index and which was defined as the gold standard for this exercise, is displayed on the left. In all 3 cases, we see that despite slight variations in the proportion of users in each quintile, the socioeconomic profile was not dramatically affected by a simplification of the asset index, at least up to a certain point, namely until the variable number decreased below 9 items for

TABLE 2. Senegal Results for Full Asset Index and 8 Simplified Iterations

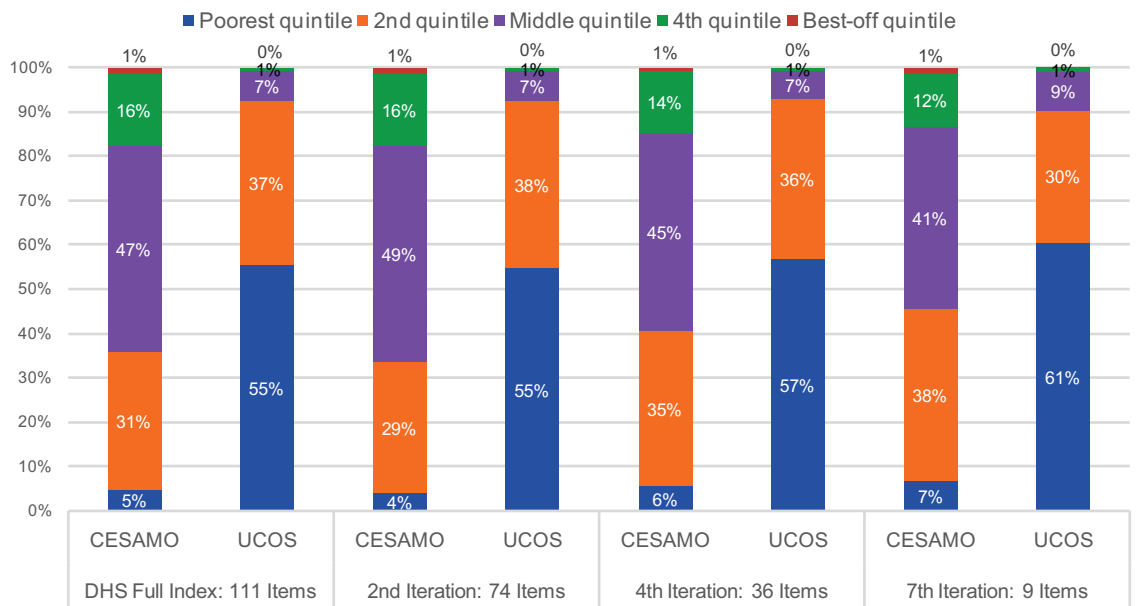
Iteration	Inclusion Criteria (absolute value of the factor loading)	No. of Questions	No. of Variables	Changes in DHS Quintile Composition Kappa Statistic (N = 7,902)	Changes in Socioeconomic Profile	
					Maximum Absolute Percentage Point Change *(in which quintile)*	Kappa Statistic (N = 1,423)
(a)	(b)	(c)	(d)	(e)	(f)	(g)
Full asset index (reference)	All variables included	36	103	1.000	NA	1.000
1	>0.05	34	82	0.997	1% *(Q1&2)*	0.925
2	>0.10	32	63	0.969	1% *(Q1&2)*	0.950
3	>0.20	24	40	0.920	4% *(Q1&2)*	0.867
4	>0.30	20	32	0.882	8% *(Q1)*	0.751
5	>0.40	14	21	0.814	7% *(Q2)*	0.746
6	>0.50	11	16	0.779	8% *(Q1&2)*	0.713
7	>0.60	9	10	0.675	12% *(Q1&2)*	0.553
8	>0.70	3	4	0.310	42% *(Q2)*	0.231

FIGURE 1. Socioeconomic Profile of Service Users Based on the DHS Full Asset Index and for 8 Simplified Iterations, Using Data From (a) Honduras UCOS, (b) Honduras CESAMO, and (c) Senegal



Abbreviations: CESAMO, Centro de Salud con Médico y Odontólogo (Ministry of Health clinics); DHS, Demographic and Health Survey; UCOS, Unidades Comunitarios (community-based health units).

FIGURE 2. Socioeconomic Profile of Service Users, by Provider Type, Based on the DHS Full Asset Index and for Selected Iterations, Using Data From Honduras



Abbreviation: DHS, Demographic and Health Survey.

Honduras and below 10 items for Senegal. The Senegal data and the Honduras UCOS data suggest a pro-poor policy in which the percentages of users in the lowest 2 quintiles vastly exceeded the expected 40% in these categories. However, for Senegal, the relative mix of users from the first and second quintiles changed, whereby from the fifth iteration onward (21 or fewer variables), the lowest 2 quintiles are almost equally represented among service users.

The number of variables required to construct the asset index can be reduced considerably without leading to different policy recommendations.

To examine the extent to which the use of a simplified asset index would result in similar conclusions from a policy standpoint, Figure 2 presents a comparison of the 2 Honduras user populations under 4 scenarios: all 111 variables (used as the gold standard), 74 variables, 36 variables, and 9 variables. These data suggest that the main messages would remain the same, even for the iteration in which the asset index was constructed using only 9 asset variables: (1) UCOS is pro-poor, and (2) it is more pro-poor than CESAMO.

In terms of the possibility of using a single asset index across countries, Table 3 shows, for each iteration, how much overlap occurred between the lists of asset variables in each of the 2 countries. Of note, the list of asset variables included in the original full asset index, which was part of the DHS dataset, differed considerably between the 2 countries, with the 2 lists having less than 60% of asset variables in common. In none of the iterations did this proportion exceed 50%.

DISCUSSION

Although equity in health service utilization is considered of great importance, it is rarely evaluated at the level of programs or interventions because of concerns about administering a long and complex questionnaire. In this study, we sought to evaluate the scope for simplifying the asset index by reducing the number of variables included in its calculation. Using 2 concrete examples from 2 different countries where a recent household survey with an asset index—in this case a DHS—was available, we assessed the extent to which a simplification of the asset index affects the main message and possible

TABLE 3. Comparison of Variables Included in Honduras and Senegal Iterations

Iteration	Inclusion Criteria (absolute value of the factor loading)	No. of Variables Included		
		Honduras (Total)	Overlapping	Senegal (Total)
Full asset index (reference)	All variables included	111	57	103
1	>0.05	86	39	82
2	>0.10	74	29	63
3	>0.20	48	18	40
4	>0.30	36	13	32
5	>0.40	24	9	21
6	>0.50	17	5	16
7	>0.60	9	3	10
8	>0.70	2	0	4

associated policy recommendations. These 2 examples clearly demonstrate that the number of variables and the number of questions required to construct the asset index can be reduced considerably without substantially altering the main findings, and without leading to different policy recommendations.

The extent to which the list of variables and questions can be reduced varied between study sites. In the Honduras example, the 111 asset variables derived from 41 questions could be reduced to as few as 9 variables, captured by only 8 questions, without altering the main conclusions. In the Senegal example, in which the initial questionnaire contained 103 asset variables and 36 questions, the possible reduction appeared to be more modest, with findings, especially in terms of the percentage of clients in each of the 2 lowest quintiles, remaining consistent when the number of variables was reduced down to 32 and the number of questions to 20. One possible explanation for this difference between the 2 country examples is that the key findings in the original analysis were stronger in the Honduras example to begin with, with larger differences between quintiles, which provided more room for variation.

There was not a strict correlation between the reduction in the number of variables and in the number of questions. As long as at least one of the response options remains in the list of asset variables, the question needs to be retained. That question, however, may become much more specific. Instead of a question such as "What is the main material of the floor?" followed by all the possible options, the question may become "Is the main material of the floor cement?" that requires a simple yes or no answer. Even though it still counts as a question, obtaining a valid answer to this reformulated question will likely be considerably faster. The drawback, however, is that the development of the questionnaire will require some rephrasing of the original questions, rather than simply removing unnecessary ones.

As noted, we also explored the feasibility of developing a small common set of questions that would be universal and could be used across countries for comparison purposes. Our findings demonstrate that such an approach may be problematic. In our study, which used DHS data from Honduras and Senegal, there was only a 60% overlap in asset variables in the full sets used to construct asset indices. The percentage of overlap dropped in each iteration, indicating that the variables that contribute most to the asset index are to a considerable extent country-specific. This suggests that, depending on the similarities of DHS and other questionnaires, which are usually tailored to reflect country specificities, developing a standardized, simplified asset questionnaire may prove difficult.

The variables that contribute most to the asset index are to a considerable extent country-specific. Developing a standardized, simplified asset questionnaire may therefore prove difficult.

A limiting factor in using a more restricted set of questions is the analysis needed to generate the shortened list of key variables and the associated weights and quintile cut-off points. Much of the process used in this analysis to create such lists can be automated. All the information required for an

implementer or researcher to assess the different options of selecting a shorter set of variables and questions and their consequences (i.e., list of variables, questions, and Kappa statistics) and to calculate the asset index for the selected option (i.e., weights, quintile cut-off points, and possibly regression coefficients) could be generated automatically. This would need to be accompanied by additional resources, however, to ensure that an implementer or researcher fully understands the approach. The fact that our analysis showed that there is only limited overlap between the lists of asset variables in the 2 country examples makes such computerization even more relevant, given that a standardized, simplified questionnaire is unlikely to do a good job.

CONCLUSIONS

It is possible to produce valid asset index results using a limited set of yes/no or multiple choice questions that take only a few minutes to administer to clients. These findings are important. One of the main reasons why many implementers are currently reluctant to assessing whether their intervention is pro-poor is the perceived complexity of the equity analysis involved. Our findings show that this barrier can be overcome. They show that the analysis can be made considerably less burdensome, especially if the simplification process is automated. While additional evidence on the feasibility of the proposed simplification would be welcome, steps can be taken now to make the construction and use of a simplified asset index more user-friendly.

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GLOBAL HEALTH: SCIENCE AND PRACTICE
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FIELD ACTION REPORT

Results-Based Financing in Mozambique's Central Medical Store: A Review After 1 Year

Cary Spisak,[a] Lindsay Morgan,[b] Rena Eichler,[c] James Rosen,[d] Brian Serumaga,[a] Angela Wang[a]

The RBF scheme, which paid incentives for verified results, steadily improved the CMS's performance over 1 year, particularly for supply and distribution planning. Key apparent success factors:

1) The CMS had full discretion over how to spend the funds.
2) Payment was shared with and dependent on all staff, which encouraged teamwork.
3) Performance indicators were challenging yet achievable.
4) The quarterly payment cycle was frequent enough to be motivating.

Recommendations for future programs: focus on both quality and quantity indicators; strengthen results verification processes; and work toward institutionalizing the approach.

ABSTRACT

Background: Public health commodity supply chains are typically weak in low-income countries, partly because they have many disparate yet interdependent functions and components. Approaches to strengthening supply chains in such settings have often fallen short—they address technical weaknesses, but not the incentives that motivate staff to perform better.

Methods: We reviewed the first year of a results-based financing (RBF) program in Mozambique, which began in January 2013. The program aimed to improve the performance of the central medical store—*Central de Medicamentos e Artigos Medicos* (CMAM)—by realigning incentives. We completed in-depth interviews and focus group discussions with 33 key informants, including representatives from CMAM and donor agencies, and collected quantitative data on performance measures and use of funds.

Implementation: The RBF agreement linked CMAM performance payments to quarterly results on 5 performance indicators related to supply planning, distribution planning, and warehouse management. RBF is predicated on the theory that a combination of carrot and stick—i.e., shared financial incentives, plus increased accountability for results—will spur changes in behavior. Important design elements: (1) indicators were measured against quarterly targets, and payments were made only for indicators that met those targets; (2) targets were set based on documented performance, at levels that could be reasonably attained, yet pushed for improvement; (3) payment was shared with and dependent on all staff, encouraging teamwork and collaboration; (4) results were validated by verifiable data sources; and (5) CMAM had discretion over how to use the funds.

Findings: We found that CMAM's performance continually improved over baseline and that CMAM achieved many of its performance targets, for example, timely submission of quarterly supply and distribution planning reports. Warehouse indicators, such as inventory management and order fulfillment, proved more challenging but were nonetheless positive. By linking payments to periodic verified results, and giving CMAM discretion over how to spend the funds, the RBF agreement motivated the workforce; focused attention on results; strengthened data collection; encouraged teamwork and innovation; and ultimately strengthened the central supply chain.

Conclusion: Policy makers and program managers can use performance incentives to catalyze and leverage existing investments. To further strengthen the approach, such incentive programs can shift attention from quantity to quality indicators, improve verification processes, and aim to institutionalize the approach.

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BACKGROUND

In the decades following the end of a prolonged civil war, Mozambique made important strides in health, including a decrease in the under-5 mortality rate, from 219 per 1,000 live births in 1990 to 97 per 1,000 in

Public-sector supply chains in many low-income countries suffer from poor performance, often due to misaligned incentives.

2011.[1] However, serious gaps have persisted. The maternal mortality ratio remains high, at 480 deaths per 100,000 live births (2013)[2]; the prevalence of modern contraceptives is only 7% in rural areas (2011)[3]; and both HIV and malaria are hyperendemic—the national HIV prevalence is 10.6% (2014 estimates).[4]

One of the underlying challenges is the poor performance of the public health supply chain. The Central Medical Store—*Central de Medicamentos e Artigos Medicos* (CMAM)—is responsible for managing the procurement, importation, central-level warehousing, and distribution of medicines and commodities used by the public health system to provinces. Over the years, reductions to its administrative autonomy and to access to resources created operational challenges that hindered the organization's ability to respond both to emergencies and to routine needs. An assessment of medicines procurement and the supply chain management system, undertaken in February 2011,[5] found multiple shortcomings:

- Poor information accuracy and flow between the central, provincial, and district levels
- Ad hoc distribution of medicines from provinces to districts and health facilities
- Fragmented management responsibility
- Inflexible financing

Supply chains are foundational for any health system, encompassing "the planning and management of all activities involved in sourcing and procurement … and all logistics management activities. [This] also includes coordination and collaboration with … suppliers, intermediaries, third-party service providers, and customers."[6]

For health supply chains to work, many actors in different locations must do their part.

For health supply chains to work—for the right goods to be received and delivered in the right quantities, in good condition, to the right place, at the right time, for the right cost—many actors working in different locations, with different responsibilities, need to be motivated to do their part. And they must be held accountable. These actors—from central-level planners and procurement specialists, to regional warehouse and transportation teams, to local storekeepers and service providers—depend on each other for timely and accurate information and a reliable supply of health commodities. One break in the chain, one delay, can have repercussions throughout the system, ultimately affecting whether families can access life-saving medicines and commodities.

Public-sector supply chains in many low-income countries suffer from poor performance. A key contributor is the often misaligned incentives at work in highly centralized public-sector bureaucracies, where the responsibility for essential, but disparate, tasks are assigned to individuals who may have weak incentives to perform well or in concert with one another.[7] Misaligned incentives may be found throughout the supply chain and may include low compensation for staff paid irrespective of performance; poor communication, coordination, and accountability arrangements; or insufficient resources for management to invest in the necessary infrastructure and other investments to support the long-term success.

In Mozambique, underperformance at CMAM has negatively affected the functioning of the supply chain as a whole, resulting in inaccurate information about stock levels and expiries, as well as delayed and inefficient distribution. Many strategies have been tried to improve the performance of CMAM. A warehouse management system was introduced, for example, providing tools to better control and manage stock and data. A monitoring and evaluation (M&E) framework was developed and a dedicated M&E unit created within CMAM to routinely track performance. And an electronic payment system—e-SISTAFE—has enabled CMAM to pay some suppliers and manage limited funds, independent of the Ministry of Health's Department of Administration and Finance (DAF).

Donor financial and technical support has been significant. CMAM receives technical assistance and commodities from the US Government (USG); operational funding and commodities from the World Bank; and commodities from the Global Fund to Fight AIDS, Tuberculosis and Malaria (The Global Fund). The USG alone invests an average of US$10–15 million annually for technical assistance to CMAM.

Additionally, the Ministry of Health and its partners have developed supportive action plans and policies, such as the Supply Chain Logistic Plan of Action 2012[8] and the Pharmaceutical Logistics Strategic Plan 2013,[9] which includes a performance indicator and monitoring framework. These plans identify several goals:

- Improved quality and timeliness of information flow between districts, provinces, and CMAM, and better use of this information for planning and procurement

- Better planning for distribution from provincial warehouses to the districts
- Stronger supervision and internal audit of province/district stores by CMAM

Despite these improvements, CMAM has lacked data to demonstrate improved supply chain outcomes, and stakeholders in Maputo believed that CMAM's performance was not improving as expected.

In this context, result-based financing (RBF) was proposed, both to realign incentives and to catalyze other investments in CMAM. RBF refers to "any program that rewards the delivery of one or more outputs or outcomes by one or more incentives, financial or otherwise, upon verification that the agreed-upon result has actually been delivered."[10] RBF programs vary widely, but most address poor performance by providing performance payments for verified results and some measure of autonomy over how to spend the incentives.

The vast majority of RBF programs in low- and middle-income countries provide incentives either to patients, to encourage and enable them to seek and access health services, or to health care providers, to increase the quantity and improve the quality of the services they provide. Where RBF is being tried, experience suggests it can have an impact on health and may strengthen the health system in the process.[12]

Although use of performance incentives is common in high-income country supply chains, until recently, few—if any—RBF programs directly targeted public health supply chains in low-income countries. Momentum is increasing, however, to develop RBF approaches that specifically target these health supply chains. By linking incentives with verified results, RBF is increasingly viewed as one way to motivate the supply chain workforce; focus attention on—and provide demonstrable evidence of—measurable results; strengthen data collection and information systems; and, ultimately, strengthen the supply chain and improve health.

This paper reports on how Mozambique used RBF to improve the performance of CMAM and the supply chain. RBF was incorporated into a fixed amount reimbursement agreement (FARA or FAR agreement), a type of assistance from the United States Agency for International Development (USAID) that disburses a fixed amount of funds based on outputs rather than inputs. FARAs closely align with RBF approaches: the agreements condition payments upon the achievement of specific, time-bound, target-based, verified results. Mozambique's supply chain FARA was the first time RBF had been used in the public health supply chain to drive improvements in operational performance.

The agreement was designed in coordination with the Ministry of Health—*Ministerio da Saude,* or MISAU—and its key partners: USAID, the World Bank, and The Global Fund. All parties had an interest in leveraging past investments in and assistance to CMAM, as well as in creating synergies with planned and future initiatives. For example, a World Bank RBF project will aim to strengthen the supply chain at the provincial level, thus complementing USAID's investments in strengthening central medical store performance.

Results-based financing (RBF) was introduced in Mozambique to improve the performance of the public health supply chain.

The FARA was signed on December 6, 2012, between USAID and the Directorate of Planning and Coordination (DPC) within MISAU, with a 1-year performance period beginning January 2013. (The DPC coordinates MISAU's national directorates. At the time of this review, CMAM was positioned under the National Directorate for Medical Assistance—*Direcção Nacional de Assistência Médica*, or DNAM. In April 2014, CMAM was promoted to the level of national directorate.)

EVALUATION METHODS

To understand what drove performance improvements at CMAM under the FARA, in March 2014 (14 months after the performance period began), the authors—a representative from the USAID | DELIVER PROJECT and a representative from USAID's Health Finance and Governance (HFG) project—completed in-depth interviews and focus group discussions with 33 key informants in Maputo. Using a semi-structured interview guide, the consultants met with program stakeholders, including representatives from CMAM, USAID and other donor agencies—the World Bank, UK's Department for International Development (DFID), and the United Nations Population Fund (UNFPA)—as well as mid- and lower-level staff at CMAM.

Where possible, basic quantitative data points related to performance measures of supply and distribution planning and warehouse operations, as well as use of funds, were collected.

Results-based financing is predicated on the theory that financial incentives will spur changes in behavior. The authors hypothesized that performance incentives would improve supply chain performance through 3 principal pathways:

1. Improved staff motivation—leading to better attendance and job performance
2. Improved collaboration and cooperation
3. Increased investment in supply chain infrastructure

In analyzing data, we sought to understand the extent to which respondent narratives matched our hypotheses, the extent to which they differed, and whether they differed depending on the respondent's position in the organization or the sectors in which they worked. The interview guide, as a flexible qualitative instrument, was modified as new themes were uncovered.

THE INTERVENTION: RBF FOR THE PUBLIC HEALTH SUPPLY CHAIN IN MOZAMBIQUE

Most RBF agreements include several key elements:

- An incentive recipient, who stands to receive a financial incentive contingent upon verified results
- Performance indicators and targets that must be reached
- A process to verify results at a certain frequency (e.g., each quarter, twice a year, annually)
- The structure of the payment itself

Incentive Recipient: CMAM—the Central Medical Store

The incentive recipient in the FARA was CMAM. The objective of the agreement was to improve the performance of the central medical store, and thereby spark improvements in the supply chain generally for all key commodities in Mozambique.

Performance Indicators and Targets

The FARA specified 5 performance indicators (Table), which focused on 3 priority areas or *sectors*—supply planning, distribution planning, and warehouse operations. Each sector had a history of underperformance at CMAM and, if improved, could facilitate continuous improvements within the sectors as well as improvements in lower levels of the supply chain.

Performance targets were not too easy nor too hard to achieve.

The **supply planning** sector used planning and quantification reports to inform annual procurement and funding decisions, as well as periodic inventory replenishment activities. Each quarter, the Medicines Working Group—*Grupo de Trabalho de Medicamentos* (GTM)—convened meetings for each of its product category "subgroups" to agree on quarterly commodity supply plans or annual quantification plan reports. The supply planning performance indicator required these quarterly reports to be submitted on time, and according to specific quality criteria. Eight product category subgroups were measured by this indicator: HIV/AIDS, malaria, tuberculosis, essential medicines, laboratory, reproductive health, vaccines, and medical materials.

Similarly, **distribution planning** is an important step in CMAM's order fulfillment cycle—when orders are validated and inventory allocated, and if necessary, rationed. Timely distribution planning could enable more timely delivery of orders to provincial and district levels, thereby reducing the risk of stock-outs at lower levels.

Warehouse indicators measured the accuracy of filling quarterly orders ("order pick and pack" accuracy); the time required to dispatch quarterly orders to recipients; and the ongoing maintenance of accurate physical inventory against inventory records.

The indicators chosen for the FARA were considered *core* supply chain performance indicators: areas on which broader supply chain performance improvements would rely. For example, measuring and improving inventory accuracy is necessary *before* other inventory- and finance-related data—such as product leakage or expiry rates—can be measured.

Only indicators that could be routinely measured and verified were chosen, and data sources and reporting mechanisms were validated or created for each indicator. Additionally, all of the indicators were defined with targets to be measured on a quarterly basis. This ensured that performance data were being collected and monitored on a regular basis, facilitating periodic evaluation and adjustment, and that staff were continuously working toward a near-term goal. This structure also aligned with the common commercial-sector practice of quarterly reporting of business results.

The targets themselves were set based on baseline performance and at levels that presented a reasonable challenge while nonetheless being within CMAM's control to achieve. In other words, the targets were not too easy, nor too hard. For 2 indicators, "order pick and pack accuracy" and "inventory accuracy," the quarterly targets became increasingly more difficult each subsequent quarter.

TABLE. Indicators, Targets, and Payment Amounts for the Mozambique Fixed Amount Reimbursement Agreement (FARA)

Functional Area	Milestones to Be Completed Each Quarter of Calendar Year 2013 *USAID will reimburse CMAM the value specified as USAID's contribution, as noted below, upon certification by DPC and approval and acceptance as certified by USAID of the following milestones at the end of each quarter of calendar year 2013.*[a]	USAID's Contribution (Fixed Reimbursement Amount) per Quarter
Supply planning/ forecasting	(a) Annual quantification plan that meets 3 predetermined criteria, for each product group,[b] *or* (b) Quarterly updated supply plan that meets 3 predetermined criteria, for each product group[b]	$25,000
Distribution planning	Order cycle time for distribution planning is 15 calendar days or less for via Clássica orders to the 18 central + provincial clients	$25,000
Warehouse	Order pick/pack accuracy for distribution to the 18 central + provincial clients is 84% for Q1, 86% for Q2, 88% for Q3, and 90% for Q4	$25,000
Warehouse	Order cycle time for dispatch is 35 calendar days or less for via Clássica orders to the 18 central + provincial clients	$25,000
Warehouse	Inventory accuracy in central warehouses that have implemented the MACS warehouse management system is 75% for Q1, 78% for Q2, 81% for Q3, and 84% for Q4	$25,000
Quarterly Total		**$125,000**
Total for Calendar Year 2013		**$500,000**

Abbreviations: CMAM, *Central de Medicamentos e Artigos Medicos* (Mozambique's central medical store); DPC, Directorate of Planning and Coordination; USAID, United Sates Agency for International Development.
[a] Indicators were weighted equally. Scores for the warehouse indicators were taken in aggregate from all 3 warehouses, with targets derived from aggregate warehouse performance.
[b] Product groups: HIV/AIDS, malaria, tuberculosis, essential medicines, laboratory, reproductive health, vaccines, and medical materials.

CMAM staff felt strongly that each performance indicator should measure the performance of an individual sector, rather than multiple sectors; staff members did not want their own results to be affected by the performance of others. This is in keeping with a lesson learned in many other RBF programs: that staff members should only be held accountable for (and thus rewarded or penalized for) something that is in their control to achieve. Otherwise, RBF may have the opposite of the intended affect: it may demotivate instead of motivate.

Verification

Verification is an essential component of RBF, validating that reported results meet the targets, time lines and other agreed-upon criteria. A robust verification process helps manage risk for all parties in an RBF agreement. Each quarter, after CMAM submitted results, a team at USAID verified those results. The team initially consisted of 2 supply chain experts and was expanded later to include 2 members of USAID's M&E team. The verification team used a standardized checklist to ensure the integrity of the verification process.

Structure of Incentive Payment

In most RBF programs, the potential incentive payment is determined, first by considering preexisting incentives (salaries, per diems, etc.), and then by considering the level of effort required to motivate improved effort, creativity, teamwork, and, ultimately, performance. The incentive payment is not intended to reimburse, for example, a health facility for the costs associated with increasing the number of immunizations it conducts. Rather, the incentive is an *additional* payment, calibrated to be high enough to be motivating, but not so high that it introduces perverse incentives (by, for example, focusing attention away from non-incentivized tasks).

The incentive payment should be high enough to be motivating but not too high that it introduces unintended negative consequences.

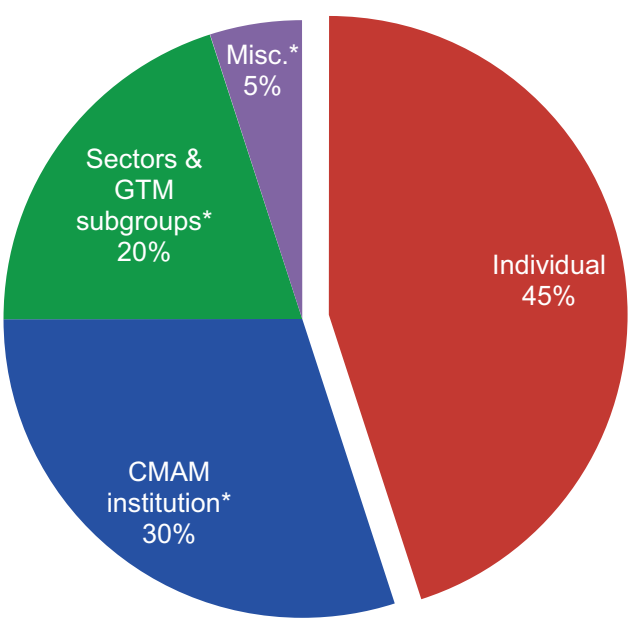
The mode for determining the performance payment differed somewhat from what is normally done in RBF programs. Because the FARA is a *reimbursement* financing mechanism, performance payments are normally determined by estimating the costs associated with completing activities and achieving targets. In the case of Mozambique, USAID considered unfunded items in CMAM's annual budget; identified those that might enable CMAM to improve its performance on the 5 performance indictors; and used the total of these items to create a budget for the performance payment (or "reimbursement" in USAID parlance). So as not to incentivize efforts related to one indicator over another, the potential reimbursement was split evenly across the indicators; that is, each of the 5 indicators was "worth" one-fifth (20%) of the total possible payment. The Table summarizes the set of indicators, the targets, the total cost of the activities, and the agreed-to payment or reimbursement schedule.

The FARA gave CMAM complete discretion in its use of the performance payment and did not require CMAM to provide proof of how it used the funds. In this way, the Mozambique RBF program is not unlike RBF programs targeted at health care providers, many of which allow health workers control and discretion over how to spend funds and consider such autonomy a key motivating factor in RBF. CMAM proposed a plan for allocating the funds, which was approved by the Minister of Health: 55% were invested in the institution, with portions of this reserved for the sectors responsible for the indicators and for the GTM product category subgroups, which, as noted earlier, contribute to the planning indicator (Figure 1). The remaining, and still substantial, share of funds (45%) was shared among all staff as personal incentives, based on an established formula that considered the rank and category of staff.

FINDINGS

During the first year of the agreement, steady progress was made on achieving the performance

FIGURE 1. CMAM Allocation of Received Funds From Results-Based Financing Program



Abbreviations: CMAM, *Central de Medicamentos e Artigos Medicos* (Mozambique's central medical store); GTM, *Grupo de Trabalho de Medicamentos* (Medicines Working Group).

* Split of institutional allocation between CMAM general, sectors and GTM subgroups, and miscellaneous is approximate.

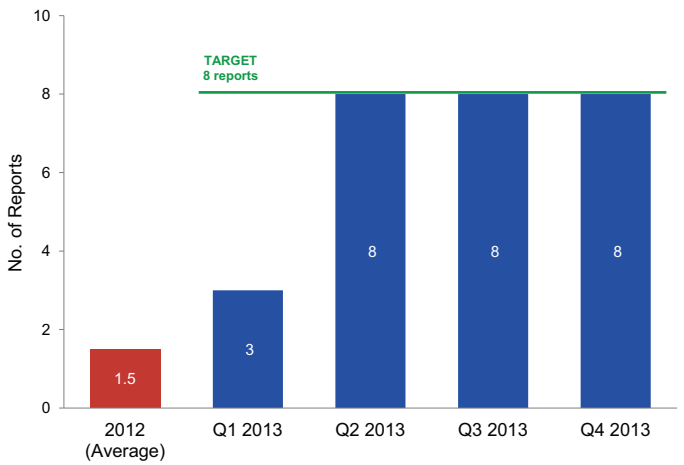
targets, particularly for planning and distribution. Progress was not as steady, but was nonetheless positive, for the warehouse performance targets. At the time of this review, data for the fourth quarter of the first year were not yet available for all indicators.

Supply Planning

To meet the target for the supply planning indicator, each of the 8 GTM product category subgroups submitted in a timely manner a quarterly planning report—either the annual quantification report or a supply plan update—that met specified quality criteria, such as documented participation by named key stakeholders.

CMAM's baseline performance for the supply planning indicator was between 1 and 2 reports submitted each quarter (Figure 2), which, informants noted, were rarely completed in a timely or participatory manner. However, after a misstep in the first quarter, when only 3 of 8 reports were submitted and verified, the planning sector consistently achieved its targets for this indicator.

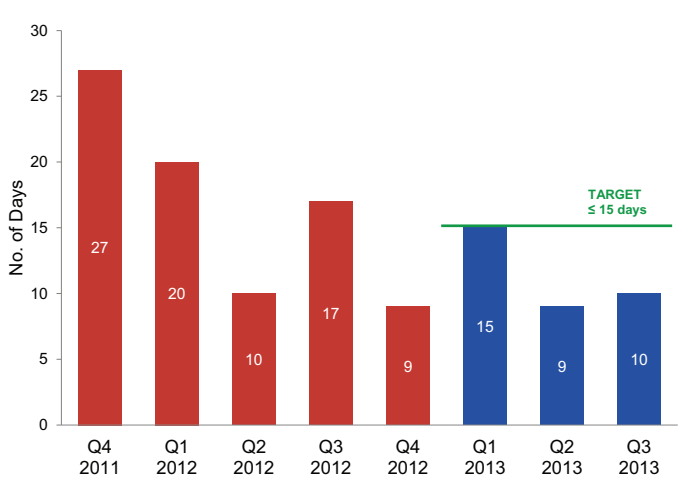
FIGURE 2. Supply Planning Results: Number of Supply Chain Reports Meeting Timely Submission Before (2012) and 1 Year After the Results-Based Financing Agreement Was Initiated in January 2013



Distribution Planning

To meet the target for the distribution planning indicator, the distribution sector had to develop and submit a quarterly distribution plan within 15 days of the beginning of the planning cycle. Past performance on this indicator was inconsistent; baseline performance for the year prior (2012) and the last quarter of 2011 was as low as 9 days and as high as 27. However, the sector consistently submitted the distribution plan within the 15-day target during the first year of the RBF agreement (Figure 3).

FIGURE 3. Distribution Planning Results: Number of Days From Receipt of Orders to Completion of Distribution Plan Before (2011–2012) and 1 Year After the Results-Based Financing Agreement Was Initiated in January 2013[a]

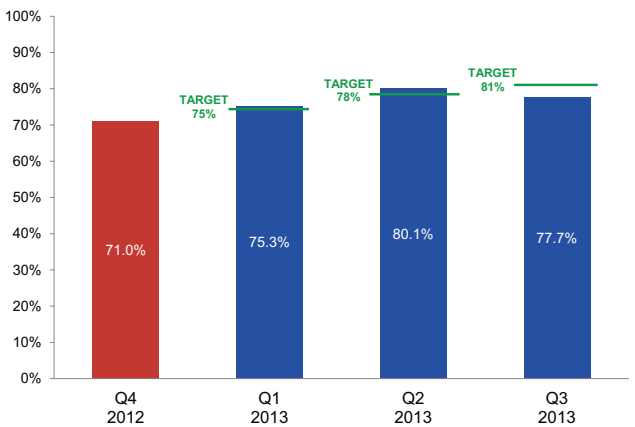


[a] Results for the fourth quarter of 2013 were not yet available at the time of this review.

Warehouse

Warehouse indicators, which monitored inventory management, order fulfillment, and delivery, proved more challenging. To meet the inventory accuracy indicator, a physical inventory count had to match an electronic inventory report within 1 percent margin of error, for a specific number of unique items (stock keeping units or SKUs) selected by random sampling. Maintaining accurate physical inventory and inventory records is critical to ensuring availability of commodities to fill orders and to good use of limited resources. The target for inventory accuracy was set based on historical performance and was increased incrementally each quarter throughout the year. CMAM achieved the

FIGURE 4. Inventory Accuracy Results: Percentage of Electronic Inventory Records Matching Physical Inventory Counts Before (Quarter 4 in 2012) and 1 Year After the Results-Based Financing Agreement Was Initiated in January 2013[a]



[a] Results for the fourth quarter of 2013 were not yet available at the time of this review. Target for the fourth quarter was set at 84%.

Warehouse performance indicators proved more challenging to meet than supply and distribution planning indicators.

inventory accuracy target during the first 2 quarters, but not in the third quarter. Nonetheless, measurable improvement in inventory accuracy was seen throughout the year (Figure 4).

The distribution plan drives the order fulfillment process, which is executed in the warehouse. The order pick and pack accuracy indicator was met when the number and quantity of products that were shipped to the customer matched the number and quantity approved to be shipped in the distribution plan. The target for this indicator was increased incrementally each quarter. This target was achieved only in the second quarter; however, performance continued to improve throughout the year (Figure 5). Fourth-quarter data were not available at the time of the assessment.

The dispatch cycle time indicator measured the timeliness of delivering orders to clients. This indicator was achieved when quarterly shipments were received by clients within 35 calendar days after the warehouse received the distribution plan. Baseline performance for this activity was around 42 days. Although the target was not met in the first quarter, it was met or exceeded in subsequent quarters (Figure 6).

Difficulty in meeting the warehouse targets was due, in part, to such context-specific issues as out-of-service equipment; low staff levels; and Internet connectivity problems, which sometimes made it difficult to connect to the warehouse management system. Some problems may be resolved in the future if CMAM uses incentive funds to maintain equipment, but others, such as lack of staff or high staff turnover, require longer-term solutions that CMAM may not be able to control.

It is also important to note that performance improved for all warehouse indicators, *even during quarters when targets were not met*. This is because the warehouses were rewarded on the basis of their aggregate scores on indicators, masking variances among them. For example, in relation to the order pick and pack accuracy indicator, the target for the third quarter of 2013 was 88%, whereas the aggregate score was 85.9%, meaning this indicator was not met for that quarter. However, a look at their individual scores shows a large variance:

- Zimpeto: 94.4%
- Beira: 65.8%
- Adil: 47.8%

The existing conditions at the warehouses seem to have a strong link to the individual warehouse results. Zimpeto central warehouse is the largest and best-equipped warehouse and is owned by CMAM. Located about 45 minutes outside downtown Maputo, it is well-equipped, well-organized, well-staffed, and well-lit. Zimpeto is, not unexpectedly, the best performer among the warehouses. The Adil warehouse is an hour outside Maputo in the opposite direction. Adil is a rented facility that is only partially equipped with racks, poorly lit and ventilated, and understaffed. Beira warehouse, an hour's flight north of Maputo, is similar in condition to Adil; it does not have racking or other features and, according to CMAM and its technical assistance partners, is generally the lowest performing warehouse of the three.

WHAT ABOUT RBF DROVE PERFORMANCE IMPROVEMENTS?

What about RBF spurred the improvements described above? In addition to the incentive itself, several characteristics of the performance payments appear to have motivated CMAM staff to exert extra effort and improve their performance.

Significance of Incentive Payment for Individuals

Although the total possible FARA payment was only about 5% of the total operational investment and support CMAM receives, for individuals at CMAM, the FARA payment was significant relative to the overall compensation package of CMAM staff. In addition to their salaries, each CMAM staff member received an individual bonus each month, as well as per diem and allowances for travel. The monthly bonus had been in place since 2011, and its allocation was based on a formula that considered each staff member's job description and rank. Eligibility for the bonus depended on individual performance and attendance. FARA payments were allocated among staff based on this established formula. Although the quarterly FARA payments were smaller than the monthly bonuses, a review against the salary scale suggested that, if CMAM achieved the targets for all indicators in 1 quarter, the amount paid to each staff member for RBF in that quarter could represent as much as 1 month's salary.

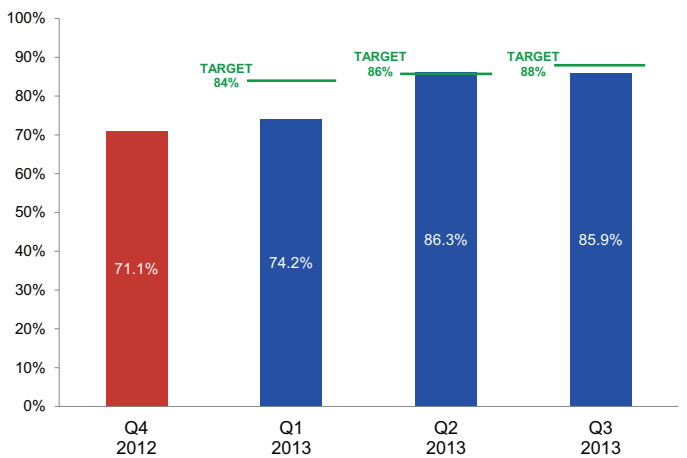
CMAM Discretion Over How to Spend Funds

CMAM had full discretion over how to spend the RBF incentive payment, a crucial difference from other financing sources, and it was not required to report or reconcile back to USAID on use of the funds. Discretion and autonomy were motivating: they allowed CMAM to address small, ad hoc needs, such as purchasing distilled water for the forklift batteries or packing materials, thereby reducing CMAM's dependence on partners and providing CMAM the ability to show fiscal responsibility.

Moreover, CMAM management employed a democratic process with sector heads to agree on how the institutional portion would be spent. At the end of each quarter, CMAM management solicited a list of priority items and estimated cost from each department. Together, the *colectivo* (i.e., the senior management team representing each department within CMAM) decided how to spend the institutional portion.

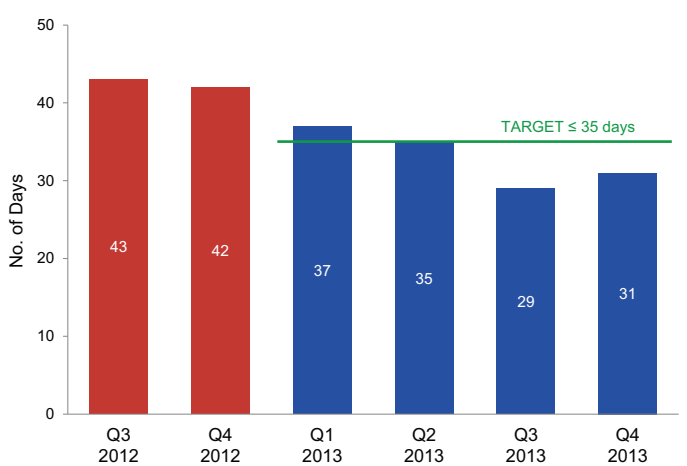
Interestingly, although the FARA did not require CMAM to report the use of funds to USAID, after the first tranche was paid, CMAM voluntarily shared the details of how it spent the funds with USAID. After CMAM received its first incentive payment, it was able to invest in infrastructure improvements; purchase of office equipment, supplies, and materials; travel costs; and workforce environment improvements such as curtains and chairs for shared spaces.

FIGURE 5. Order Pick and Pack Accuracy Results: Percentage of Products Shipped Matching Packing List in Distribution Plan Before (Quarter 4 in 2012) and 1 Year After the Results-Based Financing Agreement Was Initiated in January 2013[a]



[a] Results for the fourth quarter of 2013 were not yet available at the time of this review. Target for the fourth quarter was set at 90%.

FIGURE 6. Dispatch Cycle Time: Number of Days From Receipt of Distribution Plan to Delivery of Health Commodities Before (Quarter 3–4 in 2012) and 1 Year After the Results-Based Financing Agreement Was Initiated in January 2013



CMAM had full discretion over how to spend the RBF payment, a key factor in motivating better performance.

Staff members repeatedly praised these investments and small improvements as contributing to their workplace satisfaction and morale; they brought a sense of professional pride. Moreover, sector heads said they valued having a voice in spending decisions and seeing tangible results. The participatory process also contributed to a greater sense of transparency within the organization.

Incentive Payment Was Shared With Everyone—and Depended on Everyone

Unlike the existing monthly bonus scheme mentioned above, which is based on each individual's performance, the RBF payment was based on *team* performance. Although only a few sectors were *directly* responsible for achieving targets and reporting on the indicators, it was widely recognized that all staff had supporting roles, even if they were indirect. Interdependency to get things done was not new at CMAM, but its importance was amplified because of the FARA, where group performance translated into a tangible, personal benefit. The prospect of personal and collective gain, along with increased accountability and scrutiny of their work, seem to have created a virtuous cycle among CMAM staff members that encouraged extra effort, better attention to detail, teamwork, and collaboration.

Staff members repeatedly said they were working harder, longer hours to make sure tasks and reports were completed, adhering to processes, and using existing tools. Warehouse staff repeatedly spoke of paying more attention to detail and following standard operating procedures more closely. As an example, staff at Adil described how they began double-checking order packing accuracy: one person picked the product and another confirmed it was the correct product and quantity, even though dedicated staff members were not available for this purpose. Although a number of tools and reports were already available to CMAM staff, the data collection, measurement, and supporting documentation that were required to report performance results for the FARA encouraged their regular use.

Staff also recounted working together more closely—increasing collaboration and coordination within and among teams—and they described being proactive in seeking out data that were not forthcoming. This is important because meeting the planning and distribution indicator targets depended on the cooperation of actors from outside the responsible sectors. The head of planning at CMAM noted that, because of RBF, he was able to demand regular and timely reports from the internal technical subgroups. In the past, the groups did not regularly submit reports.

Similarly, to prepare the distribution plan before its deadline, the distribution sector relied on timely order submission from the provinces. The distribution sector head noted that during the FARA she notified provinces that if their requisitions were late, they would have lower priority during the distribution planning process. In this way, the promise of a reward spurred the distribution sector's creativity in problem solving and ability to influence changes outside the department.

Prospect of Losing the Incentive

Interestingly, the prospect of losing money also seems to have spurred improvements in performance. Although staff members had an opportunity to earn "money in our pockets," as it was described, the impact of the FARA on workplace norms was not immediate. It took the first quarter's failures and near misses to illustrate both what the staff stood to gain personally and what was possible for CMAM to receive as a whole. At the end of the first quarter, CMAM met only 2 of 5 indicators and received only 40% of the possible incentive payment (under the FARA, CMAM received zero payment for unmet targets). In the second quarter, with a better grasp of the program and what was at stake, CMAM achieved all the targets.

CHALLENGES

As with any RBF approach, unintended consequences are possible; elements meant to motivate can sometimes have the opposite effect. It is possible, for example, that jointly rewarding the warehouses had a demotivating effect. In the initial design, the high-performing warehouse(s) were, in essence, penalized by low performers. Over time, this could demotivate staff. It may also drive unintended distortions, such as gaming of the program—in other words, manipulating results for better outcomes. To address potential perverse incentives, the program may consider configuring the warehouse indicators differently, such as giving each warehouse specific targets against their own baseline.

There also appears to be some evidence that the program's approach to sharing the reward among all staff, regardless of individual contribution to

achieving the targets, may have caused frustration. Any program where incentives are shared can potentially face the free-rider problem. Some people will inevitably work, or feel they are working, harder than others. Indeed, some CMAM staff members noted frustration that they worked overtime to achieve targets, while others in their department did not, and yet the incentive did not vary according to level of effort. This design element was deliberate: it intended to drive increased accountability within CMAM, and this did appear to be happening, as discussed previously. However, this is an area that should be monitored to minimize any negative impact on morale. In the future, it may make sense to consider including an individual performance component in the allocation formula.

KEY LESSONS

Despite challenges, overall, Mozambique's experiment with RBF for the supply chain resulted in tangible and measurable positive change. Below are key lessons related to design, implementation, and future attempts at incorporating performance incentives in public health supply chains.

Program Design

In many health systems areas, funding and know-how are not enough to spur performance improvements. RBF is intended to address the "black box" of motivation—the gap between necessary funding, inputs and training, and actual effort. As such, the goal is behavior change: increased motivation and effort. For this reason, the design of any RBF program must place motivation at the center of design decisions, which Mozambique's FARA achieved.

Among our key design lessons are:

Careful and deliberative design: Stakeholders involved in Mozambique's FAR agreement allowed the necessary time (nearly 1 year) to design the agreement, ensuring that all the stakeholders understood who was accountable for what. RBF will not motivate if stakeholders do not understand what they are being held accountable for.

Collaboration: Buy-in is a necessary precondition for increased motivation. The FARA design was a collaboration between USAID and CMAM, which ensured indicators were not imposed, but agreed-to as a group. The design was an iterative, consultative process with CMAM, Health Systems 20/20 (the USAID project that preceded HFG), USAID's Supply Chain Management System (SCMS), USAID, the USAID | DELIVER PROJECT, and the World Bank, in which all participants debated and came to consensus on both the indicators and the implementation.

Specificity: The FARA clearly described each element of the agreement, including deadlines, precise indicator definitions and targets, and data sources for verification and reporting mechanisms. This ensured that the expectations and requirements were clearly defined and agreed to.

Achievable challenge: Performance indicators were the right mix of being challenging without being too difficult, and, conversely, were within CMAM's reach to achieve without being too easy. Moreover, they were relevant metrics, based on standard supply chain performance indicators; they were rigorously defined and tested during the design process.

Frequency of payment cycle: The quarterly payment cycle was frequent enough to be motivating and helped create routines among CMAM staff. Teams had renewed opportunities to meet their targets in spite of earlier failures, and quarterly deadlines were too close for staff to lose sight of them. Staff were constantly working toward *new* near-term deadlines and targets; quarterly payments kept the goal well within sight and reach and continuously offered the opportunity to achieve the desired results or lose the benefit.

The quarterly payment cycle was frequent enough to be motivating.

Implementation

The design of a program is only a template—a theory. Impact depends on how innovations are implemented. For this, the RBF FARA was also strong, in 2 important ways.

Openness to learning and revision: RBF programs are not and should not be considered static. The flexibility to evolve as lessons were learned was an important element of the positive results of the FARA in Mozambique. For example, after testing data collection and reporting for the stock accuracy indicator in late 2012, USAID agreed to change the precise definition of the stock accuracy indicator to allow for a 1 percent margin of error in stock accuracy. Without this revision, the indicator would have been unachievable. Openness to learning and

RBF programs should evolve as lessons are learned.

revision resulted in a relevant and achievable indicator.

The process for verification also evolved—going from a 2-person supply chain team to a larger team that included both supply chain and M&E experts. As the verification process was strengthened, the time from the submission by CMAM of quarterly results to the time when USAID disbursed funds was reduced from 50 days to about 30 days.

For future iterations of the agreement, stakeholders should revise the design—indicators, targets, verification—to reflect new and changing realities, while at the same time ensuring that the program remains challenging. Maintaining some core elements or core indicators may be appropriate and helpful in promoting the institutionalization of priority functions or processes, reinforcing routines and best practices.

Effective sensitization by CMAM: Effective sensitization is a foundation for any RBF program: people will not be motivated by a program they do not understand. Prior to the start of the performance period, CMAM management made sector heads responsible for communicating the program and expectations to their respective teams. No formal communication plan was set up, but the key points appeared to have been well disseminated throughout the organization, including the setting of specific targets and deadlines, that benefits would be paid only for targets that were met, and that all staff would share the benefits of meeting the targets.

RECOMMENDATIONS FOR STRENGTHENING THE APPROACH

Just as RBF programs in service delivery have shifted from a focus on *quantity* of services delivered to improvements in *quality* of care, so too can supply chain-RBF programs evolve.

Strengthen incentives for quality: Many RBF programs in service delivery have evolved from rewarding health care providers for increases in the *quantity* of services delivered to improvements in the *quality* of care. RBF approaches targeted at the supply chain may see a similar trajectory. For example, in Mozambique, the quantification and supply plan indicator initially focused on the *timeliness* of reports; efforts then shifted to focusing on their *quality*.

In future iterations, incentives for quality can be strengthened. The program may consider, for example, more closely evaluating reports against quality criteria; providing feedback when a report fails to meet the criteria; and building a culture of quality improvement and data use more generally. At CMAM, informants at the warehouses did not know either their individual warehouse performance scores or their contribution to the overall warehouse results. Access to performance data and sharing results within CMAM may further support morale and performance improvements.

Strengthen M&E and verification to detect distortions: Verification and M&E are essential components of any RBF program, both as the means for detecting gaming and other distortions and for ensuring that the results that are paid for are real. USAID refined its approach to verification, but it could be further clarified and strengthened. As in other RBF programs, it is necessary to develop a verification process that is rigorous without being prohibitively expensive or burdensome.

In addition, CMAM's capacity to monitor performance data should be strengthened, in part to ensure that non-incentivized indicators are not being neglected. At the time of this review, CMAM's M&E department was still relatively new and was responsible for monitoring 26 performance indicators in its M&E plan (which includes the RBF indicators). While no evidence suggests neglect of the other indicators in Mozambique, stakeholders expressed concern about the potential for this in the future.

Aim to institutionalize the approach: Over the long term, governments, such as the Government of Mozambique, may consider institutionalizing the RBF approach—that is, rewarding verified results—both at the central level and throughout the supply chain. As the payment amount in this intervention is modest relative to CMAM's overall budget, it is conceivable to imagine the government assuming responsibility for funding in the future. However, capacity is required for refining the systems for updating indicators, setting targets, and, critically, verifying performance. Over time, with a more fully funded operational budget, it may be possible for continued performance improvements to offset the cost of maintaining such an intervention.

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