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Impact of a multi-level intervention on facility-based births and skilled birth attendance in Kalomo District, Zambia: a mixed-methods evaluation

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Dissertation

IMPACT OF A MULTI-LEVEL INTERVENTION ON FACILITY-BASED

BIRTHS AND SKILLED BIRTH ATTENDANCE IN KALOMO DISTRICT,

ZAMBIA: A MIXED-METHODS EVALUATION

by

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DEDICATION

To my parents, for their unending love and support. To my husband, for taking extraordinary care of me and our family in all ways possible. To my children, the light of my life. In memory of Celeste Hayden Van Landingham, a star in my sky.

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IMPACT OF A MULTI-LEVEL INTERVENTION ON FACILITY-BASED BIRTHS AND SKILLED BIRTH ATTENDANCE IN KALOMO DISTRICT, ZAMBIA: A MIXED-METHODS EVALUATION

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ABSTRACT

Problem: Zambia has one of the highest maternal mortality ratios in the world. Risks of serious complications during childbirth and associated maternal morbidity and mortality can be mitigated by improving access to skilled birth attendants and emergency obstetric and newborn care (EmONC) in facilities when complications arise. In 2012, the Saving Mothers Giving Life (SMGL) initiative was launched in Kalomo District, Zambia, to reduce maternal deaths.

Methods: This study assessed the impact of SMGL in Kalomo District on rates of facility delivery, delivery with a skilled birth attendant, and facility-level changes in the provision of maternity and newborn care during the first learning phase, 2012–2013. Changes in neonatal mortality were also assessed. A mixed-methods approach utilized a quasi-experimental pre-post nonequivalent comparison group design using household data (n=21,680 women) and health facility assessments (n=77) including EmONC signal functions. Data were collected from February 2011–October 2013, before and during

SMGL program implementation, in the intervention district and a comparison area. A qualitative inquiry with key informants (n=26) was then conducted in September 2014.

Results: There was a 49% relative increase in the odds of facility-based birth during SMGL in Kalomo relative to comparison districts (OR 1.49, 95% CI: 1.21–1.77), controlling for covariates. There was no significant change in delivery with a skilled birth attendant. Newborn mortality in Kalomo decreased significantly (4.3% to 2.6%, p<0.01), even when controlling for covariates, with no change in comparison. EmONC signal functions increased from a mean of 2.7 to 3.9 (p=0.003) per facility in Kalomo, with no change in the comparison area. Most facility-level changes related to newborn care. Informants attributed impacts primarily to community mobilization by Safe Motherhood Action Group volunteers and clinical mentorship.

Conclusion: SMGL positively influenced demand for facility deliveries. Data indicate a limited measurable change in supply-side indicators of provision of intra-partum maternity care, while improving neonatal survival. Interviews suggested that mentoring existing staff might be responsible for improved care and referrals. Phase 2 should focus on strengthening human resources to increase access to skilled delivery and strategies to improve communication and transport to facilitate timely referral of emergency cases.

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LIST OF ABBREVIATIONS

AIDS ....Acquired Immuno-deficiency Syndrome

ANC .... Antenatal Care

BEmONC .... Basic Emergency Obstetric and Neonatal Care

BEmOC.. Basic Emergency Obstetric Care

BMGF .... Bill and Melinda Gates Foundation

BU .... Boston University

CDC ....Centers for Disease Control and Prevention

CDK ....Clean Delivery Kits

CHX ....Chlorhexidine Application to the Umbilical Cord

CO .... Clinical Officer

CHW ....Community Health Worker

CEmONC ....Comprehensive Emergency Obstetric and Neonatal Care

CEmOC...Comprehensive Emergency Obstetric Care

CI.. Confidence Intervals

CSH.. Communications Support for Health

DoD.. Department of Defense

DMO .... District Medical Office

DCC ....Dry Cord Care

EmONC ....Emergency Obstetric and Neonatal Care

EHT.. Environmental Health Technician

EDD ....Expected Date of Delivery

1 CHAPTER ONE: BACKGROUND

Introduction

Risks of serious complications during childbirth and associated maternal morbidity and mortality can be mitigated by improving access to skilled birth attendants and emergency obstetric care (EmOC) in health facilities. To achieve this, particularly in remote regions of low-income countries (LIC), programs must be designed to address barriers at multiple levels, including household-level decision-making to seek care, timely access to a health facility through referral and transport systems, and access to proven medical interventions at facilities with sufficient equipment, supplies, and appropriately trained staff.

In the Republic of Zambia (Zambia), the Saving Mothers Giving Life (SMGL) initiative was launched as a public-private partnership to support evidence-based interventions during labor, delivery, and immediate postpartum to reduce risk of maternal and newborn death. SMGL operated at the community and facility levels to increase both demand for and supply of high-quality obstetric care in Kalomo District, Southern Province. For this dissertation, I evaluated the SMGL program in Kalomo by measuring the program's effectiveness in attaining two of its intended outcomes: increased rates of facility-based birth (FBB) and skilled birth attendance (SBA), which encompasses both delivery with a skilled birth provider (SBP) and a facility-enabling environment for skilled delivery.

This evaluation applied a mixed-methods approach, including a quantitative study with a quasi-experimental design that compared cohorts before and during the

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intervention, using a dataset of approximately 40,000 pregnant women surveyed at the household level in both intervention and comparison districts. I also examined the impact of the intervention on supply-side outcomes using indicators of facility capacity for response, also collected before and during program implementation. Following an explanatory sequential model for mixed method inquiry (Creswell & Clark, 2007), I interviewed key stakeholders central to the program's operations to describe the contextual environment in which SMGL has operated, and to identify perceptions of barriers facing this and similar programs. Both the quantitative and qualitative data I collected have allowed me to develop a specific set of recommendations for the replication and scale-up of SMGL both in Zambia and regionally.

Background

1.1.1 The Problem

Maternal deaths are highly preventable and yet an estimated 289,000 woman die annually worldwide from maternity-related causes (World Health Organization (WHO), 2014). Moreover, for every one maternal death, an estimated 20 to 30 women experience a childbirth-related disability, defined as any illness or injury, acute or chronic, caused or aggravated by pregnancy or childbirth (Ashford, 2002). Maternal deaths and disability are leading contributors in the disease burden for women of reproductive age (Koblinsky, Chowdhury, Moran, & Ronsmans, 2012).

1.1.2   The Consequences

The death of a mother has both immediate and long-term negative consequences for the woman and her family. Children of mothers who have died have a greater likelihood of death themselves, particularly during the neonatal and newborn periods (Katz et al., 2003; Taha, Miotti, Liomba, Dallabetta, & Chiphangwi, 1996). In low-resource settings, the impact of a mother's death can detrimentally affect both the health and education of her remaining children and the entire family's economic capacity (Yamin, Boulanger, Falb, Shuma, & Leaning, 2013). Negative effects on health and development have been shown in children up to 10 years of age (Ronsmans, Chowdhury, Dasgupta, Ahmed, & Koblinsky, 2010). Furthermore, the effects of maternal morbidities can include psychological, social, and economic consequences that can negatively impact a woman and her family throughout their lifetimes (Filippi et al., 2006; Iyengar, Yadav, & Sen, 2012).

1.1.3   The Timing and Causes of Maternal Death

Complications during childbirth are unpredictable, ultimately putting every pregnant woman at risk. Most maternal deaths occur between the third trimester and the first week after the end of pregnancy (Ronsmans & Graham, 2006), with the majority of these occurring during labor, delivery, or the first 24 hours postpartum (Campbell & Graham, 2006). More than 80% of maternal deaths are due to the direct causes associated with obstetric complications that occur during the intra-partum period, including hemorrhage or severe bleeding, obstructed labor, sepsis, hypertensive disorders, and complications from unsafe abortion (Safe Motherhood Programme & World Health

Organization (WHO), 1994).

In sub-Saharan Africa (SSA), hemorrhage, hypertensive disease, and sepsis are the primary direct causes of maternal mortality, accounting for more than half of all maternal deaths (Say et al., 2014). Indirect causes account for nearly 30% of maternal deaths in the region, driven by pre-existing medical conditions (12.8%), other indirect causes (9.3%) and HIV/AIDS (6.4%) (Say et al., 2014). A recent review found little evidence linking direct causes of pregnancy-related mortality such as obstetric complications to HIV infection, indicating that non-clinical interventions may be required to address the excess mortality burden for HIV-positive women (Calvert & Ronsmans, 2013).

1.1.4   *Where Maternal Deaths Occur*

LIC disproportionately bear the maternal mortality burden, with 99% of all maternal deaths occurring in developing countries. Those in SSA alone account for more than 60% of all the world's maternal deaths (World Health Organization (WHO), 2014). Zambia has one of the highest maternal mortality ratios (MMR) in the world, though there have been improvements in the last two decades. In 1990 the country's MMR was estimated at 580 maternal deaths per 100,000 live births. This estimate increased to over 600 between 1995 and 2000, and then decreased to the 2013 estimate of 280 (World Health Organization (WHO), 2014). A woman in Zambia has a lifetime risk of maternal death of 1 in 59, compared to 1 in 160 for other LIC and 1 in 3,700 for high-income nations (World Health Organization (WHO), 2014). Globally, the MMR has declined 45% since 1990, with an average annual percent decrease of 2.6%. The Eastern African

region has seen only a 4.5% decrease since 1990. Zambia has seen a 2.4% decrease in the same period and therefore has been characterized as "making progress" towards meeting Millennium Development Goal (MDG) 5: reduction of the MMR by three quarters between 1990 and 2015 (World Health Organization (WHO), 2014).

1.1.5 Why Mothers Die

Nearly all maternal deaths are due to preventable conditions. With the onset of an obstetric emergency, a woman needs immediate access to skilled care and to reliable and functioning equipment and supplies, which are usually found only in facilities equipped for basic or comprehensive emergency obstetric care (BEmOC or CEmOC) (Paxton, Maine, Freedman, Fry, & Lobis, 2005). Once properly recognized by trained health care providers, most complications of the intra-partum period can be managed and treated using simple and cost-effective interventions. Prioritizing a "health centre intra-partum care strategy," combined with community-level interventions to increase health facility access, could substantially reduce maternal death rates in LIC, particularly in regions such as SSA where rates are high and progress has stalled (Campbell & Graham, 2006).

Solutions to the Problem

1.1.6 A Global Call for Skilled Birth Attendance and Emergency Obstetric Care

In order to achieve MDG5 by 2015, the United Nations (UN) has supported two key strategies that target intra-partum-related maternal mortality: 1) universal access to

skilled care at the time of childbirth, and 2) ensuring that every woman with complications has timely access to quality EmOC ("UNFPA," n.d.). The WHO has echoed support for these strategies with a clear focus on skilled care during pregnancy, delivery, and the immediate postpartum period, first through a joint statement with the International Confederation of Midwives (ICM) and the International Federation of Gynecology and Obstetrics (IFGO) calling for skilled attendants at all births (World Health Organization (WHO), 2004) and then through a report on strategic approaches to improve maternal and newborn survival that stresses the need for skilled care at every birth (World Health Organization (WHO), 2006).

The WHO has identified a set of medical interventions that address the direct causes of maternal death, with seven of these interventions defining BEmOC and an additional two defining CEmOC. Assessment of these interventions through signal functions at the facility level allows for measurement of a facility's capacity to handle obstetric emergencies. Table 1 illustrates the core signal functions that identify the components of BEmOC and CEmOC. The WHO recommends at a minimum one CEmOC and four BEmOC facilities per 500,000 population(World Health Organization (WHO), UNFPA, UNICEF, & AMDD, 2009).

Table 1. Signal Functions Used to Identify Basic and Comprehensive Emergency Obstetric Care Services†

Basic Services (BEmOC)
1. Administer parenteral antibiotics
2. Administer uterotonic drugs (i.e., parenteral oxytocin)
3. Administer parenteral anticonvulsants for pre-eclampsia and eclampsia (i.e., magnesium sulfate)
4. Manually remove the placenta
5. Remove retained products of conception (e.g., manual vacuum extraction, dilation and curettage)
6. Perform assisted vaginal delivery (e.g., vacuum extraction, forceps delivery)
7. Perform basic neonatal resuscitation (e.g., with bag and mask)
Comprehensive services (CEmOC)
Perform signal functions 1–7, plus:
8. Perform surgery (e.g. caesarean section)
9. Perform blood transfusion

†Reproduced from Monitoring Emergency Obstetric Care: A Handbook (World Health Organization (WHO) et al., 2009)

1.1.7 Evidence for Facility Delivery and Skilled Birth Attendance

The WHO defines a skilled birth attendant as someone "trained to proficiency in the skills needed to manage normal (uncomplicated) pregnancies, childbirth and the immediate postnatal period, and in the identification, management and referral of complications in women and newborns" (World Health Organization (WHO), 2004). Candidates for training as skilled birth attendants or providers are accredited professionals such as doctors, nurses, and nurse-midwives. However, even with these criteria, skilled attendants as defined by WHO are not guaranteed to always provide competent maternity care (Harvey et al., 2007). Competence of existing staff, both skilled and unskilled, is a major challenge for the provision of facility-based maternity care particularly in low-income settings (Koblinsky et al., 2006).

Skilled birth attendance has been defined to include access to a skilled attendant or provider and an enabling environment. An "enabling environment" is one that includes the necessary equipment and supplies plus referral and two-way communication system that make is possible for the provider to provide adequate care for the pregnant mother (Graham, Bell, & Bullough, 2001).

Much of the evidence linking SBA and mortality is correlational (Graham et al., 2001). There is historical evidence to suggest that increasing the number of midwives in a country leads to a reduction in maternal mortality over time (World Health Organization, 2005). One study assessing the impact of a skilled care initiative found no effect on mortality and attributed the lack of change to logistical and structural constraints (Hounton et al., 2008), indicating that the enabling environment may be an important factor to assess.

There is stronger evidence linking mortality outcomes for newborns and mothers and FBB, especially in or with referral to EmOC facilities. A recent review highlighted a strong association between facility delivery and both maternal mortality and early neonatal mortality rates across SSA (Moyer, Dako-Gyeke, & Adanu, 2013). Another systematic review found that health facility delivery reduced the risk of neonatal mortality in low and middle income countries by 29% compared to home delivery (Tura, Fantahun, & Worku, 2013). There is also evidence that access to EmOC, including access to a skilled attendant operating in a facility, may reduce maternal mortality (Paxton et al., 2005), including in the African setting (Ronsmans et al., 2003). Other studies have supported the importance of programs providing access to EmOC in order to

reduce maternal death (Fournier, 2009).

As rates of FBB increase, it is critical to improve facility capacity to handle obstetric emergencies (Spector et al., 2012). More recently, researchers and advocates have argued that mere contact with a skilled professional and the health system is not enough to reduce maternal deaths, and that greater attention needs to be paid to the quality of those services (Hodgins, 2013; Souza et al., 2013).

Facilitators and Barriers to the Problem

1.1.8   The Three Delays

One of the biggest challenges in realizing SBA and access to EmOC in LIC with large rural populations is connecting women with obstetric emergencies to necessary care. Cost, distance, and the time required to access care are the primary barriers to using the potentially life-saving intra-partum services that may be provided at health care facilities (Bhutta, Darmstadt, Haws, Yakoob, & Lawn, 2009).

The "Three Delays" model illustrated in Figure 1 was proposed by Thaddeus and Maine (1994) to illustrate the multiple levels of delay in seeking, accessing, and receiving high-quality and appropriate care at health care facilities and has been used since then as the predominant model for explaining maternal mortality (Thaddeus & Maine, 1994).

Figure 1. The Three Delay Model
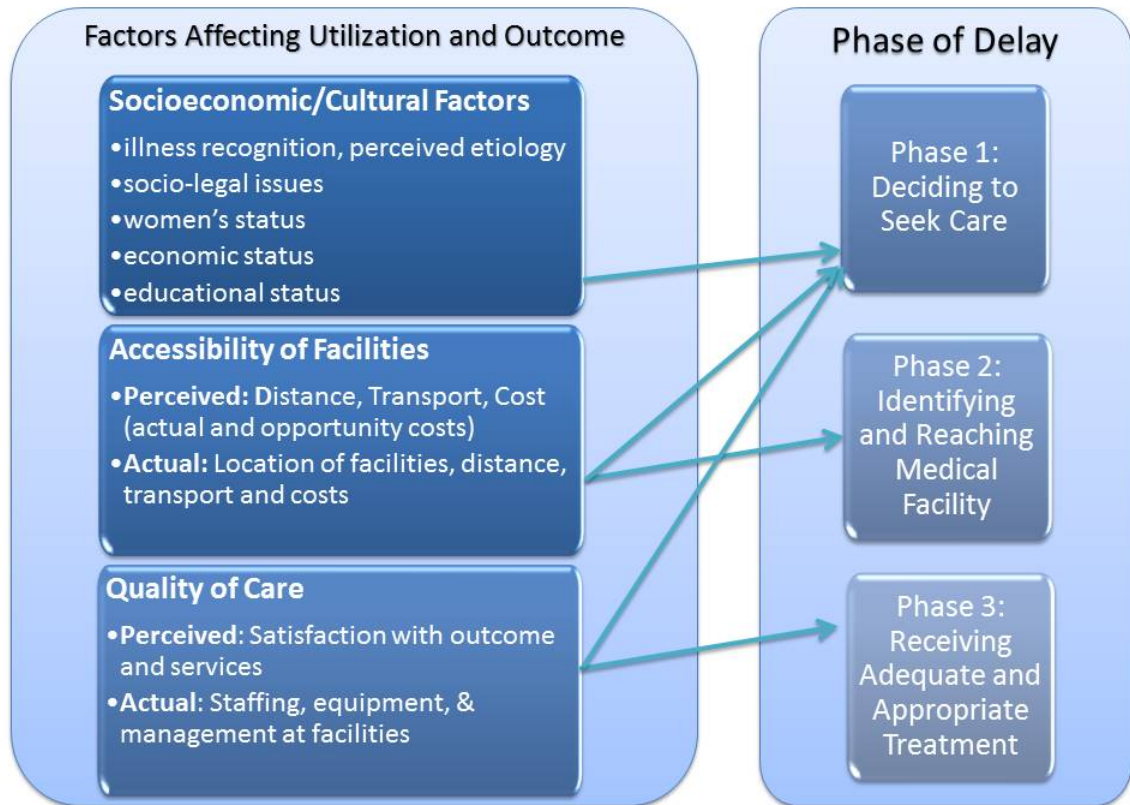
Adapted from Thaddeus and Maine (1994)

Key factors affecting utilization and outcome include household-level illness recognition and awareness of obstetric complications; women's status, education level, and other socioeconomic factors; perceived accessibility of health care facilities and perceived quality of care that the woman would receive; community-level transportation and referral challenges, and whether a facility actually has adequate infrastructure and clinician capacity to recognize and address clinical needs. This conceptual model provides the framework for this evaluation.

A recent systematic review of the drivers and deterrents of FBB and SBA in SSA

found that individual maternal factors such as education, low parity or birth order, higher

number of ANC visits, higher socioeconomic status, and living in an urban area had the

strongest evidence of association with FBB (Moyer & Mustafa, 2013). A second review

that looked at regional variation in both SSA and Asia confirmed these results (Diamond-

Smith & Sudhinaraset, 2015). This review highlighted the need to examine social factors

as important drivers of FBB, as well as women's experiences and perceptions of care

during both ANC and childbirth. The factors identified below therefore focus more on the

state of evidence regarding the influence of these relatively unexplored areas.

1.1.9   *Socio-economic and Cultural Factors*

A woman and/or her family's decision to seek care at a health facility during

pregnancy and childbirth is influenced by several social and cultural factors. In Uganda,

material resources such as funds and transport ownership have been identified as key

factors in overcoming barriers to accessing health care. At the same time, social

resources, often overlooked in the literature, were also shown to contribute to healthcare

utilization (Bakeera et al., 2009). In rural Ghana, power hierarchies in the community

were an important determinant in a woman's delivery experience, and the influence of

several community members, including a woman's husband, mother-in-law, and

community leaders played a strong role in deciding about when and where to seek care

(Moyer, Adongo, Aborigo, Hodgson, Engmann, et al., 2014). Social support has been

associated with facility delivery among pregnant women in Western Kenya, particularly

that of their mothers, mothers in law and sisters (Ono, Matsuyama, Karama, & Honda,

2013). There are ongoing concerns that despite the improvements in access, the poorest and most vulnerable, especially women, have a complex set of barriers to accessing health care, and standard interventions to address service utilization for marginalized women are not taking into account the power structures that continue to create obstacles to care (Mumtaz, Salway, Bhatti, & McIntyre, 2013).

1.1.10 Distance, Transport, and Communication

The second delay is fueled by distance to facilities, geography, road infrastructure, lack of transport options, poor communication, and costs (Holmes & Kennedy, 2010). Even when transport may be available, lack of communication such as two-way radios or cellular phones to mobilize ambulances or other transport, or arranging for a referral can delay a woman's access to a facility.

As indicated in the Three Delay Model, these barriers can be both real and perceived. In SSA, proximity to a health facility and travel time have long been factors contributing to the decision to seek care in the antenatal, labor, and postnatal periods (Gage, 2007). In a review of maternal deaths in Maharashta, India, in 1993–1995, women who died had traveled far greater distances after the decision to seek care was made and often had visisted multiple facilities before appropriate treatment was given (Ganatra, Coyaji, & Rao, 1998).

In rural Ghana, a recent study indicated that travel time negatively influenced facility delivery even when the facilities had improved capacity to handle obstetric emergencies (Masters et al., 2013). Based on data from Matlab, Bangladesh, and Java,

Indonesia, women who lived farther from a facility were less likely to have their births attended by a professional. There was an increase in odds of dying with increasing distance to the health center, though this association between distance to a health center and maternal death was not found for women unassisted by a health professional. Therefore, women may only seek care in an emergency and are then unable to reach the level of care they need in a timely manner due to distance (Scott, Chowdhury, Pambudi, Qomariyah, & Ronsmans, 2013).

1.1.11 Quality of Care

Poor quality of care is an important determinant of delayed access to appropriate care. In Tanzania, poor care leading to birth injuries has been shown to undermine women's faith in the health care system to provide a safe delivery and therefore is an important factor in whether a woman delivers at a facility (Mselle, Moland, Mvungi, Evjen-Olsen, & Kohi, 2013). Health system factors have also been found to influence quality of care provided for maternity care, particularly the lack of human resources in low-income settings (Parkhurst et al., 2005).

Perceptions of quality are also an important determinant of delayed access to care. A recent qualitative review of facilitators and barriers to FBB in low- and middle- income countries identified both low perceived quality of available care and fear of discrimination as barriers (Bohren et al., 2014). Perceived maltreatment and abuse during maternity care and delivery was documented as relatively high in communities in both rural northern Ghana (Moyer, Adongo, Aborigo, Hodgson, & Engmann, 2014), and

in Tanzania (Kruk, Kujawski, et al., 2014), and may be an important determinant in accessing facilities for delivery. In Tanzania, women who had negative experiences during their previous or current maternity care were less likely to access facilities, regardless of the actual quality of services at the facility (Larson, Hermosilla, Kimweri, Mbaruku, & Kruk, 2014).

The Three Delay Model is an essential theoretical tool for understanding the various factors that lead to the delays in seeking, accessing, and obtaining quality maternity care. Additional research highlights the intricacies and complexities of the various facilitators and barriers which are important to take into account when designing, implementing, and evaluating programs aimed at reducing maternal mortality in low-income settings.

The Zambian Context

Zambia is a landlocked nation in southern Africa that shares borders with the Democratic Republic of the Congo, Tanzania, Malawi, Mozambique, Zimbabwe and Angola. Zambia is divided into ten administrative provinces: Central, Copperbelt, Eastern, Luapula, Lusaka, Muchinga, Northern, North-Western, Southern, and Western, which together include over 100 districts. By 2010, more than 13 million people lived in Zambia, with an average population growth rate of 2.8%. Just over half of the population is female, and 60% live in rural areas (Central Statistical Office (CSO) Zambia, 2012). Life expectancy for the average Zambian is only 51 years, driven largely by HIV/AIDS, which has an adult prevalence of 14% (Central Statistical Office (CSO), Ministry of

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Health (MOH), Tropical Diseases Research Centre (TDRC), 2009). Zambia is ranked 216 out of 223 countries for life expectancy. (Central Intelligence Agency, 2014) Most Zambian residents (63%, with 89% in urban areas and 47% in rural areas) have access to improved water sources; yet only 27% (39% in urban areas, 20% in rural areas) have access to adequate sanitation-improved, unshared facilities (Central Statistical Office (CSO) Zambia, [Ministry of Health (MOH) [Zambia], & ICF International, 2014).

1.1.12 *Challenges to Facility Delivery and Skilled Birth Attendance in Zambia*

At the start of the evaluation, just over half of all Zambian women delivered at home, ranging from an estimated 30% in urban areas to 80% in rural areas. Nationally, only 47% of mothers delivered with a skilled attendant, most with a nurse or midwife, and nearly all of these occurred in a facility (97%)(Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), 2009). First-time mothers and those with higher education and greater wealth are more likely to deliver both with a skilled attendant and in a facility (Central Statistical Office (CSO), Ministry of Health (MOH), Tropical Diseases Research Centre (TDRC), 2009). A more recent assessment showed that the odds of delivery in a facility increase as distance to the facility decreases, and women are more likely to deliver in facilities better equipped to handle obstetric emergencies, suggesting that perceptions of quality are an important factor in decision making about facility-based birth.(Gabrysch, Cousens, Cox, & Campbell, 2011)

Research regarding childbirth practices and utilization of maternity services in Zambia, including ANC, confirmed regional reviews that factors such as women's

employment status, husband's educational status, and quality of available care have a positive association with care seeking, while parity and childcare burden are negatively associated with seeking facility-based maternity care (Chama-Chiliba & Koch, 2013). Distance to facilities has also been associated with the actual quality of care received for ANC, not just perceptions of care, with longer distances traveled to reach care associated with poorer services provided (Kyei, Campbell, & Gabrysch, 2012).

In 2013, ethnographers at the University of Zambia School of Medicine identified delays in disclosure of pregnancy due to fear of pregnancy loss, delay in seeking ANC, and use of herbs as reasons for delayed care-seeking; poor roads, lack of money for transport, and inability to make a phone calls due to network issues as reasons for delay in accessing obstetric services and the need to bring their own supplies to a health facility, perceptions of and actual poor quality of care, absence of staff, and lack of respectful care as deterrents to facility-based birth (University of Zambia School of Medicine, 2013). Recent research also found that intention to use maternal health care services in Zambia was associated with attitudes, personal norms, perceived behavioral control, and higher education and income levels, indicating that both a woman's socio-economic background and cultural context play a significant role in her decision to seek care for obstetric services (Sialubanje, Massar, Hamer, & Ruiter, 2014).

Zambia's health care system faces an extreme human resources shortage, as is the case with many low- and middle- income countries in SSA. There are high vacancy rates, particularly at the rural health centers, ranging from 15% in Lusaka to 96% in the Western provinces, and imbalances between the provinces. Nationwide, enrolled nurses

are the most prevalent cadre of health care workers across the country (Ferrinho, Siziya, Goma, & Dussault, 2011).

In summary, pregnant women living in remote areas in of SSA, such as rural Zambia, face the challenge of accessing adequate and timely health care during an obstetric emergency. This is particularly true for women experiencing unpredictable obstetric emergencies in the intra-partum period, which account for the majority of maternal deaths. At the time of the study, most women in Zambia were delivering at home without access to health facilities and skilled birth attendants and were therefore at high risk of both morbidity and mortality when obstetric complications arose. Life-saving interventions exist, and Zambian women are more likely to deliver in a facility if it is close by and functionally equipped to provide emergency care. Public health approaches that combine community and facility-based interventions to reduce the delays in seeking, reaching, and accessing care need increased attention.

The Response: Saving Mothers, Giving Life

The Government of Zambia (GRZ) has implemented several programs to address maternal mortality across the country. One of these programs is *Saving Mothers, Giving Life (SMGL)* a five-year initiative launched in 2011 to reduce maternal and newborn deaths. In both Zambia and Uganda, the U.S. Government's (USG) Global Health Initiative (GHI) implements SMGL as a public-private partnership with support from the USG, the Government of Norway, Merck for Mothers, Every Mother Counts, Project C.U.R.E., and the American College of Obstetricians and Gynecologists**.** In Zambia, the

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program operates in four districts (Lundazi, Nyimba, Kalomo, and Mansa) located in three provinces through the Ministry of Health (MOH) and the Ministry of Community Development, Mother and Child Health (MCDMCH). The program builds on both the Maternal and Newborn Health Roadmap (2007–2014) and the Campaign to Accelerate the Reduction of Maternal Mortality in Africa-Zambia (Zambia Ministry of Health, 2007).

The USG operates through the President's Emergency Plan for AIDS Relief (PEPFAR) and its implementing partners, the U.S. Agency for International Development (USAID), the U.S. Centers for Disease Control and Prevention (CDC), the Peace Corps, and the Department of Defense (DoD). The Zambia Centre for Applied Health Research and Development/Boston University (ZCAHRD/BU) is the primary implementing partner in Kalomo, which is located in Southern Province. ZCAHRD has worked in Zambia for more than 14 years on research and implementation projects related to the prevention of mother-to-child transmission of HIV (pMTCT), the etiology and prevention of malaria and pneumonia, and the cost-effectiveness of various maternal-child health projects. This study focused specifically on evaluating the SMGL program operating in Kalomo District during the first phase of implementation, from February 2012 through 2013.

1.1.13 *Kalomo District*

With nearly 265,000 people, Kalomo is the most heavily populated district in Southern Province, with 16.3% of the province's population (Central Statistical Office (CSO) Zambia, 2010). There were nearly 14,000 deliveries expected in 2011. When

SMGL started, fully 95% of women had at least one ANC visit, consistent with the

national rate of 94% (Central Statistical Office (CSO), Ministry of Health (MOH),

Tropical Diseases Research Centre (TDRC), 2009). An estimated 32% of deliveries

occurred in a health facility, lower than the national rate of 48%. An estimated 11% of

deliveries were attended by skilled personnel.

By 2011 only six doctors were working in the district, which has 35 health centers

and two hospitals, only one of which, the Zimba Mission Hospital, has an operating

theater. At the start of SMGL there were no functioning ambulances or emergency

vehicles for transport, and only 50 km of the roads were paved (Kalomo District Medical

Office, 2011). Communication between facilities was limited, with just seven (23%)

having functional communication capabilities for emergency use (two-way radio,

landline or cell phone with working signal). Just over half of the facilities were on the

electric grid, and there was a severe shortage of basic supplies and equipment for

childbirth. Fewer than 10 staff across the district had been trained in Emergency Obstetric

and Newborn Care (EmONC), all of whom were located at the two referral hospitals

(Kalomo District Medical Office, 2011).

1.1.14 SMGL's Goals

SMGL's program goals in its first learning phase were to "reduce maternal deaths

by 50 percent in selected districts by strengthening delivery skills of health professionals,

increasing delivery in health facilities, mobilizing communities to increase birth

preparedness and complication readiness, and strengthening health facilities to provide

quality obstetric and newborn care for normal and complicated deliveries" (Saving

Mothers' Lives Zambia Operational Plan: October 2011–December 2012, 2011).

The program had four strategic priorities:

- Increase demand for services

- Increase access to services

- Improve quality of services

- Strengthen health systems

The program operated on multiple levels to address the three delays: promoting facility deliveries and birth preparedness through a cadre of community-based health workers, developing communications and transport systems for emergencies, and building the capacity of hospitals and their staff to deliver high-quality maternity care at both district- and province-level hospitals by providing equipment and provider training (Schocken, 2013).

1.1.15 The SMGL Program

The Three Delay Model functions as a theory of change for the SMGL program and as a framework for the program's design. Figure 2 presents a logic model for SMGL, linking each type of delay with the causal pathways by which the program's interventions and activities are hypothesized to affect immediate and intermediate outcomes and thereby achieve SMGL's ultimate goals in Kalomo. The causal pathways illustrated in Figure 2 are adapted from a proposed intervention framework set forth in The Design and Evaluation of Maternal Mortality Programs (Maine, Akalin, Ward, & Kamara, 1997).

Figure 2. Logic Model for SMGL in Kalomo District, Zambia

Delay	SMGL STRATEGY	SMGL CORE ACTIVITIES	OUTCOMES Intermediate	Impact
Phase 1: Delay in Seeking Care	**DEMAND:** Educate and Mobilize Communities	**Safe Motherhood Action Groups (SMAG)** • Identify women & educate **Community Sensitization** • Radio spots • Train "Change Champions"	**Women & Families** • Aware of complications • Attend antenatal care • Develop birth plan • Positive perception of facilities • Aware of transport options • Intend to deliver at facilities **Community** • Increased support for FBB	**Increase rate of Facility-Based Birth (FBB)** **Increase rate of Skilled Birth Attendance (SBA):** Delivery with skilled birth providers (SBP) + Facilities' "Enabling Environment"
Phase 2: Delay in Reaching Facility	**ACCESS:** Improve Transport & Referral	**Improve Maternity Waiting Homes** **Emergency Response** • Develop and train staff on referral system • Communications: radio system • Acquire and use emergency vehicle	**Getting to the Facility** • Health staff refer patients when necessary • Improved communication between facilities • Emergency vehicles transport patients	
Phase 3: Delay in Accessing Quality Care	**SUPPLY:** Improve Availability and Quality of Care	**Human Resources** • Hire new clinical staff • Train providers in EmONC • Clinical mentorship **Equipment and Supplies** • Provide drugs, medicines, supplies • Upgrade facilities and equipment	**At the Facility** *Providers now:* • Identify complications • Provide appropriate, timely treatment • Utilize equipment and supplies *Facility* • Better equipped and staffed • Improved signal functions	**Ultimate:** Decrease in Maternal Mortality

The SMGL intervention package for Kalomo was intended to address each of the three delays at the household, community, and facility levels. Key SMGL activities, by level of intervention, are summarized in the table below.

Table 2. SMGL Intervention Components and Activities

Intervention Component	SMAG Activity Description
Educate and Mobilize Communities	*Activities to engage community stakeholders and drive demand for improved services and access*
SMAG	Develop cadre of community health workers to work in Safe Motherhood Action Groups (SMAG) to identify pregnant women in the community, deliver Mama Packs with clean delivery items and delivery messages regarding facility-based care
Community Sensitization • Radio spots • Train "Change Champions"	Deliver key messages about maternity care via radio and through social networks of trained local leaders within the community
Improve Transport & Referral	*Activities to improve both community-level transport of woman to facility and between-facility referral transport*
Emergency Response • Referral system • Radio system • Emergency vehicle	Improve emergency response referrals via a functional radio system, using an emergency vehicle and community transport systems
Mothers' Shelters	Refurbish mothers' shelters as an option for improving access to facilities for women in remote areas
Improve Availability and Quality of Care	*Activities to improve environment for trained providers to treat patients*
Human Resources • Hire new clinical staff • Train providers in EmONC • Clinical mentorship	Hire new clinical staff, train and mentor staff in emergency obstetric care
Equipment and Supplies • Provide drugs, medicines, supplies • Upgrade facilities and equipment	Provide necessary equipment and supplies so that staff can provide higher quality care

The Evaluation

1.1.16 Purpose and Relevance to Improving the Public's Health

Every evaluation of programs designed to reduce maternal mortality faces several challenges. Maternal deaths are rare events, and therefore it is difficult to tell if fluctuations in rates of maternal death in a particular area or region are due to specific interventions or simply to chance (Maine, Akalin, et al., 1997). The sample sizes needed to detect significant changes in mortality rates are very large, which means that studies using an experimental design such as a randomized controlled trial (RCT) can be costly and therefore not readily funded. As a result, there is a lack of systematic evidence for what interventions work to address the three delays.

Further complications relate to the ability to detect a fault in the program's theory of change or a problem with implementation. My dissertation exploited the fortunate timing of a large-scale RCT that was launched before program implementation in the SMGL intervention district, plus 5 comparison districts in Southern Province in which SMGL was not operating. I focused on immediate and intermediate outcomes from the hypothesized, evidence-based causal pathway, such as service use intentions and behaviors during pregnancy, to examine the mechanisms by which the program operated. Findings from this study provide important evidence on the effectiveness of a multi-pronged, theory-based approach in achieving outcomes related to maternal mortality, which remains a persistent problem in Zambia and much of SSA.

The learning phase of SMGL was developed with the expectation of scale-up and replication throughout Zambia, Uganda, and other countries. Each country's government

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was required to invest both local and national resources to the project. In addition, these countries were chosen specifically to leverage PEPFAR's existing infrastructure, which had been built in each of the selected districts by its implementing partners. As SMGL scales-up in Zambia and elsewhere, it is important for policy makers and implementers to understand the barriers to scale-up and be given clear recommendations for enhancing the program's success. I conclude my dissertation concludes offering these recommendations.

1.1.17 Evaluation Orientation

I developed the evaluation questions and overall plan from the perspective of utilization-focused evaluation (Patton, 2010), which focuses attention on the intended users and ensures that there is a clear purpose for using the information, while maintaining a high standard of rigor and using methods that support statements of causality. Utilizing a mixed-methods approach, I involved key stakeholders in the construction of the final evaluation plan in order to ensure that those supporting and funding the program as well as program administrators and staff would find the results to be relevant and useful.

1.1.18 Past Evaluations of the SMGL Program

Two evaluations of the SMGL program across all districts in Zambia (and the four in Uganda) have been conducted. The CDC led an evaluation that used monitoring and evaluation data collected from facilities. They employed a before-and-after design

without a comparison or control group. The methods included a health facility assessment (HFA), monthly facility statistics from health information systems, and facility-based pregnancy outcome monitoring. The results for the four districts in Zambia combined indicated that the MMR in health facilities declined 35% (310 to 203), maternal deaths from direct obstetric causes dropped by 36%, EmONC availability increased 31%, and the case-fatality rate due to direct complications declined 35% (Centers for Disease Control and Prevention, 2014).

Columbia University and New York University were contracted to conduct an external evaluation of the program. They conducted a post-only evaluation that compared the SMGL districts with a comparison district, which featured interviews and focus group discussions with implementers, policymakers, facility managers, women, and community leaders. They also assessed changes in provider knowledge and satisfaction. The Columbia evaluation focused on dose received, reach and fidelity of the program, and perceptions of the program by end-users. In Zambia, their results indicated that 47% of women had heard of SMGL, and that 52% used SMGL's services. Provider knowledge increased, and there were some increases in women's ratings of quality of care and satisfaction.

Neither of these SMGL evaluations was a rigorous impact assessment of the program with an experimental or quasi-experimental design, making it difficult to attribute any changes in outcomes to the actual SMGL program. Moreover, the indicators used to assess the rate of facility-based births were hospital-based, which is not recommended (Maine, Wardlaw, & Ward, 1997): the numerator was the number of

births in the hospital and the denominator is an estimate of the total number of births

during that same time period in the community. In contrast, the present study offered the

opportunity to conduct a retrospective impact assessment of SMGL using household-

level data.

2 CHAPTER TWO: RESEARCH DESIGN AND METHODS

Study Overview

I employed a sequential explanatory mixed-methods design (Creswell & Clark, 2007) that consisted primarily of two phases: a quantitative analysis of household survey data and HFA data, and a qualitative inquiry with key informants. In the quantitative phase (Phase 1), using a quasi-experimental design, I analyzed secondary data from a survey of pregnant woman identified at health facilities and followed at the household level through childbirth. To examine supply-side indicators of maternity care, I also analyzed quantitative data from a HFA conducted both before and after SMGL implementation.

In the Phase 2, I collected primary qualitative data from key informants to contextualize the quantitative results from Phase 1 and to address barriers to scale-up and replication. The second phase built on the first, and I used the findings of phases to develop a set of robust recommendations for future scale up and replication of the program (Creswell & Clark, 2010). The design and methods for each of the phases is described in detail below.

Objectives and Research Questions

Objectives

My evaluation study had the following objectives:

1. To determine the SMGL's impact on rates of FBB and SBA for women living in the Kalomo District (intervention) compared to other districts in Southern

Province (comparison);

2. To validate the SMGL program's proposed theory of design, which includes both

   demand generation and supply improvement activities, by examining the

   intermediate outcomes specified in the program logic model's impact pathways;

3. To assess the perceived contributory value of the SMGL intervention components

   by program stakeholders; and

4. To identify both opportunities and barriers for SMGL program scale-up and

   replication in additional provinces in Zambia's Southern Province and regionally.

Research Questions

The study addresses the following questions, listed by objective:

Objective 1: Program Impact

1. Did SMGL have an impact on FBB and SBA in Kalomo District?

   a. Is there a difference in rates of facility-based births and deliveries with a

      skilled birth provider before and after the SMGL program's

      implementation, comparing women living in Kalomo (intervention

      district) relative to those in the comparison districts?

   b. Do the differences between the SMGL and comparison districts change

      when controlling for variables that moderate the effect between the

      program and the outcome (e.g., mother's education, parity, household

      wealth)?

Objective 2: Impact by Hypothesized Pathways

2. Does SMGL operate through the immediate and intermediate outcomes as
   proposed in the logic model?

   a. Is there a difference in ***demand generation behaviors*** (rates of birth
      preparedness, service utilization intent, and service use behaviors) before
      and during the SMGL program's implementation, comparing women
      living in Kalomo relative to those in the comparison districts?

   b. Is there a difference in the ***capacity of facilities to provide life-saving care***
      in obstetric emergencies before and during the SMGL program's
      implementation, comparing women living in Kalomo relative to those in
      the comparison districts?

Objective 3: Contributory Value of Components

3. What components of the SMGL intervention did program stakeholders perceive to
   have the biggest impact? Which, if any, components should receive greater
   attention than others?

   - Safe Motherhood Action Groups (SMAG)

   - Referral and transport systems

   - Facility upgrades

   - Clinical mentorship

Objective 4: Barriers to Scale-up and Replication

4. Based on the quantitative findings on the impact of SMGL in Kalomo, how should the SMGL model be adapted as it transitions to a more scalable and sustainable model for Zambia?

   a. What barriers might exist in bringing this model to scale? What planning steps are necessary to address these barriers?

   b. What resources (financial, material, or human resources) have been necessary for Kalomo SMGL implementation, and what are needed for replication and scale-up?

Quantitative Evaluation

2.1.1 Study Setting

Southern Province, the southernmost region of Zambia, has 12% (1.6 million) of the country's total population. Seventy-five percent of households are in rural areas (Central Statistical Office (CSO) Zambia, 2012). Rates of infant and child mortality are similar to rates for the entire country (44 infant deaths per 1,000 live births compared to 45 nationally, and 68 under-5 deaths per 1,000 live births compared to 70 nationally) (Central Statistical Office (CSO) Zambia et al., 2014). Southern Province has the highest life expectancy of all provinces at 56 years compared to 51 nationally (Central Statistical Office (CSO) Zambia, 2012). The total fertility rate of 6.2 in Southern Province is higher than the 5.3 rate for the nation as a whole (Central Statistical Office (CSO) Zambia et al., 2014), but has the second lowest estimated MMR (343) among the country's provinces

(Central Statistical Office (CSO) Zambia, 2010). Kalomo District, one of ten districts in Southern Province, was selected by Zambia's MOH as one of the four intervention districts for SMGL, and the only one in Southern Province.

In Phase 1, I used data from the Zambia Chlorhexidine Application Trial (ZamCAT), a cluster-randomized controlled trial (RCT) in which 39,797 pregnant women in Southern Province were enrolled and followed through 28 days post-delivery. The study team also conducted HFA at the beginning and end of the study. Funded by the Bill and Melinda Gates Foundation and led by ZCAHRD/BU, ZamCAT's goal was to evaluate the effectiveness of using chlorhexidine cord cleansing to reduce neonatal mortality. A secondary objective was to investigate the determinants of women's birth plans and their actual childbirth practices.

ZamCAT operated in six of the ten districts of Southern Province (Choma, Kalomo, Livingstone, Mazabuka, Monze, and Siavonga). Within each district, ZamCAT randomly assigned a total of 90 facilities (clusters) to either the intervention group (chlorhexidine application to the umbilical cord-CHX) or control group (dry cord care-DCC), with 45 facilities per group. Facility-level criteria for inclusion in the study were: (1) an estimated 160 births per year in the catchment area, (2) routine provision of antenatal services, and (3) willingness of the health facility's then-called "District Health Medical Office Director" (now "District Community Medical Officer," due to the shift of responsibility for primary health care from the MOH to the MCDMCH) to participate in the study. Out of 140 facilities eligible, 90 facilities met these criteria and were selected.

Pregnant women living in the facilities' catchment areas were the target of the ZamCAT intervention. These women were identified either at their facility-based ANC visits or in the community and offered enrollment. Eligibility criteria included: 1) in the second or third trimester; 2) age 15 years or older; 3) intends to remain in the health facility's catchment area for delivery and one month post-partum 4) willingness to provide cord care as per their facility's designated protocol; and 5.) willingness to provide informed consent. Of the 44,091 women screened for the study, a total of 39,797 (90%) participated. Of these, 94% completed the study through the one month post-partum visit. A series of surveys were administered to the pregnant women before and after delivery. Details of the ZamCAT trial are described elsewhere (Hamer et al., 2015).

SMGL activities were launched in Kalomo District in early February 2012, with a three-phase rollout: Phase 1 (n=9 facilities) started with activities in February 2012, Phase 2 (n=12 facilities) in April 2012, and Phase 3 (n=13 facilities) in June 2012. SMGL was fully operational in all 34 Kalomo facilities by September 2012, nearly 20 months after ZamCAT was launched. SMGL activities continued to operate for another 13 months through the end of ZamCAT in October 2013 when the last woman enrolled gave birth. Figure 3 illustrates a timeline for both the SMGL intervention and the ZamCAT trial.

Figure 3. Timeline of SMGL and ZamCAT Events
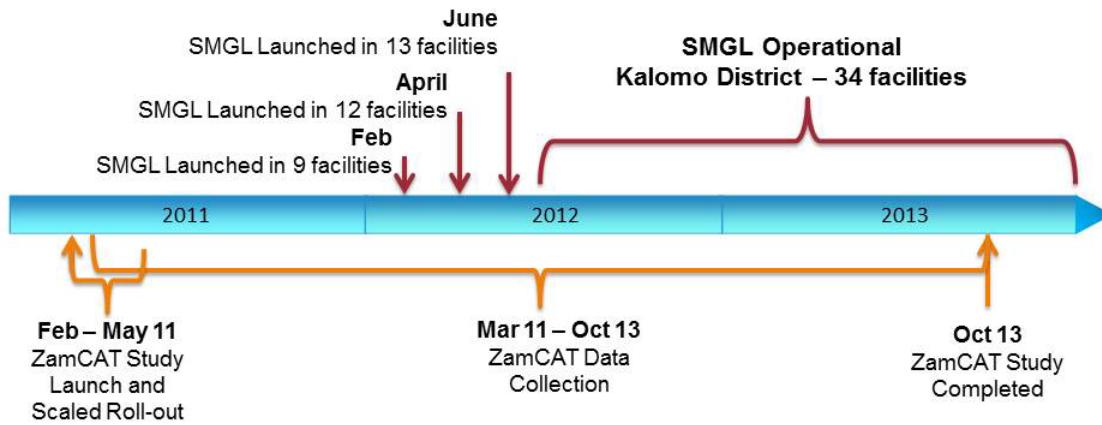
2.1.2 Research Design

Research Questions 1 and 2: Program Impact

To quantitatively assess the SMGL program's impact on FBB and SBA

(Objective 1), I used a retrospective pre-post nonequivalent comparison group design

(Grembowski, 2001). Figure 4 illustrates the study design. I compared two cohorts of

pregnant women from ZamCAT: one cohort that delivered before SMGL was

implemented, and one cohort that delivered after SMGL rollout. I treated the women

living in Kalomo District as the intervention group, while women from five ZamCAT-

participating districts where SMGL was not implemented served as the comparison

group.

I demarcated three distinct time periods for this study:

1. **Pre-SMGL**: Data collected for ZamCAT from February 2011 through

   January 2012 (n=12,148 deliveries across 6 districts). This included women

pregnant at enrollment starting in February 2011 and who delivered before or during January 2012, the time at which the SMGL rollout started.

2. **Transition**: Data collected on deliveries that occurred from February 2012 through August 2012 (n=12,206 deliveries). This included women who may have been pregnant before February 2012 but who delivered during this time period and may have had some exposure to the SMGL program.

3. **During-SMGL:** Data collected on women who delivered from September 2012 to the end of the ZamCAT data collection in October 2013 (n=13,175 deliveries).

My analysis compared the "Pre-SMGL" and "During- SMGL" periods, excluding women from the transition time period when SMGL activities were started during the three phase rollout. The comparison group served as a counterfactual, indicating what may have happened in Kalomo District absent SMGL during that same time period.

For Objective 2, I assessed whether the predicted relationships and change sequence that would lead to SMGL's outcomes, as proposed in the logic model, actually happened during implementation (Grant, Treweek, Dreischulte, Foy, & Guthrie, 2013). This included looking at immediate and intermediate outcomes such as service use intentions, service use behaviors, and facility capacity using the same design.

Figure 4. Quantitative Study Design Diagram
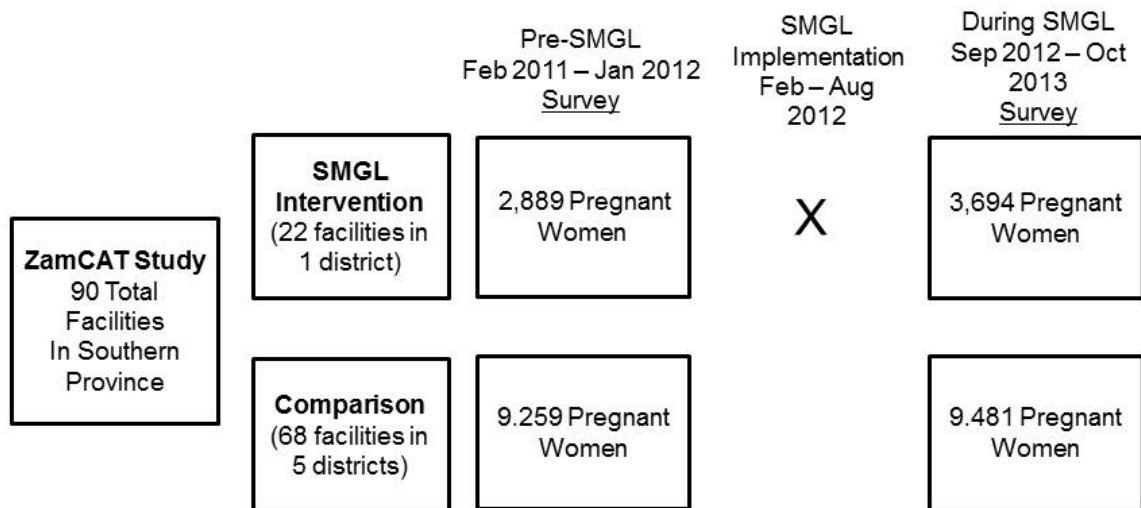
2.1.3 Measures

Research Question 1: Program Impact

For Objective 1, my primary outcome of interest was FBB, expressed as a binary variable with 1=yes and 0=no. The second outcome of interest was the proportion of women who delivered with a skilled birth provider (SBP), also expressed as a binary variable with 1=yes and 0=no. Delivery with an SBP was defined as "nurse" or "midwife" having conducted the delivery. I determined women who had an FBB and delivery with an SBP by the location of birth and type of attendant (if any) at birth, both reported by the mother in the household survey.

The main dependent variable was living in the SMGL intervention district (Kalomo) after SMGL was fully operational (1=yes, 0=no). The ZamCAT data do not provide information on actual SMGL exposure for each individual woman and thus for this analysis all women living in Kalomo District during SMGL implementation were

considered to have been exposed and thus in the intervention group.

There are several potential moderating variables for the relationship between the SMGL program and the outcomes. Additional information collected by ZamCAT include individual-level factors such as age, level of education, literacy level, parity, and number of household members, plus household-level factors such as asset ownership. Table 3 shows the definitions used for the dependent, main independent, and other independent variables included in the analysis.

I defined educational status as level of schooling completed. I defined parity as number of live and/or dead children before the current pregnancy. I used asset ownership as a proxy for socio-economic status by generating scores using an asset index developed through a principal components analysis (PCA). This index is a modified version of the DHS wealth index, which is more comprehensive and uses additional information that was not available in the ZamCAT survey (Rutstein & Johnson, 2004). I then indexed the households by their asset ownership scores into quartiles.

Table 3. Definitions of Dependent, Main Independent, and Other Independent Variables Used in Analysis

Indicator	Concept	Value	Definition
Facility-based Birth (FBB)	Delivery at a facility	1=YES 0=NO	1=Yes; if delivered at a health facility (hospital or health center)
Skilled birth attendance (SBA)	Delivery by a skilled birth attendant	1=YES 0=NO	1=Yes; if delivered by a nurse or midwife
Intervention	Living in SMGL Intervention District	1=YES 0=NO	1= Living in Kalomo District 0=Living in other districts of Southern Province
Pre-post	SMGL time period	0=PRE 1=POST	0=Delivered during or before January 2012 1=Enrolled June 2012 or after
Other Independent Variables			
Mother's age in years	Age of mother at time of survey		2-digit continuous
Mother's age category	Age of mother at time of survey	1–4	1=15–19 2=20–24 3=25–34 4=35–49
Household size	Number of family members living in household		2-digit continuous
Tribe/ethnic group	Belongs to Tonga tribe	1=YES 0=NO	1=Member of Tonga tribe 0=Member of other tribe (Ila, Lozi, Nyanja, Bemba, other)
Marital status	Currently married	1=YES 0=NO	1=Married or cohabiting 0=Single, separated, divorced, or widowed
Mother's educational status	Mother's highest education level	0–2	0=None 1=Any primary 2=Above primary
Father's educational status	Father's highest education level	0–2	0=None 1=Any primary 2=Above primary
Mother's literacy	Any reading ability	1=YES 0=NO	1=Any reading ability (a bit, well, very well) 0=Not able to read
Asset quartile	Study sample quartile for asset index	1–4	Asset index based on PCA, where: 1=Lowest quartile 4=Highest quartile
Parity	Total number of previous deliveries		2-digit continuous
Parity category	Number of previous deliveries (categorical)		0=0 previous births 1=1 previous birth 2=2 or more previous births

Indicator	Concept	Value	Definition
Distance to health facility	Facility greater than two hours away	1=YES 0=NO	1=Distance two hours or more 0=Distance up to two hours away
Mother's HIV status	Mother's HIV status	1=YES 0=NO 3=DON'T KNOW	1=Reactive 0=Non-Reactive 3=Don't know
Delivery type/mode	Caesarean delivery	1=YES 0=NO	1=Caesarean delivery 0=Vaginal delivery

Research Question 2

The SMGL logic model spells out the hypothesized causal pathways by which

women may deliver at facilities and with skilled attendants. These include changes in

both demand and supply that, combined, are expected to lead to increased rates of FBB

and SBA, and ultimately to a reduction in maternal death during the intra-partum period.

In order to validate these causal pathways, I examined the between-group differences for

the intermediate outcomes, i.e., mediating variables. Table 4 outlines the concepts that I

examined. The concepts are drawn from the logic model and the indicators from a

number of handbooks and manuals on evaluation of interventions for reproductive health,

birth preparedness, and EmOC (JHPIEGO, 2004; Safe Motherhood and Reprodcutive

Health Working Group CORE Group, 2004; Stanton & Hopkins, 2004). As already

noted, some recommended indicators were not available in the ZamCAT dataset. For

other indicators Table 4 presents examples of the questions from the ZamCAT forms that

I used. In some cases I used a question as a proxy for a certain concept. I drew indicators

on demand generation and birth preparedness from the ZamCAT questionnaires

administered to pregnant women and indicators on supply-side factors from the HFA.

Table 4. Concepts and Indicators for SMGL Causal Pathway Evaluation

Concept	Indicator	Reference	Question from ZamCAT Survey
Birth Preparedness and Complication Readiness			
Knowledge of danger signs	% of women who know key dangers signs during pregnancy/labor and childbirth	JHPIEGO, 2004	NOT AVAILABLE
Service use: Intentions	% of women who intend to save money for childbirth	JHPIEGO, 2004	NOT AVAILABLE
	% of women who plan to identify a mode of transport to place of childbirth	JHPIEGO, 2004	NOT AVAILABLE, but examined differences in means of transport to reach facility Form E: Q10 "What means of transport would you take to reach a health facility where you could get help with the kinds of problems I just mentioned?" (Options: Walk, Bicycle, Someone carry me, Cart, Bus or Taxi, Ambulance, other)
	% of women who plan for a blood donor	JHPIEGO, 2004	NOT AVAILABLE
	% of women with perceived complications who plan to seek care	Stanton, 2004	Form E: Q2–9 "What would you do if you had swollen hands, face and feet during pregnancy?" (Option "Seek help" selected)
	% of women who plan to give birth with a skilled provider	JHPIEGO, 2004	NOT AVAILABLE Use plan for skilled attendant as facility as proxy Form D: Q24 "Why do you plan to deliver at the location you named?" (Option "Need for skilled attendance" selected)
	% of women who plan to give birth in a facility	***	Form D: Q23 "Where do you plan to deliver the baby?" (Option "Health facility" selected)
Service use: Behaviors	% of women who use ANC: -3 times -4 times	Stanton, 2004; JHPIEGO, 2004	Form G: Q32 Number of antenatal visits completed
	% of women who saved money for childbirth	JHPIEGO, 2004	NOT AVAILABLE

Concept	Indicator	Reference	Question from ZamCAT Survey
	% of women who arranged for emergency transportation (if needed)	Stanton, 2004	NOT AVAILABLE
	% of women who arranged for a blood donor	JHPIEGO, 2004	NOT AVAILABLE
	% of women with perceived complications who sought care	Stanton, 2004	During pregnancy: Form G, Section 4 During labor and delivery: Form G
	% of women/families who self-refer to health facility for postpartum complications	Maternal and Newborn Standards and Indicators Compendium, 2004 (Safe Motherhood and Reproductive Health Working Group CORE Group, 2004)	<u>Form G, Q23/23a-29/29a</u> *Example Q23:* "Did you experience swollen hands, face and feet during pregnancy?" (Option: "Yes" selected) *23a* "If yes, what did you do?" (Option: "Went to health center" selected)
	% of recent mothers who report use of clean birth practices during her last delivery	Safe Motherhood, 2004	<u>Form G, Q18</u> "What items from the clean delivery kit were used at delivery?" (Options: Soap, Gloves, Cord clamp, Plastic sheet, Razor blades, Candles, Matches)
Service Delivery			
Capacity of Facility: Life Saving Functions	Mean # of signal functions at referral facility % of facilities meeting Basic EmONC requirements % of facilities with each type of 23 signal functions	JHPIEGO, 2004;(Gabrysch et al., 2012)	Health Facility (HF) Survey <u>Section V. EMOC Signal Functions</u>
Delivery Care Available 24/7	% of facilities with delivery care available 24 hours a day 7 days a week	JHPIEGO, 2004	HF Survey Q40

2.1.4 Selection of Subjects

Table 5 lists the number of facilities in each of ZamCAT's two groups, the total population of pregnant women who completed the study, and the proportion of total facilities in each district that were included in the initial analysis. Out of the 35 facilities implementing SMGL in Kalomo, ZamCAT operated in 22 (63%), including facilities from all three phases (7 out of 9 in Phase 2, 9 out of 12 in Phase 2, 6 out of 13 in Phase 3). There were no significant differences in the characteristics of women in the CHX or DCC groups relevant to this study, so I combined the two groups together (Appendix A). Since all facilities in Kalomo were part of SMGL, all pregnant women who enrolled in ZamCAT in Kalomo District were considered part of the intervention group for Objective 1.

Table 5. Number of Facilities and Pregnant Women in ZamCAT, by District

District Name	Chlorhexi-dine Care Group (CHX)	Dry Cord Care Group (DCC)	Total # Facilities Selected	Total # Women completed study (both groups)	Total # Facilities	Proportion of Total Facilities in Study
Choma	10	8	18	7,487	35	51%
Kalomo	9	13	22	9,722	35	63%
Livingstone	2	3	5	2,166	14	36%
Mazabuka	11	8	19	7,459	46	41%
Monze	9	9	18	7,719	26	69%
Siavonga	4	4	8	2,912	16	50%
TOTAL	**45**	**45**	**90**	**37,465**	171	53%

The initial analysis was conducted with all six ZamCAT districts. However, to ensure that characteristics of pregnant women at baseline were comparable between the intervention (Kalomo District) and comparison groups (other ZamCAT districts), I examined the characteristics of the five possible comparison districts and purposively selected those districts that were most similar to Kalomo in respondent-level background characteristics (mother's age, education, marital status, parity, household distance to health facility and mother's HIV status until I reached the target sample size. The final districts selected were Choma, Mazabuka and Monze.

Sample Size

To estimate the sample size needed to assess Objective 1, my primary outcome indicator was FBB, expressed as the proportion of pregnant women delivering at a health facility. A January 2014 report on the SMGL program by the CDC estimated a baseline FBB rate of 63% across all four SMGL intervention districts in Zambia (including Kalomo) and a post-SMGL rate of 84% (Centers for Disease Control and Prevention, 2014). At the time I was establishing the study's sample size, the estimate from the Zambia Demographic and Health Survey (ZDHS), 2013–2014 was unavailable. Therefore, I chose to use the baseline estimate from SMGL, as it was more current than the ZDHS's most recent population-based FBB estimate for Southern Province (38%) published in 2007 (DHS 2007).

The minimum effect size was chosen based on the smallest difference anticipated between the change in proportion from pre to post for the intervention group (SMGL) and

the change in proportion from pre to post for the comparison group (non-SMGL). Based on the explanation above, I estimated that the baseline FBB rates for both Kalomo and the comparison group were approximately 60%. In the comparison districts, this rate might increase to an estimated 65% due to ZamCAT–related activities. I estimated that the SMGL intervention districts might increase to approximately 70%, a more conservative estimate than the one reported from the CDC SMGL evaluation. Therefore, the difference in post proportion for the intervention and comparison groups was estimated at five percentage points.

Even though the outcome observations were made at the individual level, the health facility was the level at which the SMGL program was implemented, therefore making it important to take clustering into account.(Ukoumunne & Gulliford, 1999) Therefore, I also included an estimated intra-class correlation coefficient, which is the proportion of the total variance in the outcome due to between-cluster variation. I used an estimate of 0.05, based on a recent study on maternal mortality in Brazil (Haddad et al., 2012). Using the STATA sampsi and sampclus commands (StataCorp., 2009), I calculated the necessary sample size to declare a difference of 5% in the above dichotomous outcome to be statistically significant, given the following parameters and assumptions:

- Alpha = .05, the conventional estimates for a Type I error (two-tailed test)
- Power = .80, or the probability of correctly rejecting the null hypothesis of equal post proportions in the two groups
- Intra-class correlation coefficient=0.05

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- Average observations per cluster=100 (estimated number of pregnant women per facility in each time period of the study)

To meet these requirements, the minimum number of facilities needed per group was 18, and the sample size required per group was 899 pregnancies. The complete ZamCAT study had 22 clusters in Kalomo, and 68 clusters in the 5 other districts. Table 6 illustrates the number of women in Kalomo and three comparison districts selected for the final analysis, based on time period of the study.

Table 6. Number of Women in Study Area for Each Study Period for Final Analysis

Study area	Pre-SMGL *Feb 2011–Jan 2012*	Transition: *Feb–Aug 2012*	During SMGL: *Sept 2012–Aug 2013*	Total # of Women
Kalomo	2,889	3,145	3,694	9,728
Comparison – 3 districts	7,737	7,469	7,689	22,895
TOTAL	**10,626**	**10,614**	**11,383***	**32,196**

*1800 women missing information about delivery date

There were a total of 2,889 deliveries in Kalomo in the pre-SMGL period, and 3,694 deliveries in the during-SMGL period. In the comparison group's three districts, there were 7,737 pre-SMGL and 7,689 post-SMGL. Thus, using the ZamCAT data I was able to meet the necessary requirements for sample size even when limiting to only three of the five comparison districts.

In my final analysis, I excluded those women in ZamCAT who did not have data on the primary outcome of FBB (n=2,289, 5.8%), and those women who were not in the pre-SMGL or during-SMGL groups (n=14,356, 36.2%). The comparison group consisted

of those women living only in Choma, Mazabuka or Monze, excluding a further 5,256 women living in Livingstone and Siavonga Districts (13.3% of the entire ZamCAT sample). My final sample included all women with FBB outcome data during the pre- and during- SMGL periods in Kalomo (n=6,477) and comparison districts of Choma, Monze and Mazabuka (n=15,203). For the health facility analysis, I included all facilities in Kalomo (n=22), and facilities in the three selected comparison group districts (n=55).

2.1.5 *Data Collection*

The ZamCAT investigators collected household and individual-level data from study respondents between February 2011 and October 2013. The survey involved 14 different forms that were administered at different points in time – four were SMGL-relevant: Form A: Screening at facility ANC visit; Form D: Antenatal home visit; Form F: Day 1 postpartum visit; and Form G: Day 4 postpartum visit. The forms are included in Appendix B. Nearly identical HFA tools were used in ZamCAT and SMGL. The data was collected in the same facility on a single day t some point between September and October 2011 (baseline) and June and August 2013 (endline). The ZamCAT HFA tool is attached in Appendix C.

2.1.6 *Data Analysis*

Descriptive Statistics

First, I conducted a descriptive analysis of the entire ZamCAT sample. I determined the comparability of the SMGL and non-SMGL groups at baseline (pre-SMGL) by examining the individual and household characteristics related to FBB and

delivery with a skilled birth attendant. Once I had selected the comparison districts based

on this analysis, I then examined the changes in characteristics from the pre-SMGL to

during-SMGL time periods for Kalomo, the three-district comparison group, and the final

four-district sample. Next, I conducted bivariate analyses to examine the associations

between background characteristics and the outcomes of interest to determine what

factors needed to be controlled for in the regression analyses. I used the Chi-square test

for categorical variables; for continuous variables I used t-tests if the data were normally

distributed or non-parametric Wilcoxon rank-sum tests if non-normally distributed. Any

characteristics associated with outcome variables with < 0.20 were included in the

adjusted logistic regression model (Objective 1, research question 1b).

Objective 1: Difference-in-Differences Estimation and Run Charts

Research Question 1a: To assess the SMGL program's overall impact, I first

calculated a difference-in-differences estimate for the two groups. The rationale for

selecting this method was that it controls for secular changes that occur over time.

Having a comparison group enabled me to approximate what changes would have

happened in Kalomo absent the SMGL program (ZamCAT only), while also taking into

account changes that may have occurred due to the ZamCAT implementation alone. To

calculate the net effect of the SMGL program, I first subtracted the baseline percentage

from the endline percentage for each experimental group. I then determined the absolute

value of that difference. Next, I subtracted the SMGL absolute difference (in percentage

points) from the comparison absolute difference. Figure 5 illustrates this procedure.

Next, I constructed confidence intervals (CI) for the absolute differences for each group.

Figure 5. Illustration of a Difference-in-differences Estimate

I^0: SMGL (intervention) baseline I^1 = SMGL (intervention) endline
C^0: Comparison group baseline C^1 = Comparison group endline
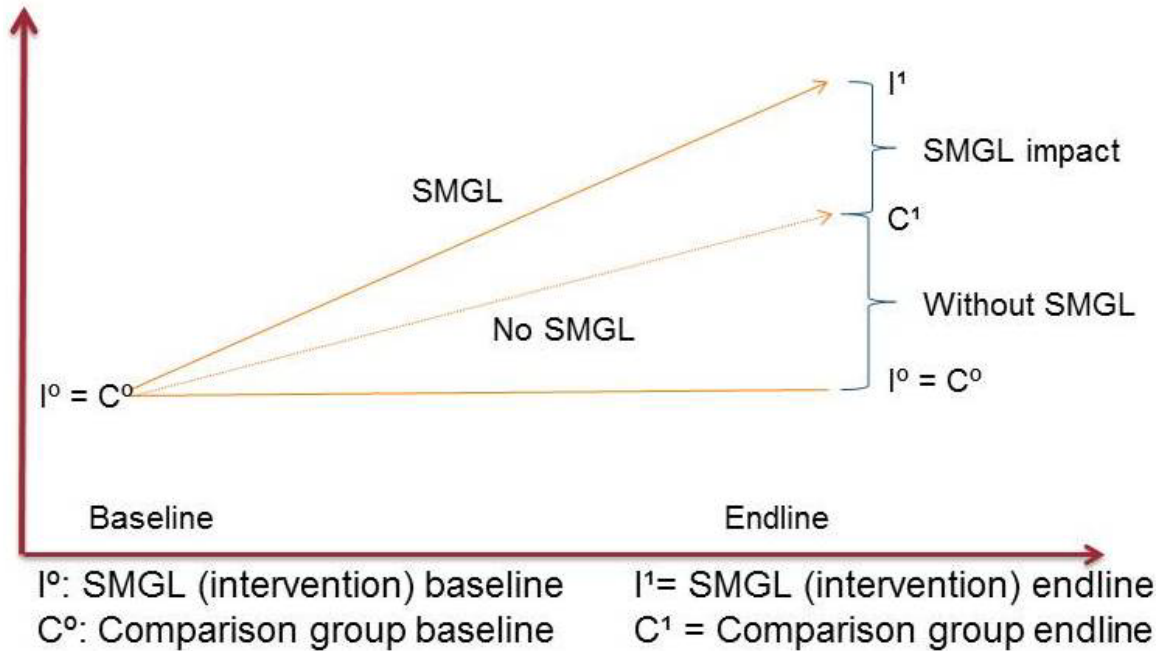
Run Charts

To account for potential bias in the difference-in-difference method, I examined changes over time, using run charts to examine trends and shifts in rates of FBB and delivery with a skilled birth attendant by looking at monthly rates over the entire project period. Run charts are a simple and visual analytic tool that are used widely in quality improvement work, including most recently in health care settings, as a more detailed way to examine improvements over time (Perla, Provost, & Murray, 2011). This analysis allowed for a finer detection of changes that were correlated with the timing and level of program implementation in Kalomo. The rules for detecting a trend is a minimum of seven data points continuously increasing or decreasing for more than 20 observation points, and a shift is at least six data points above or below the median.

Research Question 1b:

First, for each of the experimental groups, I constructed both unadjusted and adjusted odds ratios (OR) for the likelihood of FBB and use of an SBA after the intervention was implemented, with the reference group of before SMGL. The adjusted ORs controlled for several socio-demographic covariates: mother's age, education, parity, distance to the health facility, children under 5 in the household, and asset quartile.

Next I used multi-level logistic regression modeling to test the net effect of the SMGL intervention by comparing the SMGL and comparison sites while controlling for the same set of moderating factors. Multi-level logistic regression could account for the clustering of individuals by facility and allowed for the simultaneous examination of the effects of group-level (facility) and individual-level variables on the individual-level outcomes.

I regressed the primary individual-level outcomes (FBB and use of an SBA) against a dummy interaction variable that I created by taking the product of time (pre-SMGL vs. during SMGL) by group (SMGL vs. comparison sites). I adjusted the analysis for socio-demographic covariates that may have moderated the effect of SMGL on the outcomes. The model that I used is shown below:

$Y = \beta_0 + \beta_1 T + \beta_2 I + \beta_3 TI + yX + e$

Where:

Y = binary response variable for both FBB (yes/no) and SBA (yes/no).

T = time variable (before SMGL=0, during/after SMGL implementation=1)

I = the intervention variable (SMGL district=1, comparison districts=0)

X = vector of covariates, including household size, maternal age, maternal

education, facility more than two hours away, 4+ ANC visits, and parity

β_0 = a constant, and y is a vector representing the impact of covariates

β_1 = the measure of change in the response variable between baseline and final

survey

β_2 = the difference in response variable between the intervention and comparison

sites

β_3 = the interaction term that measures the impact of the intervention

e = error term

As was done is a similar study, I calculated standard errors that were clustered by

facility (the primary sampling unit) to address the assumption of independent and

identically distributed errors within districts (Mohanan et al., 2013) (Azmat et al., 2013).

In order to account for the sampling plan used in ZamCAT, I had to account for both

stratification (urban/rural) and cluster randomization. To do so I used both stratum and

cluster in the logistic model.

I used SAS Version 9.3 for descriptive analysis and model estimation. The "proc

survey logistic" command in SAS uses the Taylor expansion approximation and

incorporates the sample design information, including stratification and clustering,

computes variances within each stratum, and pools variance estimates together.

Propensity Score Matching Analysis

To account for differences in the Kalomo and comparison site populations, I also matched individuals in the intervention district with a sample of women from the comparison districts who had similar observable characteristics. To do this, I calculated the propensity score for each individual based on the estimated probability that this person might be in the SMGL group (D'Agostino, 1998). I matched women using the socio-demographic characteristics and other predictors that were both different between the two intervention groups and strongly associated with the outcome of FBB in the overall study population. These included: mother's age, mother's tribe, mother's education, parity, distance to a health facility, HIV status and household asset quartile. Individuals in the comparison areas without near matches were excluded. With that data in hand, I created a comparison group of individuals that did not have exposure to SMGL but shared the same characteristics as the SMGL-exposed group.

To do the matching, I used the "greedy 5->1" algorithm (Parsons, 2001), meaning that I rounded the propensity score to 5 significant figures, and selected random pairs that matched exactly. For the remaining unmatched subjects, I rounded the score to 4 significant figures and made exact matches and then I continued the process for 3, 2 and 1 significant figures until all matches were made. Once a match was made it was never reconsidered. Next, I measured the average difference in the FBB outcome variable between the participants and the non-participants. I then ran the regression model again with the intervention and propensity score matched comparison group to estimate program effects.

Objective 2: Program Impact on Immediate and Intermediate Outcomes

I tested the program's logic model by examining the differences between the SMGL and comparison groups with the pre- to post-test changes shown for outcomes such as service use intent and service use behaviors. Within each experimental group, I compared the proportions for the pre and post time periods using the Chi-squared test.

I used a similar analysis strategy to examine supply-side indicators from the HFA focusing on signal functions and other facility-level indicators of maternity care provided. Within each experimental group I compared the proportions for the pre and post time periods using the Chi-squared test. To test changes in the mean signal function, I made similar comparisons using the t-test.

Qualitative Evaluation

2.1.7   Purpose

My purpose in conducting qualitative key informant interviews (KII) with stakeholders was to generate more detailed data on factors affecting SMGL program implementation in Kalomo District. This allowed me to contextualize the quantitative findings and to identify factors that may facilitate or prevent program sustainability, replication, and scale-up. The KIIs focused on the respondents' experiences as policy or program-level decision-makers, program implementers, or participants in the delivery of maternal health care and the SMGL program activities.

2.1.8   *Sample Selection and Recruitment of Informants*

In Table 7, I list the type and number of participants recruited for the qualitative interviews. For each international agency and provincial and district-level MOH office, I sought to interview the main point-of-contact for the SMGL program (one or two persons at each). For the facility-level interviews, I sampled eight facilities, including seven rural health centers and one hospital (approximately 23% of the 35 total for the district) to interview both senior clinicians (nurses, clinical officers, or other health providers) and one of the SMAG members.   For facility-level informants at the seven rural health centers (not hospitals), I selected two types of facilities: three "high-functioning" facilities and four "low-functioning" facilities, which were classified on the basis of the pre-SMGL HFA that assessed facility capacity to handle obstetric emergencies. I interviewed available clinicians and SMAGs, provided that the individuals met the criteria outlined above.

I identified potential informants by creating a comprehensive list of candidates, including representatives from the implementing partners in Kalomo, donor representatives, provincial-level MOH representatives, district-level health staff, SMGL project staff, facility-level clinicians, and community health workers in the SMAGs. I then worked with ZCHARD/BU leadership to clarify the roles and responsibilities of each potential informant, after which I narrowed down the list. Criteria for inclusion in my focused list of potential informants included: 1) involvement in SMGL for more than one year to ensure they were active during the time period I was evaluating; 2) senior decision-maker at their organization/post (except for SMAG); and 3) available to meet

during the time I proposed to conduct interviews. The only informant I was unable to interview was a provincial-level government official from Southern Province, due to time limitations.

Table 7. Key Informants for SMGL Evaluation

	Type of Key Informant	**Number**
A	Kalomo District Community Health Workers (CHW) from SMAG	5
B	Kalomo Health Facility Lead Clinicians (Doctor, Clinical Officer or Nurse/Midwife)	8 (2 hospital and 6 rural health center)
C	Kalomo District Health Officers	2
D	SMGL Project Director, Kalomo	1
E	SMGL Senior Clinical Mentor (1) and Clinical Mentors (3)	4
F	MOH and MCDMCH Representatives	2
G	USAID/CDC Representatives	3
H	Representative from Zambia Integrated Systems Strengthening Project (ZISSP) another Kalomo SMGL implementing partner	1
	TOTAL	**26**

2.1.9 Instrumentation and Data Collection

I conducted in-person interviews using a semi-structured interview guide. (See Appendix D). The interviews with all informants except for two SMAG members were conducted and transcribed in English; I worked with translators to interview the two SMAG members in their native language, Tonga. Each interview took place in a private location convenient to the participant, such as a private room at the facility or outside away from other individuals. The interviews lasted between 35–60 minutes.

Approval for the interview procedure was granted from the Internal Review Board (IRB) at both Boston University and ERES Converge in Zambia. I obtained

written informed consent from all participants prior to conducting the interviews.

2.1.10 Data Analysis

The purpose of the qualitative analysis was to: 1) create an explanatory account for the quantitative analysis by examining context, program implementation factors, and observed outcomes, and 2) develop a set of recommendations regarding future scale-up and implementation. I conducted all qualitative data analysis using Nvivo10.(QSR International Pty Ltd., 2012)

I followed the "framework" approach for the analysis of qualitative data in applied research, which uses the following steps: 1) familiarization; 2) identifying a thematic framework; 3) indexing; 4) charting; and 5) mapping and interpretation (Ritchie & Spencer, 1993). I personally transcribed all interviews, and then reviewed the transcripts to identify a general set of initial themes and topics, taking notes and identifying variables to explore as additional indicators in the quantitative analysis.

Next I began constructing a codebook, using questions from the interview guide and components from the logic model and the Three Delays Model. I preliminarily coded one transcript from each of the five types of respondents: SMAG member, health facility provider, SMGL program implementer, government official, and lead implementing partner/donor to test the framework and make adjustments. During the coding process, I continued to refine the codebook, re-organizing the framework after each transcript was coded. Once a complete codebook was created, I fully re-coded all of the transcripts a second time. I continually changed the framework to add, merge, and reformat codes

until it reflected all of the themes and subthemes present.

       Next, I sorted the data by themes and synthesized the findings. I analyzed both for common themes as well as for atypical responses that were unique to particular types of individuals. I conducted queries using outcome frequencies and then framework matrices to compare topics by type of respondent. I revisited the quantitative data to identify additional questions to exposure using the informants' responses. I used these data to triangulate some of the findings from the quantitative phase, when appropriate.

3 CHAPTER THREE: RESULTS

Characteristics of the Study Sample

3.1.1   Quantitative Study

A total of 21,680 women were included in the final analysis for the quantitative study, across both intervention and comparison districts, and in the pre-intervention and intervention time periods combined. Table 8 highlights the exclusions made from the full study sample in ZamCAT. In addition, a total of 77 HFA were analyzed, including 22 from Kalomo and 55 from the comparison area.

Table 8. Quantitative Study Sample Overview

Characteristic	N	%
Number of women in ZamCAT	39,679	100.0
Exclusions		
Missing data on outcome: Facility -based birth*	2,289	5.8
Missing time period or "in transition"	14,356	36.2
-Missing date of delivery	2,150	5.4
-Delivered Feb–August 2012 ("Transition" time period)	12,206	30.8
Livingstone or Siavonga Districts	5,256	13.3
Number of women with complete data on key outcome variable	**21,680**	
Facility-based birth	13,733	63.3
Non-facility based birth	7,947	36.7

*Women with data on FBB as an outcome were less likely than women missing FBB to live more than two hours from a facility (23% v 31%, respectively). Women missing data on FBB were also for the most part missing data on HIV status (31%) and type of birth (59%).

The background characteristics of study participants in Kalomo (n=6,477) and the comparison districts (n=15,203) are presented in Table 9. Women in the comparison area were slightly younger (mean age 25.5 versus to 26.0 years in Kalomo), less likely to be of

Tonga ethnicity (90.4% versus 94.2%), less likely to be married (80.6% versus 87.5%), and more likely to have some education (92.8% versus 89.2%). On average women in the comparison area also had fewer children (parity of 2.4 versus 2.8 in Kalomo), were more likely to have a health facility within two hours distance (70.0% versus 61.7%) and had greater likelihood of HIV infection (9.7% versus 3.6%). There was no difference between the two areas in number of family members living in the household.

Table 9. Characteristics of Women in ZamCAT during Pre and Post-SMGL Implementation Periods, Kalomo District and Three Comparison Districts

Characteristic	Intervention District (Kalomo) n=6,477	Comparison Districts (Choma, Mazabuka and Monze) n=15,203
Woman's age in years(%)**		
15 – 19	21.7	24.4
20–24	26.0	27.2
25–34	37.5	34.7
35–49	14.0	13.2
Missing	0.8	0.5
Age in years (mean, sd)**	26.0 (6.9)	25.5 (6.9)
Household size (mean, sd)	6.6 (4.2)	6.7 (4.1)
Tribe/Ethnic group(%)**		
Tonga	94.2	90.4
Other	5.1	9.1
Missing	0.7	0.5
Marital status(%)**		
Married/Cohabiting	87.5	80.6
Single/Divorced /Widowed	11.8	18.9
Missing	0.7	0.5
Mother's highest education(%)**		
None (0)	10.8	7.2
Any primary (1–7)	57.5	52.5
More than primary (7+)	31.0	39.9
Missing	0.7	0.5
Father's highest education(%)**		

		Intervention District (Kalomo) n=6,477	Comparison Districts (Choma, Mazabuka and Monze) n=15,203
Characteristic			
None (0)		5.2	2.9
Any primary (1–7)		47.4	36.8
More than primary (7+)		41.2	3.9
Missing		6.4	6.4
Respondent's literacy(%)**			
Not at all		30.5	22.2
A bit		8.7	49.1
Very well		19.4	28.1
No answer		0.6	0.2
Missing		0.9	0.5
Asset quartile(%)**			
1–Lowest		42.9	21.1
2		27.9	25.7
3		17.7	27.7
4–Highest		11.5	25.6
Parity(%)**			
0		20.1	24.1
1		15.8	18.8
>=2		63.3	56.6
Missing		0.7	0.6
Mean parity (mean, sd)**		2.8 (2.4)	2.4 (2.3)
Distance to health facility ≥ 2 hours(%)**			
Yes		36.7	28.8
No		61.7	70.0
Missing		1.6	1.3
Mother's HIV status(%)**			
Reactive		3.6	9.7
Non-reactive		91.9	85.6
Don't know		1.3	1.1
Missing		3.2	3.7
Delivery type/mode(%)*			
Vaginal		96.5	96.3
Caesarean		0.6	1.1
Missing		2.9	2.7
	TOTAL	**100.0**	**100.0**

*p<0.05; **p<0.001

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3.1.2 *Qualitative Study*

I conducted interviews with a total of 26 respondents, including five SMAGs; eight health facility staff (four rural nurses/midwives, one rural environmental health technician (EHT) one rural clinical officer (CO), one hospital-based nurse and one hospital-based physician); six SMGL project staff (three clinical mentors and three mentors/supervisors); four government health officials from ministry to district level; and three lead implementing partner/donor representatives. There were a total of 15 females and 11 males interviewed; five had 0–1 year of experience in their current position, six had 2 years, three had 3 years; and six had 5 or more years in their current role.

Objective 1: Program Impact

Of the 21,680 women in the quantitative study, 63.3% delivered in facilities (13,733/21,680) and 52.5% delivered with an SBP (11,391/21,680). Of those who delivered in facilities, 86.3% delivered with an SBP (11,350/13,142); nearly all (99.6%) of the women delivering with a SBP did so in a facility. In Kalomo District, 60.3% (3903/6477) delivered in facilities overall across both time periods and 47.2% (3058/6,477) delivered with an SBP. In the comparison area, 64.7% (9,830 /15,203) delivered in facilities and 54.8% (8,333/15,203) delivered with an SBP.

3.1.3 *Background Characteristics Before and During Program Implementation*

The background characteristics of the study participants before and during SMGL program implementation in Kalomo are presented in Table 10 for both Kalomo and comparison districts. Overall, socio-demographic characteristics changed only slightly

between the two time periods, and trends for both Kalomo and the comparison area were similar. Women who delivered on or after September 2012 were slightly younger (25.5 versus 25.8 years of age, p=0.02), had slightly smaller households (6.6 versus 6.9 members, p<0.0001), were slightly more likely to be married (83.9% versus 82.3%, p<0.01), and had a greater proportion of households in the lowest asset category (29.9% versus 25.1%, p<0.0001). Overall, there was no difference between the two time periods in parents' education level, and in Kalomo there was no change over time. However, in the comparison area a slightly larger proportion of both mothers and fathers had more than a primary school education (p<0.01).

Women who delivered during SMGL in Kalomo had slightly fewer children that those who delivered before SMGL (2.4 versus 2.5). Overall, post-intervention there was a higher proportion of women who traveled more than two hours to reach a health facility (35.0% versus 27.8%, p<0.01), and this trend was evident in both the Kalomo and comparison area. Fewer women in both groups were HIV-reactive in the post-intervention period (6.6% versus 9.8% overall, p<0.01), again with similar trends in both groups. There was no difference in type of delivery (vaginal or Caesarean) between the two time periods for either group.

Table 10. Characteristics of Women in ZamCAT, Kalomo District and Three Other Districts at Baseline and Endline

Characteristic	Kalomo District Before SMGL†	Kalomo District During SMGL‡	*p-value*	Comparison Districts Before SMGL	Comparison Districts During SMGL	*p-value*	All Subjects Before SMGL	All Subjects During SMGL	*p-value*
n	2,859	3,618		7,559	7,644		10,418	11,262	
Woman's age in years (%)									
15–19	21.8	22.0	0.22	24.1	25.0	0.007	23.4	24.0	0.005
20–24	25.1	27.1		26.6	28.2		26.2	27.8	
25–34	39.0	36.9		35.4	34.3		36.4	35.1	
35–49	14.1	14.1		14.0	12.5		14.0	13.0	
Age in years (mean, sd)	25.6 (7.0)	25.4 (6.8)	0.01	26.1 (6.9)	25.9 (6.9)	0.44	25.8 (7.0)	25.5 (6.9)	0.02
Household size (mean, sd)	6.9 (4.2)	6.6 (4.0)	<0.0001	6.8 (4.4)	6.5 (4.2)	0.01	6.9 (4.3)	6.6 (4.0)	<0.0001
Tribe/Ethnic group (%)									
Tonga	94.0	95.6	0.004	91.0	90.6	0.45	91.8	92.2	0.28
Other	6.0	4.4		9.0	9.4		8.2	7.8	
Marital status (%)									
Married/cohabiting	85.4	90.2	<0.001	81.0	81.0	0.95	82.3	83.9	0.001
Single/divorced /widowed	14.5	9.8		19.0	19.0		17.8	16.1	
Mother's highest education (%)									
None (0)	10.2	11.3	0.19	7.5	6.9	0.005	8.2	8.3	0.31
Any primary (1–7)	57.6	58.2		53.8	51.7		54.8	53.8	
More than primary (7+)	32.2	30.5		38.8	41.3		37.0	37.8	

Characteristic	Kalomo District		p-value	Comparison Districts		p-value	All Subjects		p-value
	Before SMGL†	During SMGL‡		Before SMGL	During SMGL		Before SMGL	During SMGL	
Father's highest education (%)[1]									
None (0)	5.4	5.7	0.30	3.6	2.7	0.002	4.1	3.7	0.30
Any primary (1–7)	49.6	51.3		39.9	38.7		42.6	42.8	
More than primary (7+)	45.0	43.0		56.6	58.6		53.3	53.5	
Respondent's literacy (%)									
Not at all	31.8	29.9	<0.0001	23.2	21.4	0.005	25.6	24.1	<0.0001
A bit	46.0	51.5		48.1	50.6		47.5	50.9	
Very well	21.8	17.9		28.7	27.8		26.8	24.6	
No answer	0.5	0.7		0.1	0.2		0.2	0.4	
Asset quartile (%)									
1–Lowest	39.5	45.6	<0.0001	19.7	22.5	<0.0001	25.1	29.9	<0.0001
2	30.0	26.3		25.1	26.2		26.5	26.2	
3	18.9	16.8		27.6	27.7		25.2	24.2	
4–Highest	11.7	11.4		27.6	23.6		23.2	19.7	
Parity (%)									
0	20.9	19.8	0.54	23.4	25.1	0.0002	22.7	23.4	0.02
1	15.7	16.1		18.1	19.7		17.5	18.6	
>=2	63.4	64.1		58.6	55.2		60.0	58.1	
Parity (mean, sd)	2.5 (2.3)	2.4 (2.3)	0.0005	2.8 (2.4)	2.8 (2.4)	0.79	2.6 (2.3)	2.5 (2.3)	0.01
Distance to health facility greater than 2 hours (%)[2]									
Yes	33.7	40.1	<0.0001	25.6	32.6	<0.0001	27.8	35.0	<0.0001

Characteristic	Kalomo District		p-value	Comparison Districts		p-value	All Subjects		p-value
	Before SMGL†	During SMGL‡		Before SMGL	During SMGL		Before SMGL	During SMGL	
No	66.3	59.9		74.4	67.4		72.3	65.0	
Mother's HIV status (%)[3]									
Reactive	4.8	2.9	<0.0001	11.7	8.4	<0.0001	9.8	6.6	<0.0001
Non–reactive	93.6	95.9		87.2	90.5		89.0	92.3	
Don't know	1.6	1.2		1.1	1.1		1.2	1.1	
Delivery type/mode (%)[4]									
Vaginal	99.2	99.6	0.11	98.8	98.9	0.36	98.9	99.2	0.09
Caesarean	0.8	0.5		1.2	1.0		1.1	0.8	
TOTAL	**100.0**	**100.0**		**100.0**	**100.0**		**100.0**	**100.0**	

† Before SMGL refers to women who delivered before January 2012

‡ During SMGL refers to women who delivered after August 2012

[1] Missing data on n=1376: Kalomo n=411, Comparison n=965

[2] Missing data on n=300: Kalomo n=105, Comparison n=195

[3] Missing data on n=760: Kalomo n=204, Comparison n=556

[4] Missing data on n=591: Kalomo n=188; Comparison n=403

3.1.4 Association between Background Characteristics and Outcomes

Mother's age, tribe, marital status, parity, and distance to facility were all associated with both FBB and delivery with an SBP in both Kalomo and the comparison districts (Tables 11 and 12). Older women, women of Tonga ethnicity, women who were married, women with more than one child, and women living more than two hours away from a health facility were less likely to deliver in a facility or deliver with an SBP.

Both mother's and father's education were associated with FBB for both groups, and with delivery with an SBP for the overall study population and for the comparison group. Mothers with more education were more likely to deliver at a facility. In Kalomo, however, while more than primary education was associated with delivery with an SBP, any primary education for either mother or father was not (Table 11). In both areas women who were HIV-reactive were more likely to deliver in a facility and with an SBP.

Table 11. Association of Background Characteristics with Facility-Based Birth in Kalomo District and Comparison Districts (Pre-Intervention and Intervention Periods Combined)

Characteristic	Total Sample (N=21,680) OR(95% CI)	Kalomo District (n=6,477) OR (95% CI)	Comparison Districts (n=15,203) OR (95% CI)
Woman's age in years			
15–19*	1.0	1.0	1.0
20–24	0.65 (0.60,0.70)	0.68 (0.59,0.79)	0.63 (0.57,0.70)
25–34	0.61 (0.56,0.66)	0.62 (0.54,0.71)	0.61 (0.56,0.67)
>35	0.62 (0.56,0.69)	0.71 (0.60,0.84)	0.58 (0.52,0.65)
Tribe/Ethnic group			
Other*	1.0	1.0	1.0
Tonga	0.63 (0.57,0.70)	0.61(0.48,0.78)	0.65 (0.58,0.74)
Marital status			
Single/divorced/widowed*	1.0	1.0	1.0
Married/Cohabitating	0.58 (0.53,0.62)	0.67 (0.57,0.79)	0.56 (0.51,0.61)
Mother's highest education			
None (0)*	1.0	1.0	1.0
Any primary (1–7)	1.30 (1.17, 1.43)	1.17 (0.99,1.37)	1.32 (1.09,1.60)
More than primary (7+)	2.34 (2.11,2.60)	2.01 (1.69,2.40)	2.24 (1.85,2.71)
Father's highest education			
None (0)*	1.0	1.0	1.0
Any primary (1–7)	1.31 (1.13,1.52)	1.29 (1.03,1.61)	1.27 (1.04,1.54)
More than primary (7+)	2.20 (1.90,2.54)	2.01 (1.60,2.53)	2.19 (1.81,2.65)
Asset quartile			
1-Lowest*	1.0	1.0	1.0
2	1.12 (1.04,1.21)	1.05 (0.93,1.19)	1.15 (1.04,1.27)
3	1.17 (1.09,1.27)	1.12 (0.97,1.29)	1.18 (1.07,1.30)
4-Highest	1.46 (1.35,1.59)	0.96 (0.82,1.13)	1.58 (1.44,1.75)
Parity			
0*	1.0	1.0	1.0
1	0.48 (0.44,0.53)	0.59 (0.50,0.71)	0.44 (0.40,0.49)
≥2	0.42 (0.39,0.45)	0.48 (0.42,0.55)	0.40 (0.36,0.43)
Respondent's distance to facility			
<2 hours*	1.0	1.0	1.0
≥2 hours	0.49 (0.46,0.52)	0.63 (0.57,0.70)	0.44 (0.41,0.48)
Mother's HIV status			
Non-Reactive*	1.0	1.0	1.0
Reactive	1.89 (1.69,2.12)	2.70 (1.95,3.73)	1.73 (1.53, 1.95)

*Indicates reference group

Table 12. Association between Background Characteristics and Delivery with a Skilled Birth Attendant in Kalomo District and Comparison Districts (Pre-Intervention and Intervention Periods Combined)

Characteristic	Total Sample (N=21,680) OR (95% CI)	Kalomo District (n=6,477) OR (95% CI)	Comparison Districts (n=15,203) OR (95% CI)
Woman's age in years			
15–19*	1.0	1.0	1.0
20–24	0.72 (0.66, 0.78)	0.72 (0.62,0.83)	0.72 (0.66, 0.79)
25–34	0.67 (0.62,0.72)	0.63 (0.55,0.72)	0.69 (0.63, 0.76)
>35	0.67 (0.61,0.73)	0.69 (0.58,.082)	0.67 (0.60, 0.75)
Tribe/Ethnic group			
Other*	1.0	1.0	1.0
Tonga	0.63 (0.57, 0.70)	0.55 (0.43, 0.69)	0.68 (0.61, 0.77)
Marital status			
Single/divorced/widowed*	1.0	1.0	1.0
Married/Cohabitating	0.60 (0.55, 0.65)	0.63 (0.54, 0.74)	0.61 (0.56, 0.67)
Mother's highest education			
None (0)*	1.0	1.0	1.0
Any primary (1–7)	1.41 (1.27, 1.56)	1.13 (0.95, 1.33)	1.49 (1.31, 1.69)
More than primary (7+)	2.51 (2.26, 2.79)	1.97 (1.65, 2.35)	2.57 (2.25, 2.94)
Father's highest education			
None (0)*	1.0	1.0	1.0
Any primary (1–7)	1.29 (1.11, 1.50)	1.12 (0.89, 1.42)	1.38 (1.13, 1.69)
More than primary (7+)	2.15 (1.85, 2.50)	1.84 (1.46, 2.33)	2.24 (1.84, 2.73)
Asset quartile			
1-Lowest*	1.0	1.0	1.0
2	1.13 (1.05,1.22)	1.13 (1.00,1.27)	1.07 (0.98,1.18)
3	1.16 (1.08,1.26)	1.19 (1.03,1.37)	1.07 (0.98,1.18)
4-Highest	1.60 (1.48,1.73)	1.23 (1.04,1.45)	1.54 (1.40,1.70)
Parity			
0*	1.0	1.0	1.0
1	0.58 (0.54, 0.64)	0.71 (0.60, 0.84)	0.53 (0.49, 0.60)
≥2	0.50 (0.46, 0.53)	0.55 (0.48, 0.62)	0.49 (0.45, 0.53)
Respondent's distance to facility			
<2 hours*	1.0	1.0	1.0
≥2 hours	0.53 (0.50, 0.57)	0.64 (0.58, 0.71)	0.50 (0.47, 0.54)
Mother's HIV status			
Non-Reactive*	1.0	1.0	1.0
Reactive	1.83 (1.65, 2.04)	3.09 (2.28, 4.18)	1.59 (1.42, 1.78)

*Indicates reference group

3.1.5 Program Impact: Facility-Based Birth

Quantitative Results

The proportion of FBB increased from 54.8% (1567/2859) in the Kalomo district before the intervention to 64.6% (2336/3618) during the intervention, an absolute difference of 9.8 percentage points (95% CI: 7.4, 12.2, p<0.01). In the comparison area there was a slight, non-significant increase of 0.2 percentage points (95% CI: -1.4,1.7). This resulted in a 9.6 net percentage point increase in the intervention area versus the comparison area (Table 13).

Table 13. Differences-in-differences Analysis of Facility-based Birth Before and During SMGL between SMGL and Non-SMGL Areas

Time Period	Facility-based birth		
	Pre- SMGL	**During SMGL**	**Absolute Difference (95% CI)**
Kalomo **N (%)**	54.8 (1567/2859)	64.6** (2336/3618)	**+9.8 (7.4, 12.2)**
Comparison **N (%)**	64.6 (4881/7559)	64.7 (4949/7644)	**+0.2 (-1.4, 1.7)**
		Net difference	**+9.6**

**p<0.01

In the Kalomo intervention district, controlling for mother's age, education, parity and distance to the health facility, the adjusted odds of FBB during the intervention was 60% greater (OR: 1.60, 95% CI: 1.28,1.99) compared to the rate before the intervention period (Table 14). In the comparison districts, there was no difference in the adjusted odds of FBB during the intervention compared to before the intervention (OR: 1.05, 95% CI: 0.87, 1.25).

Table 14. Likelihood of Facility-based Birth Before and During SMGL Implementation, Intervention vs. Comparison Districts*

	Number of Births	Facility-based Births No (%)	Odds ratio (95% CI)	Adjusted OR (95% CI)
Kalomo District				
Before†	2859	1567 (54.8)	1.00	1.00
During	3618	2336 (64.6)	1.50 (1.21, 1.87)	1.60 (1.28,1.99)
Comparison				
Before†	7559	4881 (64.6)	1.00	1.00
During	7644	4949 (64.7)	1.01 (0.85, 1.19)	1.05 (0.87,1.25)

†reference group

*Controlling for mother's age, education, parity, distance to health facility, children under five, and asset quartile

In the model, there was a significant interaction between area of intervention and the time-period (p = 0.005) (Table 15). There was 49% relative increase in the odds of FBB in the intervention district after SMGL compared to the comparison area (OR 1.49, 95% CI: 1.21-1.77), adjusting for household size, maternal age, any maternal education, facility more than two hours away, four or more ANC visits, and parity. Another model adjusted for mother's HIV status and found the same results (not shown here).

Table 15. Facility-based Birth Before and During the SMGL Program Implementation Time Period in Kalomo District and Comparison Districts

	Adjusted OR (95% CI)*		
	Model 1**	Model 2†	Model 3‡
Intervention Period x Intervention Area			
Before, Intervention versus Comparison	1	1	1
During, Intervention versus Comparison	1.54 (1.25, 1.83)	1.53 (1.26, 1.82)	1.49(1.21, 1.77)
Respondent's Distance to Facility			
<2 hours		1	1
≥2 hours		0.51 (0.44, 0.60)	0.51 (0.44, 0.60)
Antenatal Care			
<4 visits			1
≥4 visits			1.54 (1.35, 1.75)

*Consecutive adjustment of covariates in the model and changes of odds ratios of facility-based birth before and during, intervention district versus comparison district.
** Adjusted for household size, mother's age, mother's education (any), parity, marital status, and asset quartile
† Adjusted for covariates in model 1 + respondent's distance to facility
‡ Adjusted for covariates in model 2 + number of antenatal care visits

Results of the propensity score analysis (PSA) also demonstrated the positive change in Kalomo. Using multivariate regression with the sample created using PSA, the OR for the difference in FBB between SMGL and non-SMGL groups, before and during SMGL—controlling for household size, maternal age, any maternal education, facility more than hours away, four or more ANC visits, and parity–was 1.43 (95% CI: 1.14, 1.71). I also observed significant interaction between area of intervention and the time period (p = 0.01) (Tables for PSA in Appendix E).

Time Series Results

A time series analysis revealed that the increase in FBB in Kalomo did not occur until the final 4–6 months of the study period, starting in early 2013 (Figure 6). Following the three-phased start of the SMGL intervention which lasted from February to June 2012, there was a positive trend in FBB, from 56% in May to 66% in November. This was not statistically significant. The month of September saw a decrease to 63% from 64% in August and therefore were not seven consecutive months of increase, as required to reach statistical significance. However, starting in January 2013, there was a statistically significant shift, with six points above the median (December 2012 through June 2013). In December of both 20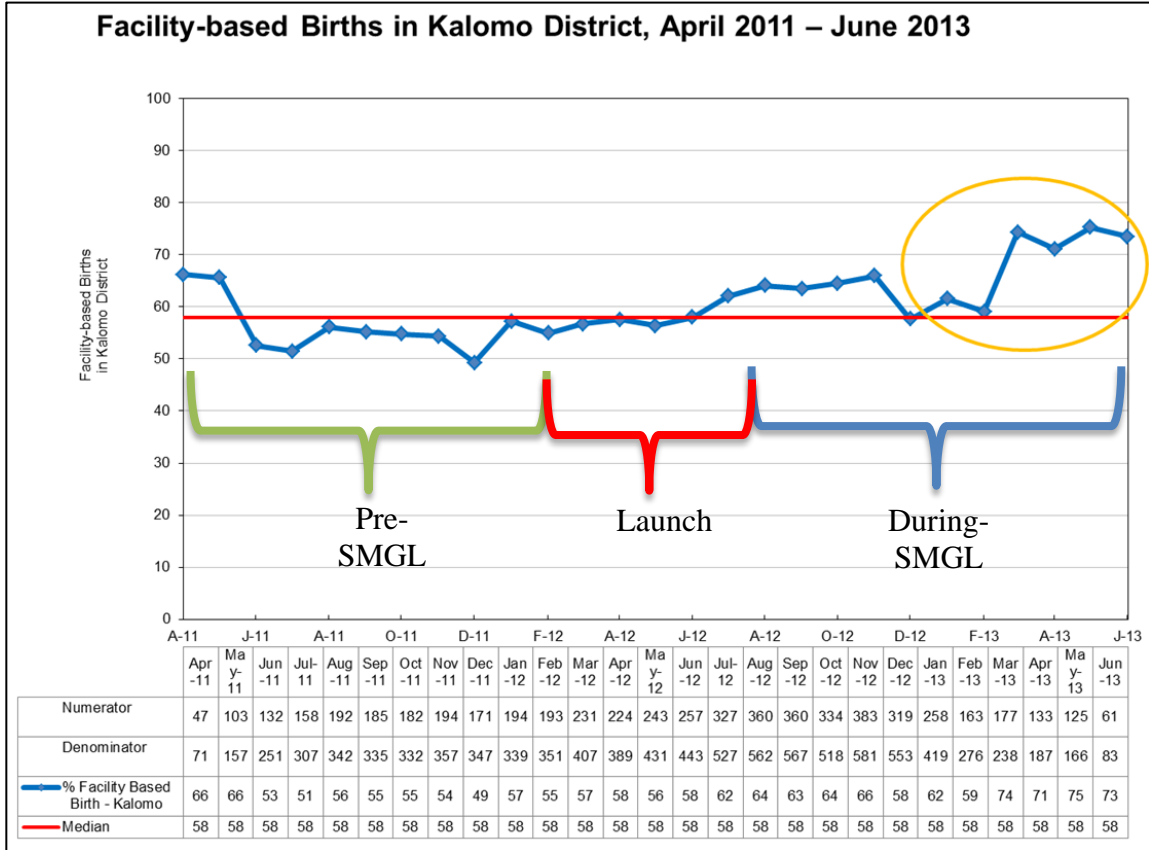12 and 2013, there was a decrease in FBB, indicating a possible seasonal decrease regardless of the overall trend. For the comparison group, the run charts indicate neither positive trends nor statistically significant shifts in FBB rates during the study period (Figure 7).
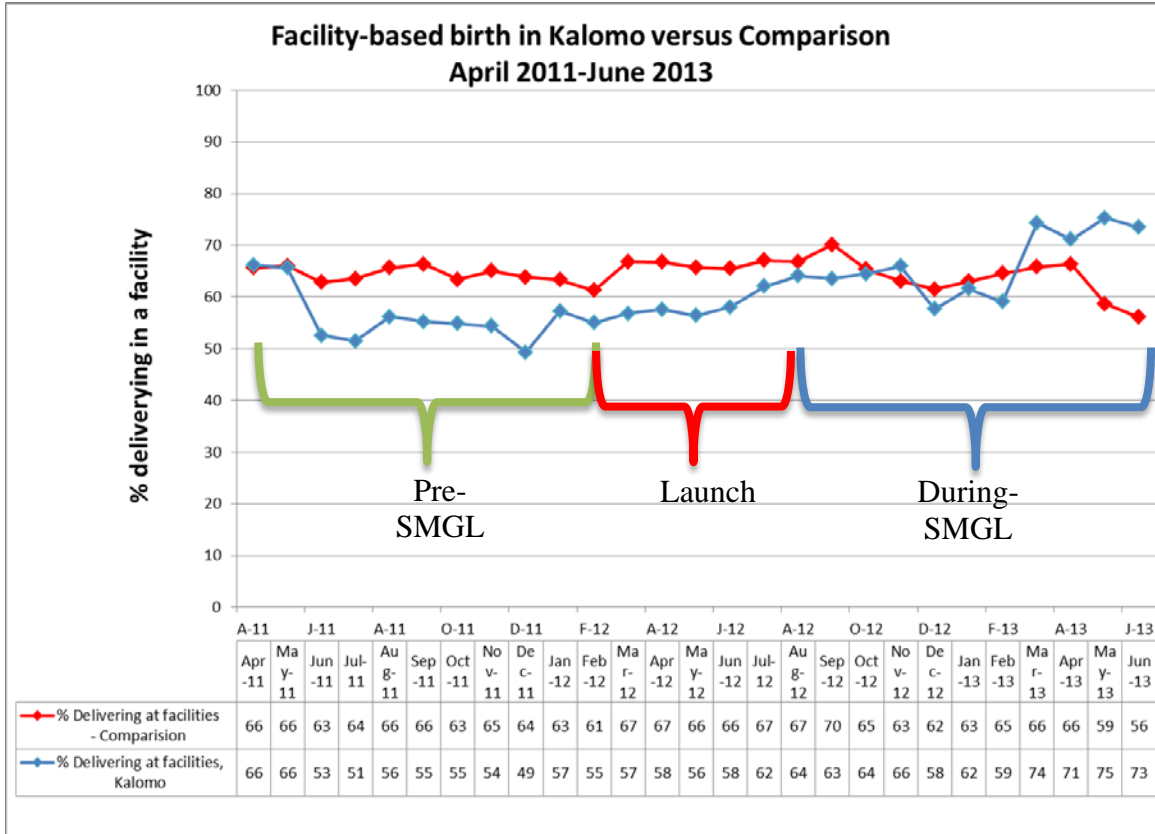
Figure 6. Run Chart of Facility-based Births in Kalomo District, April 2011– June 2013

Facility-based Births in Kalomo District, April 2011 – June 2013

	Apr -11	May- 11	Jun -11	Jul- 11	Aug -11	Sep -11	Oct -11	Nov -11	Dec -11	Jan -12	Feb -12	Mar -12	Apr -12	May- 12	Jun -12	Jul- 12	Aug -12	Sep -12	Oct -12	Nov -12	Dec -12	Jan -13	Feb -13	Mar -13	Apr -13	May- 13	Jun -13
Numerator	47	103	132	158	192	185	182	194	171	194	193	231	224	243	257	327	360	360	334	383	319	258	163	177	133	125	61
Denominator	71	157	251	307	342	335	332	357	347	339	351	407	389	431	443	527	562	567	518	581	553	419	276	238	187	166	83
% Facility Based Birth - Kalomo	66	66	53	51	56	55	55	54	49	57	55	57	58	56	58	62	64	63	64	66	58	62	59	74	71	75	73
Median	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58	58

†Circled area indicates a statistically significant shift

Figure 7. Run Chart of Facility-based Births in Kalomo District and Comparison Districts, April 2011– June 2013

Facility-based birth in Kalomo versus Comparison April 2011-June 2013

	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13
% Delivering at facilities - Comparision	66	66	63	64	66	66	63	65	64	63	61	67	67	66	66	67	67	70	65	63	62	63	65	66	66	59	56
% Delivering at facilities, Kalomo	66	66	53	51	56	55	55	54	49	57	55	57	58	56	58	62	64	63	64	66	58	62	59	74	71	75	73

Qualitative Results

When asked to describe their perception of SMGL's impact, the majority of respondents (65%, n=17/26) cited an increase in facility deliveries. This was the most frequently mentioned outcome cited by every type of respondent. In the interviews, the SMAG and health facility staff had the highest number of references to facility delivery. A typical response was:

"Then at the same time this information is given to us, the same information also we are giving the SMAGs in the community, so we find that now all those mothers who are having a negative attitude, they are coming to deliver at the facility, they are now coming"

-Rural midwife

One of the respondents, in the donor/lead implementing partner category, had a less-than-favorable response, indicating that facility delivery had in fact increased in Kalomo, but to a lesser degree than the other three SMGL districts in Zambia.

Summary

Both the quantitative and qualitative data provide strong evidence of a change in FBB in Kalomo during the implementation of the SMGL program, in comparison to the three comparison districts where SMGL was not implemented.

3.1.6 Program Impact: Skilled Birth Attendance

Quantitative Results

Proportion of deliveries attended by skilled birth providers

The proportion of women who delivered with an SBP increased from 46.2% (1261/2730) in the SMGL intervention district before the intervention to 51.7% (1797/3475) during the intervention period, an absolute difference of 5.5 percentage points (95% CI: 3.0, 8.0, $p<0.0001$). In the comparison area there was a slight decrease of 0.4 percentage points (95% CI: -2.0,1.2). This resulted in 5.9 net percentage point increase in the intervention over the comparison (Table 16).

Table 16. Differences-in-differences Analysis of Delivery with a Skilled Birth Provider Before and During SMGL between SMGL and Non-SMGL Areas

Time Period	Birth Attended by an SBP		
	Pre- SMGL	During SMGL	Difference
Kalomo **N (%)**	46.2 (1261/2730)	51.7** (1797/3475)	+5.5 (3.0, 8.0)
Comparison **N (%)**	57.1 (4153/7274)	56.7 (4180/7376)	-0.4 (-2.0, 1.2)
		Net difference	**5.9**

** p<0.0001

However, adjusting for mother's age, education, parity, and distance to the health facility, there was no significant increase in delivering with an SBP for either the Kalomo District (OR: 1.32, 95% CI: 0.94,1.83) or the comparison area (OR: 1.01, 95% CI: 0.81, 1.26) (Table 17).

Table 17. Likelihood of Delivery with a Skilled Birth Provider, Before and During SMGL Implementation, by Intervention or Comparison Districts

	Number of Births	Birth Attended by SBP n (%)	OR (95% CI)	Adjusted OR (95% CI)
Kalomo District				
Before	2730	1261 (46.2)	1.00	1.00
During	3475	1797 (51.7)	1.25 (0.90, 1.72)	1.32 (0.94, 1.83)
Comparison				
Before	7274	4153 (57.1)	1.00	1.00
During	7376	4180 (56.7)	0.98 (0.80, 1.21)	1.01 (0.81, 1.26)

*Controlling for mother's age, education, parity, distance to health facility, children under five, and asset quartile

Using a regression model, the OR for the difference in rate of delivery with an SBP between SMGL and non SMGL groups, before and during SMGL—controlling for household size, maternal age, any maternal education, facility more than 2 hours away, 4 or more ANC visits, and parity—is 1.27 (95% CI 0.87, 1.66). There was no significant interaction between area of intervention and the time period (P = 0.24). Since the outcomes of FBB and SBP are highly correlated, I explore reasons for the difference in the results for FBB and delivery with an SBP in the discussion section.

Number of skilled birth providers at facilities

The proportion of health facilities in Kalomo indicating that they had at least one skilled provider was nearly 91% at the start of SMGL and did not change, though in the comparison area there was a marginally significant increase (90.9% to 100.0%, p=0.06). The mean number of providers at rural health centers also did not change in either Kalomo or the comparison area (Table 18).

Table 18. Proportion of Health Facilities with Skilled Providers

	Kalomo			Comparison		
Skilled providers* at facility	Before SMGL (n=22) N (%)	During SMGL (n=22) N (%)	p-value	Before SMGL (n=55) N (%)	During SMGL (n=54) N (%)	p-value
At least one	20/22 (90.9%)	20/22 (90.9)	1.0	50/55 (90.9)	54/54 (100.0)	0.06
Mean number	2.50 (4.08)	2.23 (2.25)	0.78	3.45 (4.24)	4.17 (4.92)	0.42

* Skilled provider can be a registered or enrolled nurse, nurse-midwife, general doctor or OBGYN at facility

Time Series Results

The time series analysis revealed that there is an indication of the start of a shift in the rate of delivery with an SBP in Kalomo starting in March 2013. This positive increase corresponds with the increase in FBB shown in Figure 8. However, the data only extend through June 2013, and thus cannot meet the requirements of at least six data points above the median for declaring statistical significance. The run chart for the comparison group (Figure 9) indicates neither a positive trend nor a statistically significant shift in the rates of delivery with an SBP over the study period. There does appear to be a decrease in the comparison group as the rate in Kalomo begins to increase.

Figure 8. Delivery with an SBP in Kalomo District, April 2011– June 2013

	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13
Numerator	40	85	108	126	140	150	146	159	141	160	164	180	170	198	210	265	274	277	271	282	231	201	123	133	105	105	49
Denominator	69	155	239	293	321	320	316	344	333	326	339	396	371	406	424	503	538	544	502	554	536	400	263	229	179	159	80
% SBA - Kalomo	58	55	45	43	44	47	46	46	42	49	48	45	46	49	50	53	51	51	54	51	43	50	47	58	59	66	61
Median	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50	50

	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan-13	Feb-13	Mar-13	Apr-13	May-13	Jun-13
% Delivered with SBA - Comparision	60	58	56	57	57	58	56	58	56	56	55	60	60	59	61	61	60	63	56	57	53	55	55	56	59	53	41
% Delivering with SBA - Kalomo	58	55	45	43	44	47	46	46	43	49	49	45	46	49	49	53	51	51	54	51	43	50	47	58	59	67	61

Qualitative Results

When asked about program impact, no respondent explicitly mentioned an increase in delivery with an SBP. On the other hand, nearly half (n=12/26) mentioned an improvement in the capacity of existing facility staff to handle maternal complications and emergencies. Of these, seven respondents specifically cited the improvements in skills and capabilities among the lay, or untrained staff, such as EHTs or COs. These staff are not considered SBP due to their limited qualifications and obstetrical training, but through the SMGL mentorship program they were mentored and counseled on how to

handle specific obstetric cases since they were the only available staff at the facility. In fact, they reported to care for women presenting with complications:

> "I can relate a story that I got from doctor at the hospital… he told me 'I think [name of supervisor] and your team, you are doing a very commendable job, because before you came in we received, we were being called almost every night to come and to deal with the postpartum hemorrhage and eclampsia. We are now able to sleep because the nurses are able to manage PPH on their own and they rarely call us...' And I was very happy to hear that. And there are quite many of them because all the other places we have been to like [rural] health center, the staff were able to tell us, we are actually managing PPH…"
>
> -SMGL project staff

> "Yeah, the first one, it was very, I feared, because I had never done it. But when the baby came, and then I recalled what I learned for helping the baby, I brought the appliances, starting applying all the [equipment] and then the baby survived, and then another one survived. There are three of them."
>
> -Rural Clinical Officer

Summary

While there was a positive trend in Kalomo District for deliveries with an SBP, the change was not statistically significant when compared to the comparison area. Qualitative data support the finding of no change in delivery with an SBP due to SMGL, but provide evidence of an increase in the knowledge and skills of existing facility staff, regardless of training level, in handling obstetric emergencies.

3.1.7   Program Impact: Maternal Mortality

Quantitative Results

Maternal death was a very rare outcome in both Kalomo and the comparison districts. In Kalomo there were four deaths per 2,889 population (0.14%) before SMGL and 1 in 3,694 during SMGL (0.03%). This represents a 78.6% reduction in deaths, but this change was non-significant (p=0.17). In the comparison area there was no change in deaths, from 4/7,737 (0.05%) to 6/7,689 (0.08%).

Qualitative Results

The second most frequently cited outcome of SMGL was a decrease in maternal mortality. Nearly all respondents were asked to reflect on this indicator. Interestingly, the government and donor/lead implementing partner respondents mentioned this outcome in detail more often than facility staff and SMAG members:

> "In Kalomo I think the impact also is there. Maybe I will give it in terms of absolute figures. Our institutional mortalities were in the range of 10–12 annually. But this year, so far, we have had only 4 institutional mortalities, and this is the 10th month…so it is having an impact."
>
> -Government official

SMAGs frequently responded with a simple "yes" when asked about whether they believed that the impact seen across all SMGL districts was similar to what they had observed in Kalomo.

Health facility staff and SMGL project staff who monitored facilities both reported on what they observed within their own facilities, having kept their own records

for the program:

> "Because, um, when you look at the time when we were counting maternal death, you see the time when SMGL was just coming in, but since SMGL, maybe, and up to where we are now, we have never had any reports... there have been no report of maternal death at the facility or at home, so I feel there is an improvement. Yes."
>
> > -Rural midwife

> "For Kalomo I might not be confident with the figures. But what I would say, I would say there has been some change….Why do I say so? Because...I attend the MDRs [Maternal Death Reviews]. If previously maybe there is, there is about ten deaths, maybe 8, and now you start seeing 3 or 4, which means there has been an improvement. Even at facility level…like yesterday I went to I was visiting [rural health facility], when I was counting those deliveries there were something like 55, 53, so, but if previously....so I was going through the register there but they had about 50 deliveries, and all those without deaths"
>
> > -SMGL program staff

One of the health facility staff said that although maternal mortality had improved overall, there had been no improvements in a village that lay between the catchment area of two different rural health centers where SMAGs had yet to be deployed.

Summary

I was not able to draw any conclusions regarding maternal mortality based on the quantitative data, given that the outcome was so rare. Qualitative data indicate that staff on the ground, such as SMAGs, clinical mentors, and health facility staff, have observed a decrease over time.

3.1.8   Program Impact: Neonatal Mortality

Quantitative Results

I conducted an additional analysis to estimate neonatal mortality in Kalomo

versus the comparison area during the pre-intervention and intervention time periods

(Tables 20 and 21). The data do indicate a reduction in neonatal deaths in Kalomo

District during SMGL implementation, from 4.3% (67/1565) to 2.6% (61/2336), p<0.01,

with no change in the comparison area. When controlling for other factors, such as

mother's age, marital status, parity, child's sex, and asset quintiles, there was a significant

pre-to-post reduction in the odds of newborn mortality in Kalomo (OR 0.63, 95% CI:

0.42, 0.96) with no change in the comparison area.

Table 19. Newborn Mortality Among Infants Born in Facilities, Before and During SMGL, by Intervention or Comparison Area

Time Period	Newborn Mortality	
	Pre- SMGL	During SMGL
Kalomo **%(n/N)**	4.3 (67/1565)	2.6** (61/2336)
Comparison **%(n/N)**	3.4 (166/4880)	3.1 (154/4949)

**p<0.01

Table 20. Likelihood of Newborn Death Among Newborns Delivered in a Facility, Before and During SMGL implementation, by Intervention or Comparison Area

	Births No.	Newborn Death (%)	Odds ratio (95%CI)	Adjusted OR (95%CI)
Kalomo District				
Before	1565	67 (4.3)	1.00	1.00
During	2336	61 (2.6)	0.60	0.63
			(0.39,0.93)	(0.42,0.96)
Comparison				
Before	4880	166 (3.4)	1.00	1.00
During	4949	154 (3.1)	0.91	0.95
			(0.71,1.18)	(0.73,1.22)

***Controlling for mother's age, marital status, parity, child's sex, asset quartile

3.1.9 Program Impact: Other Ultimate Outcomes

Qualitative Results

Other outcomes not measured quantitatively but mentioned by participants in the interviews included a reduction in complicated referrals (n=2; health provider and SMGL program staff), improvement in infection prevention (n=2; SMGL program staff), reduction in newborn deaths (n=1; SMGL program staff), and an increase in postnatal care (n=3; 2 SMAG and 1 SMGL program staff). A typical response regarding other outcomes of SMGL is:

> "I will tell you another one before I forget. When you talk of infection prevention, you go to a facility...each time they have a delivery, the baby has come back infected, meaning the standards of IP [infection prevention] are very poor. So what interventions, you make sure the labor ward are clean, the instruments are sterilized, and now you find the, all the babies you deliver when they come after 6 days, the cord is clean, there is no fever. So that's a plus."

> -SMGL program staff

There was mixed feedback on changes in stillbirth, with two respondents reported no change, and one reported an increase. This increase , however, was reportedly due stillbirths occurring at facilities and therefore being counted, whereas previously stillbirths in the community would not be known.

3.1.10 Program Impact Summary

There is clear evidence of SMGL's effectiveness on FBB. For delivery with an SBP, results from both types of data indicate no change, though the qualitative data tell a different story regarding the increased capacity of providers at the clinics to provide care in emergencies. There is some evidence of a positive change in maternal mortality using quantitative data, but no definite conclusions can be drawn, whereas using qualitative data most respondents indicated a positive change based on their own observations. There is evidence of a reduction in neonatal mortality.

Objective 2: Impact by Hypothesized Pathways

This section describes the results of a qualitative assessment of the validity of the

logic model and the Three Delay Model, which provided the theoretical underpinnings

for the SMGL program. I also provide quantitative and qualitative evidence of change for

the intermediate outcomes by which the activities of SMGL should have operated to

create the program's impact.

3.1.11 Validation of the Theoretical Model: Three Delays

The theoretical underpinning for SMGL is based on the assumption that in the

Zambian context, the factors contributing to the high rates of maternal mortality and

morbidity are due to the "Three Delays" and that program activities focused on

improving service utilization and quality of care at the individual, community, and

facility level will therefore improve the ultimate outcomes, by way of the specified

intermediate pathways. Below are the results from interviews with key informants about

what factors they believed were drivers of maternal mortality and home delivery in

Kalomo. It is important to note that during the interview I did not probe specifically for

challenges within each phase of delay but rather asked generally about challenges that

they observed in their own communities.

<u>Complications</u>

When asked about the complications that women presented with either in the

community or at health facilities, SMAGs and health facility staff listed nine: 1. abortion;

2. fetal distress; 3. need for newborn resuscitation; 4. bleeding during pregnancy or

postpartum hemorrhage (PPH); 5. prolonged labor; 6. retained products of labor; 7.

obstructed labor/need for vacuum delivery; 8. malaria in pregnancy; and 9. use traditional

herbs or medicines to speed labor, which can lead to complications. Postpartum

hemorrhage was mentioned most frequently as the primary complication that woman had

when arriving at facilities.

The Three Delay Model

Table 20 illustrates the challenges in the delivery of maternal health care in

Kalomo District as reported in the interviews.

Table 21. Challenges in Delivery of Maternal Health Care, by Phase of Delay

Phase 1: Deciding to Seek Care	Phase 2: Identifying and Reaching Medical Facility	Phase 3: Receiving Adequate and Appropriate Treatment

Community level
• Lack of education and access to information
Socio-cultural Factors
• Family-related
  o Need to care for children at home and not leave for mother's shelter
  o Relatives' negative influence (husband and mother-in-law)
• "Ignorance" and lack of education
• Traditional beliefs
Negative perception of care at facilities
	Come to the facility too late
	• Seek ANC late in pregnancy
	• Believe they can manage normal labor at home
	• Deliver at home by accident
	• Come to clinic too late to be referred
	Distance
	• Vast district; facilities spaced too wide
	• Population scattered
	• Referral centers far from facilities
	• Need to cross through large farms or game reserves
	Poor road and bridge infrastructure
		Insufficient equipment and supplies
		
		Referral center challenges
		• Kalomo District Hospital has no operating theater
		Human resource challenges
		• Leaving deliveries to untrained TBAs
		• Negative staff attitudes
		• Overwhelmed
		• Staff turnover
		• Weak clinical skills, especially for lay staff and non-clinical staff
		• No midwives at facilities
		• Nurses doing midwifery jobs without training
		• Overall shortage of staff

Phase 1: Deciding to Seek Care	Phase 2: Identifying and Reaching Medical Facility	Phase 3: Receiving Adequate and Appropriate Treatment
	• Rainy season challenges Transport challenges • Need ambulances • No transport to clinic or referral center available for families • No money for transport Communication • Need to find anthills (large mounds) for signal • Poor network coverage	

Factors that respondents mentioned that influenced the delay in seeking care were consistent with the Three Delay Model, such as limited access to education and information in rural communities, socio-cultural factors including family and traditional beliefs, and negative perceptions of care available at rural facilities.

Respondents frequently mentioned that women arrive at the health facilities too late, whether for ANC late in their pregnancy or for delivery. Factors leading to this included the assumption that women could manage their labor at home, or that they delayed making the decision to go to the facility until they were already into labor, leading them to experience complications on their way to or at facilities when it was too late for them to be referred.

Factors leading to the delay in reaching facilities included those from the Three Delay Model, such as distance from families' homes to the facilities, distance from rural facilities to referral centers, poor communication, poor road and bridge infrastructure and limited access to adequate transport, including ambulances.

Again consistent with the model, respondents mentioned factors contributing to challenges in providing adequate and appropriate treatment for woman in obstetric emergencies: insufficient equipment and supplies, inadequate facility capacity at the hospitals, including the lack of an operating theater in KDH, and human resource challenges. Chief among these was a shortage of staff, leaving many facilities with no midwife, and nurses or with non-clinical staff delivering care. Respondents reported staff feeling overwhelmed and having negative attitudes, with high rates of turnover compounding the problem. Respondents did not mention socio-economic and cultural factors such as legal issues, economic status and educational status.

The study population did not include recently delivered or pregnant women who were users of the facilities, so I was unable to capture factors such as perceived satisfaction with health outcomes and services or perceived distance, transport, or cost of accessing care.

Summary

The respondents' descriptions of the factors leading to maternal mortality in Kalomo and in their own communities were generally consistent with factors included in the Three Delay Model, which was used to develop and design the SMGL program and its key activities.

3.1.12 Intermediate Outcomes: Quantitative Results

Of the several immediate and intermediate outcomes mapped out in the SMGL logic model (Figure 2), only a small number were measured and quantifiable using the

ZamCAT survey and dataset. Primarily among these were indicators about service use

intent and service use behaviors during pregnancy. Several indicators that I had intended

to analyze were unreliable or had definitions that did not match what I needed for my

analysis, including: use of an ambulance, planned transport to reach a facility, proportion

of women who planned to seek care during pregnancy for perceived complications, and

the proportion of women who did seek care during pregnancy for perceived

complications.

Demand Generation: Service Use Intent

The proportion of women who intended to deliver in a facility increased from

86.0% (2445/2843) in Kalomo before to 92.5% (3299/3565) during the intervention

period, an absolute difference of 6.5 percentage points (95% CI: 5.0, 8.0, p<0.01). In the

comparison area there was an increase of 1.7 percentage points (95% CI: 0.9, 2.5,

p>0.01). This resulted in a 4.8 net percentage point increase in the intervention area over

the comparison area.

Controlling for mother's age, education, parity, number of children under five,

distance to the health facility, and asset quartile, the adjusted odds of intent to deliver in a

facility in Kalomo during the intervention was 111% greater (OR: 2.11, 95% CI:

1.46,2.71) than the rate before the intervention period (Table 21). The adjusted odds of

intent to deliver at a facility during the intervention in the comparison area was 34%

greater than before the intervention (OR: 1.34, 95% CI: 1.02, 1.77). In Kalomo, there was

a positive increase for actual delivery in a facility among those who intended to do so

during pregnancy (60.4% before to 66.8% during the intervention), and this difference

was statistically significant (p<0.01). There was a slight decrease in the comparison area

(67.4% to 66.3%) but this was not statistically significant.

Table 22. Likelihood of Intent to Deliver in a Facility, Before and During SMGL Implementation, by Intervention or Comparison Districts

	Number of Births	Intent to deliver n (%)	Odds ratio (95% CI)	Adjusted OR (95% CI)
Kalomo District				
Before	2843	24745(86.0)	1.00	1.00
During	3565	3299 (92.5)	2.02 (1.43, 2.85)	2.11 (1.52, 2.93)
Comparison				
Before	7503	6928 (92.3)	1.00	1.00
During	7596	7142 (94.0)	1.31 (0.99, 1.73)	1.34 (1.02, 1.77)

*Controlling for mother's age, education, parity, distance to health facility, children under five, and asset quartile

Demand Generation: Service Use Behavior

There are challenges in interpreting the results of service use behaviors since in

the ZamCAT, researchers provided study participants with clean delivery kits (CDK);

counseled women on pregnancy complications; and urged them to deliver in facilities.

Therefore, positive trends for both Kalomo and comparison districts would be expected

for many of these behaviors, and a greater change in Kalomo might result due to the more

intensive counseling and referral activities in SMGL.

In Kalomo, there were no differences in service use behaviors related to care

seeking during pregnancy, labor, or postpartum between the before and during-

intervention periods. In the comparison areas, however, there were some statistically

significant positive differences in care seeking for those with perceived complications

during pregnancy and labor. Women in both the intervention and comparison areas were

more likely to attend at least three or four ANC visits during the intervention period compared to before (Table 22).

There was an increase in the use of all CDK components in Kalomo District while there was a statistically significant decrease in the comparison areas. There was no difference in the use of specific CDK components but an increase in the comparison area. However, since ZamCAT provided CDK for all study participants, these results should be interpreted with caution.

Table 23. Relationship between SMGL and Intermediate Outcomes within Districts of Kalomo and Comparison Area

	Kalomo District		Comparison Districts	
	Before SMGL (n=2859)	During SMGL (n=3618)	Before SMGL (n=7559)	During SMGL (n=7644)
Service use: intent				
No. (%) of women who plan to seek care if complications arise (all complications)	2334 (81.6)	2794 (77.2)**	6554 (86.7)	6800 (88.9)**
No. (%) of women who plan to give birth with an SBP†	1857/2445 (76.0)	2565/3299 (77.8)	5667/6927 (81.8)	5928/7142 (83.0)
Service use: behavior				
No. (%) of women who sought care at a facility among those with perceived complications (any time)	238/352 (67.6)	201/283 (71.0)	1088/1429 (76.1)	679/8835 (81.3)*
Pregnancy only: swollen, bleeding, headache	146/217 (67.3)	146/211 (69.2)	600/859 (69.9)	416/534 (77.9)**
Labor only: long labor	91/160 (56.9)	43/72 (59.7)	407/566 (71.9)	239/305 (78.4)**
Postpartum hemorrhage	53/119 (44.5)	29/82 (35.4)	253/471 (53.7)	118/242 (48.8)
No. (%) who use any CDK component	2835 (99.2)	3582 (99.1)	7513 (99.4)	7611 (99.7)**
No. (%) who use 4 key CDK components (soap, gloves, razor plastic sheet)	2242 (78.4)	2871 (79.4)	5167 (68.4)	4898 (64.2)**
No. (%) who use all CDK	2134 (74.6)	2825 (78.1)**	5308 (70.2)	4985 (65.3)**
No. (%) who attend 4+ ANC	1241 (44.9)	1947 (55.0)**	2707 (36.7)	2714 (36.6)
No. (%) who attended 3+ ANC	2274 (82.3)	3081 (87.1)**	5704 (77.4)	6004 (80.9)**

†Among those who planned to deliver at a facility, those who indicated need for skilled assistance
*p<0.05, ** p <0.01

Supply Provision: Health Facilities

General Health Facility Characteristics

The health facility characteristics in both Kalomo and the comparison districts were similar at baseline with the exception of communication tools and reliable electricity, with the comparison districts having a higher percentage of facilities meeting both requirements (Table 23). In Kalomo, the only change from before to during the intervention was in the proportion of facilities with reliable electricity (18.2% to 63.6%, $p<0.01$). There were no statistically significant changes in the comparison area.

Obstetric Care

For both time periods, a lower proportion of Kalomo facilities met requirements for routine obstetric care than in the comparison areas. There were no statistically significant changes in routine obstetric care indicators in either Kalomo or the comparison area from before to during the intervention period, though in Kalomo there was a marginally significant positive increase in facilities providing active management of the third stage of labor (AMSTL) (63.7% to 90.5%, $p=0.07$). In Kalomo, only one out of six indicators of BEmOC had a statistically significant increase from before to during intervention: removal of retained placental products (0 to 40.9%, $p<0.001$). In the comparison area, there was a decrease in use of parenteral antibiotics for maternal infection (81.8% to 55.6%, $p<0.01$), and no statistically significant changes in other

BEmOC indicators. There were no changes in the two indicators for CEmOC in either area.

Newborn Care

Two of the three routine newborn care indicators were measured, with only one changing in the intervention district: thermal protection (9.1% to 68.2%, p<0.001), with no changes in the comparison area. I was only able to assess two of the seven indicators of BEmNC , including those newly proposed by Gabrysch et al. (2012). One of these had a statistically significant positive change from before to during SMGL in Kalomo, with no change in the comparison area: resuscitation of newborn with bag and mask (31.8% to 86.4%, p<0.001). The other indicator of BEmNC, Kangaroo Mother Care (KMC) for premature or very small babies, changed in both the intervention ((13.6% to 90.0%, p<0.0001) and comparison areas (58.2% to 87.0%, p<0.0007). Of the two CEmNC indicators, only availability of IV fluids for newborns increased in Kalomo (4.6% to 45.5%, p=0.002), with no change in the comparison area.

Using the originally proposed signal functions for BEmOC (7) and CEmOC (9), both of which include resuscitation of non-breathing baby with bag and mask, the mean signal function in Kalomo before intervention was 2.68 (SD 1.09) and increased to 3.86 (SD 1.39) during the intervention (p=0.003). There was a decline in mean signal function in the comparison area (2.51 to 2.33) that was not statistically significant.

Maternal Death Review

I found an increase in the use of MDR in the Kalomo facilities, from 7/22 facilities at baseline to 12/22 during the intervention period, though the findings were not statistically significant. There was a slight decrease in MDR in the comparison area, from six facilities before SMGL to four during the intervention.

Table 24. Proportion of Facilities with Signal Functions and Other Characteristics in Kalomo and Comparison Districts, Before and During SMGL Implementation‡

	Kalomo			Comparison		
	Before SMGL intervention (n=22) N(%)	During SMGL Intervention (n=22) N(%)	p-value	Before Intervention Time Period (n=55) N(%)	During Intervention Time Period (n=54) N(%)	p-value
Health facility characteristics						
Service availability 24/7 – Labor ward	22 (100)	22 (100)	1.0	54 (98.2)	51 (94.4)	0.36
At least 1 skilled provider[1]	20 (90.9)	20 (90.9)	1.0	50 (90.9)	54(100.0)	0.06
Communication tools[2]	4(18.2)	14(63.6)	0.005	22(40.0)	27(50.0)	0.29
Transportation for referral[3]	4(18.2)	9(40.9)	0.19	11(20.0)	6(11.1)	0.20
Reliable electricity[4]	6(27.8)	12(54.6)	0.07	32(58.2)	39(72.2)	0.13
Toilet or latrine – for clients[5]	21(95.5)	19 (86.4)	0.61	52(94.6)	54(100.0)	0.24
Reliable water supply[6]	18(81.8)	18 (81.8)	1.0	46(83.6)	45(83.3)	0.97
Routine obstetric care						
Monitoring and management of labor with partograph (any use)	18(81.8)	21(95.5)	0.34	51(92.7)	49(90.7)	0.74
Infection prevention measures for hands (soap or sterile gloves in labor ward)	18(81.8)	22 (100.0)	0.11	53(96.4)	53(98.2)	1.0
Active management of third stage of labor (AMSTL)	14(63.7)	19(90.5)	0.07	54(98.2)	51(94.4)	0.36
Basic EmOC	0(0)	0(0)		0(0)	0(0)	
Parenteral magnesium sulfate for pre-eclampsia	5(22.7)	6(27.3)	0.73	10(18.2)	12(22.2)	0.60

	Kalomo			Comparison		
	Before SMGL intervention (n=22) N(%)	**During SMGL Intervention (n=22) N(%)**	**p-value**	**Before Intervention Time Period (n=55) N(%)**	**During Intervention Time Period (n=54) N(%)**	**p-value**
Assisted vaginal delivery	1(4.6)	4(19.1)	0.19	0(0)	0(0)	
Parenteral antibiotics for maternal infection	20(95.2)	19(86.4)	0.61	45(81.8)	30(55.6)	0.003
Parenteral oxytocic drugs for hemorrhage	20(95.0)	21(100.0)	1.0	52(98.1)	51(96.2)	1.0
Manual removal of placenta for retained placenta	6(27.3)	7(31.8)	0.74	10(18.2)	12(22.2)	0.63
Removal of retained products of conception	0(0)	9(40.9)	0.001	4(7.3)	3(5.6)	1.0
Comprehensive EmOC	0(0)	0(0)		0(0)	0(0)	
Surgery (C-Section)	0(0)	0(0)		0(0)	0(0)	
Blood transfusion	0(0)	0(0)		1(1.8)	0(0)	1.0
Routine newborn care						
Thermal protection[7]	2(9.1)	15(68.2)	<0.0001	26(47.3)	28(51.9)	0.70
Immediate and exclusive breastfeeding	20(90.9)	20(95.2)	1.0	51(92.7)	52(98.1)	0.36
Infection prevention including hygienic cord care	NA	NA		NA	NA	
Basic EmNC						
Resuscitation with bag and mask of non-breathing baby	7(31.8)	19(86.4)	0.0002	17(30.9)	18(33.3)	0.79

	Kalomo			Comparison		
	Before SMGL intervention (n=22) N(%)	**During SMGL Intervention (n=22) N(%)**	**p-value**	**Before Intervention Time Period (n=55) N(%)**	**During Intervention Time Period (n=54) N(%)**	**p-value**
Antibiotics to mother if preterm or prolonged PROM	NA	NA		NA	NA	
Corticosteroids in preterm labour	NA	NA		NA	NA	
KMC for premature/very small babies	3(13.6)	20(90.9)	<0.0001	32(58.2)	47(87.0)	0.0007
Alternative feeding if baby unable to breastfeed	NA	NA		NA	NA	
Injectable antibiotics for neonatal sepsis	NA	NA		NA	NA	
(PMCTC if HIV-positive mother)	NA	NA		NA	NA	
Comprehensive EmNC						
Intravenous fluids[8]	1(4.6)	10(45.5)	0.002	11 (20.0)	12(22.2)	0.77
Safe administration of oxygen[9]	1(4.6)	1(4.6)	1.0	5(9.1)	4(7.4)	1.0
Mean signal functions for B/CEmOC (Max 9)	2.68 (1.09)	3.86(1.39)	0.003	2.51(1.00)	2.33(1.39)	0.45
Other Variables						
Maternal Death Review†	7(31.8)	12(54.6)	0.13	6(11.3)	4(7.4)	0.53

‡ List adapted from proposed obstetric and newborn functions (Gabrysch et al., 2012)

[1] At least one nurse, midwife, general doctor or OBGYN at facility

[2] Functioning communication equipment (landline, mobile or radio). This does not include private cell phones unless the facility reimburses for cost of phone calls. (World Health Organization, 2014)

[3] Facility has a functioning motorized vehicle with fuel that is routinely available and can be used for emergency transportation or access to a vehicle in near proximity that can be used for that purpose (World Health Organization, 2014)

[4] Facility routinely has electricity for lights and communication (at a minimum) from any power source during normal working hours; there has not been a break in power for more than two hours per day during the past seven days (World Health Organization, 2014)

[5]The toilet/latrine is classified using uniform criteria for improved sanitation promoted by UNICEF. These include the following: Flush/pour flush to piped sewer system or septic tank or pit latrine; pit latrine (ventilated improved pit or other) with slab; composting toilet (World Health Organization, 2014)

[6]Improved water source uses uniform definitions for safe water sources promoted by UNICEF; these include the following: Piped, public tap, standpipe, tubewell/borehole, protected dug well, protected spring, rain water (World Health Organization, 2014)

[7]Thermal protection: drying baby immediately after birth, skin-to-skin contact with mother, wrapping, no bath in first six hours(AMDD, n.d.)

[8]Newborn intravenous fluid kit available in labor ward

[9]Newborn oxygen available in labor ward

†Facility performs regular maternal death reviews

Summary

There were few improvements in health facility infrastructure over the course of the SMGL project in Kalomo, and there was no change in the proportion of facilities meeting either BEmOC or CEmOC requirements. While there were only a few positive changes in obstetric care indicators in Kalomo (two of the nine assessed), there was no positive change in the comparison area. Likewise, of the six newborn care functions we were able to assess in Kalomo four showed a positive change in Kalomo with only one positive change in the comparison area. While not as comprehensive as anticipated by the SMGL program, these results do indicate a positive modest trend in facility level changes in the intervention area for specific activities, particularly those related to newborn care.

3.1.13 Intermediate Outcomes: Qualitative Results

Participants discussed several changes that fall under the category of immediate or intermediate outcomes in the program logic model. Table 24 illustrates the types of responses for each level of respondent (SMAG, health facility staff, SMGL implementer, government representative, and donor/implementing partner), which are organized into demand, access, and supply-side outcomes. Nearly all are positive; those in red highlight any that had neutral or negative outcomes, contrasting with the others.

Table 25. Frequency of Responses Regarding Change in Demand, Access, and Supply During SMGL Program Implementation in Kalomo District, by Type of Respondent

Type of Respondent	Demand	Access	Supply
SMAG (n=5)	- Community awareness (2) - Mothers' knowledge (3) - Communities don't need to use force/penalties (2) - ANC attendance (1) - Male involvement (2) - Perceptions of care at facilities (1) - SMAG proud of work (1)	- Mothers' shelters utilized (4) - Women accessing facilities (2) - Transport: Ambulance came (1)	- Human resources - Change in attitudes (1) - Capacity to handle emergencies (1) - Knowledge and skills: sensitization (1) - Equipment and supplies: - Lights and space (1) No change (1) - Women receive help (2)
Health Facility Provider (n=8)	- Community awareness (2) - Mothers' knowledge (2) - ANC attendance (1) ANC no change (1) - Male involvement (1) - SMAGs ease work for staff (1)	- Mothers' shelters utilized (2) - Women accessing facilities (1) - Referral form - Eased our job (2) - Identify cases (1) - Learn from mistakes (1) - Pay attention to feedback (1) - Prepared to detect and refer (1) - Refer early (1) - Time to facility reduced (1)	- Human resources (7) - Capacity to handle emergencies (6) - Knowledge and skills (3) - Mentees receptive (1) - Available (1) - Mentees mentor (1) - Equipment and supplies (6) - Better equipped (3) - Ultrasound (2)

Type of Respondent	Demand	Access	Supply

		• Transport
		  o Ambulance picking up on time (1)
		  o No change (1)
		  o Starting to prefer maternal cases (1)
		  o Time to facility reduced (1)
		  o General change (1)
			o Lights and space (1)
			  o Test urine (1)
			
			• Handle higher capacity of patients (1)
			• Women receive help (1)

SMGL Implementer/ Clinical Mentor (n=6)	• Male involvement (2)
	• Pregnant women now know what to do (2)
	• ANC attendance (1)
	• Community awareness (1)
	• FP utilization (1)
	• Low SMAG drop out (1)
	• SMAG keep good records (1)
	• SMAG proud of work (1)
		• Mothers' shelters utilized (1)
		• Referral System (5)
		  o Refer early (3)
		  o Stabilize patients (3)
		  o Referrals better through mentorship (2)
		  o Prepared to detect and refer (1)
		
		• Referral form
		  o Staff can stabilize (1)
		  o Staff appreciate (1)
			• Human resources (6)
			  o Capacity to handle emergencies (6)
			  o Positive attitudes (2)
			  o Knowledge and skills (2)
			  o Mentees mentor (1)
			
			• Equipment and supplies (1)
			  o For cleaning (1)
			  o Ultrasound (1)

Government Representative (n=4)	• Accelerate decision-making at family level (1)
	• Male involvement (1)
	• Perception of care at facilities (1)
	• SMAGs
		• Mothers' shelters utilized (1)
		• Referral System
		  o Efficient (1)
		  o Successful (1)
		
		• Referral form
			• Human resources (4)
			  o Hiring of new staff (3)
			  o Positive attitudes (2)
			  o Capacity to handle emergencies (2)

Type of Respondent	Demand	Access	Supply
	o change traditional perceptions (1) o creating demand (1) o have power in community (1)	o Helps monitor women (1) o Hospital knows where to start (1) • Transport (1) o Ambulance came (1)	o Knowledge and skills (1) Equipment and supplies (2) o Better equipped (1) o Drugs available (1) o Logistics and systems (1) • Women receive help (1)
Donor/Lead Implementing Partner (n=3)	• Community awareness (1) • Perception of care at facilities (1) • Saturation of knowledge in communities (1) • SMAGs o taken up easily, and worked well (1) o Created demand (1)	• Referral system (2) o Cutting down the third delay o Prepared receiving staff (1) o Reduced (1) • Information and communication worked (1) • Transport didn't change much (late arrival of ambulances)	• Human resources (2) o Positive attitudes (2) o Capacity to handle emergencies (1) o Knowledge and skills (1) • No change in C-section rate • Districts made their own changes (1)

<u>**Demand Generation: Women's Knowledge, Perceptions, and Community**</u>

    <u>**Awareness**</u>

Across type of respondents, greater community awareness, improved women's knowledge and attitudes in the community, increased male involvement and the success of SMAGs in generating demand for ANC and facility delivery were identified as key, positive intermediate outcomes of the SMGL project.

> "The change in attitudes is that they have, they have found, they are very helpful because the women who were delivering in the homes would bleed and sometime, even, even collapse at home after bleeding and there was no help, but now they have realized as soon as they deliver here, if there is any, any excess bleeding, they have been, they have received a lot of help to stop the bleeding, so they would rather come here, deliver here. They have received a lot of help."

    -SMAG

In one case a SMGL staff member expressed witnessing a woman's awareness of the need to reach a facility, and how the woman's family's lack of understanding of the urgency ultimately contributed to her death:

> "And then at least mothers have wealth of information on when something goes wrong….we have had one woman who died even saying 'Me, I told them to move me to the facility early, but they have moved me late, now I am dying' …and she died, in a facility. But she was determined to go..., meaning that she got information, and knew what to do, but support from the family."

    -SMGL Program Staff

Respondents expressed that using community-based volunteers (SMAGs) was an effective strategy to deliver messages to pregnant women and in many cases their spouses:

> "They [SMAGs] are known by their community leadership, and they are known

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by their own communities whereby husbands are trying to call and say my…, my wife is pregnant, can you record her please?"

-SMGL Implementer

"SMAG training and the empowerment at the community level, um, you know often previous traditional birth attendants, other community workers, I think they got lots of good training, they were excited, they took it seriously and so they, they reinforced and got women to come to the clinics"

- Lead implementing partner/donor

Both SMAG members and donors also mentioned improved community-level perceptions of care at facilities, though I was not able to ask this of the actual users of the facilities.

Access: Getting to the Facility

Referral System

Respondents frequently mentioned the referral system and its impact on women accessing care. Half of the respondents (n=13), mostly health facility staff, described how the process for referring patients needing urgent care at hospitals had changed due to the program. SMGL program activities enabled them to identify cases and refer early, reduced time in getting patients to a referral center, and eased their job. Clinical mentors/program implementers highlighted both the stabilization of patients during the process and early referral due to the mentorship program.

"When we just started, a lot of mothers would be referred to facilities even in Choma and the facilities are just into Choma district go to the nearest government hospital, which is Choma, um, so the mothers would come in a state that was not good, you know, like but now with SMGL they would receive these mothers in a very stabilized form and we also introduced the, the referral…where they were

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actually asked to stabilize the mother, the referral forms were filled in to actually say what they had been able to do to the mother."

-SMGL Program Staff

"And also the nurses, it is just what we are now beginning to hear, that they were able to manage emergencies, they were able to identify women who needed to be referred, and also, from the referral, the, the, the referral sites, when they would be there saying when women come from SMGL district they are well stabilized. Before it would be a lot of work for us, rushing around doing ABCD but now they come, well stabilized, with notes on what needs to be done, what needs to be done, you know, so, so that was impact."

-SMGL Program Staff

Likewise, government officials highlighted the efficiency of the system and how the referral form itself helped staff monitor women and give the referral hospital a place to start. Respondents also mentioned learning from their previous mistakes based on the feedback system that SMGL implemented.

"Because you find that like I will give you an example for [rural health facility] itself. The time that we had two cars and we used to visit twice in a center. You will find that if they didn't put up an IV line, those people at [referral hospital] told them that you, no IV line was done or this and that they will improve, because the next patient will have everything on that patient. Meaning that it was effective to some while others never actually responded because they've never seen a feedback."

-SMGL Program Staff

Mothers' Shelters

Several of the respondents across all types, excluding the donors/implementing partners, mentioned the increased utilization of the mother's shelters as an important change due to SMGL.

"OK, some of them wait at home, then it depends on the...the EDD [Expected delivery date] date. If they know that their EDD is near, they will actually come a

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week or two. Some, some will come from very far, actually, and stay for a month at the mothers' shelter. Some, just a few days."

-SMAG

"…if you went to the so-called mothers' shelters and looked at the registers, you find a great number of women who attended there, because of the difficult situation, I would say those are achievements."

-SMGL Implementer

Transport

The third most often mentioned change in improving access was transport. Several respondents, including SMAGs, health facility staff, and government representatives, mentioned that before SMGL ambulances were not arriving to pick up patients and take them to the referral center. Some of the health facility staff described a reduction in time for referral due to improved transport and a change in policy for ambulances to prioritize maternal cases.

"From the time at least we have been again, even transportation of patients, I don't know because once you call for a, for an ambulance you tell them I have this.... complication I need transport they know that you have called them and they are (indicated) on time. So as of late you find you have called for an ambulance at 7 hours the ambulance will come at 15, but this time at least I don't know if they, the issue of it's like they have transport now, and it was (designated) to them, so now they are picking up the patient on time."

-Rural health provider

However, at least one health facility staff member cited that there was no change in transport at their facility, and this may have to do with their closest referral center being

outside of Kalomo District. Ambulances provided to Kalomo by SMGL did not benefit that particular facility.

Supply Provision

Human Resources

All types of respondents described changes in human resources due to SMGL, including changes in attitudes, with capacity to handle emergencies at the facilities as the most commonly highlighted change.

> "It was useful in the sense that uh it equipped me with knowledge to understand when a woman has PPH and what I should do. Before I call for an ambulance, because saving a woman starts here. It starts right there in the delivery...so if I know something here I can start something and before the woman reaches either Kalomo or Choma I have done something. Rather than just do nothing..."
>
> -Rural health provider

> "It's the time when I taught one eh nurse in one of the clinics, one because we had a number each, about PPH. And then we did a drill, new drill, this one, pre-test, drill, then post-test and then fortunately, I can't say...I don't know whether to say fortunately or unfortunately a case came [right yes] and she did exactly what I taught her, and she rang me. I think the following day when it happened she was thanking me so much for having made her aware of how to arrest the PP in a woman after delivery."
>
> -SMGL project staff

Other changes mentioned included improvements in knowledge, and skills, and attitudes.

> "Um, also on the manual removal of the placenta. They were taught on the manual removal of the placenta and also on the, the uh vacuum. In cases of obstructed labor, yes, on the vacuum...they were also taught, to do...a few simple procedures, but lifesaving. Lifesaving skills. Yes."
>
> -Government official

"Before the project, people had had knowledge, but perhaps the attitudes were not, people were not so alert. But with the coming of the project and a lot of sensitization, a lot of people, a lot people's attitudes have changed to handle…so people are more careful now to handle maternity complications than they were before. They had the knowledge, but somehow there is a change in attitudes in how to handle emergencies."

-SMAG

A few respondents described health facility staff who were formally receiving mentorship and then providing instruction to other health staff.

"I would say the same facility, [yeah] was just 1 nurse, she is the only qualified staff. And the others are just like supportive, so, working with her, because the mentorship started with her, then when she caught the concept, when I am out she will sit with the other staff, then try to mentor them as well [that's wonderful] so at times when she is not feeling well she will just say, no, check on the timetable, SMGL team is coming, please work with them, I am not feeling well, so you find that even the time when I went there the other time when I found her not-, unwell she said don't worry, we have been working with these people and I have already oriented them in the program, they know what goes on so you can just continue, [aside that] those supportive people, they are able to conduct deliveries now, [wow] they were people who were just like dispensing drugs, but to be taken from dispensing to the labor ward and to be able to conduct a delivery, even working with the TBAs, traditional birth attendants, you find that... .I would mentor her, but in my absence she would see to those people to say I am alone, in case I am not there you should be able to take up these patients...women should not go back home unattended to. So [yeah] you would find that even antenatal clinic, it can be done by lay supportive people. "

-SMGL Implementer

The government representative and donors likewise mentioned improvements in human resources, citing the hiring of new staff (contracted midwives), positive attitudes, changes in staff knowledge and skills, and improved capacity to handle emergencies at the facility.

"Another thing I think that health care, in terms of the health care workers themselves, we empowered the health care worker to feel we can do interventions. Number one, you don't need a lot of health care providers, I mean, we think we need a lot of numbers of nurses of midwives to implement change? We realize, the ones that you have, if you work with what you have, empower them with knowledge [yeah] let them have good referral services."

-Lead implementing partner/donor

"I think they felt trained and empowered, and then I think more than that it was having the mentors show up monthly and reinforce it."

-Lead implementing partner/donor

Equipment and Supplies

Not as many respondents mentioned changes in equipment and supplies. SMAGs identified few changes that they had witnessed at their facilities, with one saying there was no change, and one mentioning improved lighting and space. Three of the health facility staff said they were better equipped thanks to SMGL, and two mentioned new ultrasound machines that aided them in problem identification.

"For example when we suspected breech we were not sure, [the] presentation of the baby it was always a challenge. OK. For example, maybe you suspected um maybe twin pregnancy or, we could just refer. Or maybe the mother does not know her EDD, or those cases, we used to refer. But the coming of the machine, it has really helped us because it is not (just us alone). Even the clinics around we're (providing) to [Rural health facilities]...they refer their mothers to here just for the ultrasound services. It has helped us with the distance, referring mothers to [Referral Center]. And it also helps us to prepare, how to prepare for this mother. For example, we detect OK maybe this is a breech. We need to put up a plan. Are we going to handle this or no? It is easier for us to plan. Because what we can do with the ultrasound it makes our work simple. It just from there when we just plan, how do we plan this…so it has very helped us."

-Rural health facility staff

The SMGL implementers also mentioned ultrasound, and described the importance of new supplies for cleaning and disinfecting.

> "You could see some, because with, with the bleach, a lot of people used to clean their, especially the delivery packs, very effectively, I think even the infections went down…Gloves, even now, we give out a lot of gloves. Even now they only have one box which consist of about 200 or so, but we supplemented by supplying all these centers with gloves. So I thought with that they were working more better in a cleaner place. And cross infection was much less."
>
> -SMGL Implementer/Clinical Mentor

The government level respondent described more drugs being available and facilities being better equipped. In contrast, donors did not highlight major changes in equipment and supplies.

> "Also, when they go to, because what was happening is these center staff were not equipped. So even when a woman comes in with PPH,….but actually now they are equipped"
>
> -Government representative

3.1.14 Intermediate Outcomes Summary

Both the limited quantitative results and comments from the respondents about immediate and intermediate demand-side factors were consistent with both the planned and resulting outcomes outlined in the SMGL program's logic model. Overall, at the community level service use intent and service use behaviors increased, with more women intending to delivery at facilities, going to mothers' shelters, and accessing services. The referral system strengthened by SMGL led to more efficient and timely referrals and problem identification, and an increase in the existing facility staff's

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capacity for identifying cases and providing some basic care.

SMGL fell short in fulfilling the outcomes related to the supply-side factors outlined in the logic model. The provision of appropriate equipment and adequate staffing were not as successful, with only limited changes due to SMGL. The impact of SMGL on the provision of quality care occurred more on an individual level, rather than through systemic change.

Objective 3: Contributory Value of Components

This section describes the results of the key informant interviews regarding the implementation of planned SMGL activities and the contribution of those activities to overall program impact.

3.1.15 SMGL Intervention Implementation

Respondents were asked to describe the SMGL's key activities. Table 25 summarizes the activities that were highlighted, with a description of the activities using the language of the respondents themselves.

Table 26. Key SMGL Activities Highlighted by Informants

Demand: Education and Mobilize Communities
- **SMAGs**
  - Volunteer workforce recruited from the community; provided incentives
  - Engage headmen, chiefs, and community through outreach
  - Identify and monitor pregnant women in their community
  - Sometimes engage husbands in delivery of messages
  - Encourage antenatal care, transition to mothers' shelters, and facility delivery
  - Teach importance of facility-based birth, danger signs, birth preparedness, postnatal care, sometimes family planning
  - Refer and escort mothers to facilities
  - Sometimes notify officials of community-based death
- **Community Sensitization**
  - Basic community education and meetings
  - Involve chiefs and traditional leaders
  - Involve males
  - Clinical mentors sensitize [community members] at clinics
  - Communication Support for Health (local NGO) communication activities

Access: Improve Access to Health Facilities
- **Emergency Response**
  - **Referral system**
    - Identification of cases for referral by using the list created by Zimba Hospital and use of referral form
    - Detailed referral form provided steps for monitoring and stabilizing patient and minimizing time for referral
    - Feedback system provided doctor/nurse feedback from referral center to promote learning
  - **Transport**
    - Ambulances were provided; policy for use for only maternal cases sometimes supported
    - General transport support provided
- **Mothers' Shelters**
  - Referrals to shelter made at ANC; direct referral to antenatal ward facilitated
  - All mothers meant to be accommodated
  - Logbooks implemented to track mother's progression in shelters

> **Supply: Improve Availability and Quality of Care**
> - **Provision of Equipment and Supplies**
> - **Human resources**
>   - **Clinical mentorship**
>   - A separate team of nurse-midwives was hired by ZCHARD to conduct mentorship activities
>   - Activities included monthly visits to rural health facilities and hospitals to teach clinical skills and transfer knowledge
>   - All staff (midwives, nurses, non-clinical/lay staff) were included in drills
>   - Topics of drills included how to call for help, handling emergencies, infection prevention, newborn care, and specific obstetric conditions
>   - Style of teaching included focused, hands-on learning involving observation
>   - Mentors provided direct care to patients and observed mentees practicing
>   - ZISSP had a separate, parallel form of mentorship working with the DMO to identify gaps in skills and services at health facilities
>   - **Staffing health facilities improved with retired midwives contracted by CDC**
>   - **Formal training for rural facility staff in HBB and EmONC**

Demand

SMAGs

Across all types of respondent, the SMAGs were the most frequently cited SMGL component for creating service demand by educating and mobilizing communities. The SMAGs were described as a volunteer workforce recruited from within communities and provided small incentives for participation. They educated headmen, chiefs, and their own communities about safe motherhood. Their core activities were to identify and monitor pregnant women in their community; teach about danger signs, institutional delivery, and birth preparedness; encourage mothers to attend ANC; move to the

mothers' shelter before labor; and to deliver at facilities. Often SMAGs were reported to be referring and personally escorting women to facilities and notifying facilities of any community-based deaths of newborns.

Community Sensitization

Fewer than half of respondents (n=9) provided general comments about important community education activities under SMGL that were not specific to SMAGs. Two respondents highlighted the role of including chiefs and traditional leaders, and one reported the inclusion of men in the community. Communication Support for Health (CSH), an implementing partner focused on communications at the community level, was mentioned by one of the implementers as a partner in message delivery, and two respondents cited birth planning messages. One of the SMGL implementers mentioned how mentors would conduct basic education for community members while at the facility. Not one of the respondents specifically mentioned radio spots or media messages, which had been in the original SMGL implementation plan through CSH.

Access

Referral System

The most frequently referenced component of SMGL's access-related activities was the referral system. Respondents discussed the detailed referral form as a useful tool to help lead both formally trained (nurse/midwife) and non-clinical staff through clear steps for identifying complicated cases, and for monitoring and stabilizing patients as they prepared them for a referral center.

"They [SMGL] have helped us putting up the, the referral, the referral form, the referral form which covers almost everything so it makes our work simple, so when we have a refer a maternal case there is ...because everything is captured there"

-Rural midwife

"When you are filling out the referral form you are stabilizing the patient. It gives you a guide, things which you have forgotten you say uh! I have forgotten so it will guide you, to do the right thing. So I think the referral worked well."

-Clinical Mentor

"The pilot referral form is a lot of work…that is a lot of work, but it is good. It will tell you if I am bringing my woman to you, I am able to tell you what I have, the state that she is in so that even you know where to start"

-Government representative

The feedback section of the referral form–a place on the form where doctors and nurses at referral centers could provide a short message back to the referring facility about how the case was handled and the outcome–was mentioned by more than half of those discussing referral as a key learning tool. There were conflicting responses regarding on who at the hospital was responsible for writing the feedback, the doctor or the nurse. BU/ZCHARD was also mentioned as an important contributor in delivering the feedback to facilities.

Transport

Respondents also mentioned transport as a key element of SMGL's emergency response, though only half as many respondents mentioned this compared to the referral

system. Of those who discussed transport, most discussed the provision of ambulances, while others mentioned general transport support. Of note, one person highlighted that ambulances were to prioritize maternal cases only. One lead implementer/donor representative said there was little change in transport due to the relatively late arrival of new ambulances during the SMGL project:

> "…but somehow differences were able to be made without the transport, which I think is one of the bigger surprises, because we identified transport to be a big issue, and then in all of our districts and US government contracts and the slowness with which they move, none of our districts really got transport until the end of the first year, and so, any differences we saw in the first year, it would be hard pressed to attribute them to transport. "
>
> -Lead Implementing Partner/Donor

Mothers' Shelters

One third of respondents, all SMGL implementers and health facility staff, discussed the role of mothers' shelters as part of SMGL. All mothers were to be accommodated, and the shelters were reported to be more actively used. Health facility staff were reported to monitor women in the shelter. In some cases, a logbook was implemented to facilitate tracking of the women's progression during the last few days or weeks of their pregnancy. A few respondents mentioned the role of mothers' shelters in referring both from ANC to the shelter and from the shelter directly to the antenatal ward.

<u>**Supply**</u>

Equipment and Supplies

More than half of the respondents noted that the SMGL project was provisioning

facilities with equipment and/or supplies. Emergency kits, *jik* or bleach, and drugs were

often mentioned, as were other specific supplies such as cabinets, partographs, scales, and

delivery packs. Several respondents described the provision of ultrasound machines at a

few of the rural health clinics, and several mentioned the installation of electricity at their

clinics. One of the donors described the blood safety system, but none of the other

respondents mentioned this.

Human Resources

Clinical Mentorship

Nearly all of the respondents mentioned some aspect of SMGL's activities

relating to human resource development. The clinical mentorship program implemented

by ZCHARD was described by 19 respondents, with 15 different sources describing key

activities. The most frequently cited activity was teaching clinical skills and conducting

drills with staff at the health facilities. Clinical mentors themselves described teaching

anyone at the facility, not just the nurses, midwives, or trained clinical staff.

> "Mentorship itself for me, I would say it is one of the activity which Saving
> Mother Giving Life has really helped us. How? Because of (working on) the
> skills. When they come for mentorship they plan which topic, which lesson are
> we going to mentor this facility."
>
> -Rural Midwife

"…we go out there in the rural health centers and have to mentor the people we found, we find, in the clinics, regardless of whether nurse or general worker because you find that in these centers the women using that to deliver will…, so for them to have even the basic knowledge about how to deal with these women when they are in labor, we have to teach these people…And how to go about it, how to….find the complications, and advise them to refer most cases"

  -SMGL Project Staff

The style of teaching was described as focused, hands-on, and intentional. The mentors taught by having their trainees observe and learn by doing, and they used pre- and post-assessments to evaluate their teaching. The content included how to handle emergencies, prevent infection, provide newborn care, identify and treat specific obstetric conditions, review referrals, and use checklists. The most useful topics mentioned were PPH, eclampsia, shoulder dystocia, breech birth, and newborn resuscitation.

A few of the mentors mentioned spending overnights at health facilities as having been a very useful, but expensive teaching activity. Respondents also mentioned mentors providing direct assistance and care for patients upon arrival at the clinic, not specific to maternity, and helping to "clear the line" of patients to make time and space for mentoring.

"Some facilities when I would visit, we had to clear the patients before the mentors could do any activity. So I am a nurse, by profession, so I participated in the, just whatever I could do to help in clearing the patients, so that we could focus on mentoring the skilled providers."

  -SMGL Program Staff

The ZISSP implementing partner also conducted a similar, parallel mentorship program. This program was described as asking facility staff questions, identifying gaps

in care, and assisting with decision-making about handling emergencies. Funding

limitations for ZISSP were highlighted as one of the key differences between the ZISSP

and ZCHARD models, especially for transport to the facilities. ZISSP leadership

described attempts to work with the District Medical Office staff, who would attend the

mentoring sessions as well.

Staffing

Several respondents mentioned the hiring of 12 midwives directly contracted by

the CDC to operate in rural facilities that were facing severe staffing shortages. With

their long-term experiences, the midwives were helping to provide care and supporting

the existing health facility staff.

> "Because in some centers like our center, we employed a midwife, a retired a midwife…she is helping, she is teaching us, so even if even when she is out we are able to handle most of the clients, we are able to tell here there is a problem we have to refer… and since they have started I can say we have, like for us, we've never had a maternal death"
>
>   -Rural nurse

Formal Training

Nearly one third of respondents from all types mentioned formal training in either

EmONC or Helping Babies Breath (HBB) as a major SMGL activity. A few of the

respondents described how HBB was a training not just for clinical staff but for any staff

working at the rural facilities.

> "Apparently the HBB skills are not only for, for professional staff, but also for cleaners, and um, all those who work within the hospital that have been trained. I

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remember mentoring four, I didn't find a qualified staff, at eh one facility…., and eh I think I recorded this on my phone I think... I found 4 women, lay counselors, some of them were TBAs, they surrounded me and we did HBB together. We were, I was teaching them on how to put on the masks, and how to handle the ambu-bag, and just show them how to do when a baby doesn't breath."

-SMGL Program Staff

Other SMGL Activities

Additional activities mentioned by participants as core to SMGL included data collection, providing extra resources, maternal death review, and partner and visitor coordination.

Summary of SMGL Activity Implementation

Overall, responses from key informants indicated that there was a perception of strong fidelity to the planned SMGL activities. Those components not mentioned as often included distribution of "mamapacks" to women in the communities and community sensitization activities such as radio spots. Improvements in communications such as a mobile phone network were not mentioned, and there were only few mentions of any type of SMS system, mostly having to do with HIV care. There was little hiring of new clinical staff, mainly the retired midwives. Equipment and supplies were also not mentioned as often as other components.

3.1.16 Perception of Impact of Key SMGL Activities on Outcomes

Table 26 illustrates the perceived contributory value of four of the key SMGL interventions on program impact (facility delivery, mortality): SMAGs and community

sensitization; referral and transport; facility upgrade, including equipment and supplies; and clinical mentorship. Below is a summary of the top activities that respondents reported playing a role in the impact of SMGL.

Table 27. Number of Respondents Who Indicated a Positive Influence of SMGL Intervention Component, by Type of Respondent

Topic Area:	SMAG/Community Sensitization	Referral and Transport	Facility Upgrade	Clinical Mentorship
SMAG (n=5)	2	0	0	0
Health facility provider (n=8)	4	1	2	5
SMGL Program Staff (Mentor, Supervisor) (n=6)	3	5	3	3
Government (n=4)	2	1	0	0
Donor (n=3)	3	0	0	3
All (n=26)	**12**	**7**	**5**	**10**

SMAG

Of all the intervention components, the SMAGs were referenced most often as having a positive influence on outcomes, with nearly half of all respondents, including all types of respondent, citing them when asked about key SMGL activities (n=12).

> "Because before the initiation of SMAG initiated, there, there were a lot of maternal deaths because women had no advice, they didn't know the danger signs, they didn't know where to deliver from, but after, SMAGs were trained, and women were sensitized, the, the maternal deaths have reduced…..….since she became a SMAG, no one has delivered at home, most of them, she makes sure they deliver at the facility, or if they are referred, during antenatal by the clinic staff, she makes sure they go and deliver at the hospital"

> -SMAG [Translated from Tonga]

> "So what were the interventions? I think SMAGs were trained starting at community level, people report danger signs, they had the danger signs, when

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they saw those signs early they know what to do they come to the clinic. At the clinic the staff was there, referred early to the hospital, hospital maybe C-section done. At the end of the day the mother goes back. So there are a lot of indicators which can say, which we can say there's been an improvement. Even though I am not able to give figures, but I am able to see."

-SMGL Program Staff

 "So these SMAGs, they have played a very dynamic role in mobilizing the communities and also helping to change some of the traditional perceptions. Things like husbands would not be interested in having their wives deliver by male midwives or for some other reason they did not like their wives to deliver at the health facility."

-Government official

Clinical Mentorship

The activity with the second highest number of positive citations was clinical

mentorship: ten of 26 respondents stated that clinical mentorship had a significant impact

on SMGL program outcomes. The donors, SMGL program implementers, and health

facility providers all mentioned this activity, but government and SMAG respondents did

not.

"One thing with the mentorship component what we taught them, if you have knowledge, don't hold it to yourself, share it with the younger you know, younger nurses and midwives. From the provincial level, because we have worked with the maternal child health coordinators, we have clinical care specialists at the province, and their work is really to go down and mentor, [yes] at the district level. Before SMGL they would go in and ask, oh do you have any problems and then they would walk away. Well we tried to, to you know, not just say that it happens in every province, but what we saw is that wasn't very hands-on [yeah] what we showed them is when you go down to offer technical support, to the facilities, don't stand and just ask them questions, work with them, if they have patients, see the patients with them, finish the volume of work and then sit with them and ask them if they have any challenges or if they, I mean, for

example, if there is um a breech delivery, work with them, show them how to do a breech delivery. If they have a postpartum hemorrhage don't wait for them to deal with the complication and then tell them you could have done this. Get your hands as well and get in the weeds and work with them"

-Lead Implementing Partner/Donor

"Yes, we have benefited a lot…I think we have benefited in terms of skills like I said I am non clinical and being non-clinical staff means I have, I have to learn a lot of things by the mentors, so that helped a lot, because without their support I would have not been able to manage to help mothers, but I manage to help."

-Rural health center staff

Others Activities: Referral, Transport, and Facility Upgrade

Referral and transport were cited as positive SMGL intervention components, mostly by SMGL program implementers, plus one government official and one health facility provider, but not donors or SMAGs.

"I remember once time we were passing through one of these hospitals, checking on our feedback boxes, and the nurse just walked to us and said 'Hi, how are you?', we said 'Oh, fine'. 'Oh you've come to check on your box,' then I responded 'Yes, we want to see how many referrals you have posted here.' 'Oh! We have a number of them, just open. Those are from some time back, but of late, we have received, we haven't been receiving many complications or referrals from these facilities...what are you people doing?' Yes...it's like, 'You are doing so much, we stopped receiving referrals, complicated cases from this area.' Because previously they would receive a lot of complicated cases of PPH, eclampsia, shoulder dystocia, other...but of late, they have reduced, according to her report, and she is in charge of the maternity ward [sure, sure]… 'The number of referrals has reduced, we used to receive a lot of referrals from this facility, now it is going down, what is your role?' So I started explaining to her, and she said 'Ha, no wonder this number has been going down because we had a lot of referrals from this area.'"

-SMGL Program Staff

Facility upgrade was only noted by a few SMGL program implementers and
health facility workers, but not SMAGs, government-based respondents or donors.

3.1.17 Reasons for Success

Beyond the key activities that influenced perceived changes in outcomes, several
sources cited more general reasons for SMGL's apparent success. These included
government-level factors, implementation logistics, and other seemingly minor but
important factors. Table 28 illustrates these additional reasons for program success
offered by respondents.

Table 28. Reasons for SMGL Success Cited by Key Informants

Government-related
• Fortuitous government environment
• People involved: Change of key personnel, DMO support, and supportive leadership
• Plans:
o Aligning with GRZ and operationalizing existing national plans
o Engaging districts/purposively selecting districts
▪ Kalomo on the main roads
▪ Kalomo willing and able to participate
Implementation-related
• All factors together – not just one
• Intervention was low-tech
• Interaction with DMOs office (e.g., sharing clinical mentor schedules)
• USG partners and clinical mentors showing up as a morale booster
• Partner collaboration
o Unique CDC-USAID collaboration
o Community engagement
o Concerted efforts of all implementing partners
Other Comments
• "Reach their hearts"
• Relationship building
• Teamwork

Objective 4: Barriers to Scale-up and Replication

3.1.18 Challenges to Continued Program Implementation, Scale up and Replication

When questioned about challenges with the SMGL program and outstanding gaps in the provision of maternal care in Kalomo District, respondents cited a variety of gaps in demand-generation activities, access issues, and challenges in the supply of quality, accessible services. Table 28 illustrates these challenges.

Table 29. Challenges in SMGL Implementation and Strategies for Improvement

	Gaps or challenges	Strategies to Improve
Demand		
Community Level	• Traditions take time to change • Women don't know Estimated Due Date (EDD), leading to late presentation to clinics • "Mamapacks" were delivered late then stopped due to concerns not having enough	• Work with community leaders to change social norms • Continue SMAG sensitization activities • Intensify health education program • Focus on pre-pregnancy education with adolescents and young women
SMAGs	• Demand for SMAGs outweighs supply of trained volunteers • Long distances to women's houses and facilities • Transport to escort women to facilities • Reliance on unpaid volunteers from communities • Incentives inconsistent and sometimes lacking • No SMAGs for some villages • Seasonal access issues to get to households	• Continue to motivate and provide incentives for SMAGs to volunteer • Continue to train additional community members as SMAGs • Facilitate communication between SMAG and facilities (e.g. provide mobile phones, radios)
Access		

Emergency Response	• Communication:
	  o Weak network and ongoing challenges
	  o Mothers' inability to communicate directly with SMAGs
		• Communication:
		  o Improve the mobile network (more towers)
		  o Use SMS for communication between facilities and providers

	Gaps or challenges	Strategies to Improve

	• Referral System:
	  o Clinics don't always refer patients in need
	  o Late referral due to transport issues
	  o No link with nearest referral center
	  o Referrals during labor mean ANC strategy is poor
	  o Form needs changes
	  o Facilities don't always provide correct referral information
	
	• Transport:
	  o Ambulance issues: funds for maintenance, too few vehicles
	  o No referral transport for ultrasound
	  o Impassable roads
		• Referral System:
		  o Refer during ANC
		  o Change form
		  o Provide more feedback to RHC providers
		  o Utilize DMO regular visits for delivery of feedback
		  o Obtain transport support for DMO to visit more often
		• Transport
		  o Zonal transport (ambulances)
		  o More ambulances
		  o Provide transport refund scheme (e.g. SMGL Uganda)
		  o Improve bridges for rainy season issues

Mothers' Shelters	• Not every facility has an operating shelter • Often they are overcrowded • Poor condition • Mothers' belief that they need supplies to stay in the shelter	• Improve mothers' shelters
Supply		
Facility Improvement	• Not enough focus on infection prevention • More space for labor rooms and postnatal wards • More space for ANC counseling • Staff housing	• Provide *jik* and other supplies • Provide training in infection prevention • Provide capital for projects to improve space • Provide a "friendly maternal corner" in facilities for health

	Gaps or challenges	Strategies to Improve
		education and information
Equipment and Supplies	• Supply deliveries were delayed and reliant on the clinical mentor visits rather than a routine, reliable source • Not enough: delivery packs, light, partographs, drugs, lab facilities • Need for more ultrasound services • Stock out of drugs, staff not checking on expiration dates • Substandard materials in huge shipments from SMGL	• Work on supply chain for timely delivery • More delivery beds, sheets, blankets • More partographs
Human Resources	• CDC-contracted midwives may not be sustained by government • Lay staff have weak, insufficient clinical skill • Nurses overwhelmed by demand • Rotating/shifting staff • Negative staff attitudes towards patients • Staffing issues: absent midwives, inadequate staffing types, lack of specialty training, non-clinical staff only	• Hire contracted midwives permanently through the government • Hire more nurses and midwives • Hire other staff (e.g. cleaners) • Continue training for lower-level staff • Promote respectful care • Focus on skill development at health centers: monitor all women with a partograph • Integrate services such as FP and cervical cancer; focus on newborn
Clinical Mentorship	• No DMO involvement on ZCAHRD teams • Overnights too expensive • Parallel mentorship teams • Ran out of teaching supplies	• Work directly with DMO from the start, integrate mentor teams • Identify local mentor to provide ongoing support • Provide follow-up mentoring

	Gaps or challenges	Strategies to Improve
	- Staff at facilities busy - Too much time spent traveling; transport to get to facilities limited - Funding: ZISSP limited in ability to provide mentoring - No mentor exchange visits as planned	- Provide more skills training by mentors - Provide more teaching aids (checklists, posters, etc.) - Train all mentors in EmONC - Mentor symposia and meetings plus incentives
Training	- Not enough EmONC provided - Hard for facility staff to get more formal training	- Train more rural nurses and midwives in EmONC - Provide more formal training in midwifery

Demand Generation Challenges

Ten respondents across all types mentioned challenges with demand-generation activities, especially with the SMAG program. One health facility staff member shared her concern about limited SMAG coverage, indicating that in a remote village that was part of her catchment area there were persistent challenges in preventing maternal death, and that a SMAGs had not yet been deployed there.

> "Most of the home deliveries we are experiencing they are coming from, we have a certain village, but it is very far from here, so it is like they are in the middle of a next clinic, and here, so they, and we don't have our volunteers in that area."
>
>   -Rural midwife

Current SMAGs faced challenges in reaching women in their communities, as village homesteads are scattered and far from one another. Without support such as a bicycle for transport, they faced significant challenges in reaching women and escorting them to facilities.

> "So the most challenge she is facing is long distance, to visit her clients for postnatal, so after training they were given bicycles, but not everyone was given so they have to share, so in her case she's got some villages which she is overseeing, of which the other village maybe say in the north, the other one in the south, so maybe she is called, from someone who has delivered, she has to walk on foot, so (the biggest) challenge is long distance, and walking."
>
>   -SMAG (Translated from Tonga)

Access Issues

More than half (n=15) of the respondents mentioned access issues as key challenges in the SMGL program implementation. The issues were centered around

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communication, mothers' shelters, the referral system, and transport. Most of the respondents focused on the referral system.

Communication

Two respondents identified persistent issues with the communication network as a major challenge for women accessing care at an appropriate level, and one mentioned the issue of women not being able to communicate with SMAGs due to a lack of access to mobile phones or a network.

Referral System

Most respondents described ongoing challenges with the referral system, ranging from issues with communication and transport leading to delays; having no link with the nearest referral hospital, leading to challenges obtaining transport; and the expense of production and distribution of the paper referral forms.

> "BU/ZCAHRD we, we came up with the referral forms, pilot referral forms, which were done at the cost, these are sort of books, but when we are gone, I don't see, the government institutions, because of lack of funding, so they might resort back to using plain papers"
>
> -SMGL project staff

Despite the usefulness of the form in providing a structure for health facility staff to stabilize patients, sometimes the information was inaccurate, so that staff at the referral centers couldn't rely on it. There was a discrepancy between what the staff believed they were providing the hospital and the actual usefulness of the information.

"The other thing that usually comes with them is the antenatal card, but the biggest challenge on that is that, um, the past history is not always accurate. And same with that form, it depends on who the interviewer is at the clinic, and how, how much they interrogate the patient, because like sometimes you are misled by that information and you are getting wrong information so that was like a big challenge."

-Hospital-based provider

Ten respondents, mostly health facility staff, identified issues with the referral feedback system. They would often learn of their patients' outcome from family members, and would receive feedback on the diagnosis and treatment they provided only if clinical mentors collected forms and reviewed them during mentorship sessions, but often this occurred months after the patient was referred.

"On the feedback I think, eh,... because I don't know the proper procedure, if even nurses are supposed to collect but it's like if we just wait for the... team to pass by and bring the feedback. So at times you find that you are anxious, want to know what happened to your patient but at times you have to wait for the whole month, then maybe we just see the patient coming or bringing the baby for postnatal visit at six days…so you…find out from the patient…before the feedback comes."

-Rural midwife

Staff at the hospitals were thought not to pay attention to the feedback section, giving it low priority.

"We found a lot of referral forms not filled in, and yet it's a main hospital, with quite a good number of staff, but they were not sitting down to input what they were able to do with the mother…most of them say no, the information they had, but they felt they were sometimes too busy. Too busy to just sit down and write….I think it's an issue of staff attitudes. Because the others were able to fill in, and be able to, to input in the boxes for us to bring back."

-SMGL Project Staff

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Transport

Nine respondents cited issues with accessing ambulances provided not just by
SMGL, but the district, funding for fuel and maintenance, and other transport-related
issues such as no transport for ultrasound referrals and mentors, and impassable roads
even when transport was available.

> "Yes, as soon as they had left they called again, another center called and said we
> need the ambulance, so that means you have to go to the other place"

> -Government official

> "I know, like, they helped with the transport issue, as far as, you actually need
> good transport to get the patients and bring them, but, and some of it is still
> logistically hard just because of the environment, because like maybe you leave
> from Kalomo or Zimba and it's four hours from here to get to that clinic, to pick
> the patient up and then come back you are talking… "

> -Hospital-based provider

Mothers' Shelters

Five respondents across types described challenges with mothers' shelters: they
were either not available at all facilities, at or above capacity, or in poor condition. This
discouraged mothers from staying, and led to mothers arriving too late for proper
treatment and referral when necessary.

> "Yeah, just the general condition of the mothers' shelter, it's like, not ah, an
> encouraging thing to want to come to stay there, maybe it's is a factor to play in
> why they don't turn out"

> -Hospital-based provider

> "But like eh our experience here most of the people are coming from very far,
> they are at the mothers' shelters, and also those who are nearby, because we have

very limited space at the mothers' shelter, so those that are nearby, we advise them to wait from home, but to come when labor starts, [yes yes] so we find at times they will come on time, at times they will delay, when they are coming they are fully dilated"

        -Rural midwife

Supply

Nearly all of the respondents (24 out of 26) specifically mentioned challenges and gaps in SMGL's provision of quality care. A general concern was that the successful demand generated by the SMAGs at the community level overwhelmed the system's capacity. This was expressed as a caution for the future districts planning to implement SMGL.

"Yeah, one of the challenges they will definitely run into is that, eh, they will...create a lot of demand for facility deliveries. We, we feel it as well. There will a lot of demand because there will be little structures to incorporate all of these women. In terms of delivery rooms, in terms of mothers' shelters, in terms of…so that will be there, so they will see how do they handle it, how do they do damage control…to make sure that they don't discourage these mothers."

        -Government official

Human Resources

Most of the respondents (21 out of 26) discussed challenges related to human resources. The predominant issue was staffing at the health facilities, with inadequate staffing types most often mentioned, as well as having no midwives, absent midwives, a lack of specialty-trained staff, and having only non-clinical staff available.

"For Saving Mothers Giving Life you need a midwife, you need a rural based clinical officer. Um, you need a nurse with experience if you have to use an

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ordinary nurse but the best is a midwife. There are very few midwives in these facilities. And not only that, in just an ordinary nurse, Kalomo was struggling to have properly trained personnel, as a result we used Environment Health Technologist with no idea about nursing or midwifery."

-Government official

"So she says that it is actually the number, if, if the number of midwives were to increase there are times when midwives have to be called for workshops or they are on leave, or something just happens and they have only one midwife, so it leaves the facility without a staff skilled attendant. That means whoever remains here are not midwives, so the women are at the mercy of anybody else who has no skills to conduct the deliveries. So she would rather have many so if one is out, there are, there's one or two remaining, one gets sick, one of two...one gets, goes on leave, there is always somebody there."

-SMAG

A few respondents mentioned that nurses were overwhelmed by the demand, and there

were challenges with lay staff's weak clinical skills and a lack of adequate mentorship.

"think, I think there is a story there. [yeah] but then again the challenge I think that we had is we had this group of extra, eh, cadre of people in the community that were ready, we've trained them, this knowledge, they want to increase the demand, however, we did not prepare the facilities in terms of the health care providers who they themselves were challenge with this extra volume of people coming, how could they deal with the SMAGs? They are not health care providers, they are not under the Ministry Of Health or Ministry of Community Development, Mother And Child, and at the same time, they are there saying we are not delivering these women in the community anymore we are bringing them to you. So what we saw in some of the places where the health care workers were overwhelmed, they were still using the SMAGS or traditional birth attendants, to deliver the women in the maternity"

-Lead implementing partner/donor

Despite many advances in mentorship, the referral system, and education, the hospital

staff still gave examples of how this was insufficient.

"One example I can give was like, last week, there was a rural health center, Mobanga, which is Kalomo district, for some reason they were attempting a vaginal breech delivery there, they even cut an episiotomy, I don't know why, that was at 21 hours at night, they got to Kalomo hospital at 3 o'clock in the morning, then they got here to Zimba at like at 5:30 in the morning so I don't know what happened...whereas, the thing was, the patient, they knew the patient was breech. They were keeping her there for two weeks because on the antenatal visit on 11 September, on the antenatal visit, 20, uh, 18 September breech and she went into labor two weeks later on the 25th, so they had two weeks to refer the patient, why the patient didn't get referred, I don't know, she wasn't told, and she said she didn't have money, or...so when they come, well then, it's a dead baby. We had to do a Caesar just to get the baby delivered, then it's a waste of a Caesar because they baby has already died, whereas if she had just come we would have done a Caesar any time in those two weeks period."

-Hospital-based provider

Finally, even with the SMGL project activities that have been deemed successful, there are challenges in terms of sustaining them over time In the case of the CDC-contracted midwives, there were concerns that this is only a temporary solution.

"Well, government has got limited positions so they cannot absorb as many of them as there are positions. In fact government even before the SMGL came, it was already employing retired midwives. So these came more like vertical. They had positions, but (SMGL) was going to pay them...so at the moment they are still in contract with CDC, for another 6 months or so, so we don't know what happens after that..."

-Government official

Facility Improvement

Fifteen of the respondents described some challenge or gap in the facility, equipment, or supplies. Clinical mentors identified the need for a focus on infection prevention, and several respondents identified a need for more space at the facility, either

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for labor rooms, postnatal wards, or ANC counseling. Staff housing was also an issue.

There were 21 references to the need for more equipment and supplies, ranging from running water and electricity to delivery packs and drugs. Issues with supply ordering were mentioned, focused on concerns about the SMGL's procurement process.

> "There is an also an issue of buying substandard things. So, people who procure, I question them very much…the issue of procurement, buying expired things, and buying substandard things. Most especially when you look at the amount of money involved. So that one I think is very, very serious."
>
> -SMGL program staff

The mechanism of supply delivery was also of concern, as it relied heavily on the clinical mentorship team visits.

> "Even the supplies, it has been our teams taking the supplies, not the medication but the equipment, supplies, to the facilities whenever they would be visiting, but when, when we leave Kalomo what's going to happen?"
>
> -SMGL program staff

Clinical Mentorship

All of the clinical mentors identified challenges in their program, and the most frequently cited was the lack of DMO involvement with the SMGL program, which led to parallel mentorship teams, one with ZCHARD and one with ZISSP.

> "Our SMGL coordinator, who you will meet, also used to do her own mentorship, but now, and then our team used to do that, so she would go with government people, but we would have trouble getting government personnel with us from the district so that they are part of this team, and we are all trying to build one mentorship team, so we found that there are two teams. So we come to the end of Phase 1 and we find that we have not actually built a mentorship team"
>
> -SMGL program staff

Mentors also cited issues with running out of teaching supplies, working with busy health facility staff, the need to standardize protocols, and spending too much time on the road.

> "Because effective mentorship, per se, should start, you wake up with the staff as they come with the facility you are with them from then...but what happens here is that the time they are working and seeing a lot of patients, you are traveling. You have very little time to spend with them and when you reach there maybe there is an emergency and maybe you..."
>
> -SMGL program staff

Transport to get to facilities and expenses associated with both the ZCHARD and ZISSP mentorship programs were also challenges that respondents dealt with during SMGL, and that they forecast would be an issue in the future. The most beneficial mentoring strategy- spending overnights at facilities, as cited by some of the clinical mentors-was also the most expensive.

> "We did that, it was wonderful, but it was, it was so much a drain on the coffers…yes, yes, the limitation was, the limitation was it was a drain on the coffers, but it is the best strategy."
>
> -SMGL program staff

Training

Three sources mentioned issues with formal training: there were absences at the provided training workshops, not enough EmONC training, or it was hard for current health facility staff to obtain further formal training due to demands on their time or their family situation. Several respondents working at health facilities had not received EmONc training, including one of the clinical midwives, even though they wished they had.

<u>**Other General Challenges**</u>

There were several other general challenges to the SMGL program, including the need for data to support decision-making at the ground level by program implementers.

"I think I'm interested when I'm working, say for the year, and I am working at collecting data, after three months, which is a quarter, I think I would like to see a situation whereby we see, as SMGL, we review the data, look at our indicators, look at the indicator, which, are, are going up, which are now going down, because it helps in planning, but what I see is, eh, that we submit data, every month, we go and collect the data, but data is analyzed at the higher level, but it never comes (back)"

-SMGL program staff

Also mentioned was a gap in the provision of family planning services. Patients' fear of hospital death could also be a challenge. One health facility worker described a story where all the proper referrals were made and advice given, yet due to the woman's experience at the hospital, she died. This story indicates a further need to counsel women and their experiences at hospital.

"There was this woman who came in...the nurse when examining her palpation found some strange object down there, so she thought maybe this woman had placenta previa, just from palpation, because she was highly pregnant and the head was floating, so she said go to [rural health facility] where there is a scan ultrasound, and then she went to [rural health facility] and it showed nice placenta previa. She came back to the clinic, the nurse read and said your case is for [referral hospital]. She came...and...I think she was having forced labor. She came back to [rural health facility], and the nurse said no you have to go to [referral hospital], for sure it was forced labor, she went to [referral hospital] and...they did another ultrasound, and it was placenta previa, type two or something like that. She was in the ward for I don't know how many days, close to a week. Now the unfortunate thing...the woman who was next to her died for some reason in in [referral hospital], so she looked and she says, 'If this one can die, I am the next

one', she ran away, went back home to the village, now she, she, she came, she

started having true labor and she came to, to [rural health facility] bleeding, and

the nurse was there, didn't even touch her, all that she did was go to the referral

book. Unfortunately there was a [track, she came with a track], yes, and that's

how, when she died on the way, she didn't even reach there. She bled until she

died. So that was the cause of her death."

      -SMGL program staff

Role of Government

Nine informants–mostly SMGL program staff, government personnel and

donors–mentioned challenges with the role of the government. Most frequently

mentioned was the lack of DMO ownership.

> "Issues of integration come here, because the DMO should show ownership of the
> SMGL project, because one day BU and, or ZCHARD will be gone, so we are
> talking of continuity of care. When we are going the DMO should be able to pick
> it up where we leave it and continue. "

      -SMGL program staff

The provincial government's lack of involvement and issues between the government and

donor agencies regarding communication and the transfer of project activities were also

mentioned. Lack of understanding of the project context even at the highest level at the

SMGL project headquarters, in Washington, DC, was also an issue.

Implementation Challenges

Several issues with actual program implementation were cited across type of

respondent. These included leadership not being asked to participate in national level

trainings, inadequate office space for project staff to organize and lead coordination

efforts, a slow start, and the system being slow to change. One respondent indicated that the phased implementation may have led to the delayed impact on outcomes.

Exit Strategy, Funding, and Sustainability

Several issues regarding an exit strategy, funding issues, and sustainability challenges were highlighted by the respondents.

> "The model of funding, the model of doing things like in SMGL, it's inherently very expensive. To save one woman's life, using the SMGL model, is extremely expensive, OK. It's much cheaper when you do, when you pool funds, with a through basket funding and you deploy a response. What Ministry of Community Development, Mother and Child Health is able to do if assisted with half the amount invested through SMGL, it's a whole lot more then when you mobilized one project dealing with communication, one project dealing with bringing ambulances, one project dealing with bringing what...you look at the overheads which are inherent there, look at the stuff, it's a very, very expensive model. And inherently, therein lies the difficulty that can least be replicated. And if you were to replicate that type of thing for the whole of Zambia, it's unsustainable…It's expensive. So inherently, it's the model, the model, which has the, has the flaws."

> -Government official

In contrast, donors highlighted that there had already been government support and that while there will be challenges; the exit strategy shouldn't be as problematic as many on the ground expressed:

> "You know, I, I know if we walk away from all of our activities tomorrow, it'll cause problems, but I also know that the government continues to put resources in, you know, we, we, you know the blood bank is a great example. They went from us supporting everything to us supporting less than a third of it, you know, and so, there is political will to keep the ball rolling. And so, if we are smart, we will tap into that to keep it going."

> -Lead implementing partner/donor

Summary

There were challenges and gaps in program delivery across all levels: demand, access, and supply, with most of the issues being related to access and supply. Human resources and facility improvement continue to be major challenges in the provision of quality care at the community level. Issues with SMGL's actual implementation and integration with the government caused several respondents to have concerns about sustaining activities that have been the key to improving outcomes. This also caused them to question how the model will be applied without similar challenges in other areas.

3.1.19 *Strategies for Improvement*

Respondents mentioned several strategies and suggestions to address each type of challenge, which are also listed in Table 28. Most suggestions corresponded with the identified gaps. Not included in the table, but critical to SMGL's next phase of implementation, are several other areas that respondents discussed, including a change in the government's role in implementation and improved implementation strategies.

Role of Government

Ten respondents of all types, except for SMAGs, mentioned some way that the collaboration between the government and SMGL partners should change both for improving operations in Kalomo and for the program's future expansion. There were general concerns about the government and the SMGL partners needing to provide a clear plan for moving forward together:

"Looking at what they have done, I would say they have done a good job so far, yeah, but eh, as they are leaving to other districts I think (in relation) to the Ministry, they are supposed to really see the way forward together...before finally SMGL completely goes out to other districts so that even if they completely go, we should not see a gap".

-Rural midwife

GRZ Ownership from the Start

Respondents expressed the need to obtain government buy-in and support from the start, and to fund SMGL through existing systems rather than creating any type of parallel or vertical mechanisms.

"You see the plans are there, the roadmaps are there, what needs to be done, it's not rocket science, what needs to be done is known, it's easier, it's cheaper, and there's more bang for the buck when you invest through an existing system."

-Government official

One example in particular was the contracted midwives. While having the CDC hire them directly may have been a short-term benefit, their employment might not be sustainable.

"Unlike Kalomo, Eastern Province maybe put more support into the provincial health office directly which means the government hired the people, so, so they, they hired their midwives through the government…instead of through an implementing partner, which took us much longer to implement…(The) good news is, the provincial health officer does what we always do when we're, we hire people on time limited resources, they scramble to keep them, so I actually think that model, the model in Southern worked really well, for impact, for speed, but the model in Eastern might turn out to be a longer-term sustainable."

-Lead implementing partner/donor

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Working with the District Medical Office

The SMGL implementers, as well as representative from the district medical office itself, emphasized the need for closer collaboration between SMGL and the DMO. In Kalomo, there was concern about the ability of the DMO to continue to connect with the rural health facilities.

> "So my pray is if DMO can take it up, the way we've been doing, though they can't manage to go daily as we have been doing, but maybe once in a while just to check on the low performing facilities, because these are the facilities we know they will continue with the same."
>
>   -SMGL program staff

The importance of integration and ownership from the start came through.

> "The only thing that would be very helpful for the project to continue is to start with DMO as we are starting the Phase 2 just as I have told you… I think that would be like more helpful, because we don't know when the funding is there and when the funding is not there, so if we start with the DMO we know that even when the funding is not there, the skill that has been transferred will still be there."
>
>   -SMGL program staff

> "So we need to start working very hard with the provincial medical office so they, they own the SMGL project. They own the SMGL, the whole process. If they start owning it, then they start supervising the districts, and the districts will supervise the health facilities, and the health facilities will go down to the community. So that way we have a continuation, from...we have direct oversight from the province to the grassroots. So we will be speaking the same language."
>
>   -SMGL program staff

Implementation Strategies

Ten different respondents across all types, except for SMAGs, provided

suggestions for improving the actual implementation strategy. These included having a more timely start to project activities, involving on-the-ground mentors and program staff in decision-making, and having more project ownership by the community, which is able to do their own supplementary activities to improve the status of mothers' shelters for example, without outside funding. Two sources also described the need to have "one voice" among the implementing partners and improved coordination, among both partners and across government levels.

> "I want to see a very united team, a very, ah, a team that is going to work together from the province to the district down to the community as a united front. I want to see that very much. I also want to see, um, more skills being imparted with mentors, because knowledge is dynamic. And I would have loved to see all SMGL project, eh, implementing partners, receive the same training, using the same tools, uniformity of all the strategies, and where it's a platform where we are able to learn from each other, where we are able to analyze our data, where we are able to not only push our data upwards, but use it to analyze our own situation, and find interventions and strategies to work to improve our situation. I would like to see more of such meetings where we can share ideas."

> -SMGL program staff

Needs Assessment, Monitoring & Evaluation and Data for Decision Making

Respondents mentioned the need for a different needs assessment approach at the start of the next phase, with the use of local data collectors to avoid extra costs of using Central Statistics Office staff that travel to sites, and possibly more clinically trained data collectors to assess the facilities adequately. Another area of needed improvement was the monitoring and evaluation (M&E) and data collection system. A few of the respondents said that by only collecting the data and sending it up the chain to the CDC,

they were not able to understand the program challenges and to act accordingly.

> "But if we are reviewing data together with the DMO I think we should be able to find the reasons why, why are the deliveries always low. Some you find maybe there is no mothers' shelter, so our planning will be to lobby for funds, and build a mothers' shelter. Some, maybe there's... high home deliveries. Then the question will be to (about the) SMAGs, if they don't have, so you train SMAGs you can go out and sensitize. But that's why I think, most especially for me I have been advocating, we should be working, having data review meetings, look at the indicators, so that we....because, see, for me mentorship is, should be focused, [yes] and [yes] (xx) yes and should be focused so it is not like we are just shooting in the air."

> -SMGL program staff

Exit Strategy and Sustainability Planning

Five respondents gave specific suggestions for improving both an exit strategy and plans for sustaining SMGL's efforts, with an emphasis on planning for both from the start, and then phasing out slowly. There was a sense that sustainability should be discussed from the beginning of the project, which was not a strong aspect of SMGL.

> "And also for sustainability I feel that from the get go, when we start a project in a district we need to start discussing sustainability issues. If we are going to do this, this strategy or activity, is it sustainable? and the people who are who, the government should be able to say this is how we feel we will be able to sustain this. Because it's one way having an activity because there is funding and so forth and it will run smoothly, but once funding is eh reduced, then everything falls apart."

> -SMGL program staff

> "Number one suggestion is that, ah, they must be involved from the beginning. Not regard this as a project that has come and they put in to do everything. They must be involved in everything, the planning, they must be involved in the implementation. When the mentorship is happening they should form combined teams, clinical teams combined for the mentorship… then it means we have to get

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in ownership from the beginning, and the, we also fixing in from the beginning sustainability"

-Government official

There was mention also of the need for more transparency about the SMGL budget in order for the government to plan for key activities and to understand how to sustain them in the future.

Future Recruitment of Staff

SMAGs and clinical mentors were asked to describe what they believed are important qualities they need for their profession, which bears on recruitment for future project staff. Among current SMAG members, those qualities that were mentioned as desirable for community members who may become SMAGs in the future were to be able to express themselves clearly, enjoy teaching, and wish to be part of the change:

> "Qualities of a SMAG should be someone with a good heart who is able to sacrifice, work as a volunteer, even if you are not paid, be prepared to work outside working hours, even if you are not getting benefits"

-SMAG

One SMAG described the need to communicate effectively as having to "lower yourself" when working with community members:

> "It would be [to be] courageous and to lower himself, because when you approach those mothers, you have to lower yourself so they understand you and if you put yourself on a higher level, they will refuse."

-SMAG

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Among current clinical mentors, those qualities that were mentioned as desirable for future clinical mentors were to have a high level of knowledge, be tactful and able to listen, and love midwifery, but not restricting oneself to obstetrics, but instead providing a full package of care. They should be ready to travel, enjoy teaching, and working as a team. Non-mentors described current mentors as "cheerleaders," collegial, and available at all hours to address any issues that arose.

> "They need to be...to be able to listen….it's a two way, it's a two way process. They listen and learn. It's not always about you imparting knowledge into somebody, but also about being able to listen, to listen and learn from them. So it's vice-versa, so it's give and take."
>
> -SMGL program staff

3.1.20 Summary

Strategies for improving SMGL's program operations and success included aligning with government priorities and integrating with the District Medical Office from the start, with clear plans for both an exit strategy and sustainability. Activity-specific suggestions meant to fill the gaps outlined in the previous section included continued awareness raising at the community level, more training for the health staff, increased provision of supplies and equipment, and improved facilities for maternity services.

Overall Praise for SMGL

Several respondents had general praise for the program, despite its shortfalls.

> "There are a number of contributing factors. Eh, to me, what this project has showed is that once certain strategies are put in place, things can move….someone will see the negative, but I think us inside will, have seen the change."
>
> -SMGL program staff

"I wish SMGL good luck where they are going. Otherwise they are good program. They have really changed the, the, the face of Kalomo."

-Rural Midwife

"So, she actually thinks this is a very good program and she wants to see it continue because it has been an, an, an eye-opener to a lot of people, because in the community now you don't have to force the women to, to come to the facility, you just talk to them and they even ask her to say 'oh, when am I supposed to go…?"

-SMAG

"My experience with SMGL has been very good, how I wish it could continue….the maternal deaths, neonatal deaths, the didn't just help us to...they also helped us to capture even things that happened in the community...even sensitizing the community, address the barriers...we are very grateful....but they have also given us a lot of skills and a lot of equipment. They gave a lot of skills for the community, knowledge, a lot of help and change, you go there and they will tell you, 'ah yes SMGL...'

-Government official

4 CHAPTER FOUR: DISCUSSION

Overview

The overall purpose of this study was to assess the impact of the SMGL program in Kalomo District, Zambia, on both the utilization of facilities for deliveries and the provision of intra-partum maternal and newborn care at facilities, as well as the mechanisms by which such impacts were (or were not) achieved. Furthermore, I designed the study both to identify barriers and opportunities to sustain the program's impact in Kalomo and to plan for successful scale-up and expansion across Southern Province and to other districts in Zambia as SMGL enters its second phase.

This chapter discusses the implications of my findings for each of the four central research questions, answering each with relevant results and framing these results in the context of the broader literature. The chapter concludes with recommendations for the next phase of SMGL implementation, including lessons for expansion and scale-up not only in Zambia but in other similar environments.

Objective 1: Program Impact

This first section describes the program's overall impact on the proposed outcomes: utilization, measured as rate of FBB, and quality of maternity care, measured as skilled birth attendance. Skilled birth attendance comprises having both an SBP at delivery and a facility-enabling environment, which I measured as facility capacity to provide maternal obstetric and newborn care services.

4.1.1 Impact on Utilization: SMGL Increased Rates of Facility-based Birth

The data show that the SMGL program, as implemented in Kalomo District, Zambia, increased the rate of FBB. This increase was achieved even when taking into account other factors that drive traditional home-based deliveries in Zambia, such as mother's age and education level, number of children under age five, marital status, and distance to a health facility. The proportion of women delivering at facilities started to change just after program implementation began in mid-2012 and then increased progressively until one year after full implementation, when rates were consistently higher than in the pre-implementation phase. Key informants provided supportive anecdotal evidence with their own observations.

During 2013–2014, while SMGL was ongoing, the Zambia Demographic and Health Survey (ZDHS) estimated rates of facility delivery at 67.4% nationwide and 55.9% for Southern Province (Central Statistical Office (CSO) Zambia, 2015). The Southern Province rate is similar to this study's baseline rate in 2011–2012 (54.8%), providing additional evidence that the increase seen in Kalomo is attributable to SMGL and not to other trends in the province.

SMGL used community mobilization as a core strategy for demand generation. The results of this study confirm that community mobilization can increase facility delivery, a finding that is strongly supported in the literature. A recent review of strategies linking families and facilities found that community mobilization and engagement can significantly increase rates of institutional birth (with an increase of 71% in the investigators' meta-analysis) and skilled birth attendance, leading to a reduction in

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early neonatal mortality (Lee et al., 2009). In that review, programs that had an impact

on mortality had high levels of active community participation and the involvement of

key community leaders, two components that were clearly identified by key informants

as being core to SMGL. In addition, a recent evaluation of a program similar to SMGL

that had utilized SMAGs to raise awareness about maternity care in another Zambian

district also showed a significant increase in facility delivery from 49% to 75%,

compared to the non-intervention areas (Ensor et al., 2014).

4.1.2   Impact on Quality: SMGL Had No Detectable Impact on Skilled Birth Attendance at Rural Facilities

Quality Indicator 1: Delivery with a Skilled Birth Provider

Despite the improvement in rates of FBB, there was no significant change in the

proportion of women delivering with an SBP in Kalomo at the RHCs. While the rate of

delivering with an SBP in Kalomo increased nearly six percentage points over the course

of SMGL's implementation, from 46.2% to 51.7%, there was not a significant change

when controlling for other covariates. Also, this proportion remained lower than the rate

for the whole of Southern Province in 2013–2014, which was estimated at 55.0%

(Central Statistical Office (CSO) Zambia, 2015).

The facility-level data was consistent with the limited change seen in the

proportion of deliveries with an SBP, as there was no significant change in the proportion

of facilities with at least one SBP in Kalomo. This might have been expected, since most

of the facilities had at least one SBP before SMGL (91%). However, informants

expressed concern that a sole provider cannot meet the needs of the population a facility serves, particularly because they are often absent when pregnant mothers come to deliver due to trainings, meetings, or being on holiday or leave. The results further indicate that there was no change in staffing levels, generally, as the mean number of providers at Kalomo RHCs decreased slightly over the course of SMGL, while there was a slight but non-significant increase in the comparison districts.

One of the major initiatives of SMGL was to deploy additional midwives in areas of the district where they were needed most. The CDC contracted 13 retired midwives to return to work to provide immediate support beginning in January 2012. Given this, one would expect the mean number of midwives to increase over the study period in Kalomo. Our finding of no change in mean number of providers in Kalomo, however, is not consistent with SMGL's strategy.

Even though the SMGL brought additional human resources to Kalomo, it did not have the intended impact at the rural facility level. One plausible explanation is that the midwives were not stationed at the RHCs as planned. Figure 10 illustrates the actual deployment of the retired midwives. Three were sent to Kalomo District Hospital (KDH) and three to Zimba Mission Hospital (ZM), and not to the rural health centers (RHC). Of the RHCs to which retired midwives were deployed, only four of those health centers were included in ZamCAT.

The deployment of several midwives to hospitals may have been a deviation from the original plan due to limited living accommodations at some of the RHCs. It is possible that the deployment of midwives at the hospitals helped to deal with the increase

in facility deliveries at the sites and improved the hospitals' capacity to provide skilled

care at birth, which was not assessed in this analysis. Therefore, while I cannot conclude

that there was a change in delivery with an SBP in Kalomo's rural facilities, it is possible

that the deployment of retired midwives had a positive impact, though not as dramatic as

anticipated by the SMGL implementers.

Figure 10. Deployment of Retired Midwives for SMGL
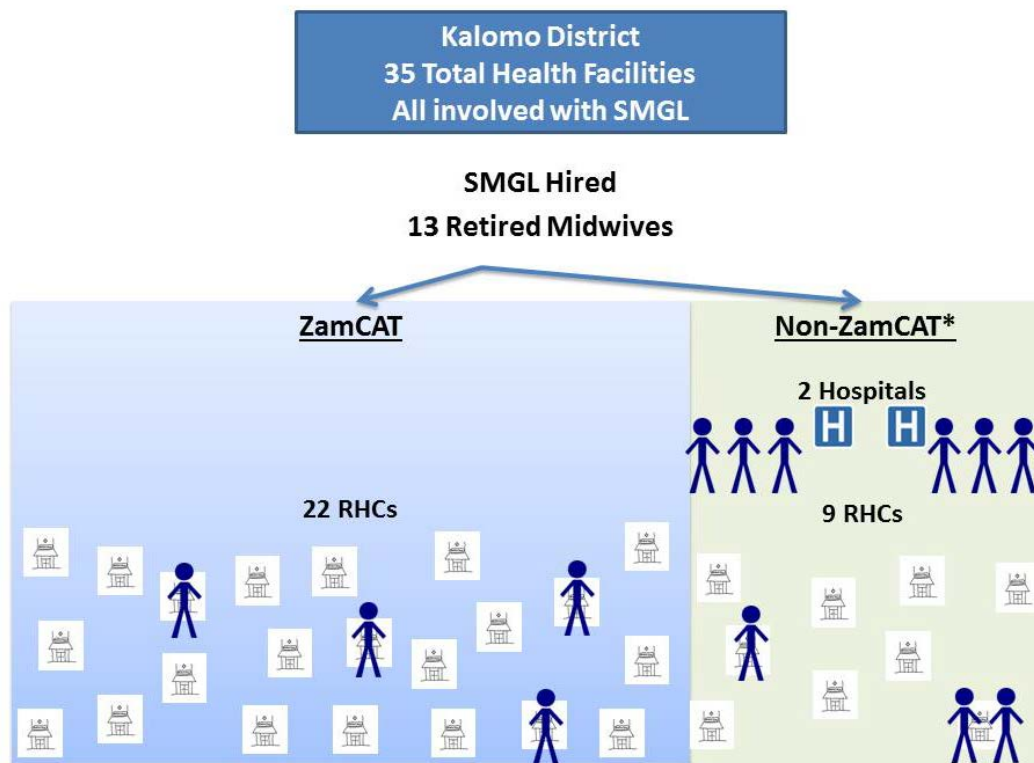
I also assessed differences in the characteristics of the RHCs included in

ZamCAT (n=22) and the RHCs in Kalomo not included in ZamCAT (n=9). At baseline,

before SMGL implementation, there was a significantly lower mean number of deliveries

at the RHCs not included in the study (mean of 5.8 versus 12.0, $p<0.05$). This was by

design, as those RHCs selected for ZamCAT had at least 160 deliveries per year. There were also fewer skilled providers at the non-selected RHCs (0.8 versus 2.5 per facility, $p<0.05$). There were no other significant differences in number of services provided or EmONC signal functions at baseline (Appendix F).

It is likely that the four midwives deployed to non-ZamCAT RHCs were sent there because of the facilities' extreme lack of skilled staff, compared even to other Kalomo RHCs. It is also likely, therefore, that the inclusion of additional midwives in those facilities increased women's deliveries with an SBP. There are far fewer deliveries in those facilities, however, so even if they had been included in my analysis as intervention sites, the change in rate of delivery with an SBP may still not have been detectable at the population level.

There is also a difference between the ZDHS rates and those in my study. The ZDHS estimate used a broader definition of SBP, including "clinical officer" as one of the skilled providers. I was unable to include this in the study definition, as it was not one of the choices on the ZamCAT survey and therefore was included under "other". It is possible that had I been able to include this category the SBA rates might have been be equivalent to those in the ZDHS.

That said, the SBP indicator used in this analysis, and all analyses, should be interpreted with caution. It might have been difficult for the respondents to properly identify a true SBP, in the study's case a nurse/midwife at the facility with proper training (Adegoke & Van Den Broek, 2009). One study illustrated that many providers who by definition would be called "skilled" actually lacked the proper knowledge and skills to

provide skilled care (Harvey et al., 2007). Therefore, the true proportion of women

delivering with an SBP in this study may actually be lower than what was reported.

However, since the same definition of SBP, excluding "clinical officer," and the same

approach to asking women was used in the DHS and this study, it is likely that the results

are comparable.

Due to the increased demand generation, the difference between FBB and

delivery with an SBP widened over the course of SMGL's implementation in Kalomo.

Before SMGL an estimated 84.3% of women who delivered at facilities did so with a

skilled attendant. During SMGL, this decreased 4.1 percentage points to 80.2%, leaving a

critical gap (Figure 11).

Figure 11. Gap between FBB and SBA in Kalomo, Before SMGL to During SMGL
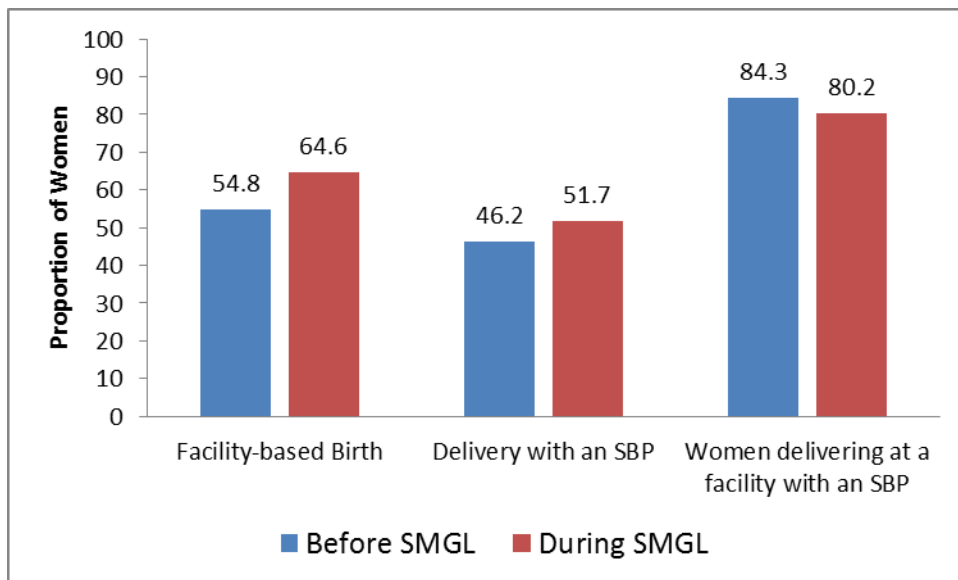
A recent paper from Zambia, which included analysis of ZamCAT data plus data

from two other Zambian-based studies, supported this result, finding that nearly 14% of

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deliveries within health facilities were attended by unskilled staff, the majority of whom (71%) were traditional birth attendants (TBAs) (Biemba, Yeboah-Antwi, Semrau, Hammond, & Hamer, 2014). An experimental study in Pakistan evaluating a community-based safe motherhood project involving women, their husbands, trained TBA's and community leaders had results similar to the present study, with a slight increase in facility delivery but no change in delivery with a skilled birth attendant (Midhet & Becker, 2010). Notably, the Pakistan intervention did not invest heavily in supply-side outputs such as provider training or facility upgrades, as SMGL did.

These results are concerning as the SMGL program relies on the evidence-based logic that both increased demand as well as increased skilled birth attendance are necessary to reduce intra-partum-related mortality. The present findings are likely an indicator of the challenges facing most LIC in staffing rural facilities with trained staff, given the extreme human resource shortage they face. Section 1.2.3 explores this in more depth.

Quality Indicator 2: Facility Enabling Environment

Even if access to skilled birth attendants increases, a facility-enabling environment, which includes appropriate equipment and supplies, is also necessary for increasing skilled birth attendance and to having an impact on both maternal and neonatal mortality and morbidity. In one comparative study, researchers postulated that countries with high rates of deliveries by SBPs rely on functional health systems with the capacity to handle emergencies, access to referral, and widespread deployment of the skilled

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attendants within the system (Parkhurst et al., 2005).

One measure of an enabling environment is the facility's capacity for a response to maternal and newborn complications, which includes both ability of staff to perform signal functions and having the equipment and supplies to do so. The data from the repeated HFAs data showed only a slight increase (just over one) in the average number of signal functions performed at rural health facilities during SMGL implementation and there was no change in the proportion of facilities providing BEmONC. It appears that changes in individual indicators of facility performance including removal of retained products of conception and elements of newborn care, such as newborn resuscitation, thermal protection, and KMC for premature babies, can be directly linked to the formal EmONC and HBB training that SMGL provided to several Kalomo providers. The finding that some signal functions changed as a direct result of focused training workshops is consistent with the Columbia/NYU evaluation's findings of improved knowledge among providers trained in EmONC by SMGL (Kruk & Galea, 2013). However, changing only a few of the signal functions is not sufficient to change a facility's ability to provide comprehensive EmONC.

In addition, although SMGL attempted to make some changes in equipment and supplies at the RHCs, their efforts were not sufficient. The minimal change in equipment and supplies at facilities is likely related to the irregular supply by the government health system and insufficient changes in the supply chain on a larger scale.

Combined with there being no change in staffing levels, these results on facility capacity indicate a modest positive change that should not go unmentioned, but also

signal insufficient progress on changing the environment to provide high-quality intra-partum care at rural health centers in Kalomo.

4.1.3   Ultimate Impact: Maternal Mortality

SMGL's ultimate goal was to reduce maternal mortality by 50% in one year. The data indicate a slight but non-significant decrease in maternal mortality during SMGL's implementation in Kalomo District, which was supported by key informants' stories of improved maternal survival at rural health facilities. As it was the most publicized outcome of the program in both the news media and program reports, frequent mention in the interviews is not surprising. However, as with the challenge of evaluating most maternal health programs, I could not attribute any definitive change in mortality to SMGL due to the rarity of this outcome.

For the respondents, it may have been difficult to discern between actual and perceived changes in the risk of maternal death. It is likely that both internal project and external media reports influenced their responses, since nearly all respondents could recall the reported 35% nationwide decrease in maternal mortality due to SMGL. Moreover, most informants may have been biased to report positive outcomes, as this result would be due to their hard work and commitment over the past three years.

4.1.4   Comparison to CDC Evaluation Results

In order to appropriately compare our impact results with those of the CDC evaluation, I adjusted the study's time periods to match those of the CDC. The pre-intervention time period ran from June 2011–May 2012, and the post-intervention period

was between June 2012–May 2013. This included the "transition" time that had been

excluded from the previous estimates. (See Appendix G).

Table 29 illustrates the differences between the CDC's results for four districts in

Zambia and those in Kalomo District for the indicators measured by both the CDC and

the present study.

Table 30. CDC and Study Results for Maternal Health Indicators: Percent Change from the Periods June 2011–May 2012 to June 2012–May 2013

Indicator	CDC Study – All Districts, Zambia	Present Study– Kalomo District
Maternal mortality ratio[1]	-35%	-79%†
Stillbirth rate[2]	-19%	-23%‡
Availability of 24/7 services provided at health centers	+44%	0**
Deliveries taking place in a health facility	+35%	+17%

[1] Defined as the Number of maternal deaths per 100,000 live births
[2] Defined as the number of stillbirths per 1,000 live births
†Not a statistically significant difference: MMR of 95 (4/4226) to 19 (1/5130)
‡Marginally significant difference (p=0.08)
**At baseline, all facilities met the requirements for 24/7 care available in the labor ward

The present study's finding of a 17% increase in facility delivery is approximately

half of the CDC's report of a 35% increase. It is likely that this difference is due in part to

how each indicator was measured: the CDC used a denominator of anticipated deliveries

in the district based on the population of women of reproductive age, whereas the present

study used a denominator based on a household survey that produced a more accurate

estimate of the actual number of pregnant women.

The present study's findings are also consistent with the CDC's evaluation in

indicating a reduction in maternal mortality and stillbirths, though this study's results are

weak on these two indicators. Maternal mortality ratio is a more robust indicator when measured across four districts, as in the CDC evaluation; the present study does not have the statistical power to show similar changes. It is also possible that difference in the magnitude of the results are due to SMGL having a greater impact in the three other districts where SMGL was implemented, as one of the lead implementing partner/donor respondents had suggested when interviewed.

As discussed previously, it is possible that the facilities included in ZamCAT (n=22), and therefore the women living in their catchment areas, were different than those in Kalomo as a whole (n=35 including two referral hospitals). Those facilities selected for ZamCAT had at least 160 births per years in their catchment area and provided regular antenatal services. As mentioned, those RHCs not included in ZamCAT had a lower mean number of births per month, as well as a lower number of skilled staff. The two referral hospitals had a much higher mean number of both skilled staff and deliveries, and also provided a more comprehensive set of services than any of the rural health facilities. All facilities, regardless of their situation, were included in the CDC evaluation. It is possible that improvements made at those 9 RHCs that were not included in the present evaluation and at the two hospitals account for some of the difference in reported outcomes between the two investigations.

4.1.5 Program Impact Summary

SMGL had a major impact on improving demand for facility delivery, and more women accessed rural health facilities to deliver babies since the program's implementation. However, the gap between increased facility deliveries and the relatively

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stagnant level of high-quality maternity and obstetric care at Kalomo's rural facilities suggests that the SMGL model, as implemented that district, was far more successful at creating demand than providing supply, thereby creating an unbalanced strategy that may not be effective in reducing maternal deaths. Indeed, this has been a concern about safe motherhood programs in the past: declaring a program to be a success after increasing institutional delivery without actually changing the factors that impact mortality (Maine, 2007).

Objectives 2 and 3: The How and Why

It is important to assess the process by which an intervention achieves its outcomes when evaluating maternal mortality programs, due to challenges faced when measuring impact, but also to understand the program impact pathways and then draw informed conclusions (Maine, Akalin, et al., 1997). This section addresses objectives 2 and 3 by identifying the process by which the program's impacts were (and were not) achieved, using both quantitative and qualitative results.

The present study's findings support the Three Delay Model as the theoretical model used by SMGL to identify and then address the multiple factors that lead to delays in the demand for, access to, and provision of quality and timely obstetric care. The key informants' descriptions of the factors leading to maternal mortality in Kalomo and their own communities were consistent with the model. However, the data illustrate that the degree to which each of the delays was addressed, with a disproportionate focus on the first delay, related to demand, may have significantly compromised the program's

impact. Each section below examines how the three delays were addressed through SMGL activities and what may have contributed to or prevented program impact.

4.1.6 Delay 1 - Demand Generation

SMAGs and Community Mobilization Increase Demand

The key informants attributed SMGL's successful increase in demand generation to the cadre of SMAGs working with SMGL and their role in the registering, monitoring, and counseling of pregnant women, plus their community mobilization activities. This finding is strongly supported in the literature. In addition to the review by Lee at al. (Lee et al., 2009) about linking families with facilities, another recent review found that community-based intervention packages that involved family members and outreach workers with a community mobilization effort were one the most successful strategies for impacting referrals and reducing morbidity and neonatal mortality, particularly where skilled birth attendants were absent (Lassi, Haider, & Bhutta, 2010).

The present study's results show some improvements in service use intentions and behaviors, but not as dramatic as the improved rate of FBB. This may be partially due to limitations in the study's ability to construct indicators of service use intent and behavior from the surveys that had been done, especially individual-level indicators of knowledge and beliefs among the women in Kalomo. In addition, since ZamCAT researchers provided ongoing counseling to pregnant women over the course of the study, many of the service use intentions that were measured may have changed in both Kalomo and the comparison districts, such as care-seeking during pregnancy. In fact, however, simple counseling and encouragement to deliver at a facility may have changed intent, but did

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not in the end change the rate of facility delivery in ZamCAT's comparison areas.

Therefore, the present study adds to the strong body of evidence that by utilizing existing

community members who are trained to mobilize women and their families to recognize

complications and seek care at those facilities, the SMGL model increases utilization of

facilities for deliveries.

Successful but Potential Counterproductive

At the same time, the relatively small change in supply-side factors may have

served to minimize the increase in facility deliveries in Kalomo. Women's cultural

beliefs and perceptions of facility-based care have been found to be major drivers of

facility delivery (Moyer et al., 2013). The perceived quality of the facility can deter

women and encourage them to bypass primary care facilities in favor of level or

provincial level hospitals (Kruk, Mbaruku, et al., 2009), or even to seek care with

traditional healers. Ensuring that equipment and supplies are available when a woman

arrives to deliver, and that she is treated by providers with respect, are also important

determinants of future delivery (Kruk, Paczkowski, Mbaruku, de Pinho, & Galea, 2009).

In Tanzania, a woman's previous or current experience with the health system, including

whether or not she was treated with respect during ANC or delivery, moved to be more

important that the perceived quality of the facility itself (Larson et al., 2014).

If a woman arrives at an RHC based on the recommendation of her local chief,

her husband, members of her extended family or community, or the community-based

SMAG, but no provider is available, or supplies and equipment to deliver her baby safely

are lacking, she may be reluctant to deliver there in the future. A recent review of human

resources and EmOC quality found that staff shortages, and poor quality of EmOC services will discourage facility use for deliveries (Dogba & Fournier, 2009). While the present data does not extend long enough to assess this change over time, despite the improvements SMGL has had on demand generation, if the supply-side factors aren't improved then it is possible that the gain in FBB could reverse.

4.1.7   Delay 2 – Access

The Referral System: Minimal but Important Improvements

The goal of SMGL's referral system is to identify, stabilize, and transport patients needing immediate care due to obstetric complications to fully equipped referral centers. The referral form implemented by SMGL was hailed as a great improvement and an important component of the program by several key informants. The qualitative results also indicate that multiple stakeholders perceived that the status of patients upon arrival at tertiary care facilities improved as a result. This is one positive indicator of improvement due to the referral system changes. It is important to recognize, however, that the referral system was limited mostly to use of the form in documenting the steps taken for patient stabilization and transfer once a complication was identified, as well as to track the time between the call for a transfer the ambulance's arrival. Unfortunately there were limitations form's utility at the referral center due to improper or mistaken completion. Moreover, a fully competent referral system relies on communication and transportation links, both of which did not show marked improvement over the project period.

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The Role of Skilled Staff in the Referral System

Due to concerns regarding misdiagnosis at the facility level or unreliable information being recorded on the referral form, there were limitations on what the referral form alone could achieve in changing the actual quality of care. In Rwanda, the implementation of a referral system to link rural health centers with an EmONC referral facility led to improved access to care (Tayler-Smith et al., 2013). Two of this intervention's components were an equipped and staffed EmONC referral facility as well as "robust protocols for the effective identification of obstetric complications, together with health centre staff trained in the proficient use of these protocols" (Tayler-Smith et al., 2013). Another review of referral systems in maternity care cited the need for appropriate communication, and transport, as well as appropriate protocols and monitoring of staff performance (Murray & Pearson, 2006). This further supports the importance of having properly trained staff at the facilities for early case detection. A referral system alone will not solve the problem if trained staff are not appropriately managing patients at the first level of care.

The Role of Transport and Communication in the Referral System

In Rwanda, the referral system also relied on hospital ambulances being available 24/7 and staffed with a midwife, plus having functional two-way communication. In the present study, however, there were limited changes in the actual transport of referrals due to the late addition of the SMGL-provided ambulance in Kalomo and the limited alternative transportation options in the community. Moreover, there are changes outside

the scope of the SMGL project that had an impact on transport and referral, such as the absence of passable roads, especially bridges during the rainy season. Similarly, without changes in the cellular network, such as the installation of cellular towers to connect far-reaching facilities, no marked improvements in communication are possible. Such changes were beyond SMGL's capacity absent a significant financial investment in larger infrastructure projects. This may also explain the minimal changes in ultimate outcomes observed in Kalomo.

Some of the informants described the use of SMS and mobile phone technology as part of SMGL, and a pilot program using SMS was ongoing in some of the facilities. The respondents mostly described using SMS for reporting and tracking purposes. Several respondents requested that mobile phones be provided to SMAGs for communicating with the facilities. Recent studies have demonstrated the effectiveness of having CHWs use mobile phones to reduce delays in seeking and accessing care, improving health education and promotion, and facilitating timely referrals (Philbrick, 2013) . It has been suggested that improving health systems and provider training through the use of mobile technology could help reduce neonatal mortality, but there is limited evidence to demonstrate its effectiveness on maternal or newborn mortality outcomes (Agravat, 2013). Nevertheless, there is an opportunity with SMGL to further improve the referral system with a strengthened network and greater use of SMS.

A recent study on a similar intervention reported the successful implementation and use of transportation vouchers as a mechanism for improving the transport of mothers to the facilities. The authors viewed the voucher component as the key to

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increasing facility deliveries (Ekirapa-Kiracho et al., 2011). The program used both service vouchers which covered the cost of ANC, delivery, and postnatal services, and transport vouchers. The transport vouchers, with a set price to cover the cost of transport to any facility, were primarily used with local motorcyclists who had a financial incentive to provide the service once the voucher system was in place. Previous research from the program's design phase indicated that engaging the private sector transport providers was an important feature and that the availability of transport made a large difference in increasing access for maternity care (Pariyo et al., 2011). Demand-side financing schemes such as vouchers have been introduced in several countries and have been effective in increasing the utilization of maternity care (Brody, Bellows, Campbell, & Potts, 2013; Murray, Hunter, Bisht, Ensor, & Bick, 2014).

The Role of Mothers' Shelters in Referral

The present study's qualitative results indicated that mother's shelters, also known as Maternity Waiting Homes (MWH), a part of the overall referral approach, played an important role in improving women's access to care at the rural facilities. Women who knew their EDD were expected to stay at the homes one or two weeks prior to their delivery date. A study in Zambia indicated that MWH may play an important role in the reduction of perinatal mortality (van Lonkhuijzen, Stegeman, Nyirongo, & van Roosmalen, 2003). More recently, however, a comprehensive literature review found no evidence that MWH are effective in reducing maternal and newborn mortality (van Lonkhuijzen, Stekelenburg, & van Roosmalen, 2012). In the present study, the

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respondents mentioned that the waiting homes were most useful when the women were tracked during their stay, but they often encountered the same issues as when women presented from the community: mothers would only come to the facility from the waiting home when they were already in full labor. More research is warranted to gauge whether MWH can be an effective strategy.

4.1.8   Delay 3 – Supply and Provision of Quality Maternity Services

The quality of maternity care at the SMGL facilities is reliant on changes in the knowledge, attitudes, and skills of providers who are attending pregnant women at delivery, and on changes at the facility level. The present study's results indicate that SMGL fell short of expectations in both regards. Section 1.1.2.2 discussed changes in the "enabling environment," including facility-level changes. This section further develops the implications of the study's findings regarding the human resource shortage and identifies unanticipated impacts that SMGL activities may have had on the provision of obstetric and newborn care.

As discussed in Section 4.2.2, even with the hiring of the 13 retired midwives, it is impossible to change dramatically the quantity of trained staff, particularly in RHCs, without a major recruitment and hiring drive by the government. I believe that SMGL's one year implementation period made it impossible to make significant changes. The study indicates, however, that one way SMGL may have contributed to improving access to some types of potentially life-saving care was through the mentorship and training of both skilled and unskilled staff in recognition and early detection of pregnancy-related

complications, stabilization for referral, and patient management in the absence of timely referral to a hospital.

Improving Intra-partum Care and Newborn Mortality

Recent research has provided evidence of the positive impact of skilled birth care on neonatal mortality, even in the absence of EmOC (Bhutta et al., 2014)(Yakoob et al., 2011). This is particularly due to improved skills in neonatal resuscitation (Wall et al., 2009). Several of the supply-side indicators that changed at the facility level when SMGL was implemented were related to immediate newborn care. Therefore, it is reasonable to think that SMGL's training programs improved neonatal survival. The positive finding of a reduction in neonatal mortality in our study is consistent with the findings of other studies.

One important limitation is that in the present study, the outcome of neonatal mortality is somewhat complicated ZamCAT, which had the goal of reducing neonatal deaths using chlorhexidine cord cleansing after birth. However, ZamCAT found that there was no significant difference between dry cord care and 4% chlorhexidine for the prevention of neonatal mortality. Therefore, any difference between Kalomo and the other districts is likely due to SMGL activities. It is possible, therefore, that this quantitative finding does in fact indicate that the SMGL training and mentorship activities were successful, though perhaps not to the degree they could be with additional health systems support.

Alternative Approaches to the Human Resource Challenge

Task-shifting is a strategy endorsed by the 2008 Addis Ababa Declaration (World Health Organization, 2010) that has been employed to broaden the range of clinical activities that non-physician clinicians (NPC), non-clinical staff, and community-based volunteers can provide to improve patient care, including emergency obstetric services (FIGO Safe Motherhood and Newborn Health Committee, 2009). In light of the ongoing shortage of qualified health providers in LIC such as Zambia, most governments in sub-Saharan Africa have identified task shifting as a key strategy and have rapidly employed and trained NPCs (Mullan & Frehywot, 2007). There is a growing body of evidence that training NPCs in maternity care services such as obstetric surgeries, anesthesia, and abortion services has little to no impact on either clinician performance or patient outcomes (Dawson, Buchan, Duffield, Homer, & Wijewardena, 2014). More generally, there is limited evidence of the impact of this or other human resources approaches on maternal mortality (FIGO Safe Motherhood and Newborn Health Committee, 2009), and there remains controversy over the potential role of task-shifting to non-clinical staff to prevent maternal death.

SMGL Success Strategy 1: In-service Training for Midwives and Nurses

The qualitative results indicated that both formal training and clinical mentorship through SMGL led to an increase in existing health facility staff's knowledge and skills in handling obstetric emergencies, including newborn care such as resuscitation. Several of the informants were nurses or midwives who had not had any continuing medical education or in-service training since their formal education ended several years prior.

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Training in EmONC and HBB through SMGL may have qualified them as SBP. One recent review found that in-service training, obstetric simulations and drills, and safety checklists can improve providers' knowledge, competency, and skills (Hofmeyr et al., 2009). Another review found that in-service training for SBP was associated with a significant decrease in the risk of maternal death (Lassi, Das, Salam, & Bhutta, 2014). The authors of a third review on human resources and EmOC quality recommended that future programs implement skills-based training, coupled with ongoing clinical supervision, on managing the third phase of labor (Dogba & Fournier, 2009), which was a core activity of the SMGL's clinical mentorship component in Kalomo.

Success strategy 2: Improving the Delivery Skills of Lay Health Providers

At the outset, SMGL aimed to provide in-service training for skilled staff, but the clinical mentorship team in Kalomo ended up training whomever was present at the facilities, since they knew that these were the only providers who would be attending births. The qualitative data suggest that while not optimal, increasing the awareness and knowledge of lay staff may avert morbidity and mortality by increasing their ability to detect and refer complications when they are presented and to stabilize patients who are being referred.

There is limited evidence of the impact of lay providers on either maternal or newborn outcomes. In Zimbabwe, there is some evidence that with the proper referral support systems in place, nurse aides can conduct normal deliveries without a negative impact on perinatal mortality (Manungo, Peterson, & Mthamo, 1996). Most of the literature, however, indicates that skilled birth attendants cannot be replaced by unskilled

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birth attendants (Bhutta, Lassi, & Mansoor, 2010). Instead, recent arguments have favored enabling health workers at all levels to understand basic intensive care treatment so that they can stabilize patients until they can obtain true emergency obstetric care (Costello, Azad, & Barnett, 2006). Further evidence has shown that the recognition of complications and a strong referral systems are the most important components of community-based care (Bhutta et al., 2010). Historically, improvements associated with TBA program implementation have been shown to be due to the referral systems and the quality of obstetric services at the referral centers (Bhutta et al., 2010).

Concerns about supporting any type of training in maternity care to lay health providers arise from too much of a shift in focus from the need to train skilled staff on a continuous basis. The training of lay staff for any health tasks should be complementary only and part of a larger program improvement strategy (Philips, Zachariah, & Venis, 2008).

The present study highlights the challenges faced when skilled staff are unavailable at rural facilities and supports the strategy of improving the continuing education program for nurses and nurse-midwives, many of whom have not received any type of further education since graduating from their nursing or midwifery programs, while also mentoring those staff not trained in midwifery to understand the basic concepts of maternity care in order to facilitate early detection and referral and to implement important elements of immediate newborn care.

Objective 4: Barriers and Opportunities

Since the MDGs were launched in 2000, maternal mortality overall has decreased 47%, which, while very positive, is far from the MDG5 target of 75% (World Health Organization (WHO), 2014). At this point it is unclear what the target will be for the new Sustainable Development Goals, the follow-on to the MDGs expiring in 2015 (Requejo & Bhutta, 2015).

The global health and development community has set new long-term targets for ending preventable maternal and newborn deaths. In May 2014, the World Health Assembly advocated for a substantial reduction in maternal mortality (down to 70 deaths per 100,000 live births), newborn mortality (10 deaths per 1,000 live births) and stillbirths (10 deaths per 1,000 live births) by 2035 (Saving Mothers Giving Life Phase 2 Launch Report, 2014).

Likewise, the UN Secretary General's Global Strategy for Women's Children's and Adolescents' Health 2016–2030 is currently being updated under the Every Woman Every Child movement for release in late 2015. This will build on the 2010–2015 Global Strategy which provided a roadmap for the MDGs. Strengthening maternal health care has been proposed as one of the pillars in this new strategy, with a focus on trained primary health care workers such as nurses and midwives, and an effective referral system (Temmerman, Khosla, Laski, Say, 2015).

As SMGL continues implementation with Phase 2, there is increased scrutiny on countries where improvement in maternal mortality indicators is lagging. Therefore, the SMGL program has an important role to play in continuing to develop and support an

evidence-based model for maternity and newborn care.

The previous section highlighted several activity-related gaps and possible solutions in the areas of demand, access and supply. This section outlines both the barriers and opportunities for continued strategic program development and implementation of SMGL in its expansion for Phase 2, based on the learning from Phase 1 in Kalomo. There were three themes highlighted by program stakeholders that if unaddressed may hinder future expansion of the SMGL model in the Southern Province.

Government Collaboration

In the first phase of SMGL, program implementers made clear efforts to align the program activities both with an evidence-based theory and the current government initiatives and strategic plans for MNH. While the district-level officers were perceived as being very supportive, due to multiple competing priorities and limited staff, they were also reported to have had limited engagement in the program's actual implementation. Moreover, this perceived lack of involvement extended to the province-level officials as well.

While it is easy to criticize the lack of government involvement, with the rollout of any project's pilot or learning phase there is a natural course for achieving buy-in. In many ways, the government may have needed SMGL's "proof of concept" phase in order to support the program completely, though even now some officials seem hesitant to fully engage due to a lack of a clear sustainability plan. Now that there is evidence about the SMGL's effectiveness from multiple sources, and an opportunity to build on the lessons

learned from the learning phase, there is a ripe opportunity for starting in Choma and

Pemba Districts with a clear strategic plan for how to collaborate closely with the District

and Provincial Medical Officers to conduct an in-depth needs assessment that will

identify existing gaps that can be addressed over the next four years; integrate plans for

training and mentorship; and streamline protocol development.

Exit Strategy and Sustainability Plan

Key informants expressed concerns about an appropriate exit strategy for Kalomo and a

sustainability plan both for Kalomo and future iterations of SMGL. The Columbia/NYU

evaluation identified the lack of a sustainability plan as a central weakness in SMGL's

implementation (Kruk, Rabkin, et al., 2014). It is important to note, however, that the

stated goal of SMGL was not to implement a sustainable model, but to galvanize support

from the government and donors to tackle a major health issue. Janet Fleischman of the

Center for Strategic & International Studies postulated at the start of SMGL's

implementation that SMGL's greatest achievement could be that it serves as a "catalyst,

not a milestone" (Fleischman, 2012). In fact, with several additional donors joining the

front, the second phase may be where SMGL's ultimate impacts are achieved, based on

lessons learned from Kalomo and the other three learning-phase districts. In Phase 2,

there is an opportunity to design the SMGL roll out the program with a clear exit strategy

in mind, and more effectively partner with the government to integrate activities. In short,

a slower, more deliberate roll out of key activities identified from Phase 1 as successful

may prove more feasible for creating a long-term impact.

Scale-up: The Need for a Scalable Model

A recent study aimed to assess the steps required for government and program implementers to scale up promising innovations in MNH, including many of the SMGL program activities. The following needs were identified as central to scale-up: increasing the capacity of frontline health workers, providing tools for improved communication, strengthening referrals systems, and strengthening communities (Spicer et al., 2014). These activities are similar to SMGL's core strategy. The authors went on to generate a list of requirements for effective advocacy to move governments to adopt and finance health innovations:

- design scalable innovations,
- embed scale up in programme design and allocating time and resources,
- build implementer capacity to catalyze scale up,
- adopt effective approaches to advocacy,
- present strong evidence to support government decision making,
- involve government in programme design,
- invoke policy champions and networks,
- strengthen harmonization among external programmes, and
- align innovations with health systems and priorities.

SMGL program leaders could use this set of guidelines to adapt the SMGL model for future scale-up. This would include ensuring that interventions have government support for future financing and scale-up and sharing the financial implications of continuing to implement the program. For example, the actual cost of paying clinical mentors, fueling vehicles for the mentorship visits, replicating referral forms, or providing SMAG incentives should be shared, and with a plan mutually decided upon between SMGL and the government so that they can be continued in the future.

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Meanwhile, SMGL's core staff, such as clinical mentors, should take on a more advisory role in building the capacity of existing provincial and district health staff to provide ongoing mentorship to the rural health facilities. This would also include the development of protocols for training field personnel in the identification and management of complications.

5 CHAPTER FIVE: LIMITATIONS

There are several limitations to both the quantitative and qualitative phases of my study, which I describe below.

Quantitative Study

Study Design

I employed a retrospective quasi-experimental design. A randomized trial would have been more rigorous, but was impossible given how the entire Kalomo District was purposively selected for SMGL implementation. The quasi-experimental design controlled for the internal validity threats of history, maturation, testing, and instrumentation, but there are limitations to the inferences that I can draw due to the selection of the comparison group.

The comparison group of three districts in Southern Province was selected, first because of their inclusion within ZamCAT, and second because of their similarity to Kalomo, compared to the districts of Livingstone and Siavonga. Since there were still baseline differences between Kalomo and the three designated comparison districts, this limits the comparability of the intervention and non-intervention areas, though I attempted to address this with a PSA and found no difference in the outcomes.

It is possible that there were district-level factors that influenced the outcomes. The MOH and MCDMCH selected Kalomo Districts for SMGL implementation due to several factors, including the strength of local leadership and its motivation to cooperate. There is also a strong history of BU/ZCHARD implementing public health programs

there, meaning that the impact of the SMGL program in Kalomo may be different than it would have been for other districts and other parts of the region.

ZamCAT Data

Though I benefitted by having a large sample size from the ZamCAT that covered both the pre-SMGL and intervention time periods, there are several limitations that resulted from using data from ZamCAT.

Study Sample Selection

First, I was limited by the selection criteria for the study, both at the individual and facility levels. Facilities were eligible for the study if they provided ANC services and had at least 160 deliveries per year. The participating facilities were then randomly selected until the sample size of 90 facilities was reached. Therefore I cannot generalize to all facilities in the four districts, nor can I generalize to the patient population of the four districts since the characteristics of the women served by the non-eligible facilities may be different.

With ZamCAT, the women who were surveyed had to be willing to participate in a newborn health research study, and so the women who refused to participate may have different characteristics compared to the study sample. However, since just 10% of the women who were screened were not enrolled, with only a 3.2% loss to follow-up, it is highly unlikely that this factor was a significant source of bias.

The recruitment criteria for ZamCAT omitted women who did not attend ANC

and did not participate in community outreach activities for recruitment. It is conceivable, therefore, that the true rate of FBB could be lower than what was reported since those women not attending ANC would be more likely to not have delivered at a facility and would have been included in the denominator when calculating the FBB rate. However, given the high ANC coverage in Southern Province, estimated at 97.7% in 2013–2014, it the study sample is in fact representative of most women of reproductive age in the selected districts.

Study Tools and Variable Construction

I was limited in my ability construct certain variables due to the questions asked on the ZamCAT tools. There were several indicators relevant to maternity care that were not assessed as part of ZamCAT, particularly relating to the woman's knowledge of danger signs, use of transport, and so forth. There were other potential confounders that were not measured such as gestational age at birth, and number of surviving children.

Data Quality

By using the ZamCAT data as a secondary data set, I relied on the ZamCAT team's data collection procedures and processes, particularly their decisions around data collection, entry, and initial cleaning. They may have made decisions about how to treat missing or unclear data differently than I would have based on their objectives and outcomes. I did, however, conduct my own cleaning on the variables in the final dataset and confirmed entries with the ZamCAT team when I had questions.

Effect of ZamCAT Intervention

As mentioned previously, the activities that took place as part of ZamCAT may have influenced the outcomes, especially counseling provided by the ZamCAT data collectors and reminders to seek care at the facilities, especially for delivery. This may have particularly influenced the indicators on service use intent and behaviors. Almost all of the women in the study, regardless of intervention or non-intervention group, indicated they would go to a health facility for any complication. However, we saw no change in the comparison areas where women got the same messaging from data collectors but not the SMGL intervention.

Timeline

As indicated in the run charts, the timeline for the ZamCAT was a limitation, in that behavior change takes time, and I was only able to assess changes that occurred between three and 20 months after program implementation began. Thus, it is possible that the SMGL program had an impact on mortality that I was not able to detect yet. In using run charts, short time periods can be a limitation, as many interventions start to show improvement starting only after 1 year.

Nature of the SMGL Interventions

Complex Set of Interventions

Working with the quantitative data, I was unable to identify the singular impact of any one component of the SMGL intervention. I attempted to do so with the qualitative

interview data, though the approach had several inherent limitations. It is likely that a combination of activities contributed to the observed change.

Another limitation is that SMGL's pilot phase included a good deal of heterogeneity in its implementation across the sites. Unfortunately program documents were not sufficiently detailed to allow a facility-level assessment of implementation fidelity. Therefore, it may be that in those facilities and catchment areas where SMGL was fully implemented, women had higher FBB rates, and in those where SMGL was only partially implemented or with less fidelity, the rates were lower. While I cannot anticipate the direction of bias, it is likely that the study results minimize the effect of SMGL's impact.

Actual Exposure and Spillover Effects

There were no questions in ZamCAT about exposure to the SMGL program, so I had to assume that program exposure had occurred. This means that I compared a mixed group of exposed and unexposed women in the SMGL district to a group of unexposed women in the comparison districts. Potentially this led to an underestimate of SMGL's impact.

In addition, it is likely that there was a spillover effect, particularly for Choma District, one of the three comparison districts. Macha Hospital and Choma District Hospital, both located in Choma, were the closest referral centers for many of the facilities in Kalomo's northern and eastern sections. The clinical mentorship team conducted limited activities with the hospital staff in Choma so that they understood the nature of the SMGL program, particularly for receiving referrals. It is possible that there

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was an increase in facility-based births in Choma District since women in Kalomo would be referred to their two hospitals, and if so, then this would minimize the difference between Kalomo and the comparison area.

Qualitative Limitations

This study's qualitative component has two important limitations. First, I collected data from a sample of key informants whose perceptions and beliefs may not match what others in their organizations would report. Time, budget, and accessibility constraints limited the number of people I could interview. It is important to interpret the results carefully given each person's role, responsibilities, and relationship with the SMGL program. Second, my data collection tools and my analytic approach were informed by *a priori* reasoning, based on the conceptual model for the program, expected program outcomes, the program logic model, and findings from the quantitative analysis. This led to a series of questions that may have missed opportunities to identify gaps or lessons that I had not thought to ask about.

There are several additional limitations to consider. Any frequencies reported could be due to unintentional prompting for a certain word or phrase based on how the questions was asked, especially regarding the programs' impact. It is possible there were cultural language barriers that led to misunderstanding of the questions, or of my role as an evaluator, rather from a participant in SMGL's implementation. The interviews conducted later were informed by previous interviews and therefore used different prompts and probes, which may have led to more information being provided by those

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interviewed. Each interview was conducted in a different time and place, which may have influenced participants' engagement and openness. Finally, participants may have responded positively because they thought that I was associated with the project or because they thought it might benefit them. To minimize this possibility I attempted to clearly state that my relationship with the project was as an evaluator and not an implementer, and that I hoped to understand both the positive and negative impact of the program to provide suggestions for improvement.

6 CHAPTER SIX: RECOMMENDATIONS

In August 2014, the SMGL program issued a Phase 2 Program Report. In this report the programs' leadership laid out several country-specific strategies for SMGL's next phase of SMGL, to start in 2015. The core goal of the second phase is to create "access to emergency services within two hours" ("Saving Mothers Giving Life Phase 2 Launch Report" 2014). This is an ambitious goal given the remaining gaps that need to be filled in Kalomo at a time when the program is shifting resources to new districts.

In Zambia, the plan is to expand to 12 new districts, including two more in Southern Province, Choma and Pemba, with a long-term goal of national scale-up. SMGL's focus will expand to include providing newborn care more directly; training health workers in both an integrated HIV- and MNH-related curriculum and EmONC; increasing maternal and perinatal death surveillance systems; supporting ongoing data collection and use; and working with the government on health systems strengthening. The program will also support a public-private partnership to improve the use of MWH, and to enhance onsite training and mentorship ("Saving Mothers Giving Life Phase 2 Launch Report" 2014).

The following recommendations for SMGL's Phase 2 are rooted in the findings of this dissertation, plus a review of relevant literature and other program documents and reports. Given that the second phase starts implementation in 2015, the recommendations are oriented towards those program implementers and policy makers that will influence programmatic decision-making for the project's next four years, as well as others who

plan to implement such programs in Zambia or s settings in the future.

Invest Heavily in Human Resources

Advocate for the Government to Hire Trained Staff

It may be beyond the scope of SMGL to hire and train skilled nurses, midwives, or doctors in Phase 2's relatively short time frame. It is imperative, therefore, that SMGL program implementers advocate with the government, using results from this and other rigorous evaluations of the Phase 1, to test novel approaches for health worker recruitment and retention, and at the very least to increase the overall number of trained providers at the RHCs currently without nurses or nurse-midwives. There is some indication that MOH work plans call for increased staffing, but not nearly enough to meet the current need. Insufficient human resources are a major driver of maternal mortality in Kalomo and likely for the entire province.

Continue and Strengthen Training and Clinical Mentorship Programs

The SMGL program cannot, or should not, hire trained midwives or nurses directly, leaving the SPMO to create new, long-term positions. Instead, the program should strengthen the DMO teams' capacity to train and mentor existing staff, both with formal in-service training in EmONC and HBB for existing nurses and midwives and training drills and checklists for lay health staff to support early recognition of complications, patient , and efficient referral. While the approach of training unskilled staff in obstetrical and newborn care was not SMGL's goal, and remains somewhat controversial in the international community, within the limitations of the human

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resource strain in Southern Province it seems to warrant further assessment. All providers at rural health facilities should receive mentorship through the DMO, supported by the SMGL mentorship team. The SMGL team should explore novel solutions to promoting mentorship by utilizing existing experienced staff within the district rather than relying on a parallel project-funded mentorship team alone.

Invest in Facility Upgrades

Needs Assessment

An enabling environment is a key driver of retaining existing staff, recruiting new staff and in providing high-quality maternal and newborn care, as well as attracting patients. The government and the SMGL program need to conduct comprehensive needs assessments at each facility to identify the barriers to upgrading those facilities to provide BEmONC and to design a strategy to address these key barriers in a timely way.

Improve Signal Functions

At the very minimum, the rural health facilities that currently have nurse-midwives should receive training and support to become BEmONC facilities, which means that facilities would have to perform all seven signal functions. This would require additional investment in EmONC training for providers across all the rural health facilities, as well as a steady supply of essential antibiotics and drugs such as magnesium sulfate and oxytocin.

Improve Transport and Communication

Transportation and communication continue to be challenges despite SMGL's efforts to improve both. Based on both the implementation of transport and service vouchers as part of SMGL activities in Uganda, as well as additional evidence from Uganda on the success of transport vouchers for improving institutional deliveries (Ekirapa-Kiracho et al. 2011), the SMGL program in Zambia should consider adding transportation vouchers to its activities. Note, however, that the cost of a voucher system was identified as a barrier in SMGL in Uganda (Kruk et al. 2014), which means that SMGL should work collaboratively with the MCDMCH and MOH to design a sustainable program. Given that women have been accessing rural health centers without significant support from SMGL, particular attention should be paid to utilizing existing community-based forms of transport to support transfer from the facilities to the referral centers.

Program implementers should continue to make use of both existing and new evidence regarding mHealth strategies to improve communication between patients, SMAGs, facilities, and referral centers. While cellular towers are pivotal to improving network coverage, there are other small changes that could have a profound effect on communication, for example, supporting the purchase of cell phones and minutes for SMS messaging for providers who currently use their personal phones, and providing inexpensive phones to SMAG volunteers.

Use Data for Decision Making at All Levels

Utilize Quality Improvement Methods for Providers, Mentors and DMO Teams

Since data collection for SMGL project activities is ongoing, this data should be fed back to the DMO, mentorship teams, and providers. The provided data could include real-time feedback on health facility improvements or delays and indicators of service use. It could also be expanded to include reports of patient satisfaction. Quality improvement strategies using this data should be employed both to motivate providers on the ground and to identify challenges and weaknesses for future drills and mentorship.

Continue to Support and Expand Maternal Death Review

In 2004, WHO issued a set of guidelines for conducting MDRs or audits to learn why women were dying and how to address any identified barriers to improved access (WHO 2004). Facility-based MDR is one of the five key approaches that can be used in developing country settings to develop this information.

In the absence of ongoing, real-time data feedback to on-the-ground providers, MDR can provide quick evidence of what is and what is not working in the health system (Lewis 2003). MDR has been recently used in India as an ongoing method for identifying gaps in the provision of maternity care services, and the real-time challenges presented by limited with transportation and communication systems (Raj et al. 2013).

In our interviews, three respondents from different levels specifically mentioned the MDR as an SMGL activity that promoted discussion of maternal deaths to help identify key barriers to improved services. MDR was described as an activity that took

place when a facility notified the district, after which the district interviewed community members, gathered stakeholders, and discussed the death. MDR was also cited as a way of knowing the program's impact, since all deaths were counted and discussed. One participant mentioned that the District Commission Officer chaired the MDRs, which was important since many of the barriers were beyond the DMO's jurisdiction, in particular transport, communication, and other infrastructure issues. Continuing to include multiple government officials in the MDRs is essential to addressing these types of barriers.

It is important that the "no name, no blame" approach is applied when conducting an MDR. This means protecting the confidentiality of those who report specific challenges and identify failures of the system, as opposed to individuals (Lewis 2003). The DMO should ensure that anyone involved with the MDR process is appropriately trained.

Consider Infrastructure Improvements

While possibly beyond the scope of the SMGL budget, infrastructure improvements that support the health system should be addressed whenever possible. These include investments in electricity and cellular networks, bridges, and road construction projects.

Proceed with Existing Demand Generation Activities with Caution

Demand-generation activities, including the use of SMAGs, were central to SMGL's overall success in improving the rate of facility deliveries in Kalomo. This strategy should continue to be employed, and SMAGs should be provided with limited

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but meaningful incentives to recognize their volunteer status, such as simple provision of bicycles or uniforms. However, the investment in demand-generation should not outstrip what the supply-provision activities can achieve, and should take place when significant strides have been made in upgrading facilities and ensuring that personnel have the basic set of skills required for early detection and referral of patients presenting with complications.

Integration and Sustainability Plan from the Start

While SMGL was built upon the principle of utilizing existing platforms and aligning with government initiatives, in its second phase SMGL has a greater opportunity to build support from the government due to its reported impact on reducing maternal mortality. This is the perfect time to partner more closely with each level of government, including the provincial and ministerial levels, to design clearly integrated work plans that include clear steps for sustainability and transition.

Ongoing evaluation

The SMGL program will benefit from continued rigorous evaluation. Unfortunately, funding for comprehensive quasi-experimental studies is limited. One lesson from this dissertation is that data may exist from past or ongoing studies by which more robust comparisons and even quasi-experimental designs can be assembled to evaluate the program's effectiveness, though it is unlikely that there would be studies with as large a sample size as ZamCAT provided for my analysis. SMGL researchers and donors should look for opportunities to create such studies to learn about the program's

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impact in Phase 2. The SMGL initiative should also improve the quality of routine data collected at the health center level and its flow up to the district and national level. This would allow for more reliable routinely collected data and analysis in the short term of progress on key indicators.

7 CHAPTER SEVEN: CONCLUSION

Skilled birth attendance and access to EmONC are essential for reducing maternal mortality, particularly in the LIC of SSA. The SMGL program aimed to address the delays in seeking, accessing, and receiving adequate and timely maternal and newborn care in Zambia's rural Kalomo District to reduce maternal and newborn deaths. This study was unique in providing a quantitative impact assessment of SMGL using household-level data on women's pregnancies and deliveries, including data for a comparison group of similar women from three other districts within Southern Province where SMGL was not implemented and drawing upon health facility assessment data for Kalomo and the comparison facilities.

This study provides evidence on the impact of a package of interventions designed to address both demand and supply-side factors that drive high rates of maternal and newborn death, and demonstrates the potential contribution that demand-side factors such as community mobilization and outreach can have on increasing facility-based births. The study also identifies the ongoing challenges to changing supply-side factors within a limited time, given the incredible human resource shortage in Zambia.

There are few evaluation studies that use the rigor of this mixed-methods, quasi-experimental approach. This study, by utilizing ongoing investigations, offers a potential solution to the challenges in designing rigorous quasi-experimental or experimental designs for evaluating maternal mortality reduction programs. I hope that these findings will provide a basis for making programmatic and policy decisions for the SMGL's Phase

2 expansion and scale-up and for the design and implementation of similar programs

attempting to reduce maternal and newborn deaths.

8 APPENDICES

A.   ZamCAT Tables: Comparison of CHX and DCC groups

B.   ZamCAT Survey Forms

C.   ZamCAT HFA Tool

D.   Semi-structured Interview Guide

E.   PSA Tables

F.   Comparison of ZamCAT and non-ZamCAT Facilities

G.   Analysis using CDC Time Periods

Appendix A: Baseline Tables Comparing ZamCAT CHX and DCC Groups

Baseline Characteristics of ZamCAT Trial Sample

Parameter	Intervention	Control	All Subjects	95% CI
Number of Respondents	19628	20049	39677	
Respondent Characteristics				
1.1 Respondent's Age				
Mean Age in years (se)	25.5 (0.0)	25.7 (0.0)	25.6 (0.0)	.
Median Age in years (IQR)	24.00 (20.00 to 30.00)	24.00 (20.00 to 30.00)	24.00 (20.00 to 30.00)	.
Median Age in years (range)	24.00 (14 to 93)	24.00 (14 to 95)	24.00 (14.00 to 95.00)	.
< 20 years	24.0% (4,669/19,454)	23.0% (4,579/19,895)	23.5% (9,248/39,349)	(23.1% to 23.9%)
20–35 years	65.6% (12,765/19,454)	65.9% (13,118/19,895)	65.8% (25,883/39,349)	(65.3% to 66.2%)
> 35 years	10.4% (2,020/19,454)	11.0% (2,198/19,895)	10.7% (4,218/39,349)	(10.4% to 11.0%)
Mean Housesize (se)	6.4 (0.0)	6.5 (0.0)	6.4 (0.0)	.
Median Housesize (IQR)	6.00 (4.00 to 8.00)	6.00 (4.00 to 8.00)	6.00 (4.00 to 8.00)	.
Median Housesize (range)	6.00 (0 to 59)	6.00 (0 to 69)	6.00 (0.00 to 69.00)	.
Mothers Highest level of Education				
No education	9.9% (1,936/19,458)	9.8% (1,958/19,903)	9.9% (3,894/39,361)	(9.6% to 10.2%)
Lower primary (grade 1–4)	11.8% (2,293/19,458)	12.9% (2,562/19,903)	12.3% (4,855/39,361)	(12.0% to 12.7%)
Upper primary (grade 5–7)	39.7% (7,729/19,458)	39.6% (7,875/19,903)	39.6% (15,604/39,361)	(39.2% to 40.1%)
Junior secondary (grade 8–9)	27.9% (5,422/19,458)	27.6% (5,498/19,903)	27.7% (10,920/39,361)	(27.3% to 28.2%)
Upper secondary (grade 10–12)	9.7% (1,895/19,458)	9.2% (1,840/19,903)	9.5% (3,735/39,361)	(9.2% to 9.8%)
More than upper secondary	0.9% (180/19,458)	0.8% (160/19,903)	0.9% (340/39,361)	(0.8% to 1.0%)
Don't know	0.0% (3/19,458)	0.1% (10/19,903)	0.0% (13/39,361)	(0.0% to 0.1%)
1.3 Respondent's Ethnic group/tribe				
Tonga	87.4% (17,001/19,459)	88.6% (17,649/19,911)	88.0% (34,650/39,370)	(87.7% to 88.3%)
Ila	0.5% (105/19,459)	0.6% (121/19,911)	0.6% (226/39,370)	(0.5% to 0.6%)
Lozi	4.0% (786/19,459)	4.0% (795/19,911)	4.0% (1,581/39,370)	(3.8% to 4.2%)
Nyanja	2.7% (525/19,459)	2.2% (432/19,911)	2.4% (957/39,370)	(2.3% to 2.6%)

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Parameter	Intervention	Control	All Subjects	95% CI
Bemba	2.1% (413/19,459)	2.2% (433/19,911)	2.1% (846/39,370)	(2.0% to 2.3%)
Other (specify)	3.2% (629/19,459)	2.4% (481/19,911)	2.8% (1,110/39,370)	(2.7% to 3.0%)
Mean Gravida (se)	3.5 (0.0)	3.6 (0.0)	3.5 (0.0)	.
Median Gravida (IQR)	3.00 (2.00 to 5.00)	3.00 (2.00 to 5.00)	3.00 (2.00 to 5.00)	.
Median Gravida (range)	3.00 (0 to 14)	3.00 (0 to 14)	3.00 (0.00 to 14.00)	.
Intended Place of Delivery				
No plan	1.0% (197/19,415)	1.5% (306/19,864)	1.3% (503/39,279)	(1.2% to 1.4%)
Health facility	93.4% (18,132/19,415)	93.3% (18,533/19,864)	93.3% (36,665/39,279)	(93.1% to 93.6%)
Home	5.4% (1,046/19,415)	4.8% (944/19,864)	5.1% (1,990/39,279)	(4.8% to 5.3%)
Other (specify)	0.2% (40/19,415)	0.4% (81/19,864)	0.3% (121/39,279)	(0.3% to 0.4%)
Respondent's Marital status				
Single	15.5% (3,021/19,461)	15.7% (3,133/19,909)	15.6% (6,154/39,370)	(15.3% to 16.0%)
Married	82.8% (16,105/19,461)	82.9% (16,498/19,909)	82.8% (32,603/39,370)	(82.4% to 83.2%)
Separated	0.6% (112/19,461)	0.5% (102/19,909)	0.5% (214/39,370)	(0.5% to 0.6%)
Divorced	0.3% (56/19,461)	0.2% (41/19,909)	0.2% (97/39,370)	(0.2% to 0.3%)
Widowed	0.3% (56/19,461)	0.2% (44/19,909)	0.3% (100/39,370)	(0.2% to 0.3%)
Cohabiting	0.6% (109/19,461)	0.4% (89/19,909)	0.5% (198/39,370)	(0.4% to 0.6%)
No answer	0.0% (2/19,461)	0.0% (2/19,909)	0.0% (4/39,370)	(0.0% to 0.0%)
Slept under bednet last night	57.2% (11,091/19,400)	59.3% (11,783/19,857)	58.3% (22,874/39,257)	(57.8% to 58.8%)
Mother Literacy				
Not at all	25.9% (5,036/19,439)	27.6% (5,491/19,902)	26.8% (10,527/39,341)	(26.3% to 27.2%)
A bit	45.4% (8,834/19,439)	47.8% (9,515/19,902)	46.6% (18,349/39,341)	(46.1% to 47.1%)
Very well	28.3% (5,492/19,439)	24.3% (4,835/19,902)	26.2% (10,327/39,341)	(25.8% to 26.7%)
No answer	0.4% (77/19,439)	0.3% (61/19,902)	0.4% (138/39,341)	(0.3% to 0.4%)
Water Source				

Parameter	Intervention	Control	All Subjects	95% CI
Household tap	9.6% (1,861/19,437)	8.6% (1,715/19,874)	9.1% (3,576/39,311)	(8.8% to 9.4%)
Community tap	9.9% (1,918/19,437)	8.9% (1,761/19,874)	9.4% (3,679/39,311)	(9.1% to 9.6%)
Other water source on own property e.g. boreh	11.8% (2,295/19,437)	12.1% (2,402/19,874)	11.9% (4,697/39,311)	(11.6% to 12.3%)
Other communal water source e.g. well river	68.1% (13,240/19,437)	69.3% (13,768/19,874)	68.7% (27,008/39,311)	(68.2% to 69.2%)
No answer	0.3% (56/19,437)	0.3% (62/19,874)	0.3% (118/39,311)	(0.2% to 0.4%)
Other (specify)	0.3% (67/19,437)	0.8% (166/19,874)	0.6% (233/39,311)	(0.5% to 0.7%)
Roof Type				
Iron sheets/asbestos	45.7% (8,853/19,392)	41.5% (8,241/19,852)	43.6% (17,094/39,244)	(43.1% to 44.0%)
Thatched grass	53.9% (10,461/19,392)	58.1% (11,530/19,852)	56.0% (21,991/39,244)	(55.5% to 56.5%)
Don't know	0.2% (36/19,392)	0.2% (37/19,852)	0.2% (73/39,244)	(0.1% to 0.2%)
Other (specify)	0.2% (42/19,392)	0.2% (44/19,852)	0.2% (86/39,244)	(0.2% to 0.3%)
Respondent's Marital status				
Cement bricks without plaster	3.9% (763/19,444)	3.9% (767/19,903)	3.9% (1,530/39,347)	(3.7% to 4.1%)
Cement bricks with plaster	10.4% (2,017/19,444)	9.9% (1,971/19,903)	10.1% (3,988/39,347)	(9.8% to 10.4%)
Other bricks without plaster	65.7% (12,779/19,444)	65.4% (13,021/19,903)	65.6% (25,800/39,347)	(65.1% to 66.0%)
Other bricks with plaster	13.4% (2,607/19,444)	15.1% (2,997/19,903)	14.2% (5,604/39,347)	(13.9% to 14.6%)
Mud and poles	6.2% (1,196/19,444)	5.3% (1,063/19,903)	5.7% (2,259/39,347)	(5.5% to 6.0%)
Don't know	0.0% (1/19,444)	0.0% (3/19,903)	0.0% (4/39,347)	(0.0% to 0.0%)
Other (specify)	0.4% (81/19,444)	0.4% (81/19,903)	0.4% (162/39,347)	(0.3% to 0.5%)
TV Radio				
Neither	35.6% (6,909/19,406)	37.4% (7,432/19,869)	36.5% (14,341/39,275)	(36.0% to 37.0%)
Radio	43.2% (8,390/19,406)	43.3% (8,613/19,869)	43.3% (17,003/39,275)	(42.8% to 43.8%)
Television	3.2% (612/19,406)	2.6% (511/19,869)	2.9% (1,123/39,275)	(2.7% to 3.0%)
Both a radio and a television	18.0% (3,495/19,406)	16.7% (3,313/19,869)	17.3% (6,808/39,275)	(17.0% to 17.7%)

Parameter	Intervention	Control	All Subjects	95% CI
Respondent's Electricity status				
Electricity	8.5% (1,660/19,444)	6.9% (1,378/19,903)	7.7% (3,038/39,347)	(7.5% to 8.0%)
Lantern (kerosene lamp)	9.9% (1,921/19,444)	11.1% (2,218/19,903)	10.5% (4,139/39,347)	(10.2% to 10.8%)
Candle	17.1% (3,330/19,444)	16.6% (3,307/19,903)	16.9% (6,637/39,347)	(16.5% to 17.2%)
Battery	59.1% (11,494/19,444)	54.9% (10,936/19,903)	57.0% (22,430/39,347)	(56.5% to 57.5%)
Other (specify)	5.3% (1,023/19,444)	10.3% (2,041/19,903)	7.8% (3,064/39,347)	(7.5% to 8.1%)
Respondent's Distance to Facility				
less than 1 hour	33.0% (6,403/19,410)	34.2% (6,784/19,853)	33.6% (13,187/39,263)	(33.1% to 34.1%)
1 hour to less than 2 hours	35.3% (6,854/19,410)	36.5% (7,237/19,853)	35.9% (14,091/39,263)	(35.4% to 36.4%)
2 hours to less than 3 hours	21.5% (4,178/19,410)	21.2% (4,208/19,853)	21.4% (8,386/39,263)	(21.0% to 21.8%)
3 hours to less than 4 hours	7.3% (1,425/19,410)	5.5% (1,093/19,853)	6.4% (2,518/39,263)	(6.2% to 6.7%)
4 hours to less than 5 hours	1.5% (284/19,410)	1.7% (329/19,853)	1.6% (613/39,263)	(1.4% to 1.7%)
5 hours to less than 6 hours	0.8% (157/19,410)	0.4% (71/19,853)	0.6% (228/39,263)	(0.5% to 0.7%)
6 hours or more	0.3% (55/19,410)	0.1% (10/19,853)	0.2% (65/39,263)	(0.1% to 0.2%)
No answer	0.0% (3/19,410)	0.0% (9/19,853)	0.0% (12/39,263)	(0.0% to 0.0%)
Don't know	0.3% (51/19,410)	0.6% (112/19,853)	0.4% (163/39,263)	(0.4% to 0.5%)
Number of deliveries (parity)				
Mean (se)	2.4 (0.0)	2.5 (0.0)	2.5 (0.0)	.
Median (IQR)	2.00 (1.00 to 4.00)	2.00 (1.00 to 4.00)	2.00 (1.00 to 4.00)	.
Median (range)	2.00 (0 to 99)	2.00 (0 to 21)	2.00 (0.00 to 99.00)	.
Number of pregnancies (gravida)				
Mean (se)	3.5 (0.0)	3.6 (0.0)	3.5 (0.0)	.
Median (IQR)	3.00 (2.00 to 5.00)	3.00 (2.00 to 5.00)	3.00 (2.00 to 5.00)	.
Median (range)	3.00 (0 to 14)	3.00 (0 to 14)	3.00 (0.00 to 14.00)	.
Previous live births delivered but died within 1st 28 days o				

Parameter	Intervention	Control	All Subjects	95% CI
Mean (se)	0.1 (0.0)	0.1 (0.0)	0.1 (0.0)	.
Median (IQR)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)	0.00 (0.00 to 0.00)	.
Median (range)	0.00 (0 to 99)	0.00 (0 to 60)	0.00 (0.00 to 99.00)	.
Gestational Age at Enrollment (weeks)				
Mean (se)	28.0 (0.1)	28.4 (0.1)	28.2 (0.0)	.
Median (IQR)	28.00 (23.00 to 34.00)	29.00 (23.00 to 34.00)	28.00 (23.00 to 34.00)	.
Median (range)	28.00 (-36 to 92)	29.00 (-37 to 88)	28.00 (-37.00 to 92.00)	.

Appendix B: ZamCAT Survey Forms

ZamCAT
BASELINE FORM: FORM D

Study ID

Cluster:

Field Monitor ID:

Date of enrollment (dd/mm/yy):

Mother's date of birth (dd/mm/yy):

Age of mother:

_____ years

Field monitor says: "Now that you have agreed to enroll in the study and we have your tracing information, we would like to collect some information about you and your household. This information will be kept confidential." Remember to shade each circle completely and to use black pen only. Shade one circle unless otherwise specified.

Section I. Household Information

1. What tribe are you?

O Tonga

O Ila

O Lozi

O Nyanja

O Bemba

O Other, specify: _____

2. What is your marital status?

O Single

O Married

O Separated

O Divorced

O Widowed

O Cohabiting

O No answer

3. Did you sleep under an insecticide-treated net last night?

O No

O Yes

4. Are you able to read either English or local language?

O Not at all

O A bit

O Very well

O No answer

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Date scanned: _____ {For office use only}

5.How far have you gone in your education?

○ No education

○ Lower primary (grade 1-4)

○ Upper primary (grade 5-7)

○ Junior secondary (grade 8-9)

○ Upper secondary (grade 10-12)

○ More than upper secondary

○ Don't know

6.How far has the father of your baby gone in his education?

○ No education

○ Lower primary (grade 1-4)

○ Upper primary (grade 5-7)

○ Junior secondary (grade 8-9)

○ Upper secondary (grade 10-12)

○ More than upper secondary

○ Don't know

7. What is your occupation (job)?

○ Job in a formal business, farm organisation, or agency

○ Work in the informal sector for someone else (including domestic service, agricultural worker)

○ Self-employed (formal or informal)

○ Unemployed

○ Housewife

○ Studying/in school

○ Retired

○ Subsistence farmer

○ Other (specify): _____

8. What is the occupation (job) of your baby's father?

○ Job in a formal business, farm organisation, or agency

○ Work in the informal sector for someone else (including domestic service, agricultural worker)

○ Self-employed (formal or informal)

○ Unemployed

○ Studying/in school

○ Retired

○ Subsistence farmer

○ Other (specify): _____

Pagelink

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9. Where do you get the drinking water that you use at home ?

○ Tap

○ Community tap

○ Community borehole

○ Other water source on own property e.g. borehole, well

○ Other communal water source e.g. well, river

○ No answer

○ Other (specify): _____

10. What type of roof is on your house ?

○ Iron sheets/asbestos

○ Thatched grass

○ Don't know

○ Other (specify): _____

11. What type of walls does your house have?

○ Cement bricks without plaster

○ Cement bricks with plaster

○ Other bricks without plaster

○ Other bricks with plaster

○ Mud and poles

○ Don't know

○ Other (specify): _____

12. What type of floor is in your house?

○ Cement

○ Mud

○ Don't know

○ Other (specify): _____

13. Do you have a radio or television? Shade ONE box only.

○ Neither

○ Radio

○ Televison

○ Both a radio and a television

Pagelink

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14. What is your main source of light in the house? Shade ONE box only.

O None

O Lantern (kerosene lamp)

O Candle

O Electric lamp

O Other (specify):

15. Do you have any of the following? Shade ALL that apply.

O Electricity

O Refrigerator

O Car

O Cellular telephone

O Bicycle

O Own house

O Land

16. Does your household have any livestock?

O No

O Yes

16a. If YES to 16, how many of each type of livestock does your household have? Enter the number of each type below. If you do not have any of a type of livestock, enter "0" in each of the adjacent boxes.

1. Cattle

2. Goats/Sheep

3. Pigs

4. Chickens

5. Donkey

Examples:

The household has 10 cattle. ⟹ | 0 | 0 | 1 | 0 |

The household has no goats. ⟹ | 0 | 0 | 0 |

Please enter appropriate numbers in the following boxes .Write 01 for 1, 02 for 2, etc.

(Be sure to count the study participant in these numbers. Write 99 if no answer.)

17. How many adults older than 16 years live in your home, including you?

18. How many children 5–16 years old live in your home?

19. How many children under 5 years old live in your home?

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20. What fuel(s) are used for cooking in your home?

	Fuels used in rainy season	Fuels used MOST in rainy season	Fuels used in dry season	Fuels used MOST in dry season
	Shade ALL that apply.	Shade only ONE.	Shade ALL that apply.	Shade only ONE.
a. Crop residues (e.g. corn cobs)	O	O	O	O
b. Collected firewood	O	O	O	O
c. Purchased firewood	O	O	O	O
d. Charcoal	O	O	O	O
e. Kerosene	O	O	O	O
f. Gas	O	O	O	O
g. Electricity	O	O	O	O
h. Other (specify):	O	O	O	O

_____

21. On average, how many meals do you cook per day?

22. Which choice best describes the cooking area?

O Open space (outside)

O Room without a window or open space at top

O Room with a window or open space at top

Section II. Birth Plan

Field monitor says: "Now I would like to ask you a few questions about your plans for the delivery of the baby with which you are currently pregnant. This information will be kept confidential and will not impact the medical care you receive either at ANC or in labor and delivery."

23. Where do you plan to deliver the baby?

O No plan

O Health facility, name: _____

O Home

O Other (specify): _____

24. Why do you plan to deliver at the location you named? *(DO NOT read answers, shade ALL that apply.)*

○ Same location as prior delivery

○ Convenience

○ Need for skilled attendance

○ Financial

○ Distance

○ Relationship with providers/attendants

○ Family/social expectations

○ Safety for mother/baby

○ Not applicable (No plan)

○ Other (specify): _____

25. How long does it take you to walk from your house to the health facility where you receive ANC?

○ Less than 1 hour

○ 1 hour to less than 2 hours

○ 2 hours to less than 3 hours

○ 3 hours to less than 4 hours

○ 4 hours to less than 5 hours

○ 5 hours to less than 6 hours

○ 6 hours or more

○ No answer

Section III. ANC Information

The following information should be recorded from the mother's ANC card.

26. Name of ANC clinic (booking): _____

26a. Name of ANC clinic (follow-up): _____

27. Last menstrual period (dd/mm/yy): *If unknown, enter 99 99 99.*

☐☐ ☐☐ ☐☐

28. Estimated date of delivery (dd/mm/yy): *If unknown, enter 99 99 99.*

☐☐ ☐☐ ☐☐

29. Check the ANC card; if hospital delivery is recommended, please shade the "yes" circle.

○ No

○ Yes

30. Number of pregnancies (gravida), including this one: ☐☐

31. Number of deliveries (parity): ☐☐

32. Number of previously live births who died within the first 28 days of life: ☐☐

Field monitor says: "Thank you for enrolling in the study. I will visit you at your home in the next two weeks. Can we set a date for the home visit?"

Reminder:
Share newborn care messages
Give mother enrollment card

---

33. Scheduled date of home visit (dd/mm/yy): ☐☐ ☐☐ ☐☐

For Data Tracking Only

Field supervisor

Form checked on   Day ☐☐ Month ☐☐ Year ☐☐☐☐

Field supervisor's signature   _____

District manager

Form checked on   Day ☐☐ Month ☐☐ Year ☐☐☐☐

District manager's signature   _____

ZamCAT
ANTENATAL HOME VISIT FORM: FORM E

Study ID	Date of Home Visit (dd/mm/yy):	Time of Visit (HH:MM)

Cluster:	Field Monitor ID:

Field monitor says: "Thank you for letting me visit you at your home. I am here to follow up on the umbilical cord study you recently joined. I am here to check on you and your pregnancy. I am going to ask a few questions, but will keep this visit as short as possible."

1. Are you still planning on remaining in the catchment area until 1 month after delivery?

O No

O Yes

1a. If NO, where are you going?

_____

1b. Can you still be followed-up at this new location?

O No

O Yes

If NO, thank the woman and end the interview.

Field monitor says: "Now, I would like to ask you a few questions about your plans for the delivery in case you experience some different situations."

2. What would you do if you had swollen hands, face and feet during pregnancy?

O Nothing

O Seek help (specify where): _____

O Don't know

O Other (specify): _____

3. What would you do if you had vaginal bleeding late in pregnancy?

O Nothing

O Seek help (specify where): _____

O Don't know

O Other (specify): _____

Date scanned: _____ {For office use only}

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4. What would you do if you had bad-smelling vaginal discharge after delivery?

○ Nothing

○ Seek help (specify where): _____

○ Don't know

○ Other (specify): _____

5. What would you do if you had severe headaches and blurred vision during pregnancy?

○ Nothing

○ Seek help (specify where): _____

○ Don't know

○ Other (specify): _____

6. What would you do if you were in labor for more than 24 hours?

○ Nothing

○ Seek help (specify where): _____

○ Don't know

○ Other (specify): _____

7. What would you do if you had heavy vaginal bleeding after delivery?

○ Nothing

○ Seek help (specify where): _____

○ Don't know

○ Other (specify): _____

8. What would you do if you had fits before, during, or after delivery?

○ Nothing

○ Seek help (specify where): _____

○ Don't know

○ Other (specify): _____

9. What would you do if you had a high fever before, during, or after delivery?

○ Nothing

○ Seek help (specify where): _____

○ Don't know

○ Other (specify): _____

10. What means of transport would you take to reach a health facility where you could get help with the kinds of problems I just mentioned? Shade ALL that apply and list the time each option would take.

○ Walk   [ ][ ]:[ ][ ]

○ Transported on bicycle   [ ][ ]:[ ][ ]

○ Someone would carry me   [ ][ ]:[ ][ ]

○ Cart   [ ][ ]:[ ][ ]

○ Bus/taxi   [ ][ ]:[ ][ ]

○ Ambulance   [ ][ ]:[ ][ ]

○ Other (specify):   [ ][ ]:[ ][ ]

_____

For example, if it takes 3 hours, write

[0][3]:[0][0]

Field monitor says: "Now that we have talked about what you would do in case you had any of these problems, I would like to remind you that if you do actually have any of these problems we discussed, it is important for you to go to a health facility."

11. Ask the woman each of the following questions about her current health status. Shade the circle if she says YES.

○ Do you have a fever?

○ Do you have any vaginal bleeding?

○ Have you had convulsions or fits?

○ Have you had bad-smelling vaginal discharge?

○ Do you have swollen hands, face and feet?

○ Do you have severe headache and blurred vision?

Note: Shade ALL where the woman responds YES. If YES to any question, refer to clinic and complete REFERRAL form.

Draft

12. Did you sleep under an insecticide-treated net last night?

○ No

○ Yes

REMINDERS
Find out how the woman plans to contact the study team at the time of delivery.
Review the ZamCAT enrollment card with the woman.
Share the newborn care messages with the woman.
Remind the woman about cord care.
Remind her to fill out the information on the cord care diary.
If you are working in a chlorhexidine cluster, make sure the woman has 6 bottles of chlorhexidine.

Field monitor says: "Thank you for allowing this visit. I would like to remind you to contact me as soon as the baby is born! I will come for a visit on the day after the baby's delivery."

For Data Tracking Only

Field supervisor

   Form checked on   Day ☐☐ Month ☐☐ Year ☐☐☐☐

   Field supervisor's signature   _____

District manager

   Form checked on   Day ☐☐ Month ☐☐ Year ☐☐☐☐

   District manager's signature   _____

ZamCAT
DAY ONE (1) HOME VISIT DRY CLUSTER: FORM F

Study ID

Date of Delivery Notification (dd/mm/yy):

Time of Notification (HH:MM)

Cluster: **Field Monitor ID:**   **Date of Day 1 Visit (dd/mm/yy):**   **Time of Visit (HH:MM)**

Field monitor says: "Thank you for letting me visit you at your home. I am here to follow up on the umbilical cord study you enrolled in during your pregnancy. I am here to check on you and your newborn baby. I am going to ask a few questions, but will keep this visit as short as possible."

Section I. Infant and Maternal Health Information

1a. Determine the vital status of the baby.

○ Alive

○ Dead

○ Stillbirth

1b. Determine the vital status of the mother.

○ Alive

○ Dead

2. What is the sex of the baby?

○ Female

○ Male

If the baby died, console the mother, fill out an ADVERSE EVENT Form, and schedule a follow-up visit to fill out form J.

If the mother died, console the family and either fill out form K or schedule a follow-up visit to do so.

The following data may come from the ANC/L&D card or verbal report from the mother.

3. Date of Delivery (dd/mm/yy):

4. Time of Delivery (HH:MM)   If exact time is unknown, enter 99:99 and shade the appropriate circle in 4a.

4a. If exact time is unknown, what general time was the baby born?

○ Not applicable (respondent knew exact time)

○ Morning

○ Midday

○ Afternoon

○ Evening

○ Midnight

5. Did the baby cry when born?

○ No

○ Yes

Date scanned: _____ {For office use only}

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6. Did you and your baby sleep under an insecticide-treated net last night?

○ No; neither mother nor baby slept under a net.

○ Mother slept under a net but baby did not.

○ Baby slept under a net but mother did not.

○ Both mother and baby slept under a net.

7. How is the mother feeding the baby?

○ ONLY breast milk (exclusive breastfeeding)

○ Breast milk and other liquids (mixed feeding)

○ Formula or only other liquids (NO breast milk)

○ Other (specify) _____

8. How soon after birth was the baby breastfed?

○ Never breastfed

○ 1 hour or less

○ More than one hour

9. How much time passed between breaking of water and delivery?

○ Less than 24 hours

○ 24-48 hours

○ More than 48 hours

○ Don't know

10. Ask the mother each of the questions; shade the corresponding circle if she says YES.

○ Do you have a fever?

○ Do you have any excessive vaginal bleeding?

○ Have you had convulsions or fits?

○ Do you have any bad-smelling vaginal discharge?

Note: Shade ALL where the mother responds YES. If YES to any question, refer to clinic and complete REFERRAL form.

11. Ask the mother each of the questions; shade the corresponding circle if she says YES.

○ Is the baby having difficulty sucking?

○ Does the baby's body feel too warm (fever)?

○ Does the baby's body feel too cold?

○ Does the baby have yellow skin or eyes?

○ Has the baby had convulsions or fits?

○ Does the baby only move when stimulated?

○ Is the skin around the baby's umbilical stump red or does the stump have pus discharge?

○ Does the baby have difficulty breathing?

Note: Shade ALL where the mother responds YES. If YES to any question, refer to clinic and complete REFERRAL form.

Section II. Cord Care and Applications

"Now I would like to ask you about application of substances to the umbilical cord. "

12. Has anything been applied to the umbilical cord?

○ No

○ Yes

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Probe: "Did you apply _____?" (List each of the following substances in the following table. If the mother replies "yes," complete the table for that substance. If "no," write zero in the adjacent box.)

	Applied to Cord 0=No 1=Yes	How many hours after birth was the FIRST application made?	Number of app. since birth	Who applied it? 0=Not Applicable 1=Mother 2= Birth Attendant 3=Grandmother 4=Father
DUNG (specify): _____				
HOUSE SWEEPINGS				
ASH				
SALT WATER				
CHARCOAL				
BABY POWDER				
VASELINE				
BREAST MILK				
MBALA				
SOAP & WATER				
OTHER (specify): _____				

13. Has the baby been bathed? *If NO, skip to question 13.*

○ No

○ Yes

13a. If yes, how many hours after birth was the baby first bathed? ☐☐ hours

14. Birth weight: ☐☐☐☐ grams   *If unknown, enter 9999.*

Use the study scale and weigh the baby, recording to the nearest gram. The baby should be naked for weighing.

15. Day 1 weight: ☐☐☐☐ grams   *If unable to weigh the baby, enter 9999.*

After weighing the baby, look at the umbilical cord stump.

16. Based on the field monitor's observation, was any substance visible on the cord?

○ No

○ Yes

Section III. Information from ANC Card (ask to see the mother's ANC

17. What is the HIV status of the mother?

○ Reactive

○ Non-reactive

○ Don't know

If the mother is HIV negative, proceed to the final script to thank the mother and give her reminders.

"Do you mind if we discuss a couple of personal issues in private?"

18. If mother is reactive, did the mother get nevirapine?

○ No

○ Yes

○ Don't know

○ Unable to determine

19. If mother is reactive, did the baby get nevirapine?

○ No

○ Yes

○ Don't know

○ Unable to determine

If the mother is unsure, check her ANC and post-labor and delivery cards for information regarding nevirapine.

If the mother is HIV+ and the baby has not received NVP, refer the mother to the nearest health facility for treatment and for her baby's health.

Field monitor says: "Thank you again for letting me visit you at your home. I will come back at Day 4 to check on you and your newborn baby. When is a good time for you on that day?"

REMINDERS
Share newborn care messages.
Complete REFERRAL FORM if indicated.
Complete ADVERSE EVENT FORM if indicated.
Schedule next visit at a time convenient for the mother.

For Data Tracking Only

Field supervisor

Form checked on   Day ☐☐   Month ☐☐   Year ☐☐☐☐

Field supervisor's signature   _____

District manager

Form checked on   Day ☐☐   Month ☐☐   Year ☐☐☐☐

District manager's signature   _____

ZamCAT
DAY FOUR (4) HOME VISIT DRY CLUSTER: FORM G

Study ID	Cluster:	Field Monitor ID:	Date of Day 4 Visit (dd/mm/yy):

Time of Visit (HH:MM)

Section I. Maternal and Infant Information

1a. Determine the vital status of the baby.

○ Alive

○ Dead

1b. Determine the vital status of the mother.

○ Alive

○ Dead

If the baby died, console the mother, fill out an ADVERSE EVENT Form, and schedule a follow-up visit to fill out form J.
If the mother died, console the family and either fill out form K or schedule a follow-up visit to do so.

2. Ask the mother each of the following questions. Shade the circle if she says YES.

○ Do you have a fever?

○ Do you have any excessive vaginal bleeding?

○ Have you had convulsions or fits?

○ Do you have bad-smelling vaginal discharge?

Shade ALL where the mother responds YES. If YES to any question, refer to clinic and complete REFERRAL FORM .

3. Ask the mother each of the following questions about her baby. Shade the circle if she says YES.

○ Is the baby having difficulty sucking?

○ Does the baby's body feel too warm (fever)?

○ Does the baby's body feel too cold?

○ Does the baby have yellow skin or eyes?

○ Has the baby had convulsions or fits?

○ Does the baby only move when stimulated?

○ Is the skin around the baby's umbilical stump red or does the stump have pus discharge?

○ Does the baby have difficulty breathing?

○ Is the baby having diarrhea?

Shade ALL where the mother responds YES. If YES to any question, refer to clinic and complete REFERRAL FORM .

4. How are you feeding the baby?

○ ONLY breast milk and no other liquids (exclusive breastfeeding)

○ Breast milk and other liquids (mixed feeding)

○ Formula or other liquids only (NO breast milk)

○ Other (specify): _____

5. Did you and your baby sleep under an insecticide-treated net last night?

○ No; neither mother nor baby slept under a net.

○ Mother slept under a net but baby did not.

○ Baby slept under a net but mother did not.

○ Both mother and baby slept under a net.

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Section II. Physical Examination of the Umbilical Cord

6. Is the umbilical cord still attached?

If NO, skip to question 8.

○ No

○ Yes

7. Look at the umbilical cord. Are there any substances visible on the cord stump?

○ No

○ Yes

8. Date cord fell off (dd/mm/yy): *If the cord is still attached, enter 99 99 99.*

Section III. Cord Care and Applications

"Now I would like to ask you about application of substances to the umbilical cord."

9. Has anything been applied to the umbilical cord today?

○ No

○ Yes

Probe: "Did you apply _____?" (List each of the following substances in the table below. If the mother replies "YES," complete the table for that substance. If "NO," write zero in the adjacent box.)

	Applied to Cord 0=No 1=Yes	Number of app. today	Who applied it? 0=Not applicable 1=Mother 2= Birth Attendant 3=Grandmother 4=Father 5=Other
DUNG (specify): _____			
HOUSE SWEEPINGS			
ASH			
SALT WATER			
CHARCOAL			
BABY POWDER			
VASELINE			
BREAST MILK			
MBALA			
SOAP AND WATER			
OTHER (specify): _____			

10. Was anything applied to the umbilical cord yesterday?

○ No

○ Yes

Probe: "Did you apply _____?" (List each of the following substances in the table below. If the mother replies "YES," complete the table for that substance. If "NO," write zero in the adjacent box.)

	Applied to Cord 0=No 1=Yes	Number of app. yesterday	Who applied it? 0=Not applicable 1=Mother 2= Birth Attendant 3=Grandmother 4=Father 5=Other
DUNG (specify): _____			
HOUSE SWEEPINGS			
ASH			
SALT WATER			
CHARCOAL			
BABY POWDER			
VASELINE			
BREAST MILK			
MBALA			
SOAP AND WATER			
OTHER (specify):			

_____

11. Was anything applied to the umbilical cord two days ago (day 2 of life)?

○ No

○ Yes

Probe: "Did you apply _____?" (List each of the following substances in the table below. If the mother replies "YES," complete the table for that substance. If "NO," write zero in the adjacent box.)

	Applied to Cord 0=No 1=Yes	Number of app. two days ago	Who applied it? 0=Not applicable 1=Mother 2= Birth Attendant 3=Grandmother 4=Father 5=Other
DUNG (specify): _____			
HOUSE SWEEPINGS			
ASH			
SALT WATER			
CHARCOAL			
BABY POWDER			
VASELINE			
BREAST MILK			
MBALA			
SOAP AND WATER			
OTHER (specify):			

_____

Section IV. Delivery Information

"Now I would like to talk to you about your experience in labor and delivery."

12. Where did you deliver the baby? If not at home, please shade AND write the location's name.

○ Hospital, name: _____

○ Health center, name: _____

○ Home

○ Other (specify): _____

13. Why did you deliver at this location: (Do NOT read answers. Shade all that apply.)

O Prior experience

O Convenience

O Need for skilled attendance

O Financial

O Distance

O Birth plan

O I was told to deliver there

O Concerns about quality of care at health center

O Other (specify): _____

14. Who conducted your delivery? (Do NOT read answers. Shade all that apply.)

O Nurse/midwife

O Trained TBA

O Untrained TBA

O Family member/relative

O No one/mother delivered alone

O Other (specify): _____

15. Date of Delivery (dd/mm/yy):

☐☐ ☐☐ ☐☐

16. Time of Delivery (HH:MM) If exact time is unknown, enter 99:99 and shade the appropriate circle in 26a.

☐☐ - ☐☐

16a. If exact time is unknown, approximately when was the baby born?

O Not applicable (respondent knew exact time)

O Morning

O Mid-day

O Afternoon

O Evening

O Midnight

17. What was the mode of delivery?

O Vaginal

O Vaginal with forceps

O Vaginal with vacuum

O Cesarean section (c-section)

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18. What items from the clean delivery kit were used at delivery? (Shade all that apply.)

O Soap

O Gloves

O Cord clamp

O Plastic sheet

O Razor blade

O Candles

O Matches

19. On what surface did you deliver?

O Bed

O Mud floor

O Cement floor

O Other (specify): _____

20. Was the baby put directly on your abdomen immediately after delivery?

O No

O Yes

21. At what point was the baby dried?

O Before the placenta was delivered

O After the placenta was delivered

O Baby was not dried before being wrapped

O Don't know

22. Was the baby wrapped in a dry cloth?

O No

O Yes

For the following questions, do NOT read answers aloud. Shade all that apply.

23. Did you experience swollen hands, face and feet during pregnancy?

O No   *If NO, skip to question 24.*

O Yes

23a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

24. Did you experience vaginal bleeding late in pregnancy?

○ No   *If NO, skip to question 25.*

○ Yes

24a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

25. Did you experience severe headaches and blurred vision during pregnancy?

○ No   *If NO, skip to question 26.*

○ Yes

25a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

26. Were you in labor for more than 24 hours?

○ No

○ Yes

If NO, skip to question 27.

26a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

27. Did you have heavy vaginal bleeding after delivery?

○ No

○ Yes

If NO, skip to question 28.

27a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

28. Did you have fits/convulsions before, during or after delivery?

○ No

○ Yes

If NO, skip to question 29.

28a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

29. Did you have a high fever during pregnancy or at labour/delivery?

○ No

○ Yes

If NO, skip to question 30.

29a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

30. Did you have bad-smelling vaginal discharge during pregnancy or at labour/delivery?

○ No

○ Yes

If NO, skip to question 31.

30a. If yes, what did you do? Shade all that apply.

○ Went to health center

○ Consulted family member/elder/community member

○ Consulted traditional healer

○ Self-treated

○ Consulted community-based health agent (TBA, CHW, lay counselor)

○ Did nothing

○ Other (specify): _____

31. If the mother had symptoms from Questions 23-30 and nothing was done, ask the mother why.

```
Code box
1=swollen hands, feet, and face
2-vaginal bleeding late in pregnancy
3=severe headaches and blurred vision
4=labor lasting more than 24 hours
5=heavy vaginal bleeding after delivery
6=fits/convulsions during/after delivery
7=high fever
8=bad-smelling vaginal discharge
Place symptom for which nothing was done.
```

Code	Why was nothing done?

Code	Why was nothing done?

Section V. Information from ANC Card (ask to see the mother's ANC card)

Please copy all available information from the ANC card. Do not ask the mother for information.

32. Number of antenatal visits completed: ☐☐ visits   *If ANC card is left blank, write 00.*

33. How many times was SP (Fansidar) given to the mother at ANC? ☐☐ doses

34. Date(s) of tetanus vaccination (up to 5 injections). If no dates are written, note the number of doses in question number 35. For each dose that is ticked but has no date, enter 99 99 99. For each dose left blank, enter 00 00 00.

	DD	MM	YY
1st dose	☐☐	☐☐	☐☐
2nd dose	☐☐	☐☐	☐☐
3rd dose	☐☐	☐☐	☐☐
4th dose	☐☐	☐☐	☐☐
5th dose	☐☐	☐☐	☐☐

35. If other comments by health staff on tetanus, include below:

[   ]

36. Did the baby have a health facility visit for illness since birth?

○ No   *If NO, skip to question 37.*

○ Yes

36a. If yes, for what illness? _____

36b. If yes, when did you go? (DD-MM-YY) ☐☐ ☐☐ ☐☐

36c. If yes, what treatment was given? _____

37. Did you have a health facility visit for your own illness since the baby's delivery?

○ No   *If NO, skip to question 38.*

○ Yes

37a. If yes, for what illness? _____

37b. If yes, when did you go? (DD-MM-YY)   [ ][ ] [ ][ ] [ ][ ]

37c. If yes, what treatment was given? _____

If the baby was not weighed on Day 1, use the study scale and weigh the baby, recording to the nearest gram. The baby should be naked for weighing. If the baby was weighed on Day 1, do not weigh the baby and enter 9999.

38. Day 4 weight: [ ][ ][ ][ ] grams   *If unable to weigh the baby, enter 9999.*

Field monitor says: "Thank you again for letting me visit you at your home. I will come back at Day 10 to check on you and your newborn baby."

REMINDERS
Share newborn care messages.
Complete REFERRAL form if indicated.
Complete ADVERSE EVENT form if indicated.
Schedule next visit in 6 days.

For Data Tracking Only

Field supervisor

Form checked on   Day [ ][ ] Month [ ][ ] Year [ ][ ][ ][ ]

Field supervisor's signature   _____

District manager

Form checked on   Day [ ][ ] Month [ ][ ] Year [ ][ ][ ][ ]

District manager's signature   _____

Appendix C: ZamCAT HFA Tool

ZamCAT
HEALTH FACILITY SURVEY

Draft

Date of data collection: (DD/MM/YY)

Name of interviewer:

Cluster number:

Facility GIS coordinates, first measurement

Name of health facility:

Facility GIS coordinates, second measurement

District (shade one):

○ Choma   ○ Kalomo   ○ Livingstone   ○ Mazabuka   ○ Monze   ○ Siavonga

SECTION I. IDENTIFICATION INFORMATION

1. What is the interviewee's position at this facility?

○ doctor (medical officer)

○ medical licentiate

○ clinical officer

○ registered/certified nurse

○ enrolled nurse

○ midwife (registered or enrolled)

○ trained birth assistant

○ untrained birth assistant

○ community health worker

○ environmental health technician

○ other (specify): _____

2. What type of facility is this?

○ mission hospital

○ district hospital

○ private hospital

○ health center

○ other (specify): _____

3. Who operates this facility?

○ government

○ private organization

○ mission (religious organization)

○ non-governmental organization (NGO)

○ other (specify) _____

SECTION II. GENERAL

> **INSTRUCTIONS: Ask facility officer in charge or matron to answer the following questions about the facility's overall capacity and infrastructure. Shade the response given.**
>
> **The symbol ⇨ indicates a skip. If you see an arrow, follow the instructions next to it. If there is no skip, proceed to the next question.**

4. How many inpatient beds are available for patients in this facility (total in all departments)?

4a. How many observation beds are available for patients in this facility (total in all departments)?

5. How many beds are dedicated exclusively to obstetric patients?

5a. How often do women have to share beds?

○ Never

○ Sometimes (at least once per month)

○ Often (at least once per week)

○ Most of the time (daily)

5b. How often do women have to sleep on the floor?

○ Never

○ Sometimes (at least once per month)

○ Often (at least once per week)

○ Most of the time (daily)

6. Does this facility have electricity?

○ No ⇨ **If no, skip to question 12.**

○ Yes

7. If this facility has electricity, what is the source? **(Shade all that apply.)**

○ power lines (government)

○ power lines (private)

○ generator

○ solar

○ other (please specify): _____

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8. How often are there power cuts?

O never

O rarely (less than once per week)

O sometimes (at least once weekly but less than daily)

O often (at least once per day)

9. Is there a back-up generator available?

O No   ⇒ **If no, skip to question 12.**

O Yes

10. Is the back-up generator operational (today)?

O No

O Yes   ⇒ **If yes, skip to question 12.**

11. If the generator is not working, why not? (Shade all that apply.)

O no fuel

O needs maintenance or repair

O other (specify): _____

12. Does this facility have clean water for basic functions (i.e. hand washing for patients and staff)?

O No   ⇒ **If no, skip to question 16.**

O Yes

13. If facility has clean water, what is the water source?   (Read each option. Shade all that apply.)

O Piped- water available through municipal or government system

O Piped- water available through private system

O Piped- water pumped from local spring/ground

O Outdoor pump

O Outdoor protected well

O Rainwater catchment

O Water delivery

O Other (specify): _____

14. If facility has a source of clean water, is the water supply currently functioning?

O No

O Yes

15. How often is there an interruption to the water supply?

O Never

O Rarely (less than once a week)

O Sometimes (at least once a week, but less than daily)

O Often (at least daily)

16. Is there a functioning toilet designated for client use (indoor or outdoor)?

○ No ⇨ **If no, skip to question 19.**

○ Yes

17. If yes, what type of toilet(s) is there? (Shade all that apply.)

○ Flush/pour flush

○ Ventilated improved pit latrine (VIP)

○ Simple pit latrine

○ Open pit

18. Are soap and water available near the toilet today?

○ No

○ Yes

19. Is there a functioning toilet designated for staff use (indoor or outdoor)?

○ No ⇨ **If no, skip to question 22.**

○ Yes

20. If yes, what type of toilet(s) is there? (Shade all that apply.)

○ Flush/pour flush

○ Ventilated improved pit latrine (VIP)

○ Simple pit latrine

○ Open pit

21. Are soap and water available near the toilet today?

○ No

○ Yes

SECTION III. STAFFING

INSTRUCTIONS: List the number of staff, by qualification, that works here in the maternity and in the facility overall (in total, not by shift).

-The number in the maternity column cannot exceed the number in the total column.
-Fill all cells, enter "0" if there are no health care workers of that level.

	Cadre	Maternity	Total in facility
22.	Registered nurses and nurse-midwives		
23.	Enrolled nurses and nurse-midwives		
24.	Trained birth assistant		
25.	Untrained birth assistant		
26.	Community health worker (CHW)		
27.	Registered public health nurse		
28.	Clinical officer		
29.	Assistant medical officer		
30.	Generalist medical officer		
31.	Obstetrician/gynecologist doctor		
32.	Anesthetist doctor		
33.	Anesthetist non-doctor		
34.	Pharmacy staff (all levels)		
35.	Laboratory staff (all levels)		
36.	Environmental health technician		

Staff coverage

37. What are the facility hours of operation? **If 24 hours, enter 00:00 to 23:59.**

☐☐:☐☐ to ☐☐:☐☐

38. Is there 24-hour staff coverage?

○ No

○ Yes

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39. What are the labor and delivery hours of operation? If 24 hours, enter 00:00 to 23:59.

☐☐ - ☐☐ to ☐☐ - ☐☐

40. Is there 24-hour staff coverage on labor and delivery?

○ No

○ Yes

41. Where does the staff stay during off hours? Shade all that apply.

○ At the health facility

○ Within 20 minutes of the facility

○ More than 20 minutes but less than 1 hour from the facility

○ 1 hour or more away from the facility

SECTION IV. TRANSPORTATION AND COMMUNICATION

INSTRUCTIONS: Please ask the facility officer in charge about the availability of transport and means of communication. If an item is available, ask if it has been functional in the last week.

Does this facility have any of the following means of communication? Shade one choice for each question.

42. Land telephone(s)

○ Not available

○ At least one available and functional in the last week

○ Available, but not functional

43. Mobile telephone(s) (owned by the facility and designated for work-related calls)

○ Not available

○ At least one available and functional in the last week

○ Available, but not functional

44. Mobile telephone(s) (owned by individual health workers)

○ Not available

○ At least one available and functional in the last week

○ Available, but not functional

45. Two-way radio communication

○ Not available

○ At least one available and functional in the last week

○ Available, but not functional

46. Do you get a cell phone signal at this facility?

○ No ⟹ **If no, skip to question 49.**

○ Yes

47. If yes, which of the following cellular network(s) are available in the area? Shade all that apply.

○ Airtel (formerly Zain)

○ MTN

○ Cell Z

48. If health workers use personal mobile phones for work-related calls, are they refunded for airtime used

○ No

○ Sometimes

○ Yes

○ Not applicable

49. Does this facility have any of the following means of transportation? Shade one circle per line.

	Not available	At least one available and functional	Available but non-functional
49a. Motor vehicle ambulance	○	○	○
49b. Motorcycle ambulance	○	○	○
49c. Bicycle ambulance	○	○	○
49d. Motor vehicle (non-ambulance)	○	○	○
49e. Motorcycle	○	○	○
49f. Bicycle	○	○	○
49g. Boat	○	○	○
49h. Animal-drawn cart	○	○	○
49i. Other (specify below):	○	○	○

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Motor vehicles/motorcycles

50. Who is responsible for ensuring that the vehicle(s)/motorcycle(s) are in working order?

○ Facility in-charge

○ Transport officer

○ Community

○ District health office

○ Environmental health technician

○ Community health worker

○ Other (specify): _____

○ Not applicable

51. Who is responsible for the funds for fuel? **(Shade all that apply.)**

○ Facility in-charge

○ Transport officer

○ Community

○ District health office

○ Environmental health technician

○ Community health worker

○ Other (specify): _____

○ Not applicable

52. Are there funds available in the facility today for maintenance/repair of vehicles if needed?

○ No

○ Yes

○ Not applicable

53. Is sufficient fuel available in the facility today to transport emergency referrals if needed?

○ No

○ Yes

○ Not applicable

General referral

54. If a vehicle is not available from the facility or district, are there funds available at the facility to pay for private transport of emergency referrals?

○ No

○ Sometimes

○ Yes

○ Not applicable

55. How far is the nearest referral hospital for the following types of referral:

55a. Severe maternal complications (cesarean section, maternal hemorrhage, eclampsia, seizures, etc.) referral [ ][ ][ ] km

55b. Severe neonatal illness referral [ ][ ][ ] km

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56. How long does it take to get to the nearest referral hospital in a working vehicle? **(Record hours and minutes under ideal circumstances.)**

56a. Cesarean section referral (HH:MM)

56b. Severe neonatal illness referral (HH:MM)

For the following two questions, describe the road from this health center to the referral health facility.

57a. Cesarean section referral **(Shade all that apply.)**

O Tarred (paved)

O Unpaved but good

O Unpaved and poor

O Other (specify) _____

57b. Severe neonatal illness referral **(Shade all that apply.)**

O Tarred (paved)

O Unpaved but good

O Unpaved and poor

O Other (specify) _____

SECTION V. EMOC SIGNAL FUNCTIONS AND OTHER IMPORTANT SERVICES

INSTRUCTIONS: Answer the following questions regarding EmOC signal functions by interviewing the maternity in-charge. Where possible, confirm responses by reviewing facility registers or through observation. Record whether the function has been performed in the past three (3) months, and if not, why it has not been performed. You may need to ask several probing questions to identify the primary reason that the signal function was not performed.

Consider all of the following when determining whether a particular signal function was performed:

- Are there policies that prohibit the performance of the service at this level of facility?

- Is staff at this facility trained to provide the service?

- Are the cadres of staff working at the facility authorized to perform the service?

- Are the requisite supplies and equipment present and functioning?

- Are there internal management issues that limit the performance of the service, such as preference for a different procedure or desire for additional compensation?

- Were there no cases for which the use of a particular signal function was indicated? (See additional notes on next page.)

Based on the response to the probe questions, the research team should select one response.

Policy issues
    a. Required level of staff are not posted to this facility in adequate numbers (or at all)
    b. National or hospital policies do not allow function to be performed

Training issues
    a. Authorized cadre is available, but not trained
    b. Lack of confidence in providers' skills

Supply/equipment/drug issue
    a. Supply/equipment is not available, not functional, or broken
    b. Needed drugs are unavailable

Management issue
    a. Providers desire compensation to perform this function
    b. Providers are encouraged to perform alternative procedures
    c. Providers are uncomfortable or unwilling to perform this procedure for reasons unrelated to training

No indication
    No client needing this procedure came to the facility during the last three (3) months

Signal function 1: Parenteral antibiotics
(Parenteral is defined as administration by intravenous or intramuscular injection.)

58. Have antibiotics been administered parenterally (intravenous or intramuscular) in the last 3 months?

○ No

○ Yes ⇨ **If yes, skip to question 59.**

58a. If parenteral antibiotics were NOT administered in the last 3 months, why not?

○ not applicable

○ policy issues

○ training issues

○ supply/equipment/drug issue

○ management issue

○ no indication

○ other (specify) _____

See notes at top of page for more on these reasons.

Signal function 2: Parenteral oxytocics
59. Have oxytocics (oxytocin, ergometrine, etc.) been administered parenterally (intravenous or intramuscular) in the last 3 months?
(Parenteral is defined as administration by intravenous or intramuscular injection.)
○ No ⇨ **If no, skip to question 60.**

○ Yes

59a. If parenteral oxytocics (oxytocin, ergometrine, etc.) were administered in the last 3 months, which type of oxytocic was used? **Shade all that apply and skip the next question.**

○ oxytocin

○ ergometrine

○ other (specify) _____

Pagelink

59b. If parenteral oxytocics were NOT administered in the last 3 months, why not?

O not applicable

O policy issues

O training issues

O supply/equipment/drug issue

O management issue

O no indication

O other (specify): _____

See notes at top of previous page for more on these reasons.

Signal function 3: Parenteral anticonvulsants

60. Have anticonvulsants (e.g. magnesium) been administered parenterally (intravenous or intramuscular) in the last 3 months?

O No ⟹ **If no, skip the next question.**

O Yes

60a. If parenteral anticonvulsants (e.g. magnesium) were administered in the last 3 months, which type of anticonvulsant was used? Shade all that apply and skip the next question.

O magnesium sulfate

O diazepam

O other (specify): _____

60b. If parenteral anticonvulsants were NOT administered in the last 3 months, why not?

O not applicable

O policy issues

O training issues

O supply/equipment/drug issue

O management issue

O no indication

O other (specify) _____

See notes at top of previous page for more on these reasons.

Signal function 4: Manual removal of placenta

61. Has manual removal of placenta been performed in the last 3 months?

O No

O Yes ⟹ **If yes, skip the next question.**

61b. If manual removal of placenta was NOT performed in the last 3 months, why not?

O not applicable

O policy issues

O training issues

O supply/equipment/drug issue

O management issue

O no indication

O other (specify): _____

See notes at top of previous page for more on these reasons.

Pagelink

Signal function 5: Removal of retained products
(Reminder: Evacuations may not be performed in the maternity ward. It may be necessary to ask about other areas of the facility where evacuations are performed, such as minor theatre, etc.)

62. Has removal of retained products (MVA or D&C) been performed in the last 3 months?

○ No ⇨ **If no, skip the next question.**

○ Yes

62a. If removal of retained products was performed in the last 3 months, which method was used? **Shade all that apply and skip the next question.**

○ manual vacuum aspiration (MVA)

○ dilation and curettage (D&C)

○ other (specify): _____

62b. If removal of retained products (MVA or D&C) was NOT performed in the last 3 months, why not?

○ not applicable

○ policy issues

○ training issues

○ supply/equipment/drug issue

○ management issue

○ no indication

○ other (specify): _____

See notes at top of page 10 for more on these reasons.

Signal function 6: Assisted vaginal delivery

63. Has assisted vaginal delivery (vacuum or forceps) been performed in the last 3 months?

○ No ⇨ **If no, skip the next question.**

○ Yes

63a. If assisted vaginal delivery was performed in the last 3 months, which method was used? **Shade all that apply and skip the next question.**

○ vacuum extractor

○ forceps

63b. If assisted vaginal delivery (vacuum or forceps) was NOT performed in the last 3 months, why not?

○ not applicable

○ policy issues

○ training issues

○ supply/equipment/drug issue

○ management issue

○ no indication

○ other (specify): _____

See notes at top of page 10 for more on these reasons.

Signal function 7: Neonatal resuscitation

64. Has neonatal resuscitation with bag and mask been performed in the last 3 months?

O No

O Yes ⟹ **If yes, skip the next question.**

64a. If neonatal resuscitation with bag and mask was NOT performed in the last 3 months, why not?

O not applicable

O policy issues

O training issues

O supply/equipment/drug issue

O management issue

O no indication

O other (specify): _____

See notes at top of page 10 for more on these reasons.

64b. Which of the following neonatal resuscitation techniques have been used in the last 3 months? **Shade all that apply.**

O warming/drying the baby

O clearing the airway with bulb suction

O bag and mask ventilation

O administration of adrenaline

O intubation of the newborn

O none of the above

Signal function 8: Blood transfusion

65. Has blood transfusion been performed in the last 3 months?

O No ⟹ **If no, skip the next question.**

O Yes

65a. If blood transfusion was performed in the last 3 months, what was the source of the blood? **Shade all that apply.**

O blood comes from central blood bank

O blood comes from facility blood bank

O blood is collected from family or friends as needed (live transfusion)

O other (specify): _____

65b. If blood transfusion was NOT performed in the last 3 months, why not?

O not applicable

O policy issues

O training issues

O supply/equipment/drug issue

O management issue

O no indication

O other (specify): _____

See notes at top of page 10 for more on these reasons.

Signal function 9: Perform surgery (cesarean section)

66. Has a cesarean section been performed in the last 3 months?

○ No

○ Yes ⇨ **If yes, skip the next question.**

66a. If a cesarean section was NOT performed in the last 3 months, why not?

○ not applicable

○ policy issues

○ training issues

○ supply/equipment/drug issue

○ management issue

○ no indication

○ other (specify): _____

See notes at top of page 10 for more on these reasons.

66b. What type of anesthesia is currently provided at this facility for major surgery such as cesarean section? **Shade all that apply.**

○ anesthesia is not provided at this facility

○ general

○ spinal

○ epidural

○ ketamine

○ other (specify): _____

Other maternal-neonatal health-related services

67. How often is a partograph used at this facility?

○ Never

○ Sometimes (at least once a month) ⇨

○ Often (at least once per week)

○ Most of the time (daily)

If sometimes, often, or most of the time, skip to question 68.

67a. If a partograph has not been used to manage labor in the last 3 months, why not?

○ not applicable

○ policy issues

○ training issues

○ supply/equipment/drug issue

○ management issue

○ no indication

○ other (specify):

See notes at top of page 10 for more on these reasons.

68. Has Active Management of Third Stage Labor (AMTSL), using administration of a uterotonic *and* uterine massage *and* controlled cord traction, been performed in the last 3 months?

○ No

○ Yes ⇨ **If yes, skip to question 69.**

Pagelink

68a. If Active Management of Third Stage Labor has not been used in the last 3 months, why not?

O not applicable

O policy issues

O training issues   **See notes at top of page 10**
                                                    for more on these reasons.
O supply/equipment/drug issue

O management issue

O no indication

O other (specify):   _____

69. Has a breech delivery been performed in the last 3 months?

O No

O Yes ⇨ **If yes, skip to question 70.**

69a. If yes, was the delivery vaginal or cesarean? If both types were performed, select "both."

O vaginal

O cesarean

O both types of delivery were conducted

69b. If a breech delivery was NOT performed in the last 3 months, why not?

O not applicable

O policy issues

O training issues

O supply/equipment/drug issue   **See notes at top of page 10**
                                                    for more on these reasons.
O management issue

O no indication

O other (specify):   _____

70. For mothers with unknown HIV status, how often is rapid testing performed in the maternity ward?

O Never

O Sometimes (at least once a month) ⇨ **If sometimes, often, or most of the time,**
                                       skip to question 71
O Often (at least once per week)

O Most of the time (daily)

70a. If rapid HIV testing was not provided in the maternity ward, why not?

O not applicable

O policy issues   **See notes at top of page 10**
                                                    for more on these reasons.
O training issues

O supply/equipment/drug issue

O management issue

O no indication

O other (specify):   _____

Pagelink

71. Have ARVs been given to mothers in the maternity/labor ward in the last 3 months? Shade all regimens used.

○ No ARVs given

○ One dose of NVP at labour and delivery

○ AZT-3TC (seven day tail)

○ AZT only

○ 3TC only

○ HAART

○ Don't know

○ Other (specify) _____

⟹ **If ARVs were given, skip to question 72.**

71a. If ARV was NOT given to mothers in the maternity/labor ward in the last 3 months, why not?

○ not applicable

○ policy issues

○ training issues

○ supply/equipment/drug issue

○ management issue

○ no indication

○ other (specify): _____

See notes at top of page 10 for more on these reasons.

72. Has ARV been given to newborns in the maternity/labor ward in the last 3 months? Shade all the regimens used.

○ No ARVs given

○ NVP at birth only

○ NVP at birth and daily doses since birth

○ extended NVP

○ Don't know

○ Other (specify) _____

⟹ **If ARVs were given, skip to question 73.**

72a. If ARV was NOT given to newborns in the maternity/labor ward in the last 3 months, why not?

○ not applicable

○ policy issues

○ training issues

○ supply/equipment/drug issue

○ management issue

○ no indication

○ other (specify): _____

See notes at top of page 10 for more on these reasons.

73. How often is misoprostol used at this facility?

○ Never

⟹ **If never, skip to question 75.**

○ Sometimes (at least once a month)

○ Often (at least once per week)

○ Most of the time (daily)

74. If yes, for what indications is misoprostol used? (Shade all that apply.)

O management of postpartum hemorrhage

O post-abortion care

O induction of labor

O augmentation of labor

O induction of abortion

O other (specify): _____

75. Describe the area where women are seen for treatment. (Shade all that apply.)

O there is both visual and auditory privacy (e.g. a door that closes)

O there is visual but not auditory privacy (e.g. curtain/drape)

O there is neither visual nor auditory privacy

76. Is the treatment area for women clean (without visible soil or rubbish)?

O No

O Yes

77. Examine the delivery area. Shade the circle next to each true statement.

O Delivery equipment is sterile and ready for use.

O Cord ligatures / cord clamps are in the delivery room.

O Protective wear (sterile gloves, aprons) is available.

O Ergometrine and/or oxytocin (pitocin) is available.

O Misoprostol is available.

O Clean, dry linen is available for drying and wrapping newborns.

O Partographs are present.

O Designated place to receive and resuscitate newborns.

78. Is the following basic resuscitation equipment available in the area? Shade the circle next to each item witnessed to be present.

O oxytocin

O magnesium sulphate

O vacuum extractor

O forceps

O speculum

O aspiration syringe

O curette

O blood for transfusion

O bag-mask for infant

O infant warmer

O towels to dry infant

O bulb suction

O laryngoscope handle

O laryngoscope blade with working light (must check by attaching to handle)

O neonatal endotracheal tubes (sizes 2.5, 3.0, 4.0)

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79. When was the last time this health facility received a referral of a complicated delivery from a TBA in the catchment area?

○ never

○ more than 12 months ago

○ 4-12 months ago

○ 1-3 months ago

○ this month, but more than a week ago

○ this week

Maternal death reviews

80. Does this facility perform regular maternal death reviews?

○ No

○ Yes ⇒ **If yes, skip to question 80b.**

80a. If no, why not?

_____ ⇒ **Skip the next question.**

80b. If yes, how often?

○ monthly

○ quarterly

○ annually   **Neonatal and under 5 care**

81. Describe the area where children are seen for treatment. Shade all that apply.

○ there is both visual and auditory privacy (e.g. a door that closes)

○ there is visual but not auditory privacy (e.g. curtain/drape)

○ there is neither visual nor auditory privacy

82. Is the treatment area for children clean? (without visible soil or rubbish)

○ No

○ Yes

83. When was the last time this health facility received a referral of a sick child from a CHW?

○ never

○ more than 12 months ago

○ 4-12 months ago

○ 1-3 months ago

○ this month, but more than a week ago

○ this week

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84. When was the last time a child under 5 was referred from this facility to a higher level of care?

○ never ⟹ **If "never," skip to question 85.**

○ more than 12 months ago

○ 4–12 months ago

○ 1–3 months ago

○ this month, but more than a week ago

○ this week

84a. What are the most common reasons for referral to a higher level of care? **Shade all that apply.**

○ severe dehydration

○ severe respiratory illness

○ severe malaria

○ trauma

○ other (specify): _____

Delivery

85. Where is the baby placed after delivery?

○ on the floor

○ next to mother

○ in a cot

○ on mother's abdomen/chest

○ in another room

○ on a warmer

○ other (specify): _____

86. Is the baby dried and wrapped in a clean, dry cloth after birth?

○ neither dried nor wrapped ⟹ **If "neither dried nor wrapped," skip the next question.**

○ dried, not wrapped

○ wrapped, not dried

○ dried, then wrapped with same cloth

○ dried, then wrapped with different cloth

87. If the baby is dried, wrapped, or both, how soon after birth is this performed?

○ 0–9 minutes

○ 10–19 minutes

○ 20–29 minutes

○ 30 minutes– 1 hour

○ greater than 1 hour

88. How soon after birth is the baby first bathed?

O less than 1 hour

O one (1) to less than 6 hours

O six (6) to less than 12 hours

O twelve (12) to less than 24 hours

O 24 hours or more

89. Is the baby usually massaged with oil?

O baby is not massaged with oil

O baby is massaged with oil once daily, after a bath

O baby is massaged with oil at least twice daily, after a bath

O baby is massaged with oil once daily, not after a bath

O baby is massaged with oil at least twice daily, not after a bath

90. How soon after birth is breastfeeding generally initiated? ⟹ **90a. Is there formula available for babies whose mothers are not able to breast feed?**

O less than 1 hour

O one (1) to less than 6 hours

O six (6) to less than 12 hours

O twelve (12) to less than 24 hours

O 24 hours or more

O Yes

O No

91. When was the last time you advised mothers to practice skin-to-skin care?

O Today

O Yesterday

O Last week

O Last month

O Never

92. Which newborn babies have their temperature checked?

O none

O only babies who appear cold

O only babies who appear sick

O all babies immediately after birth

O all babies regularly, at least daily

93. What measures are taken for LBW infants (<2500 g)? Shade all that apply.

O only routine newborn care

O covered in blanket(s) and a hat

O placed skin-to-skin with mother or other person

O placed under heating lamp or radiant warmer

O placed in incubator

O temperature measured more than once daily

94. Is the environmental temperature regulated in the maternity ward and/or nursery?

O no method of temperature control

O heat source used to warm room above 25 degrees C

O heat source to warm selected newborns

O heat source to warm all newborns

95. Is the delivery room heated?

○ No, never

○ Yes, during cold season

○ Yes, year-round

○ Yes, when staff choose to heat it

96. Is the temperature in the delivery room measured?

○ No

○ Yes

SECTION VI. FACILITY CASE LOAD

INSTRUCTIONS: Review the registers and logbooks where information on the following procedures is recorded for the last three months. Keep in mind that you may need to request access to different registers for different procedures. It is helpful to keep a separate tally sheet as you look through the registers before filling this table. Do not leave boxes blank; enter 00 where there were no cases and 99 where the number is unknown.

Registers

97. Which of the following registers are present? Shade all that apply.

○ Safe mother ward register

○ Labour and delivery register

○ PMTCT integrated register

○ PMTCT delivery register

○ Under 5 register

○ Referral register

○ Outpatient register (OPD)

Referral register

98. Record the number of children under 5 who were referred to a higher level of care due to severe illness during the past 3 months.

				children

Labour and delivery register

99. Check for completeness of entries in the last 3 months. Shade each category that is complete.

○ birthweight

○ duration of pregnancy (weeks/months)

○ outcome of delivery

100. How recent is the date of the most recent entry in the register?

○ less than 7 days from today

○ 7 days or more but less than 1 month from today

○ 1 month or older

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Review the remarks in the labour and delivery register. For each cause of death, please give the number of maternal deaths in the last 3 months.

101a. severe pre-eclampsia or eclampsia ☐☐☐☐

101b. antepartum hemorrhage ☐☐☐☐

101c. obstructed or prolonged labor ☐☐☐☐

101d. ruptured uterus ☐☐☐☐

101e. postpartum sepsis ☐☐☐☐

101f. postpartum hemorrhage ☐☐☐☐

101g. unsafe abortion ☐☐☐☐

101h. ectopic pregnancy ☐☐☐☐

101i. other (specify): ☐☐☐☐ _____

102. Record the numbers of <u>sick</u> neonates (<4 weeks) seen at the center or reported within the catchment in the last 3 months. Record the number for each diagnosis. If the diagnoses are not available, only record the total number in the last row.

Condition	0-<24 hours	24-<48 hours	48 hours-<1 week	1 week- 4 weeks
Prematurity				
LBW (<2500 g)				
Birth asphyxia				
Sepsis				
Fever				
Congenital anomaly				
Jaundice				
Seizure				
Diarrhea				
Pneumonia				
Total				

Pagelink ☐☐☐

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103. Record the numbers of <u>deceased</u> neonates (<4 weeks) seen and treated in the last 3 months. Record the number for each diagnosis. If the diagnoses are not available, only record the total number in the last row.

Condition	0–<24 hours	24–<48 hours	48 hours–<1 week	1 week– 4 weeks
Prematurity				
LBW (<2500 g)				
Birth asphyxia				
Sepsis				
Fever				
Congenital anomaly				
Jaundice				
Seizure				
Diarrhea				
Pneumonia				
Total				

Review the **Health Centre Service Delivery Aggreggation Form** and give the number of cases in the last **3 months** for each of the following. Record when the data is from in the blanks below.

Write the name of the month and ⟹
yearthat is recorded at the top of the
form. **Example: March 2011**

	Month and year 1:	Month and year 2:	Month and year 3:
	_____	_____	_____

104. Child health

	Month 1	Month 2	Month 3
Under 5 Clinic Attendance			
104a. Attendance child health total	☐☐☐☐	☐☐☐☐	☐☐☐☐
Growth monitoring and nutrition			
104b. Total children <5 years weighed	☐☐☐☐	☐☐☐☐	☐☐☐☐

105. Reproductive health/Safe Motherhood

First antenatal visit			
105a. Record the number of first antenatal visits.	☐☐☐☐	☐☐☐☐	☐☐☐☐
Prophylaxis during pregnancy			
105b. ITN provided at ANC visit	☐☐☐☐	☐☐☐☐	☐☐☐☐

Postnatal	Month 1	Month 2	Month 3
105c. Postnatal care within 6 days	☐☐☐	☐☐☐	☐☐☐
105d. Postnatal care between 6 days and 6 weeks	☐☐☐	☐☐☐	☐☐☐

106. Family planning

Utilisation			
106a. Attendance family planning- new	☐☐☐	☐☐☐	☐☐☐
106b. Attendance family planning- revisit	☐☐☐	☐☐☐	☐☐☐
106c. Attendance family planning- total	☐☐☐	☐☐☐	☐☐☐

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Methods	Month 1	Month 2	Month 3
106c. Male condoms			
106d. Female condoms			
106e. Combined oral contraceptives			
106f. Progesterone only pill			
106g. Medroxyprogesterone injection			
106h. Norethisterone enanthate injection			
106i. Implant			
106j. IUCD inserted			
106k. Sterilisation- female			
106l. Sterilisation- male			

107. Obstetric Care
Deliveries

	Month 1	Month 2	Month 3
107a. Normal facility deliveries			
107b. Assisted deliveries (vacuum/forceps)			
107c. Cesarean sections			

Delivery Supervision

	Month 1	Month 2	Month 3
107d. Home deliveries by trained TBAs			
107e. Home deliveries by any TBAs			

Delivery Complications

	Month 1	Month 2	Month 3
107f. postpartum sepsis			
107g. obstructed or prolonged labor			
107h. hypertensive disorders (pre-eclampsia or eclampsia)			

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	Month 1	Month 2	Month 3
107i. postpartum hemorrhage			
107j. unsafe abortion			
107k. ruptured uterus			
107l. retained placenta			
107m. manual vacuum aspiration for incomplete abortion			
107n. manual removal of placenta			
107o. anticonvulsant given for pre-eclampsia/eclampsia			
107p. IV antibiotics given for sepsis			
107q. maternal deaths in facility			

108. Neonatal care

Live births

	Month 1	Month 2	Month 3
108a. Live births in facility, <2500 g			
108b. Live births in facility, >2500 g			

Stillbirths

108c. Macerated stillbirths			
108d. Fresh stillbirths			

Neonatal deaths

108e. Asphyxia- early neonatal deaths (within 24 hours of delivery)			
108f. Late neonatal deaths (>24 hours after delivery)			

109. PMTCT

Counseling and testing

109a. Total tested during Antenatal			
109b. Total HIV positive Antenatal clients			

PMTCT Deliveries

109c. Live birth HIV exposed			

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Record the following information from the **Health Centre Disease Aggregation Form.**

Write the name of the month and ⟹
yearthat is recorded at the top of the
form. **Example: March 2011**

Month and year 1:   Month and year 2:   Month and year 3:

110. Diagnoses: under 5 years

	Month 1	Month 2	Month 3
110a. Respiratory infection: pneumonia			
under 1 year			
1 to under 5 years			
110b. Severe diarrhoea with dehydration			
under 1 year			
1 to under 5 years			
110c. Severe malnutrition (new case)			
under 1 year			
1 to under 5 years			

111. Diagnoses: neonatal

111a. Neonatal infections (all): treated			
0 to 7 days, total			
8 to 28 days, total			
111b. Neonatal Prematurity: treated			
0 to 7 days, total			
8 to 28 days, total			

Diseases

112a. Malaria case provided with antimalarial treatment			
under 1 year			
1 to under 5 years			

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	Month 1	Month 2	Month 3

112b. Confirmed case of malaria

under 1 year

1 to under 5 years

112c. Confirmed malaria in pregnancy

Total

112d. Malaria laboratory tests (slide/RDT)

under 1 year

1 to under 5 years

5 years and over

113. Diarrhoea (non-bloody)

under 1 year

1 to under 5 years

OPD register

114. Does the OPD register contain complete entries for the past 6 months for the following for children under 5? For example, shade "age" if every entry has an age listed. If any entry is incomplete in one of the following categories, do not shade. Shade all that apply.

O age

O diagnosis

O treatment

115. How recent is the date of the most recent complete entry in the register?

O less than 7 days

O 7 days to 1 month

O older than 1 month

VII. EQUIPMENT AND SUPPLIES

INSTRUCTIONS: Ask the health worker in charge about the availability of the following items. Ask to see all items to confirm availability and functioning. Start in the labor and delivery area. If some procedures, such as uterine evacuation or instrument processing, are performed in a different room, visit that room to verify the items. You will need to visit the operating theatre for some items, as well as the pharmacy or supply room.

Labor and delivery

116. Look for the following supplies in the labor and delivery area. Shade all that are available and functional.

O electricity

O light source sufficient to perform tasks during the day

O light source sufficient to perform tasks at night

O running water (piped or from storage container with tap)

O functioning toilet

O heating/heating arrangements (if applicable)

O fan/air conditioning (if applicable)

O curtains/means of providing patient privacy

O waiting area for visitors/family members

O delivery bed/table

O blood pressure cuff/machine

O stethoscope

O fetal stethoscope

O clinical oral thermometer

O delivery packs/kits

O vaginal speculum (Cusco)

O vaginal speculum (Simms)

O adult ventilator bag and mask

O filled oxygen cylinder with cylinder carrier and valve key

O decontamination container with prepared solution

O IV fluid set (giving set)

O neonatal IV fluid set

O suture needles and suture materials

O urinary catheters (Foley)

O urine dipstick

O rapid HIV test

O warmer for infant resuscitation

O infant scale (5 to 10 g increments)

O regular trash bin

O covered contaminated trash bin

O sharps container

O sterilizer/autoclave

O soap

O antiseptics

O sterile gloves

O sterile gloves (long)

O non-sterile gloves

O non-sterile protective clothing

O scissors or razor blade for cutting cord

Laboratory

117. Look for the following supplies in the laboratory. Shade all that are available.

○ RPR testing kits
○ blood glucose testing
○ hemoglobin testing
○ bilirubin testing
○ RDT for malaria
○ RDT for HIV
○ sputum AFB smear kits
○ group B strep testing kits
○ microscope
○ blood smears
○ other (specify): _____

General

118. Look for the following general supplies. Shade all that are available.

○ jar/pitcher for ORS

○ cup/spoon for ORS

○ warmer for infant resuscitation

○ insecticide-treated bed nets

> **Look for the following. Shade the applicable circles for each. For example, if there is a broken microscope, shade "available" but do not shade "functional."**

119. Microscope
○ Available
○ Functional

120. Temperature log for refrigerators where vaccines are stored
○ Available
○ Functional

121. Adult scale
○ Available
○ Functional

122. Baby scale
○ Available
○ Functional

123. Timer/watch with second hand
○ Available
○ Functional

> **INSTRUCTIONS: For this section, visit the pharmacy or medical stores and interview the in-charge about the availability of the following medicines. For each row, shade one circle.**

	Not available	At least 1 available and unexpired	Available but expired
124. Labor and Delivery			
124a. pitocin (oxytocin)	O	O	O
124b. ergometrine (injectable)	O	O	O
124c. syntometrine	O	O	O
124d. methylergonovine	O	O	O
124e. misoprostol	O	O	O
124f. magnesium sulphate	O	O	O
124g. diazepam (injectable)	O	O	O
124h. hydralazine	O	O	O
124i. nifedipine	O	O	O
125. Antibiotics			
125a. amoxicillin	O	O	O
125b. ampicillin (IM/IV)	O	O	O
125c. ampicillin (PO)	O	O	O
125d. benzyl penicillin	O	O	O
125e. benzathine penicillin	O	O	O
125f. ceftriaxone	O	O	O
125g. ciprofloxacin	O	O	O
125h. cotrimoxazole (Septrin, trimethoprim-sulfamet hoxazole)	O	O	O
125i. doxycycline (tablets)	O	O	O
125j. metronidazole (tablets)	O	O	O
125k. metronidazole (IV)	O	O	O

Pagelink

	Not available	At least 1 available and unexpired	Available but expired
125. Antibiotics			
125l. chloramphenicol (IV)	O	O	O
125m. chloramphenicol (tablets)	O	O	O
125n. gentamicin (IV)	O	O	O
125o. erythromycin (tablets)	O	O	O
125p. flu/cloxacillin	O	O	O
125q. rifampin	O	O	O
125r. isoniazid (INH)	O	O	O
125s. other (specify):	O	O	O
126. Antimalarials			
126a. coartem/lumet (AL, artemetheter/lumefantrine)	O	O	O
126b. chloroquine	O	O	O
126c. quinine (PO)	O	O	O
131d. quinine (IM/IV)	O	O	O
126e. sulphadoxine-pyrimethamine (SP, Fansidar)	O	O	O
126f. artesunate (IV)	O	O	O
126f. other (specify):	O	O	O

	Not available	At least 1 available and unexpired	Available but expired
127. HIV medication			
127a. nevirapine (tablets)	O	O	O
127b. nevirapine (syrup)	O	O	O
127c. zidovudine (AZT)	O	O	O
127d. lamivudine (3TC)	O	O	O
127e. triomune	O	O	O
127f. tenofovir	O	O	O
128. Micronutrients/children's medication			
128a. folate	O	O	O
128b. iron	O	O	O
128c. vitamin A	O	O	O
128d. tetracycline ointment	O	O	O
128e. zinc	O	O	O
128f. multivitamin	O	O	O
129. IV fluids			
129a. normal saline	O	O	O
129b. Ringer's lactate	O	O	O
129c. dextrose/glucose	O	O	O
130. Anesthesia			
130a. halothane	O	O	O
130b. ketamine	O	O	O
130c. lignocaine (2% or 1%)	O	O	O

Pagelink

	Not available	At least 1 available and unexpired	Available but expired
131. Cleaning substances			
131a. chlorine/bleach	○	○	○
131b. alcohol/betadine swabs	○	○	○
132. Other antimicrobials/disinfectants/antivirals			
132a. gentian violet paint	○	○	○
132b. chlorhexidine	○	○	○
132c. mebendazole	○	○	○
132d. nystatin cream	○	○	○
132e. clotrimazole	○	○	○
133. Other			
133a. calcium gluconate	○	○	○
133b. ORS packets	○	○	○
133c. paracetamol	○	○	○
133d. adrenaline	○	○	○
133e. magnesium	○	○	○
133f. methyldopa	○	○	○
133g. sodium bicarbonate	○	○	○

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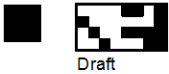
134. Immunizations

	Not available	Available and unexpired	Available but expired
134a. BCG	O	O	O
134b. OPV	O	O	O
134c. DPT/pentavalent vaccine	O	O	O
134d. measles	O	O	O
134e. HiB	O	O	O
134f. tetanus toxoid (child)	O	O	O
134e. Td (adult)	O	O	O
134f. HBV	O	O	O

Were any immunizations out of stock in the last 3 months? Write name of immunization and duration of stockout (in days) below.

139. How many days in the past month did you have stock-outs of the following drugs or supplies?

139a. AL

139b. quinine

139c. cotrimoxazole

139d. Nevirapine/ Nevirapine suspension

139e. oxytocin

139f. ORS

139g. RDT (malaria)

139h. RDT (HIV)

139i. Misoprostol

139j. SP (Fansidar, sulfadoxine, pyrimethamine)

Pagelink

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Final disposal processes

140. What is the final disposal process for filled sharps boxes?

○ never have sharps

○ incinerate

○ burn and bury

○ bury without burning

○ put in a covered pit

○ burn but do not bury

○ leave in open air without burning or burying

141. What is the final disposal process for infectious waste such as bandages and IV tubing?

○ never have infectious waste

○ incinerate

○ burn and bury

○ bury without burning

○ put in a covered pit

○ burn but do not bury

○ leave in open air without burning or burying

INSTRUCTIONS: Ask to see the place used to dispose of sharps. "Protected" is defined as inside a pit or locked fence or room or in a trash bin with a lid such that unauthorized persons cannot easily gain access.

142. Is the place used to dispose of sharps protected?

○ not observed

○ no, not protected and with visible waste

○ no, not protected but without visible waste

○ yes, protected but with visible waste

○ yes, protected and without visible waste

143. Is the place used to dispose of infectious waste protected?

○ not observed

○ no, not protected and with visible waste

○ no, not protected but without visible waste

○ yes, protected but with visible waste

○ yes, protected and without visible waste

Thank the facility staff member for his/her time in granting you this interview.
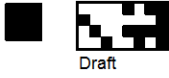
For Data Tracking Only

Data collector

Data collector's name: _____

District manager

District manager's name: _____

Form checked on(DD/MM/YY): [ ][ ] [ ][ ] [ ][ ]

District manager's signature: _____

Appendix D: Semi-Structured Interview Guide

Field Guide for Key Informant Interviews (KII)

Perceptions of "Saving Mothers, Giving Life" in Kalomo District, Zambia:

A Qualitative Evaluation

Target audience:
A. Health facility Safe Motherhood Action Group (SMAG) volunteers
B. Health clinic workers (nurses/midwives)
C. SMGL project staff
D. Kalomo District and Southern Province Health Staff
E. Zambia MOH/MCDMCH staff at national level
F. International NGO/agency implementing partner/donor representatives

INSTRUCTIONS FOR THE INTERVIEWER

STEP ONE: Informed Verbal Consent

Introduce yourself and the study. Go through the informed consent protocol. If consent is granted, leave a copy of the informed consent sheet with the participant.

Was verbal informed consent obtained?

> **YES** _____ **(Proceed with interview)**

> **NO** _____ (**STOP! Thank the participant for their time but do not proceed with the interview**)

STEP TWO: Read the following statement. If the participant wishes to conduct the interview in Tonga, please repeat the translated statement.

"Thank you for agreeing to participate in this interview. My name is _____. And I will be asking you the questions for this interview. You have been identified as someone who is knowledgeable about the Saving Mothers, Giving Life program (SMGL) that has been ongoing in Kalomo since 2012. I will be asking you a series of questions about your relationship with the SMGL program. I want to understand your views about the program, both positive and negative. Please feel free to tell me whatever you are comfortable sharing.

I will record the discussion to be sure that I capture your responses accurately. I expect this discussion to last approximately one hour. I appreciate your honesty in answering these questions. Please feel free to ask me if you have any questions or if you do not understand any of my questions. You are free to end your participation at any time or to remain quiet when I ask any questions that you do not wish to answer. Please remember that whatever is discussed during this interview will be kept confidential."

STEP THREE: Record the participant's current title or role and institution/facility affiliation, as well as their title and institution affiliation at the time of the SMGL program (if appropriate).

Current Title: _____

Institution: _____

Past Title: _____

Past Institution: _____

STEP FOUR: Record the following

1. **Interview Date (DD/MM/YYYY)**   _____/_____/_____

2. **Time Start**   _____

3. **Time Finish**   _____

STEP FIVE: Proceed to interview guide below. Please probe to obtain as in-depth and specific information you can.

THEME ONE: Roles and Responsibilities

1.1 Please describe your **current** job, including your roles and responsibilities.

   Probe Questions:
   a. How would you describe your organization's mission?
   b. Are you involved in policy, training, education, direct delivery of care, or administration? Or other?
   c. How long have you been in this position?

1.2 Please describe the job/title you held from 2012–2013 when SMGL was operating in Kalomo, including your roles and responsibilities.

   Probe Questions:
   a. How would you describe your organization's mission (at that time)?
   b. Are you involved in policy, training, education, implementation, direct delivery of care, or administration? Or other?

1.3 Please describe your involvement in the delivery of maternal health care [Now and 2012–2013, if different].

THEME TWO: Maternal Health Challenges and Priorities

2.1 Can you describe any challenges in providing safe, effective maternal health care in your (catchment area/district/Southern Province), especially during labor and delivery?

   Probe Questions:
   a. Are there policies that could use updating? Changing? New?
   b. Please describe any facility-level challenges: personnel, training, staffing, equipment and supplies.
   c. Please describe any social or cultural challenges at the community or household level.

2.2 What factors lead women to delivery in a facility to deliver at home [in your area, if applicable]?

   Probe Questions:
   a. Where do women generally deliver? Why?
   b. What role do families play in this decision? Which family members have the greatest influence over this decision?
   c. What are the characteristics of women who seek to deliver at a facility?
   d. Why might a woman not deliver at a facility?

2.2 What factors contribute to a woman having a skilled birth attendant at the time of delivery?

   Probe Questions:
   a. Is it socially desirable to have a skilled attendant?
   b. Why might a woman NOT want to have a skilled attendant?
   c. What role do husbands or other family members play in this decision?
   d. What characteristics make a woman more or less likely to seek a skilled birth attendant (education, wealth, etc.?)

THEME THREE: SMGL Program

3.1 Please describe the role you played in the SMGL's initial roll-out.

   Probe Questions:
   a. Did you work program operations? Policy? Delivery?
   b. How involved were you in SMGL?
   c. How much of an impact did SMGL operations have on your daily work?
   d. Did SMGL increase your work load?

3.2 Please describe SMGL's main activities.

   Probe Questions:
   a. What were the main activities?
   b. Who were the key people involved with the program?
   c. Were certain activities implemented better than others?

3.3 What was the impact of the SMGL program [in your area/overall]?

   Probe Questions:
   a. Did you notice any changes at the facility level?
      – Equipment and supplies?

- Workers and personnel?
- Training?
- Patient flow?
- Other?

b. Did you notice any changes in the number of facility-based births, skilled birth attendance, and quality of care delivered?

c. Were certain activities more effective than others?

3.4 Are you aware of results from any evaluations of the program? What is the general impact reported? How do you think of these results?

Probe Questions:
a. Do they capture what you experienced yourself?
b. Are you surprised by the results? Why or why not?

[Introduce preliminary results from my quantitative analysis here]

Probe Questions:
a. Do they capture what you experienced yourself?
b. Are you surprised by the results? Why or why not?

Theme Four: Future growth and scale up

4.1 Can you describe what is still needed in your area to meet the needs of women during labor and delivery? What is lacking?

Probe question:
a. What policies must be in place for SMGL, or other maternal health care-focused activities to be adopted?
b. What do you foresee as challenges for continued implementation of SMGL and future replication?
c. What do you perceive to be the roles of (a) other implementing organizations and (b) government in SMGL and other similar programs?

d. Please describe your recommendations for improving SMGL.
- Activities?
- Equipment and supplies?
- Workers and personnel?
- Training?
- Patient flow?
- Other?

Appendix E: Propensity Score Analysis Tables

Group Comparison of Percentage With Each Characteristic, Before and After Propensity Score Matching

		Before PSM			After PSM		
		Kalomo District	*Comparison Districts*	*p-value*	*Kalomo District*	*Comparison Districts*	*p-value*
Variable							
	n	6313	14783		6186	6186	
Woman's age in years							
15–19		21.8	24.3	<0.0001	22.0	21.8	0.80
20–24		26.5	27.7		26.7	26.6	
25–34		38.0	34.8		37.8	37.6	
35–49		13.7	13.2		13.4	14.0	
Tribe/ethnic group							
Tonga		95.0	91.1	<0.0001	94.9	95.1	0.68
Other		5.0	8.9		5.1	4.9	
Marital status							
Married /Cohabiting		88.0	81.1	<0.0001	87.8	88.0	0.76
Single/ Divorced /Widowed		12.0	18.9		12.2	12.0	
Mother's education							
None		10.7	6.9	<0.0001	8.8	9.1	0.66
Any primary or more		89.3	93.1		91.2	91.0	
Parity							
0		20.5	24.0	<0.0001	20.7	20.3	0.79
1		16.4	18.9		16.6	17.0	
>=2		63.1	57.1		62.6	62.7	

	Before PSM			After PSM		
	Kalomo District	*Comparison Districts*	*p-value*	*Kalomo District*	*Comparison Districts*	*p-value*
Variable						
Distance to health facility greater than 2 hours						
Yes	37.8	29.5	<0.0001	37.8	38.3	0.60
No	62.2	70.5		62.2	61.8	
Mother's HIV status						
Reactive	3.7	10.1	<0.0001	3.7	3.9	0.64
Non-reactive	96.3	89.9		96.2	96.1	
Asset quartile						
1-Lowest	42.4	20.7	<0.0001	41.3	40.9	0.94
2	28.1	26.0		28.7	29.2	
3	17.7	27.7		18.1	18.1	
4-Highest	11.7	17.9		12.0	11.8	
TOTAL	100.0	100.0		100.0	100.0	

Appendix F: Tables Comparing ZamCAT and non-ZamCAT

Facility Characteristics in Kalomo Districts

Comparison of Facility Characteristics in Kalomo for ZamCAT and non-ZamCAT Facilities

Characteristics	SMGL		non-SMGL
	Non-ZamCAT Hospitals† n=2	Non-ZamCAT RHCs n=9	ZamCAT RHCs n=22s
General requirements			
Deliveries in the last month	69.0 (21.2)	5.8 (3.6)	12.0 (7.1)**
Nearest referral center-maternal complications (km)	NA	45.8 (34.3)	54.0 (28.1)
Service availability 24/7 – Labor Ward	2 (100.0)	8 (88.9)	22 (100.0)
At least 1 skilled provider[1]	2 (100.0)	7 (77.8)	20 (90.9)
At least 1 skilled provider (including Clinical Officer)	2 (100.0)	7 (77.8)	20 (90.9)
Communication tools[2]	2 (100.0)	1 (11.1)	4 (18.2)
Transportation for referral[3]	2 (100.0)	0 (0.0)	4 (18.2)
Electricity[4]	2 (100.0)	2 (22.2)	6 (27.3)
Toilet or latrine – for Clients[5]	2 (100.0)	9 (100.0)	21 (95.5)
Water supply[6]	2 (100.0)	9 (100.0)	19 (81.8)
Routine obstetric care			
Monitoring and management of labour with partograph (any use)	2 (100.0)	4 (44.4)	18 (81.8)*
Infection prevention measures – for hands (soap or sterile gloves in labor ward)	2 (100.0)	9 (100.0)	18(81.8)
Active management of third stage of labor (AMSTL)	2 (100.0)	6 (66.7)	14(63.7)
Basic EmOC	**1 (50.0)**	**0 (0.0)**	**0 (0.0)**
Parenteral magnesium sulfate for (pre-)eclampsia	2 (100.0)	0(0.0)	5 (22.7)
Assisted vaginal delivery	1 (50.0)	0(0.0)	1 (4.6)
Parenteral antibiotics for maternal infection	2 (100.0)	8 (88.9)	20 (95.2)
Parenteral oxytocic drugs for hemorrhage	2 (100.0)	8 (88.9)	20 (95.2)
Manual removal of placenta for retained placenta	2 (100.0)	3 (33.3)	6 (27.3)
Removal of retained products of conception	2 (100.0)	1 (11.1)	0.0
Resuscitation with bag and mask of non-breathing baby	2 (100.0)	0 (0.0)	7 (31.8)*

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Comprehensive EmOC	**1 (50.0)**	**0 (0.0)**	**0 (0.0)**
Surgery (C-Section)	1 (50.0)	0 (0.0)	0 (0.0)
Blood transfusion	2 (100.0)	0 (0.0)	0 (0.0)
Routine newborn care			
Thermal protection[7]	0 (0.0)	2 (22.2)	2 (9.1)
Immediate and exclusive breastfeeding	2 (100.0)	7 (87.5)	20 (90.9)
Infection prevention including hygienic cord care	NA	NA	NA
Basic EmNC			
Antibiotics to mother if preterm or prolonged PROM	NA	NA	NA
Corticosteroids in preterm labour	NA	NA	NA
KMC for premature/very small babies	0 (100.0)	1 (11.1)	3 (13.6)
Alternative feeding if baby unable to breastfeed	NA	NA	NA
Injectable antibiotics for neonatal sepsis	NA	NA	TBD
(PMCTC if HIV-positive mother)	NA	NA	NA
Comprehensive EmNC			
Intravenous fluids[8]	0 (0.0)	0 (0.0)	1 (4.6)
Safe administration of oxygen[9]	2 (100.0)	0 (0.0)	1 (4.6)
Mean signal functions			
Bsignal_fx (Max 7)	6.5 (0.7)	2.2 (1.0)	2.7 (1.1)
Csignal_fx (Max 9)	8.0 (1.4)	2.2 (1.0)	2.7 (1.1)
Other Variables			
Maternal Death Review†	1 (50.0)	1 (11.1)	7 (31.8)
Mean skilled providers	31.0 (5.7)	0.8 (0.4)	2.5 (4.1)*
Mean skilled providers (including CO)	35.0 (8.5)	0.8 (0.4)	3.0 (4.5)**

†Hospital-Affiliated Health Centers (HAHCs) were not included as their results were very similar to hospitals and they function as a linked center

*p<0.10; **p<0.01

Appendix G: Table of CDC and Study Results for Maternal Health Indicators

CDC and Study Results for Maternal Health Indicators, from the Periods June 2011–May 2012 to June 2012–May 2013

Characteristic	Kalomo			Comparison Area		
	CDC Baseline[1] N(%)	CDC Endline[2] N(%)	p-value	CDC Baseline N(%)	CDC Endline N(%)	p-value
Maternal death	4/4222 (0.09)	1/5130 (0.02)	0.11	4/10728 (0.04)	8/11273 (0.07)	0.29
MMR (per 100,000 births)	95	19	79% reduction	37	71	92% increase
Institutional Delivery (Facility based delivery)	2299/4188 (54.9)	3196/5037 (63.5)	<0.0001	6822/10553 (64.6)	7328/11212 (65.4)	0.27
Any stillbirth	94/4226 (2.22)	88/5131 (1.72)	0.08	165/10732 (1.5)	177/11281 (1.6)	0.85
Any stillbirth (per 1,000 births)	22	17	23% reduction	15	16	7% increase
Newborn death	156/4222 (3.69)	143/5131 (2.79)	0.01	338/10726 (3.15)	321/11281 (2.85)	0.18
C-Section rate	30/4076 (0.74)	23/4937 (0.47)	0.10	117/10349 (1.13)	119/10942 (1.09)	0.76

[1] June 2011–May 2012

[2] June 2012–May 2013

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