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Maternal Health Care in the Time of Ebola: A Mixed-Method Exploration of the Impact of the Epidemic on Delivery Services in Monrovia

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Summary. — Public health emergencies like major epidemics in countries with already poor health infrastructure have the potential to set back efforts to reduce maternal deaths globally. The 2014 Ebola crisis in Liberia is claimed to have caused major disruptions to a health system not fully recovered after the country's civil war, and is an important and relevant case for studying the resilience of health systems during crises. We use data on the utilization of maternal health care services from two representative surveys, one conducted before the outbreak of Ebola, the 2013 Liberian DHS, and another, smaller survey conducted in Monrovia in December 2014, during the height of the epidemic. We focus exclusively on data for women aged 18–49 residing in urban Monrovia, restricting our samples to 1,073 and 763 respondents from the two surveys respectively. We employ a mixed methods approach, combining a multinomial logit model with in-depth semi-structured interviews. Our regression analyses indicate that deliveries in public facilities declined whereas they increased for private facilities. Furthermore, overall facility delivery rates remained stable through the Ebola epidemic: the proportion of home births did not increase. Drawing on insights from extensive qualitative interviews with medical personnel and focus groups with community members conducted in Monrovia in August–September 2015 we attribute these survey findings to a supply side “substitution effect” whereby private clinics provided an important cushion to the shock leading to lower supply of government services. Furthermore, our interviews suggest that government health care workers continued to work in private facilities in their local communities when public facilities were closed. Our findings indicate that resources to shore up healthcare institutions should be directed toward interventions that support private facilities and health personnel working privately in communities during times of crisis so that these facilities are safe alternatives for women during crisis.

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Key words — Ebola, maternal care, health, Monrovia, Liberia

1. INTRODUCTION AND BACKGROUND

Despite gradual improvements in maternal health outcomes in West Africa (WHO, UNICEF, United Nations Population Fund, World Bank, & the World Bank Group and the United Nations Population Division, 2015), exogenous shocks in the form of public health emergencies in countries risk jeopardizing these positive trends. Such shocks present a major challenge for governments to provide basic public goods, especially to the most vulnerable segments of the population, such as pregnant women and infants. In this study, we explore how a relatively fragile health system in post-conflict Monrovia, Liberia responded during the exogenous shock of Ebola in 2014. Liberia has one of the highest maternal mortality rates in the world (Moseson *et al.*, 2014). During the Ebola crisis, it had the highest count and death toll of all the countries that experienced the epidemic, but also the steepest decline in new cases.¹ As such, it represents a useful case allowing us to study how sudden shocks affect the use of maternal health care services.

There are several accounts claiming that Ebola completely overwhelmed the health systems in Liberia, implying particularly severe consequences for maternal health outcomes (e.g., Hayden, 2015; Menéndez, Lucas, & Langer, 2015). Others, however, question the sweeping transformative effect of Ebola on maternal health (e.g., Streifel, 2015: 2), highlighting the need for more detailed data. Our study builds on new, rich data to address the Ebola–maternal health nexus in a more

nuanced way in metropolitan Monrovia. More specifically, we draw on two surveys conducted before (in 2013) and during the Ebola epidemic (in December 2014) to assess whether the epidemic led to a decrease in the use of maternal health services, such as deliveries in public facilities. We combine the surveys with more than 20 in-depth interviews with local health professionals and other stakeholders and eight focus groups with community members in four townships/sections of metropolitan Monrovia in August and September of 2015.

We find that access to public delivery sites declined during the Ebola epidemic, but that overall use of maternal services did not change much because there was a shift from public to private services. During the epidemic, there was an increase in the use of private delivery services, which was a result of private facilities—including medicine stores, pharmacies, and

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clinics—substituting for public facilities. Additionally, health care professionals who worked in the public sector provided delivery services at these private facilities during the epidemic. Our findings suggest that resources to bolster health institutions should ensure that private facilities and healthcare personnel working independently receive attention during times of crisis, especially to ensure that these facilities are safe alternatives for women during crisis.

(a) *Exogenous shocks and maternal health*

Sub-Saharan Africa remains the region with the highest levels of maternal mortality, with a staggering 546 deaths per 100,000 live births in 2015 (WHO *et al.*, 2015). In addition to poverty, negative exogenous shocks to a country's health care systems also contribute to poor health outcomes. Exogenous shocks are unexpected or unpredictable events that affect an economy and/or political system either positively or negatively. Negative exogenous shocks might include civil wars, natural disasters, or diseases (e.g., Ness, 2016, p. 58). Such negative shocks have the potential to disrupt development on many different levels including impeding improvements in maternal health.

Armed conflict might be an important reason for the relatively slow rate of reduction of maternal deaths compared to other regions such as South-East Asia (Urdal & Chi, 2013). In a study of 42 African countries, O'Hare and Southall (2007) found that Maternal Mortality Ratios (MMRs) were 45% higher in post-conflict countries than in non-conflict countries. Conflict may affect maternal health both directly and indirectly. Direct effects include reduced supply of health care services, including facilities having to close down because of the security situation or as a direct result of health personnel fleeing. It may also lead to changes in behavior related to the use, or demand, of health services, for instance patients are not able to reach the health facilities because of restrictions on movement (Lori & Starke, 2012; McCarthy & Maine, 1992, p. 23; Silasi *et al.*, 2015).

The Ebola epidemic may be treated as an exogenous shock in that the magnitude of the event was unforeseeable and affected both the supply of and demand for services, and caused a major disruption in the economic, political, and social life of West Africans. In fact, the adverse effects of Ebola on maternal health may even be compounding given that Liberia is a post-conflict state. For example, hospitals and health clinics were closed for months during the Ebola epidemic, resulting in limited access to general health care in a country that already had a weakened health system after years of armed conflict.

(b) *Conflict, Ebola and Liberia's healthcare system*

The Liberian Civil Wars (1989–96 and 1999–2003) led to approximately 250,000 deaths, or nearly 10% of the population, the displacement of around a million people into refugee and IDP camps, the dismantling of the national economy and infrastructure, and the destruction of an effective Liberian state (Karim & Gorman, 2016). To fill the void, the UN Peacekeeping Mission in Liberia (UNMIL) arrived in 2003 and has remained, but official drawdown commenced in 2015. Because of the wars, Liberia's health care system broke down completely, and placed the Government of Liberia in a position of dependency on external medical humanitarian aid. Of the 293 public health facilities operating before the wars, 242 were deemed non-functional at the end of the wars due to destruction and looting and doctors, nurses and other health workers fled the country, leaving a total of only 30 physicians to serve a population of 3 million (Kruk

et al., 2010). To fill the gap, international actors flocked to the country to assist in the provision of health care. In 2007–2008 foreign donors financed approximately 80% of the country's health spending (Kruk *et al.*, 2010). Abramowitz and Panter-Brick (2015: 177) provide a description of the status of post-conflict Liberia's health care system where international non-governmental organizations (NGOs) like Médecins Sans Frontières (MSF) and Médecins du Monde effectively substituted the Liberian state in the provision of medical care. Liberia lacked “health sovereignty”—a state's ability to independently manage the health needs of its population (Chen, Evans, & Cash, 1999; Kickbusch & de Leeuw, 1999). International health care providers filled essential gaps without necessarily enabling Liberia's health care system to fully take on the responsibilities of health care for its citizens. Abramowitz and Panter-Brick (2015) and Luginaah *et al.* (2016) posit that when such international presence finally ends, the consequences may be grave as the local health system lacks capacity, resources, and training to fill the void.

The effects of healthcare sovereignty gap became widely apparent during the Ebola crisis in Liberia. The epidemic killed 4,809 individuals in Liberia out of a total of 10,675 registered cases.² The first Liberian case was reported in March 2014 in the Foya district of Lofa county near the border with Guinea. By June, the epidemic had spread to the capitol city of Monrovia, killing several health workers. The World Health Organization (WHO) stated that at the peak of transmission, during August and September 2014, Liberia was reporting between 300 and 400 new cases every week. People were largely left without medical care for routine sicknesses and injuries or were afraid of increased risks of infection at health facilities as medical facilities were overrun by Ebola patients (Strefel, 2015, p. 9). The loss of medical workers through death compounded this trend. The unavailability or excessive cost of medicines pushed people toward traditional and herbal treatments for malaria or other ailments, including Ebola (Ribacke, Saulnier, Eriksson, & von Schreeb, 2016).

Although the primary focus in emergencies, whether natural disasters or acute epidemics, is on the immediate, short-term effects, long-term consequences may be considerable and often interact or overlap with pre-existing social and economic conditions, further accentuating inequalities in health outcomes (Farmer, 1996; Parker, 2002). The lasting legacy of the epidemic in Liberia has been noticeable as thousands were left with missing family members, causing long-term economic insecurity for affected households (Bowles, Hjort, Melvin, & Werker, 2016). Furthermore, the loss of healthcare workers might have medium- to long-lasting negative consequences on maternal health outcomes. While one recent study finds no increase in overall non-Ebola-related mortality during and immediately after the epidemic (Kuehne *et al.*, 2016), another study suggests that maternal mortality increased by up to 28% in Liberia in the period immediately following the epidemic (Evans, Goldstein, & Popova, 2015).

For expecting women, there are two dimensions that impact the use and quality of health care: Their *demand* for health services and the *supply* (availability) of satisfactory medical facilities and trained personnel. Ebola presumably disrupted both the willingness of women to attend medical facilities, and the availability of such facilities. Drawing on the same survey used in this study, Morse, Grépin, Blair, and Tsai (2016) find that those that were affected by the Ebola virus, by witnessing dead bodies or knowing Ebola victims, were less likely to use health care services, suggesting that distrust and negative experiences reduced demand during the outbreak. Yet, it is not clear if, and for how long, these patterns persist.

On May 9, 2015, the WHO declared Liberia free of Ebola. The country subsequently experienced a cluster of six Ebola cases in June 2015 and was declared free of transmission again on September 3, 2015. A second cluster of three cases was reported in November 2015, and WHO declared the country free of transmission for the third time on January 14, 2016. It is in this context that we explore how Ebola affected the use of maternal health care services in Monrovia.

2. DATA AND RESEARCH DESIGN

To investigate how the Ebola epidemic affected maternal health via access to health care services, we use a multi-method approach, combining quantitative analysis of two surveys with qualitative methods that include 23 semi-structured interviews of healthcare providers and eight focus groups including both men and women.

In the surveys, we look specifically at how deliveries at home, public, and private.³ facilities varied before and after the Ebola outbreak. The first survey used is the 2013 Liberian Demographic and Health Survey (LDHS). The 2013 LDHS provides key indicators for the country as a whole, for urban and rural areas separately, for Greater Monrovia and other urban areas separately, and for each of the 15 counties. We focus on the sample population of 1,073 female residents reported as living in urban Monrovia.⁴ Tsai, Morse, and Blair (2014) administered the second survey during the height of the Ebola epidemic in December 2014 with a sample size of 1,573 respondents in Monrovia, including 763 female respondents.⁵ In the LDHS survey 189 women had given birth to their lastborn in 2012 or 2013 (before Ebola), whereas in the Tsai *et al.* (2014) survey 66⁶ women had given birth in 2014 (after the Ebola outbreak). For descriptive statistics of the data, see the [online Appendix Table A1](#).

From both surveys, we used information on where the last born was delivered (Own home, Other home, Govt. hospital, Govt. health center, Govt. health clinic, Other public sector, Private hospital/clinic, Other private medical center, Other). For this question, we grouped the home, public, and private answers to create three categories, because they represent three distinct categories for delivery. Women give birth at home or in the home of a Traditional Birth Attendant (TBA) in her community (referred to in the article as “community-based”), at a public health facility (a government-run facility), or at a private health facility. Aggregating the data, public facilities constituted the primary delivery location. Combining the two surveys, 24% (61 respondents) delivered their baby at home, 47% (120 respondents) delivered at a public facility, and 29% (74 respondents) delivered at a private facility.

Based on the two surveys we first compared the use of maternity services in Monrovia, before and during Ebola using bivariate and multivariate analyses. We only included female respondents in both surveys. We further treated the onset of the Ebola epidemic in 2014 as an exogenous shock and assessed whether delivery locations changed after the outbreak of the epidemic.

In addition to the surveys, we conducted eight focus groups and more than 20 semi-structured interviews in Monrovia in August–September 2015. The eight focus groups—four groups of women and four of men with 6–7 members in each group—were conducted in four townships/sections of metropolitan Monrovia: West Point, Peace Island, Paynesville, and Sinkor. We used variation on social and economic criteria to select these districts and obtain some variation in responses and experiences. The participants were members of their

communities selected by local community organizers. The local women and men were of different age groups and occupation: local tradesmen and salesmen, former combatants, and students. While the respondents are currently living in these communities, many of them had migrated to Monrovia from the rural counties including some of the border regions of Nimba and Lofa counties.

The 23 semi-structured interviews focused on medical personnel and administrators. We interviewed administrators at the Ministry of Health and Social Welfare, directors of major hospitals such as Redemption (public), James N. Davis Jr. Memorial Hospital (public), St. Joseph’s Catholic Hospital (private), smaller medical community health clinics (some public and some private), nurses, local community coordinators and midwives. We also interviewed representatives of UNICEF and WHO (for a list of key informant interviews, see [Online Appendix F](#)). We use the qualitative focus groups and interviews to contextualize and support our quantitative results.

3. RESULTS

In interviews, health care workers stated that there was a decrease in the demand for deliveries in public facilities because people were afraid of government hospitals.⁷ In particular, it was a common perception that Ebola was being contracted in public clinics and hospitals. One health worker stated that initially, people thought that the nurses and medical personnel were passing Ebola on to the patients (interview with male and female health staff in a local, private clinic, Sinkor, Monrovia, September 7, 2015; interview with senior administrator in Redemption Hospital, Monrovia, September 8, 2015). In another interview on September 1, 2015 the female senior medical administrator of a large hospital in Nee-Zee community, Paynesville, Monrovia described how the hospital was nearly burned down by relatives of Ebola victims who believed that their relatives were killed so Europeans and Americans would get their kidneys.

Focus group respondents stated fear of hospitals as well: “yes, you went to hospital only once and during this visit, you saw that they started to bring Ebola patients to the hospital and this was the reason you started to fear for hospitals,” but they also claimed that government clinics shut down and health care workers did not want to treat pregnant women, so there was a decrease in supply as well as demand. One stated, “[during Ebola] no one wanted to touch a pregnant woman, everyone was afraid. So it was a difficult problem” (interview with focus group, six male participants, Peace Island, September 3, 2015).

Shortage on both the demand and supply sides would suggest that there was a decline in government services from 2013 to 2014. In the 2013 LDHS survey, 23% (51 respondents) of women who gave birth in the previous year did so at home, 54% (102 respondents) delivered at a public facility, and 23% (43 respondents) delivered at a private facility. In the 2014 survey, 26% (17 respondents) of women who gave birth in the previous year did so at home, 27% (18 respondents) delivered at a public facility, and 47% (32 respondents) delivered at a private facility. These descriptive statistics suggest that there was indeed a decline in delivery at public facilities.

From the bivariate tests of the data and [Figure 1](#), we can see that the proportion of home births did not change from 2013 to 2014, so the overall proportion of facility-based deliveries was constant before and after Ebola.⁸ However, there was a significant shift from public to private facilities. The

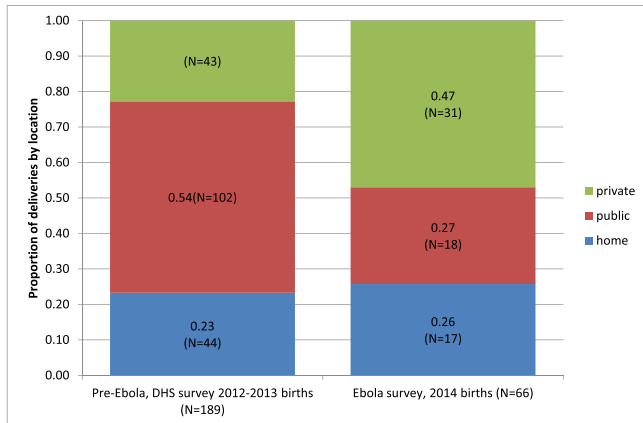


Figure 1. Location of Births in 2013 and 2014 in urban Monrovia: The data for 2013 from the 2013 Liberian Demographic and Health Survey (LDHS) and the data for 2014 come from the Tsai *et al.* (2014) survey.

proportion of births in public facilities decreased from about 54% to 27%, which is statistically significant.⁹ Correspondingly, the proportion of births at private health facilities increased from about 23–47%, which is also statistically significant.¹⁰

Figure 2 illustrates delivery patterns in urban Monrovia over a longer period, 2002–14¹¹ taking advantage of the information of birth histories from both LDHS surveys in 2006–07 and 2003, as well as the Tsai *et al.* (2014) survey. Due to the relatively small number of deliveries reported in the sample, the trend lines are erratic, especially for the 2008–2013 period.¹² Since we have no information suggesting that these spikes represent actual inter-annual changes in deliveries, we consider the linear trend lines to be the best representation of the changing patterns in deliveries in urban Monrovia over time. After the end of the second Liberian civil war in 2003, which also saw the end of a one-month siege of Monrovia during the summer of 2003, the proportion of births that took place in public health facilities increased by approximately 10 percentage points, to above 50%. Home deliveries declined similarly to just above 20% while deliveries in private health facilities have been stable at just above 20% as well. The 2014 survey reveals that while the proportion of home births is close to the trend line found in the LDHS, deliveries in private health facilities during Ebola is around 25 percentage points higher than the trend line, while the proportion of births in public health facilities is similarly lower compared to that trend line.

The facility records from Monrovia provided by the Liberian Ministry of Health and Social Welfare (MOHSW) further corroborated the shift in the use of facilities (see Online Appendices D and E for details). During the period from June through December 2014, the number of patients using public health facilities declined dramatically, while the decline in use of private facilities was more moderate. The data from MOHSW on head counts are missing most or all of the data for “other private facilities” such as pharmacies and medicine stores, which suggests that the numbers of head counts in private facilities should actually be higher than what is presented in the data. Nevertheless, as these records cannot be broken down by user groups, it is not possible to draw conclusions about deliveries, but these official records also seem to suggest that private sector facilities played an important role in health provision during the Ebola crisis.

In addition to testing the bivariate relationships of delivery sites prior to and during Ebola, we also test whether births prior to Ebola or during Ebola are more likely to be delivered at home, public, or private facilities using multivariate analysis. We conduct a multinomial logit model because the dependent variable has three, discrete independent options—home, public facility delivery, and private facility delivery. We present the data using public facilities as the reference category because we want to compare the likelihood of private and home deliveries relative to deliveries at public facilities.¹³ The main independent variable is whether the birth occurred prior to Ebola (2013) or during Ebola (2014). If the delivery occurred during Ebola, in 2014, it was coded as “1,” and if the delivery occurred prior to Ebola in 2013, it was coded as a “0”. Other control variables are added including age, education level (0—no schooling; 1—primary; 2—secondary; and 3—higher level of schooling), Muslim affiliation (as opposed to non-Muslims who are almost exclusively Christians), and the number of children under the age of five in the household.¹⁴

Table 1 provides the results for the impact of Ebola on the site of delivery. Using public facility delivery as the base category, going from 2013 (“Pre-Ebola delivery”, reference category) to 2014 (“Delivery during Ebola”) is associated with a statistically significant increase in the log odds of delivering at a private facility versus public facility. Substantively, women who delivered before Ebola were 31% less likely to deliver at a private facility than a public facility, but they were 28% more likely to deliver at a private facility than a public facility during Ebola.

Table 1 shows that going from 2013 (Pre-Ebola delivery) to 2014 (Delivery during Ebola) is also associated with an increase in the log odds of delivering at home versus government facility, but this increase is only around 3%. Thus, while deliveries at public facilities dropped during Ebola when compared to both alternatives, the decrease relative to private facilities is much stronger, indicating that women opted to use private facilities as a possible substitute for public facilities.

This substitution is further noted in Figure 3, which shows the predicted probabilities of delivery at public and private facilities. We note the sharp decrease in public facility deliveries and a sharp increase in private facility births, which may imply a substitution effect. The predicted probability of delivering at a government facility in 2013 was 57% and in 2014, it decreased to 26%.¹⁵ The predicted probability of delivering at a private facility in 2013 was 22% and in 2014, it increased to 50%.¹⁶ Again, the probability of a home birth did not change significantly during 2013–14.

Finally, it is worth noting that despite the Ebola outbreak and its consequences on public facilities, those with higher education are less likely to deliver at home, while Muslim women have a higher probability of a home delivery. These findings are consistent with other studies (Gartland, Taryor, Norman, & Vermund, 2012; Montagu, Yamey, Visconti, Harding, & Yoong, 2011). Women who have a higher number of children under the age of five are less likely to deliver at a private facility, possibly because they become accustomed to delivering at a public facility and continue to deliver there for subsequent births.

The quantitative data show a clear shift in deliveries from public to private facilities, while the proportion of home births appears to have been relatively stable at the pre-Ebola level. The qualitative material supports and contextualizes this finding. First, deliveries appear to have been provided by medical personnel (medical doctors (MDs), physician’s assistants

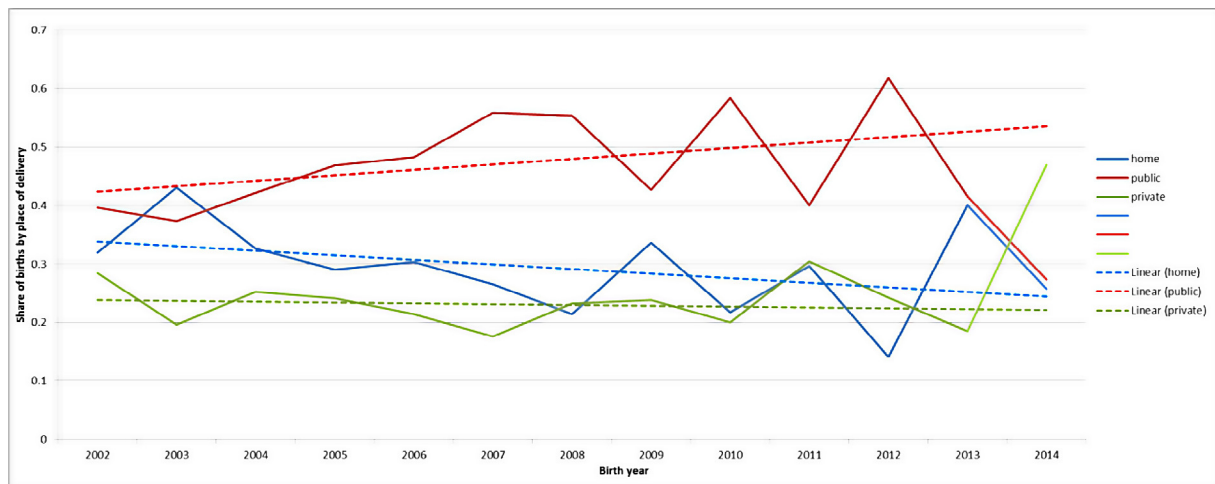


Figure 2. Location of Births 2002–2014 in urban Monrovia: The data for 2002–2007 are from the 2006–2007 Liberian Demographic and Health Survey (LDHS), while the data for 2008–2013 are from the 2013 Liberian Demographic and Health Survey (LDHS). The data for 2014 come from the Tsai et al. (2014) survey. The linear trend lines are based on the LDHS 2002–2013 data and extrapolated for 2014 to illustrate the expected pattern in 2014 based on LDHS trends.

(PAs), registered nurses (RNs), or certified midwives/registered midwives (CMs or RMs), in locations like pharmacies and medical stores, that were not legally considered to be private health facilities, but that are counted as “other private health facilities” by the government. Such locations were also used for deliveries prior to the Ebola epidemic, but, we do not have detailed data that can tell us exactly how extensively such locations were used. Due to the lack of data, it is unclear to what extent there was also a shift between conventional, private health clinics, and more *ad hoc* private health facilities. Based on the interviews it is possible that *ad hoc* private health facilities may have been used more frequently during the epidemic, even though these were technically not considered to be legal under the law (personal correspondence with Marion Subah and Kou Gbaintor-Johnson, November 2016, January 2017). Receiving assistance by a skilled birth attendant in a facility like a pharmacy or medical store would generally be considered by survey respondents to be “other private medical center” and as such coded as a private facility, while assisted births in a community (traditional) midwife’s home would be considered “other home” (Gartland, Taryor, Norman, & Vermund, 2012; Montagu, Yamey, Visconti, Harding, & Yoong, 2011).

Second, the facility in which deliveries occur is distinct from the health care worker who provides the delivery service. Thus, even though a health care practitioner may be trained by the government and work in a public health facility, he or she may provide care on the side. In Liberia, skilled birth attendants are either medical doctors (MDs), physician’s assistants (PAs), registered nurses (RNs), or certified midwives/registered midwives (CMs or RMs), but nothing prevents these skilled birth attendants from practicing in communities separate from their primary health facility. One of the interviewees provided a story which illuminates this point. The practitioner interviewed was a trained, skilled nurse, who worked at a public health clinic. However, she owns a medical store. She stated that many women in the community come to her for delivery services because they know she is a trained nurse and owns a medical store. This type of service delivery is considered private but not home-based or public. During Ebola, some health care workers reported that they were

working in their local communities even though the facility where they had their formal employment was closed, and there were government health care workers that were overseeing deliveries in their communities. This information is confirmed by Kou Gbaintor-Johnson, a female community leader in Sinkor, Monrovia, and Marion Subah, who were both nurses during the Ebola epidemic. Through the information from the interviews and focus groups, we infer that respondents in the Ebola survey likely considered seeking the care of skilled birth attendants taking place in local facilities to be a service in a “private facility” (as opposed to “own” or “other” home), regardless of the formal and legal status of the facility.

Third, based on our interviews and focus groups, it appears that there is a blending of traditional and formal practices when it comes to the provision of delivery services in Liberia. For example, in one of the interviews a health care worker stated:

“...this was not how it was during the war, but now that is how it is, pretty much. Maternal and child health, before the war, it was pretty much a traditional system in the villages and I worked for thirteen years with primary health care in the villages and mainly with mid-wives. The system was that you had traditional mid-wives from the villages. These traditional mid-wives, similar to most African countries, you were born and brought up in it. Your aunt and your grandmothers were all mid-wives and they trained you into it. And in the 1800 s when the primary health care really started in Liberia, they did a lot of trainings of traditional mid-wives [you get the name TTM, before it was TBA, Traditional Birth Attendants]. But they trained traditional mid-wives. For myself, I trained traditional mid-wives for at least ten years.”

[Interview with female healthcare worker and educator in Monrovia, September 9, 2015]

According to the interviews with health professionals, traditional midwives still play a major role in the provision of maternity services as a sort of intermediary between the formal health facility and community spheres. Traditional midwives are women in the community who serve as midwives, where knowledge of birth and maternal care is passed down from previous generations. The government has attempted to integrate these local structures through the creation of the Trained Traditional Midwives (TTM) program, where such midwives

Table 1. Risk of delivery by type of facility, multinomial logit of delivery (Log Odds)

	Home delivery [#]	Private facility [#]
Intercept	-0.20 (0.91)	-0.54 (0.90)
Delivery during Ebola (ref: Pre-Ebola delivery)	0.88** (0.40)	1.59*** (0.38)
Age	-0.01 (0.03)	0.01 (0.03)
Education (ref: No education)		
Primary	-0.04 (0.51)	-0.23 (0.54)
Secondary	-0.24 (0.42)	-0.18 (0.43)
Higher	-2.07* (1.09)	0.44 (0.55)
Muslim	0.73* (0.43)	0.03 (0.49)
Number of children under 5	-0.11 (0.91)	-0.33** (0.15)
<i>N</i> = 254		
Log Likelihood = -249.39		

Coefficients with standard errors in parentheses. * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. [#]Reference category is public facility.

receive training from the government and become certified (Ministry of Health & Social Welfare, 2011, 2016). These midwives are not on the government payroll but are considered community level workers and are included in the government's community health policy and plan.¹⁷ According to interviews, these midwives sometimes work in tandem with other private facilities in the community such as pharmacies, medical stores, and private clinics. Moreover, traditional midwives are considered as health personnel by many community members. Based on follow up interviews, we learned that community members are unlikely to know whether certain midwives are skilled, trained, or not. Regardless of their training or status as skilled birth attendants, midwives play an intermediary role in maternal health, navigating between the public and the private sphere. Legally they are under mandate to refer all delivery cases to health facilities and not assist in home deliveries. Nevertheless, during the Ebola epidemic many deliveries were taking place in facilities that were in a legal gray zone to flexibly deal with the need for maternity services in an emergency (personal correspondence with Marion Subah and Kou Gbaintor-Johnson, November 2016, January 2017).

Some interviewees suggested that traditional midwives were providing care in lieu of public facilities, thus filling an important gap. However, these services were not considered home births if taking place at a private facility (including medicine store or pharmacy). The most prototypical definition of a home birth is a traditional home birth in the respondent's home or in the home of a friend. One healthcare worker stated that "we only had one traditional midwife who suddenly died in the Ebola crisis. When the clinic was closed, she was practicing at home, during the times and conditions of Ebola, she was still practicing there" (interview with male physician's assistant at the Red Hill Field Medical Community Clinic, Virginia, Montserrado County, September 5, 2015).

Due to the danger and increased work load for all health care workers, there were many complaints by health workers about the lack of equipment: "As a midwife, when the hospital was closed, I did not have any equipment. Patients came into my house" (interview with female midwife in a private hospital, Sinkor, Monrovia September 10, 2015). Health workers that were working from locations within their local

communities did not receive much support in terms of equipment or training because it was assumed that because the facilities were closed, practice stopped, even though it did not.

Despite challenges, we found that communities showed resiliency, innovation, and rapid response to the Ebola crisis and the arrival of new information, like public health messages. Abramowitz *et al.* (2015) also highlighted similar patterns. The importance of community organization for social cohesion was emphasized in the focus groups and interviews. When the government was notably absent, local communities took Ebola prevention into their own hands. As a healthcare worker noted:

"For example, in the community, we had check points in our entries, if you are coming at a time around May/June, at the station, you have to wash your hands. One of the other things we did in our community was we couldn't allow strangers to enter our community before they were screened. And then there were people there to make sure these things were not only put into place, but also into action."

[Interview with male community organizer and healthcare worker, Virginia, Montserrado, September 5, 2015]

Some have suggested that the reliance on community ties and social capital pre-date Ebola and could have originated from the war. For example, during the conflict, focusing on the local level, women's groups and networks of local community groups were instrumental in conflict prevention efforts (Gizelis, 2011).¹⁸ These community structures and blending of community, private, and public spheres, may have thus served as an asset in countries such as Liberia, where the health infrastructure is weak.

Nevertheless, the interviews also revealed a larger issue pertaining to lack of trust in the health system. A male UNICEF official stated "we need to reach the local population through people they trust, they don't necessarily trust people in white jackets or fancy suits. They trust people from the community, so you have to work with the community leaders" (interview in Monrovia, Liberia, September 9, 2015).

In many cases, women relied on personal connections to health care workers for services, as one interviewee stated, "So it was for some of them, they went to the nearby house, where there was a midwife to help you but they had some doubt because they did not know your health status"

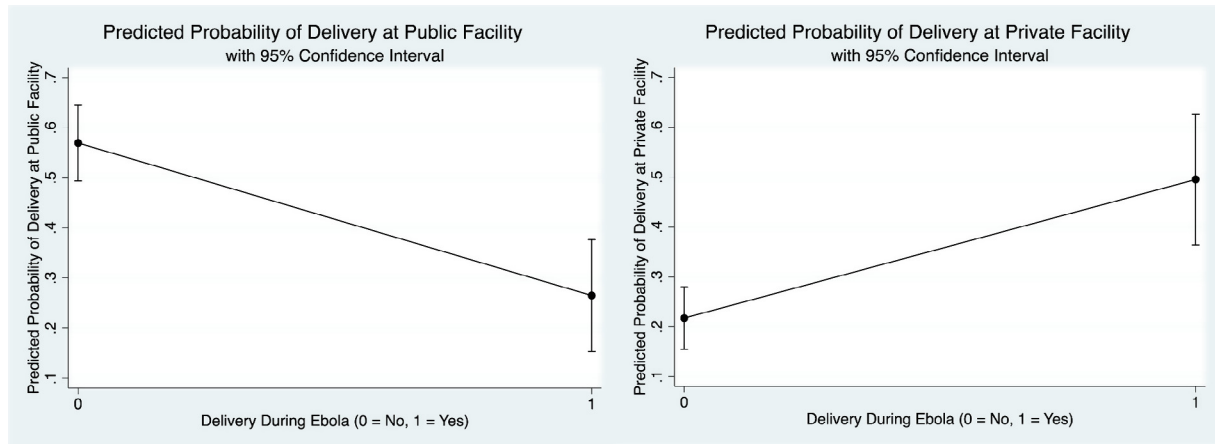


Figure 3. Using the multinomial logit model, we assess the predicted probabilities of each delivery site (using 95% Confidence Intervals). All control variables are held at their constants.

(interview with male administrator of the Liberian Red Cross, Monrovia, September 2, 2015). The female and male health staff in a private clinic in Sinkor, Monrovia, September 7, 2015 raised a similar point. The interviews indicate that while the publically-run health facilities were closed, government health care workers continued to provide health care services locally in other, private facilities. Hence, as mentioned above, we assume that respondents to the Tsai *et al.* (2014) survey likely answered that they delivered at a “private health facility,” if they were assisted in the delivery by a government health worker, irrespective of the type of facility.

Despite the increased service demand at private facilities, some of the private health facilities were reportedly struggling to provide quality care at the level of public facilities. One health care worker from a government clinic noted: “when I was doing the Ebola education, we had that problem because many of the people who were getting Ebola between June and July were because they went to private facilities.” She went on to chide the care at such private clinics: “It was the shock of my life when I was doing my rounds to do the Ebola training at these facilities because these private facilities were beyond disgusting” (interview with Marion Subah, at Jhpiego offices, Monrovia, Liberia, September 9, 2015). Marion Subah’s statement suggests that, while private facilities were crucial for providing basic maternity services, they may not have been well trained on Ebola treatment and prevention, representing a potential contamination risk. Thus, even though they appear to be a substitute for public facilities, they might not have been the safest option for women.

4. DISCUSSION AND CONCLUSION

This study looks at how Ebola impacted access to delivery services in Monrovia, Liberia. Using data from a unique survey conducted during the Ebola outbreak, the data show that there was a decline in the use of public hospital deliveries, while deliveries in private facilities increased relative to government clinic deliveries and home births, suggesting that the “private sphere” served as a cushion for the shock. The level of home births was, on the other hand, remarkably stable despite reports from interviewees that some health personnel and trained traditional midwives were occasionally treating patients in their homes.

We find that the private sector served as an important, albeit perhaps unsafe, cushion. Our data show that private clinics were an important alternative to public and home deliveries. The use of private clinics and other private health facilities (i.e., medicine stores and pharmacies) for deliveries and care also increased, as many of these facilities remained open or partially open during Ebola. However, just because some private facilities remained open does not mean that they were immune to Ebola or were safe places for delivery.¹⁹ Medicine stores, pharmacies, and even some private health centers lack the professional expertise for complications in delivery and they may not have the necessary supplies or personnel for safe births. Thus, even though the women had other options besides delivering at home, the safety of private clinics may need to be addressed in Liberian communities. Perhaps more outreach should be done to inform the public about the dangers of delivery in *ad hoc* and *informal* private health facilities or “other private health facilities.”

Additionally, during the epidemic, individuals routinely used the services of “government” doctors and nurses that work in public health facilities even when public services were shut down by approaching them privately in their homes. If registered/certified midwives, nurses, physician’s assistants, or even doctors helped women during their pregnancy or helped deliver babies *in the community*, our interviews suggest that such help was perceived as care provided by the private sector irrespective of the type of facility. This attribution is corroborated by numerous accounts by health care staff providing services despite the closure of the clinics and hospitals in which they worked.

Our study has several limitations. First, it is restricted to Monrovia, which means that our findings may not be representative to other parts of the country or other countries. In other words, the substitution between private and public facilities may not have occurred outside of Monrovia. Yet, even though our samples are restricted to Monrovia our key finding that all health providers should become an integral part of Liberia’s post-Ebola emerging healthcare system has also been flagged by other studies focusing on the impact of remoteness in rural Liberia (Kenny *et al.*, 2015). Our study demonstrates the importance of private facilities, especially *ad hoc* private facilities in increasing the resilience of the health sector during crises. Future work would do well to look at the role of private facilities in addressing delivery demands in rural parts of the

country. Second, one potential source of bias in the data is that the surveys (and the focus groups) do not include pregnant women who died due to Ebola. These pregnant women may have been more likely to deliver at home, or they may have died because they delivered at home and could not get proper care. This means that our sample could be missing women who were more likely to die of maternal health complications. This could be another reason for why we saw no change in home deliveries, as such women may have been more likely to die. Unfortunately, there is no way to verify the direction of such biases as there are no records of women who died from deliveries. Despite the limitations, we believe that our study provides important insight into the potential substitution between public and private facilities. Finally, one concern may be that we overlook the role of international NGOs in the provision of maternal healthcare during Ebola. We do not believe that the private facilities included in our study included high numbers of international NGOs. First, MOHSW's list of facilities includes very few international NGOs that have actual facilities in country. As such, the large majority of private facilities are Liberian-based. Second, most international NGOs, in particular MSF, were in the process of pulling out of the country before the Ebola crisis. By the end of 2011 MOHSW was expected to increase its stewardship over facilities from 95 in 2008 to 309 (out of 378) (Hughes, Glassman, and Gwenigale (2012, p. 20). Once Ebola started, international NGOs were late to respond, and did not focus on maternal health, but rather on containing the epidemic.²⁰

Broadly, our findings suggest several policy implications. First, despite claims about the fragility of the of the health system in metropolitan Monrovia, our study indicates a high level of flexibility and adaptability in the private sector in a situation where the provision of public services was severely restrained. The implication is that relief efforts should not only target public health institutions. Resources to shore up health institutions should be provided both in the public and private sectors during times of crisis.

Despite hospital closures, women could find care, albeit our interviews and focus groups indicate that the quality of this care may have been variable. The gap in delivery care was primarily filled by *ad hoc* private arrangements that emerged during the crisis. It is possible that many of these deliveries took place at informal or "other" private sites such as medicine stores and pharmacies. These are facilities

that at the outset lack proper equipment to handle medical situations. These sites may not be the safest place for women to deliver babies. As such, the government would do well to investigate how these other private institutions are filling the access gap, especially during a crisis. Moreover, the government should have more oversight over these more *ad hoc* private facilities that are being used by women to deliver babies. Outreach campaigns to educate women about the risks of delivery as such sites might also be worthwhile.

That health care specialists continued to work in more informal capacities even after hospital closures means that government health workers were still at risk of contracting Ebola. Thus, Ebola-related protection such as personal protective equipment (PPE) gear should be administered based on health care providers, and not only at health care facilities. That is, resources and training should be targeted toward health care providers irrespective of whether the facility in which they work shut down.

Moreover, resources for the crisis such as PPE gear and training should target different private sector initiatives and the informal sector as much as it targets the public health system. This means that there should also be continued extensive training of traditional midwives to bring them more into the formal system of health care. Traditional midwives play an important intermediary role between the public and private spheres, and during Ebola, they helped fill the gap in service delivery, despite often lacking training. As one of the midwives stated, "empower the midwives and give them adequate salaries at least" so that they can be more effective in their work. Finally, many participants stated the importance of supporting local health networks in order to prevent the spread of Ebola and other diseases (e.g., interview with female health-care worker and educator in Monrovia on September 9, 2015). There was an expectation that care could be provided locally and privately: "Give communities the tools and the resources and they often do the right thing" (quote from health care worker from interviews).

In short, the private sector played a very under-appreciated and critical role during the outbreak and it contributed to the resilience of the health systems. This dynamic needs to be taken into consideration during future crises of similar nature. Moving forward, we urge more research on the role of private facilities in cushioning shocks such as Ebola.

NOTES

1. CDC, "2014 Ebola Outbreak in West Africa—Case Counts," <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html>. Accessed March 18, 2017.

2. CDC, "2014 Ebola Outbreak in West Africa - Case Counts," <http://www.cdc.gov/vhf/ebola/outbreaks/2014-west-africa/case-counts.html>. Accessed January 25, 2017. In total, 11,315 people have been reported as having died from the disease in six countries; Liberia, Guinea, Sierra Leone, Nigeria, the US and Mali. The global number of reported cases was 28,646. For more information see <http://apps.who.int/ebola/ebola-situation-reports>. Accessed January 25, 2017.

3. We focus on the main categorization home-public-private even though the surveys include more detailed information about type of birthplace (i.e., distinguishing between different types of public birth locations, such as government hospital, government health center and

government health clinic). First, distinguishing between the three main categories is easier to interpret and also because these options represent three clear conceptual differences for places to deliver. Furthermore, we don't have sufficient variation with regard to the more nuanced breakdown of birth place in order to conduct an adequate analysis

4. Not including rural Montserrado County. We focus on urban Monrovia in this study because Monrovia represents the first major urban area to be affected by Ebola.

5. For details of the survey, see MIT Governance Lab (<https://data.hdx.rwllabs.org/dataset/data-for-ebola-recovery>). Accessed January 3, 2016).

6. The N is 65 in the Monrovia Ebola survey sample (2014) because one of the women who gave birth lacks information on the education variable

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7. The interviews confirm similar findings from other studies for example see [Streifel \(2015\)](#)
8. A two-tail t-test is not significant; the p -value is 0.6861.
9. A two-tail t-test is significant with a p -value of 0.0002.
10. A two-tail t-test is significant with a p -value of 0.0002.
11. The reason we have information back to 2002 is that the DHS recorded information on all births during the last five years preceding the interview date
12. For the entire period, the average of deliveries in urban Monrovia recorded in LDHS was 132 per year, with significant differences across years. For the 2008–13 period, the annual average number of deliveries was 102.
13. Other comparisons are shown in the [Online Appendix C, Tables C1 and C2](#).
14. Descriptive statistics of these variables can be found in the [Online Appendix A, Table A1](#).
15. Using confidence intervals at 95%, predicted probabilities ranged between 49%-64% in 2013 and 15%-38% in 2014.
16. Using confidence intervals at 95%, predicted probabilities ranged between 16%-28% in 2013 and 36%-63% in 2014.
17. Training is not consistent for this program and ceased during Ebola and afterward.
18. Other researchers have found ties to conflict and increased social capital. See [Blattman \(2009\)](#), [Gilligan, Pasquale, and Samii \(2014\)](#) and [Bellows and Miguel \(2009\)](#). Similarly, other research has found that social capital is key for resilience in local communities, see [Aldrich \(2011\)](#) and [Cannon \(1994\)](#).
19. For an interesting example of damage done to a private health facility, we note what happened to the Catholic Hospital in Monrovia. The chlorine spray for Ebola destroyed much of their equipment. The health workers noted: “we are still struggling, we lost a lot of equipment for example, and the fumigating of the hospital after the Ebola with the chlorine solution they were using was very strong chlorine like 10%. It really destroyed all our equipment. We had four ultrasound machines before Ebola but now we have only two” (interview with group of medical staff, doctors, nurses and midwives, in Sinkor, Monrovia conducted, on September 10, 2015).
20. For more details on the slow response by international NGO's see <https://www.odi.org/sites/odi.org.uk/files/odi-assets/publications-opinion-files/9903.pdf>. Accessed March 18, 2017.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.worlddev.2017.04.027>.

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