

REDUCING MAYA MATERNAL MORTALITY

PREPARED BY

MEGAN RIVERA

MASTER OF PUBLIC POLICY CANDIDATE
FRANK BATTEN SCHOOL OF LEADERSHIP AND PUBLIC POLICY



MAYA HEALTH ALLIANCE
WUQU' KAWOQ



FRANK BATTEN SCHOOL
of LEADERSHIP and PUBLIC POLICY

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DISCLAIMER

The author conducted this study as part of the program of professional education at the Frank Batten School of Leadership and Public Policy, University of Virginia. This paper is submitted in partial fulfillment of the course requirements for the Master of Public Policy degree. The judgments and conclusions are solely those of the author, and are not necessarily endorsed by the Batten School, by the University of Virginia, or by any other agency.

HONOR STATEMENT

On my honor as a University of Virginia student, I have neither given nor received unauthorized aid on this assignment.

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“Historically, the indigenous population in Latin America and the Caribbean has been invisible statistically, because few data from the region have been disaggregated by ethnicity” (Paulino et al., 2019).

Executive Summary

Guatemala's national maternal mortality rate is among the highest in Latin America at 95 deaths per 100,000 live births (UNICEF, 2019). *In Guatemala, indigenous women face a maternal mortality rate three times that of their non-indigenous counterparts* (Paulino et al., 2019).

Almost 50% of births in rural Maya communities happen under the care of a traditional birth attendant (Martinez et al., 2018). When complications occur during these home births, women either refuse to be referred to facilities for formal care or are unable to get there due to a lack of infrastructure.

This report analyzes three potential interventions intended to increase the number of Maya women who receive facility-level care when they experience complications during pregnancy and childbirth. The potential interventions are scrutinized by three criteria, *cost-effectiveness, administrative feasibility, and the likelihood of broader improvements of health outcomes* for Maya peoples. The potential courses of action are: **Allow Present Trends to Continue, Expand Maya Health Alliance mHealth Program, and Expand Access to Obstetric Care Navigators.**

Based on the evaluations of the criteria against the potential interventions, it's recommended that Maya Health Alliance expand access to their mHealth Program and their Obstetric Care Navigators model in phases. These actions will improve detections of complications, tackle cultural aspects of hospital avoidance and build up a functional referral system between home deliveries and the public hospital system in Guatemala for Maya women.

While improving the detection of complications does make home births safer, detection alone will not have a great enough impact on maternal mortality unless women follow through on the referral and get facility-level care (Austad et al., 2020).

"Most maternal deaths are preventable with timely management by a skilled health professional working in a supportive environment"
(World Health Organization, 2019).

Client Profile

Maya Health Alliance | Wuqu' Kawoq (MHA) is Guatemala based non-governmental organization founded in 2007 (Maya Health Alliance, Wuqu' Kawoq, n.d.). They focus on delivering the highest quality healthcare possible for rural indigenous Guatemalans while employing staff that speaks the indigenous Maya languages. MHA provides primary and specialty care free of charge while working to assist patients to overcome systemic barriers to health.

MHA operates out of the Tecpán municipality in the Chimaltenango department in central Guatemala. Their chronic malnutrition program treats 2,000 children annually and their cervical cancer prevention and treatment services have screened over 1,500 women. Their work in prenatal and maternal care is rooted in improving disparate outcomes for Maya women.

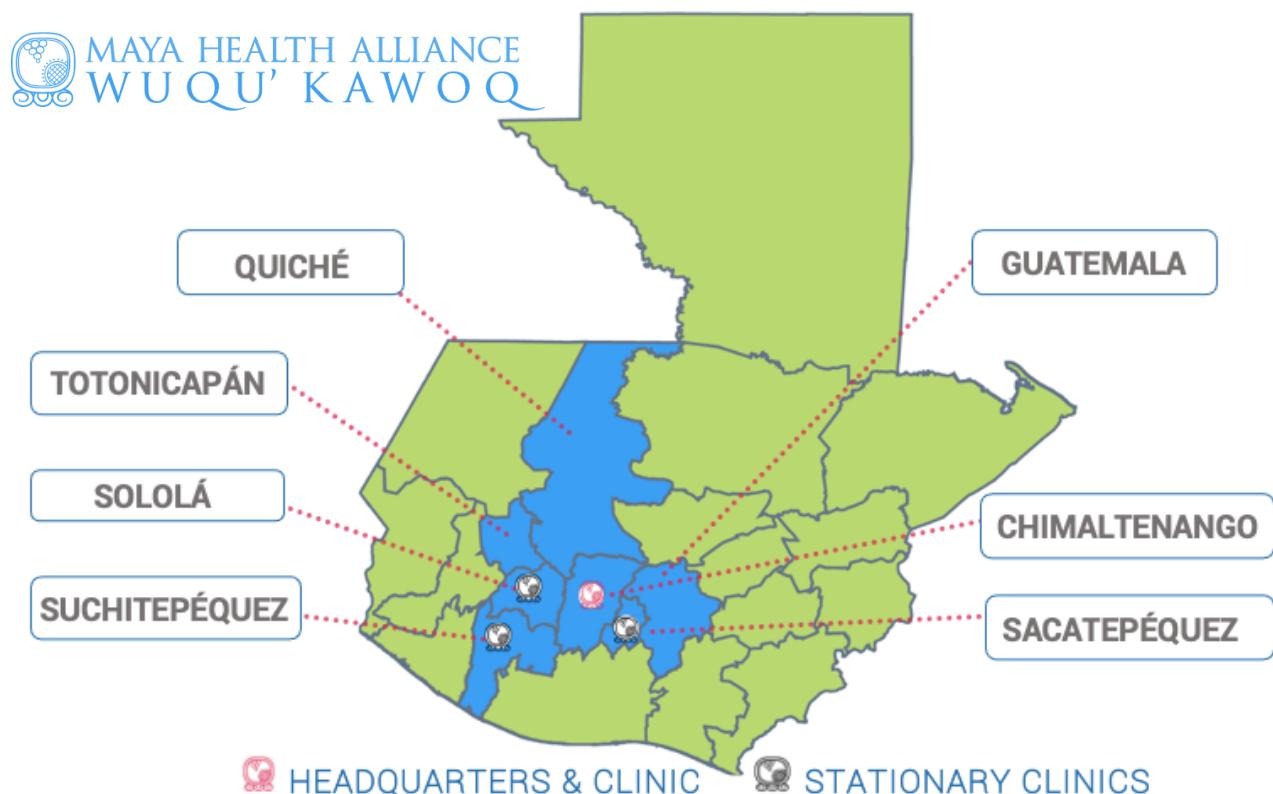


Figure 1: Map of Guatemala, Source: Maya Health Alliance, Wuqu' Kawoq.

Background

Guatemala is home to over 18 million people and 23 different ethnic groups (UNICEF, 2019). It is the second-most populous country in Central America after Mexico. The Maya population makes up 45% of the country's total population (Chary et. al, 2018). The Maya have suffered centuries of Spanish colonialism and the state-sponsored genocide that occurred during the Guatemalan civil war that took place from 1960 to 1996.

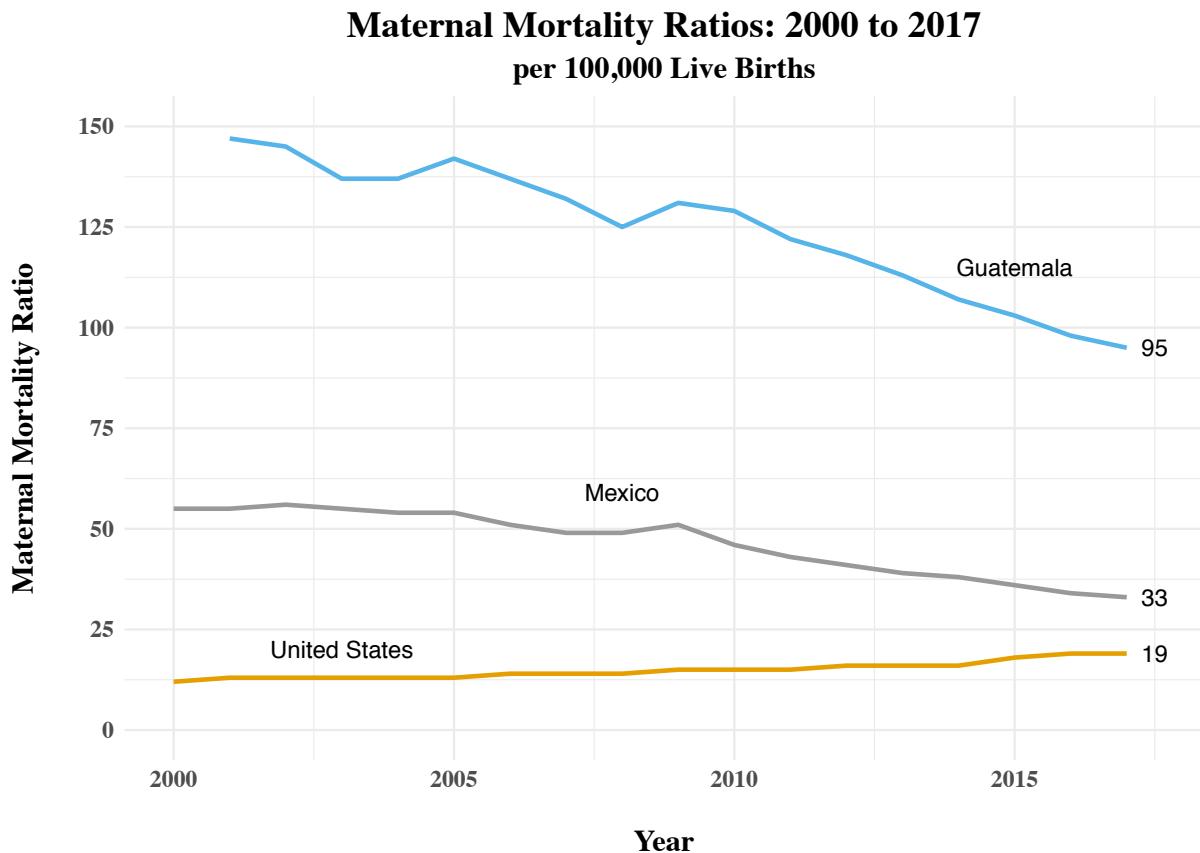
The country features prominent income disparities - although the national poverty rate is 45% - 79% of Maya people live in poverty (Martinez et. al, 2017). Only one out of every 10 indigenous women aged 20-24 years old have completed primary school compared to the national average of two out five (Guttmacher Institute, 2006). The Pan American Health Organization also found Maya women face a life expectancy that is 3 years shorter than their non-indigenous counterparts (Schooley et al., 2009).

The disparities between indigenous Guatemalan's and non-indigenous Guatemalans extend to every facet of their lives. Maya women are more than twice as likely to die from obstetric complications during childbirth than non-indigenous women (Austad et al., 2020). In 2013, Guatemala's maternal mortality rate was 113.4 deaths per 100,000 live births and of these deaths, 68.4% were indigenous women (Pan American Health Organization, n.d). The leading causes of death were hemorrhage, hypertension, infection, and abortion. (Pan American Health Organization, n.d)

Maternal Mortality

The WHO defines maternal mortality as "the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes" (World Health Organization et al., 2012).

From 2000 to 2017, Guatemala's reported maternal mortality dropped from 161 maternal deaths per 100,000 live births to only 95 maternal deaths (UNICEF, 2019). Guatemala's northern



Source: WHO, UNICEF, UNFPA, World Bank Group and UNPD (MMEIG)

Figure 2: Source: UNICEF, 2019

neighbor Mexico has a maternal mortality rate of 33 maternal deaths per 100,000 live births while the United States rate was 19 out of every 100,000 live births during the same period.

The Government of Guatemala has been working to reduce maternal mortality since the mid-1990s and the Law on Social Development, which covered reproductive health, family planning, and sexual education was passed in 2001 (Schooley et al., 2009). Guatemala's government has taken notice of its higher maternal death rate and Ladína women have seen improved rates. This difference however has not been experienced for indigenous women. **In Guatemala, indigenous women still face a maternal mortality rate three times that of their non-indigenous counterparts** (Paulino et al., 2019).

Although progress has been made, Guatemala still suffers from a high maternal mortality rate. To understand what can be done to reduce maternal mortality, we must investigate the underlying medical contributors. The major causes of maternal deaths are hemorrhage, infections, and hypertensive disorders of pregnancy including eclampsia and pre-eclampsia. Higher rates of complications are common with adolescent pregnancies. Contributors to maternal mortality can be categorized as direct or indirect. Direct contributors are pregnancy and delivery complications like bleeding, obstructed labor, infections, toxemia, and induced abortion (Palala & González, 2020). Indirect contributors include hepatitis, malaria, tuberculosis, anemia, and other diseases that are prevalent in populations that live in extreme poverty. Some contributors like eclampsia and pre-eclampsia are hypertensive problems that can be detected early during regular prenatal care. For women in poverty who are unable to get prenatal visits, pre-eclampsia and eclampsia can go undetected.

The Pan American Health Organization reported in 2013 when maternal mortality in Guatemala was 113.4 deaths per 100,000 live births, 68.4% of those deaths were indigenous women (Pan American Health Organization, n.d.). Maya women face numerous barriers to obtain high-quality obstetric care (Martinez et. al, 2017). Among them are institutional discrimination, long travel times, language barriers, and a lack of funds. This has led to a majority of indigenous Guatemalan women having home births instead of deliveries in public health facilities (Martinez et. al, 2017).

Almost 50% of births in rural Maya communities happen under the care of a traditional birth attendant (Martinez et al., 2018). Guatemala's perinatal and maternal mortality rates are higher for their rural indigenous Maya population than its non-indigenous populations (Martinez et al., 2018). The difference in indigenous and Ladína* maternal mortality is caused by a mix of reasons. Among them are that a majority of the indigenous Maya population lives in rural parts of the country that lack infrastructure and transportation resources. Historic discrimination of the Maya population in healthcare facilities has also led Maya women to prefer home births (Martinez et al., 2018). The following sections discuss the broad categorical reasons for which we see disparities in maternal mortality rates for indigenous Maya women versus non-indigenous Ladína women.

* Ladína women are non-indigenous or mestizo women in Guatemala.

Access to Healthcare

All Guatemalan citizens are guaranteed free government-sponsored health care under the Guatemalan constitution (Chary et. al, 2018). The Ministry of Health operates public clinics and hospitals that offer primary care preventative services, inpatient and tertiary care. Corruption and budget issues have caused medication stock-outs, personnel strikes, and absenteeism to plague government-run health centers and hospitals (Chary et. al, 2018). Only 8% of the total population has access to private health insurance (Pan American Health Organization, n.d)

Despite the mandate of free healthcare, over 80% of reported health-related expenditures are financed out-of-pocket by households (Chary et. al, 2018). It's common for patients to visit private pharmacies and medical facilities to obtain medications or imaging services. *For patients already living in poverty, the burden of out-of-pocket costs on top of lost wages is excessive and places them at risk of being financially exploited by private health systems.*

The Guatemalan Ministry of Health has worked to improve the quality of its public hospitals, including efforts to make the culture more respectful and less abusive to indigenous women (Juarez et al., 2019). Recently, the Ley Para la Maternidad Saludable (Healthy Maternity Law) was constructed to reform the out-of-pocket costs associated with Guatemala's public healthcare system, increase access to free medications and improve relations between non-indigenous clinicians and indigenous patients. So far, it's been suggested that the law's reforms have not been implemented. The law allows midwives and family members to join patients in the hospital, however, in practice hospitals have continued to turn away midwives who have attempted to accompany their patients (Juarez et al., 2019).

Access to care is concentrated in urban areas, twenty percent of the country's population lives in Guatemala City alongside 71% of the country's total practicing physicians (Chary et. al, 2018). Almost 55% of the country's total population lives in rural areas and Maya peoples are more likely to live in rural areas with limited access to health care compared to non-indigenous Guatemalans (Chary et. al, 2018). Some departments in Guatemala average 1.5 physicians for every 10,000 residents (Pan American Health Organization, n.d).

Recently, a government program that focused on increasing health care coverage in rural areas was ended due to funding issues, The Program for the Expansion of Coverage operated from 1996 to 2015 (Chary et. al, 2018). Over 4 million rural Guatemalans have been left without

coverage due to the programs closure.



Figure 3: Map of Guatemala's Departments, Source: WorldAtlas.com

Transportation from rural areas to government-run hospitals is an obstacle for many of the rural poor, it can take several hours to days to get to Guatemala City or other department capitals (Chary et. al, 2018).¹ This is because the travel from rural areas to urban centers often includes a mixture of walking and multiple public transportation connections.

¹ Guatemala has 22 departments that are divided into over 300 municipalities.

It's been reported that there is no "functional referral system" between rural and urban primary care clinics and hospitals that offer specialized services or tertiary care (Chary et. al, 2018). This lack of an effective referral system has placed the navigational burden on patients and for Maya peoples, this burden keeps them from getting the care they need.

Referrals

Eighty-seven percent of births in urban areas are attended by a skilled healthcare worker while only 56 % of births are in rural communities (Stroux et al., 2016). When TBA's refer women with obstetric complications to facility care, it's common for women or their families to refuse the referral out of concerns of mistreatment at the public hospital or inability to get there. For rural indigenous Guatemalans, there is no transportation to hospitals that is easily available.

The lack of a functional referral system exacerbates low referral rates and low referral success rates. Further, even if Guatemala's public hospital system develops a functional referral system, a lack of institutional trust and the issue of transportation will persist.

Referrals are considered a success if the patient receives facility-level medical care. TBA's and poor indigenous families often cannot navigate the hospital bureaucracy or overcome the language barrier to get patients to the care they need in urban areas (Chary et. al, 2018).

Language Barriers

Spanish is Guatemala's official language due to colonialism, but the country is also home to 23 distinct indigenous languages. Over 40% of Guatemalans speak an indigenous language (Schooley et al., 2009; Chary et. al, 2018). Monolingualism is common among those who speak Kaqchikel or K'iche' Mayan as well as other indigenous languages (Pan American Health Organization, n.d; Chary et. al, 2018). It's not uncommon for indigenous patients to lack Spanish fluency or literacy.

In Guatemala, most physicians and nurses are not indigenous and do not speak indigenous Maya languages (Juarez et al., 2019). The public health system does not offer professional interpretation services and often clinicians give care in Spanish. Spanish illiterate patients are often unable to navigate hospitals due to Spanish language signs between departments or paperwork only being offered in Spanish (Chary et. al, 2018). Further exasperating the language barrier, patients must provide and keep track of their medical records

since the public health facilities do not have reliable medical records systems or processes for distributing records between facilities.

Institutional Discrimination

Mistreatment of Maya patients in Guatemala by clinicians is “well-documented” and sometimes the treatment is rooted in “overt racism” (Martinez et. al, 2017; Chary et. al, 2018). Discrimination from hospital staff is common for indigenous and Maya patients, especially patients who wear traditional woven clothing or are non-Spanish speakers (Chary et. al, 2018). Patients have reported being turned away from services by security guards, secretaries, and nurses despite having appointments. The language barrier often exacerbates the problem as patients unable to advocate for themselves and have reported “fears of scolding” by hospital staff (Chary et. al, 2018).

This discrimination often causes Maya mothers and family members to opt for delivery at home in rural settings with a traditional birth attendant rather than hospitals to avoid mistreatment (Austad et al., 2020). When complications do arise and TBA’s do referral their patients to the public hospital system, patients and their families have been known to refuse care due to concerns of “disrespectful and abusive care.”

Further, it’s become common for patients to be sent on “errands” between hospital departments or medical facilities (Chary et. al, 2018). These errands include obtaining tests and paperwork – patients who have already traveled to get to the public health facilities in urban localities often get overwhelmed by the process. This frustration can lead to patients giving up and ending treatment early.

Traditional Birth Attendants (Comadronas)

Maya women overwhelmingly prefer to give birth at home, over half of Maya women use traditional birth attendants (TBA) rather than deliver in an institution (Austad et al., 2020; Martinez et al., 2018). TBA’s are indigenous women with little formal education and are considered “unskilled” attendants (Austad et al., 2017).

Since 1955, the Ministry of Health in Guatemala has offered training for the traditional birth attendants, but the programs have been criticized for not taking language differences and

cultural differences into consideration (Rööst et al., 2004). Twenty-three thousand midwives are registered with the Ministry of Health across the country (Palala & González, 2020).

TBA's are expected to utilize the "basic training" from the Ministry of Health and integrate the training into their care. TBA's are also expected to refer women to hospitals or other formal health facilities when complications arise but often women refuse the care. Another barrier TBA's often run into is the lack of a functional referral system, TBA's often do not have the resources or capacity to overcome logistical barriers to get patients into the public hospital system (Austad et al., 2020)

Adolescent Fertility Rates

42% of Guatemala's population is under the age of 15, while Guatemala's adolescent fertility rates are among the highest in the world (World Health Organization et al., 2012). Guatemala's adolescent fertility rate is 95 births for every 1,000-woman aged 15-19 years old (International Planned Parenthood Federation, 2014). The Pan American Health Organization reported that of Guatemalan women aged 10-19, 20% had already been pregnant once and 16% were already mothers (Pan American Health Organization, n.d.).

Globally the leading cause of death among girls aged 15-19 are complications during pregnancy and childbirth (World Health Organization, 2020). Mothers between the ages of 10 and 19 face significantly higher risks of "eclampsia, puerperal endometritis and systemic infections" than older mothers. Adolescent girls aged 15-19 years have an estimated 3.9 million unsafe abortions annually that contribute to maternal mortality and survivors face lasting health problems (World Health Organization, 2020).

Abortion in Guatemala

In 2013, abortion was reported to be one of the leading causes of maternal death alongside hypertension, infection, and hemorrhage (Pan American Health Organization, n.d.). In Guatemala, some 65,000 abortions occur annually among women aged 15-49 (Kestler & Mora, 2018). Further, it's estimated four-fifths of abortions performed in rural areas for indigenous women never see a "qualified provider."

Guatemala's constitution explicitly "guarantees and protects the human life from its conception, as well as the integrity and security of the person" (National Constituent Assembly,

1985). Guatemala's law does allow for abortions to save a mother's life but it is not enough, as "20,000 women are treated annually for abortion complications" (Kestler & Mora, 2018; International Planned Parenthood Federation, 2014).

Consequences of Maternal Mortality

Reducing the number of maternal deaths is a stand-alone reason to reduce these high disparate rates. However, maternal mortality has been shown to not only affect the mother but also their children.

Qualitative studies investigating the long-term effects of maternal mortality on living children and their families have found that surviving children are more likely to suffer malnutrition, less likely to have access to healthcare than children with mothers, and older surviving children are more likely to drop out of school (Molla et al., 2015).

Research on families in Bangladesh has also shown that children whose mother has died face an increased mortality risk compared to children who suffered paternal deaths (Strong, 1998). In Haiti, the impact of maternal death was measured to lead to an increase of 55% in the chance of a death of a child under the age of 12 compared to families who did not suffer maternal deaths (Anderson et al., 2007). The study also found that there was no increase in the likelihood of premature childhood deaths when the death of a mother was from causes other than pregnancy and childbirth.

High levels of stunting (low height for age) for young children who lost their mothers compared to children with both parents or only a mother (Reed et al., 2000). Linkages between poverty and the death of a family member have also been shown – economically disadvantaged peoples are vulnerable to malnutrition, infection diseases, and illiteracy (Reed et al., 2000).

Evidence

A recent study in the Bulletin by the World Health Organization investigated differences in maternal health care using indigenous languages as a proxy for ethnic differences in Central and South America (Paulino et al., 2019). Using a case study method, the researchers investigated four Latin American countries that featured large indigenous populations and high maternal mortality ratios: Guatemala, Mexico, Peru, and the Plurinational State of Bolivia. The data they utilized was from a mix of surveys executed by USAID and the United Nations Children's fund. The report found that indigenous women were more likely to experience “social and economic exclusion and to die during pregnancy or childbirth.” The authors found that the largest gaps in maternal health care indicators between indigenous and non-indigenous populations occurred in Guatemala.

The 2015 data used in the research showed vast disparities in health outcomes for indigenous women in Guatemala. Including, maternal mortality ratio’s three times higher for indigenous women compared to non-indigenous women, and the poorest quintile of women experienced an unmet need for contraception at four times the rate of the richest quintile of women. The obvious limitations of the study include the use of survey data instead of other objective measures and the use of language as a proxy for ethnic differences. It could have allowed for individuals to be misclassified as indigenous or not inaccurately. Attitudes in some countries towards indigenous populations also could lead to varying levels of people identifying as indigenous depending on its social acceptability or the prevalence of discrimination towards indigenous peoples in the country.

In Alta Verapaz in Guatemala, an NGO “TulaSalud” created a project meant to help lower the maternal mortality rate in the area (Martínez-Fernández et al., 2015). In Alta Verapaz, of the 1.2 million people who call the area home, 78% live in rural areas and 89% are indigenous (Martínez-Fernández et al., 2015). To combat the maternal mortality rate of 273 deaths for every 100,000 live births in the area, they created community facilitators who have cell phones to consult with specialists if needed. They also provided training for the community facilitators to better support the new network of telemedicine created through the program. The key interventions produced by TulaSalud were: the selection and training of the community facilitators, creating a direct way for consultation and support in emergencies when the community facilitators were present to help, continued surveillance of patients to help treat and

prevent problems before they become too serious, as well as the continuations training of the facilitators who were constant faces of community health

TulaSalud produced data to cover 5 years of the program, from 2008 to 2012 with promising results. They found that the telemedicine format did reduce maternal mortality with results that are statistically significant suggesting further research is promising. The community facilitator program suggests in addition to the limited findings of the smartphone applications that telemedicine is an avenue to help reduce maternal mortality in rural areas.

A 16-month study of family planning in six remote, predominately indigenous villages in Guatemala on Long-Term Reversible Contraceptive (LARC) uptake found insights that could assist in exploring solutions to maternal mortality (Austad et al., 2018). The study was based on mobile contraceptive educations and counseling that traveled between villages with nurses that spoke indigenous Mayan languages fluently. Barriers to higher uptake rates for long-term contraceptives included costs and provider bias or distrust in services.

Facility Care & Referrals

A study conducted in the Democratic Republic of the Congo, Pakistan, Kenya, Zambia, and Guatemala aimed at improving pregnancy outcomes through “detection and referral” found that Guatemala has the lowest rate of referral completion at 52% (Franklin et al., 2018). The study provided community-based ultrasound screening and then referred women to facilities if they detected complications – the successful referral rates in the African nations in the study were more than 90%. Transportation obstacles and logistical as well as bureaucratic barriers within the hospital are what the authors found to be behind Guatemala’s low referral success rate. The findings suggest that simply offering increased medical care is not the only barrier to lowering Maya maternal mortality.

Traditional Birth Attendants

The cultural element of traditional birth attendants is one that many researchers have investigated, like “A qualitative study of conceptions and attitudes regarding maternal mortality among traditional birth attendants in rural Guatemala” that conducted interviews with traditional birth attendants from villages around San Miguel Ixtahuacán in Guatemala (Rööst et al., 2004). The findings included that many of the traditional birth attendants they interviewed did not often

refer women to hospitals because they believed it was not necessary or that the women were afraid to go to the hospital even if it's a life-threatening complication because of a lack of trust. Other smaller reasons include beliefs that it was predetermined for either the mother or the baby to be lost in childbirth, leading the researchers to conclude there is a large religious bridge that needs to be crossed to make significant gains in lowering the maternal mortality rates in indigenous rural Maya villages.

The most significant findings from the interviews were how many of the indigenous pregnant women have a clear preference for the traditional birth attendants and substantial fear of hospitals. The fear of hospitals was rooted in the concern that the staff and doctors would treat them poorly due to their lack of ability to speak Spanish, their status as poor, and their being indigenous. These findings suggest that there might need to be a substantial effort put behind a campaign to depict the hospitals and service providers as culturally sensitive.

A limitation to the qualitative study done in San Miguel Ixtahuacán is that there was a language barrier, all of the traditional birth attendants interviewed spoke Spanish as a second language and needed a translator. All of the conversations had to be translated and then restated to ensure no mixed meanings were attributed to any of the women interviewed. Additionally, in some regions in Guatemala, it's not uncommon for women to give birth without help from anyone but their families like how 12% of all births in San Miguel Ixtahuacán are delivered (Rööst et al., 2004).

mHealth Program

The mHealth program was developed between the collaboration between Emory University and Wuqu' Kawoq | Maya Health Alliance, the smartphone application was created to be used by traditional birth attendants in rural, underserved parts of Guatemala. The application uses a combination of audio and visual instructions, records physiological signals (through the use of an accompanying 1D Doppler, pulse oximeter, and automated blood pressure cuff), and features a streamlined emergency alert response in case of complications (Stroux et. al, 2016).

The application was made accessible through its use of pictures and audio, intended for non-literate TBAs (Martinez et al., 2018). TBA's aged 18-65 years who were independently practicing in Tecpán 5 deliveries per year in the last 5 years valid license to practice issued by local health authorities were included in the initial pilot (Martinez et. al, 2018)

Traditional birth attendants are required to arrange referrals if complications arrive, but they often lack support from hospitals or have poor communication methods. In one randomized controlled trial done with support by the Maya Health Alliance, they provided traditional birth attendants with smartphone applications that were designed to offer support and guidance to traditional birth attendants while they evaluate patients (Martinez et al., 2018).

The use of the mHealth smartphone application by traditional birth attendants was found to lead to higher referral levels to facility-level care where complications can be handled by hospital staff (Martinez et. al, 2018).

The study produced a relatively low-cost way to bridge the cultural gap between the traditional birth attendants and facilities that could offer more comprehensive care if needed. Additionally, the smartphone applications were easy enough to use that the non-literate traditional birth attendants were still able to utilize the application. The study also enjoyed low levels of TBA attrition suggesting that broader implementation of the technology would not be rejected by the TBAs in other departments.

The limitations of the study include that it was only a feasibility trial and the nature of the intervention made it impossible to blind the study staff. Regardless, the initial success is promising.

Obstetric Care Navigators

In Guatemala, most physicians and nurses are not indigenous and do not speak indigenous Maya languages (Juarez et al., 2019). For Maya women, hospitals are home to “disrespectful and abusive maternity care” (Austad et. al, 2017). Hospitals lack interpreters that speak indigenous Mayan languages and only provide care in Spanish, opening the door for misunderstandings and non-consented care. Concerns of mistreatment and the other barriers to care as described in early sections have made Maya women unreceptive to referrals to public hospitals or other facilities for care.

TBA's are expected to refer women who have pregnancy-related complications to local hospitals, but often the TBA's “lack the resources and support to overcome the logistical barriers in the home” to get women into the public hospitals (Austad, et. al, 2020). It is due to these issues that Maya Health Alliance investigated the feasibility of obstetric care navigators in the Chimaltenango department of central Guatemala (Juarez et al., 2019). Inspired by patient-

centered care, the care navigation model works within the systems in place to make previously inaccessible care, possible for marginalized Maya patients through “bridging” the referral chain gaps (Chary et al., 2018). OCN’s were developed to have “four key functions – coordinate, communicate, support and advocate” (Austad, et. al, 2020).

Care navigators are indigenous women who are trained on how to navigate emergencies, hospital culture and act as a bridge between traditional birth attendants who refer their patients to the hospital. The care navigators often provide translation services and help families arrange transportation to the hospital as well as help the families advocate for their loved ones. OCN’s roles are similar to caseworkers or social workers, assisting patients in navigating and overcoming barriers to obtaining care as well as ensuring that they are given a planned treatment (Chary et. al, 2018).

The OCN intervention was created to solve issues in the home to public hospital referral chain (Austad et al., 2020). OCN’s ability to navigate hospitals, speak Spanish in addition to indigenous Mayan languages, and assist in logistical support are meant to improve patients and family’s willingness to be referred to public facilities. OCN’s can assist in coordinating travel for patients which is especially necessary for some geographic regions when the only other option would be walking.

OCN’s were given hands-on training in “medical interpretation” to make them more successful at advocating for patients, labor support, as well as conflict de-escalation (Austad et al., 2020) The care model adopted by the obstetric care navigators emphasizes indigenous Maya patient’s willingness to seek biomedical therapies rather than some studies that claim indigenous peoples prefer cultural ones.

During the 12-month pilot, 847 births were attended to and the median referral volume per month increased from 14 to 27.5 (Austad et al., 2020). During the pilot no decline in the success rate of referrals was detected – there was an overall referral success rate of 91% by the end of the pilot. Among the most common complications that needed a referral to facility-level care were hypertensive disorders (pre-eclampsia and eclampsia) and prolonged labor. The Global Network for Women and Children’s Health has concluded that hypertensive disorders are among the strongest predictors of maternal mortality in geographic regions similar to Guatemala’s (Bauserman et al., 2015). These findings suggest that promoting facility-based care could be a key strategy to reducing Maya maternal mortality.

Since the OCN's are Maya themselves and have similar cultural perspectives, they are invaluable in making Maya women's clinical encounters easier. They can explain treatment to patients and their families as well as offer moral support in a place hostile to Maya peoples (Chary et. al, 2018).

There are a few limitations to the studies of the Obstetric Care Navigators model, among them, during its pilot the TBA's that were generating the referrals were using the mHealth smartphone application program to assist in the early detection of complications. As such, the data likely reflects higher rates of both overall referrals as well as successful referrals. It's also worth noting that the chosen department to run the pilot in, Chimaltenango, is rather central in geography and may be less applicable to more rural mountainous departments in northern Guatemala (Austad et al., 2020).

Further limitations of the OCN model include that the study was not juxtaposed against a control and the homogenous population the model was intended to both serve and employ. Although they haven't yet been able to create instruments to measure patient satisfaction or improvements of care and treatment in hospitals, preliminary anecdotal feedback has been positive.

Takeaways

The evidence suggests that reducing Maya maternal mortality is multifaceted, and will require both cultural gains as well as biomedical gains. Lower maternal mortality rates for Maya women will need to account for the rural aspect as the geography and infrastructure currently in place do not accommodate the rural poor getting access to the quality care they deserve.

It seems that to improve outcomes, increased prenatal care to detect complications is needed. When those complications are present, TBA's need to be willing to refer their patients to facility care but women also need to be willing to follow through on the referral. While improving the detection of complications does make home births safer, detection alone will not have a great enough impact on maternal mortality unless women follow through on the referral and get facility-level care (Austad et al., 2020). Overcoming distrust of public health facilities, language barriers, as well as bureaucratic and transportation obstacles will need a holistic approach. The historic discrimination will not be easily forgotten.

The literature also suggests that more research could be conducted into Guatemala's high rates of adolescent fertility and how that affects the country's indigenous maternal mortality.

While lack of access to safe and legal abortions does contribute to maternal mortality, the cultural and political elements of the country suggest that change is not going to occur soon.

The historic erasure of data on indigenous populations in Latin America through disaggregating data by ethnicity has also colored the findings of the literature (Paulino et al., 2019).

Criteria

Cost-Effectiveness

The U.S. dollar cost (5-year average) in relation to anticipated effects on successful facility referral rates. This criterion emphasizes the need for Maya women to get facility-level care when complications arise and improving the "referral pathway" through higher successful referral rates to public hospitals in Guatemala (Austad et al., 2020). Through dollars spent in increases in salary, technology costs, or material costs. This criterion will rank each intervention from most cost-effective to least cost-effective.

Administrative Feasibility

The ability for any intervention to be scaled to affect all of the following states: Chimaltenango, Quiché, Totonicapán, Sololá, Suchitepéquez, Guatemala (City), and Sacatepéquez. Administrative feasibility will be determined to be high, medium, or low depending on the following rubric:

High Feasibility	Medium Feasibility	Low Feasibility
An option that does not require MHA to accomplish an: <ul style="list-style-type: none"> • Increase in budget • Increase of MHA's staff 	An option that requires MHA to accomplish one or two of the following: <ul style="list-style-type: none"> • Increase in budget • Increase of MHA's staff 	An option that requires MHA to accomplish all three: <ul style="list-style-type: none"> • Increase in budget • Increase of MHA's staff

Broader Improvement of Health Outcomes

Alternatives will be evaluated by the likelihood of broader improvements of health outcomes the implementation of the alternative could provide. The alternatives will be determined to offer a high, medium, or low likelihood of broader improvements of health outcomes. The rubric is as follows:

High Likelihood	Medium Likelihood	Low Likelihood
The literature suggests there is a high likelihood that the proposed alternative will offer additional improvements in health outcomes if implemented.	The literature suggests there is a medium likelihood of broader improvements of health outcomes with the implementation of the proposed alternative.	The literature suggests the proposed alternative will likely not offer broader improvements of health outcomes if implemented.

Potential Interventions

Option #1: Let Present Trends Continue

Guatemala's maternal mortality rate dropped 57.1% between 1980 and 2010 (World Health Organization, 2015). Falling from 205 maternal deaths in 1980 per 100,000 live births to only 88 deaths in 2010. However, Indigenous women are not experiencing equity in maternal mortality, suffering 163 maternal deaths per 100,000 live births (World Health Organization et al., 2012). Currently, 87% of births in urban areas are attended by a skilled healthcare worker while only 56 % of births are in rural communities (Stroux et al., 2016). Under this option, a majority of births in rural communities will be attended by TBA's rather than facility staff.

MHA under this course of action would continue their current services to Maya women across Guatemala.

Cost-Effectiveness

Allowing present trends to continue is not associated with any new costs nor any anticipated increase in effectiveness at successful referrals. Letting present trends continue earns a *0 for its cost-effectiveness score.*

Administrative Feasibility

The administrative feasibility of allowing present trends to continue will not require any actions to increase the size of budget nor staff size. Thus, its *administrative feasibility score is high.*

Broader Improvement of Health Outcomes

There is a *low likelihood* of broader improvements of health outcomes associated with allowing present trends to continue. This is because, without intervention, Maya maternal mortality rates will likely remain higher than Ladína women's for the foreseeable future.

Option #2: Expand MHA's *mHealth Program*

MHA could expand access in Guatemala to the tested mHealth smartphone application that has already displayed success increasing traditional birth attendant's hospital referral rates (Martinez et. al, 2018). Equipping traditional birth attendants (TBA's) across Guatemala with the mHealth program technology would start with first rolling the program out beyond Tecpán in Chimaltenango. The second phase of this expansion would be through equipping the other state's MHA serves, Quiché, Totonicapán, Sololá, Suchitepéquez, Guatemala (City), and Sacatepéquez.

Expanding the mHealth program will require equipping TBA's who qualify for the program with the Samsung S3 mini smartphone (\$100), a pulse oximeter (\$186) (Onyx, Model 9560, Nonin Medical, Inc.), a hand-held 1-dimensional Doppler ultrasound device (\$28) (AngelSounds Fetal Doppler JPD-100 s, Jumper Medical Co., Ltd.), and a self-inflating oscillometric blood pressure cuff (\$160)(Omron M7, OMRON Healthcare) (Martinez et. al, 2018; Concord Health Supply, 2021; Amazon, 2021; BP Monitor Depot. 2021).

Cost-Effectiveness

Over a five-year average, assuming 50 TBA's manage 500 births a year, *the cost-effectiveness of the mHealth Program is \$38.37 for each additional referral.*

The cost-effectiveness's assumptions include, that one TBA can handle up to 100 deliveries a year, the cost of the technology required to supplement the application, as well as an assumption the referral success rate is 91% based on findings from a study published in 2020 that the application was a part of (Austad et. al, 2020). The number of increased referrals out of the

mHealth program was calculated using the findings from the pilot's 2018 study, the trial displayed an increase in referral volume of 69%. After the initial year of the pilot, it is assumed that there will be additional referrals every year at a lower rate than the initial year, every year following was calculated to see an increase of referrals at a 10% lower rate than the previous year. TBA's access to the technology over time will see lower rates of referral increase as they become used to the increased detection abilities of the technology.

This criterion emphasizes the need for Maya women to get facility-level care when complications arise and improving the “referral pathway” through higher successful referral rates to public hospitals in Guatemala (Austad et al., 2020).

It is worth noting, that the creators of the mHealth application have shared that the system has the potential to be redesigned into a “bespoke integrated hardware system” that could lead to “significant reductions in hardware costs when used at scale” (Martinez et. al, 2017). Although these potential cost savings are not yet able to be realized, it suggests that the cost-effectiveness of the mHealth program can be made even more cost-effective.

Administrative Feasibility

Expanding the mHealth program to encompass more states that MHA serves is associated with a need for increases in staff and increases in the budget. These costs are associated with technology costs for the TBA's to utilize the mHealth smartphone application. Each smartphone with the application also requires a smartphone, a pulse oximeter, a hand-held 1-dimensional Doppler ultrasound device, as well as a self-inflating oscillometric blood pressure cuff.

Expanding the mHealth program to all seven departments MHA serves would require an increase of budget only to equip TBA's with the necessary technology and no increase in staff. Thus, on administrative feasibility expanding the mHealth program earns a score of *medium feasibility*.

Broader Improvement of Health Outcomes

The associated increase of referral rate to facilities for perinatal distress associated with the mHealth program suggests that there is a *medium likelihood* for broader improvements of health outcomes associated with the mHealth program beyond maternal mortality. These findings

are due to the technology of the mHealth program to be able to detect fetal complications in addition to maternal complications as found in the 2018 pilot study (Martinez et. al, 2018).

Option #3: Expand Obstetric Care Navigator (OCN) Program

This option would lead to MHA expanding its Patient Navigator Program beyond the original pilot program offered in Chimaltenango. This would increase the number of Care Navigators available to Maya women in case of complications requiring hospital care and a navigator.

The Patient Navigators assist Maya women through their ability to translate Spanish to Maya Kaqchikel to improve communication between the patient and the hospital staff.¹ Roughly half of indigenous Guatemalan's speak indigenous Maya languages (Tzian, 1994). The navigators further ease the experience of hospital care for Maya women through their ability to help "facilitate hospital discharge, coordinate follow-ups, purchase medications, or respond to postpartum emergencies" if they arise (Austad et. al, 2017).

TBA's are expected to refer women who have pregnancy-related complications to local hospitals, but often the TBA's "lack the resources and support to overcome the logistical barriers in the home" to get women into the public hospitals (Austad, et. al, 2020). Families often also act as barriers to getting women to hospitals as they often refuse the referral due to concerns about treatment. The navigators increase the likelihood that Maya women will go to a hospital in the case of complications, where maternal death is less likely than staying in their rural village (Austad et. al, 2017).

Expansion into Quiché, Totonicapán, Sololá, Suchitepéquez, Guatemala (City), and Sacatepéquez would allow for the greatest impact on maternal mortality rates for Maya women, as well as limit the need to build out greater MHS infrastructure as they are already active in those states. Expanding beyond Chimaltenango should be done one state at a time to limit growing pains. This option would require MHA to recruit and hire women who speak Maya Kaqchikel as well as Spanish, offer the formal training needed to educate them to a high degree of medical literacy, and allocate additional funds in their budget to support these additional

employees as well as continue the practice of allowing the navigators to have a small budget to use at their discretion.²

Cost-Effectiveness

Over a five-year average, assuming two OCNs per department, *the cost-effectiveness of OCN's is \$128.37* for each additional referral.

The cost-effectiveness accounts for the increased technology costs associated with equipping TBA's with a laptop, smartphone, and GPS. The salary of \$8,000 for the OCN's was found in a 2018 study during the preliminary studies on the OCN program's potential (Chary et al., 2018). The effects of increased successful referral rates were then calculated using the findings in Austad et al. (2020). See appendix for further information on the calculation of the cost-effectiveness analysis of increased successful referral rates.

Administrative Feasibility

Expanding the OCN program is associated with necessary increases in staff and budget to cover the associated salaries of the OCN's. The OCN salaries are \$8,000 (USD), which is more than double Guatemala's national yearly minimum wage, \$3,600 (Chary et. al, 2018). OCN's are also equipped with a laptop, a smartphone, and a GPS to handle their patient caseloads. Over time, likely, the expansion of the OCN program will also require further staff to manage OCNs as the program expands into every department. To expand the program, MHA must increase both their budget as well as their staff. Thus, expanding the OCN program scores *low on administrative feasibility*.

Broader Improvement of Health Outcomes

The OCN program is associated with broader improvements of health outcomes beyond its associated impact on maternal mortality. OCN's ability to support Maya women's health care needs beyond delivery, including facilitating referrals to psychologists for evaluation and

² The navigators' budget allows navigators to "purchase medications, supplies, or laboratory testing" that public hospitals cannot fulfill as well as "small comforts for the patient and her family, such as snacks or arrange for family accommodation" (Austad et. al, 2017).

treatment if they notice signs of depression, contributes to OCN's association with broader improvements of health outcomes. Expanding the OCN program suggests there is a *high likelihood* that the program will lead to additional health outcomes beyond affecting maternal mortality through increased successful referral rates to facility-level care.

Outcomes Matrix

	Cost-Effectiveness of Each Additional Referral Success	Administrative Feasibility	Broader Improvements of Health Outcomes
Option 1: Allow Present Trends to Continue	0\$	High <ul style="list-style-type: none"> • No necessary budget increases • No necessary staff increases 	Low Likelihood
Option 2: Expand the mHealth Smartphone Application Program	\$38.37*	Medium <ul style="list-style-type: none"> • Budget increase necessary • No necessary staff increases 	Medium Likelihood
Option 3: Expand Access to Obstetric Care Navigators	\$128.37*	Low <ul style="list-style-type: none"> • Budget increase necessary • Staff increase necessary 	High Likelihood

*See appendix for further information

Limitations

This analysis was based on findings from source studies that have been peer-reviewed. Despite this, it's worth noting that the integrity of the analysis depends on the source material and so any errors in a source study will carry over into this analysis.

Recommendation

While improving the detection of complications does make home births safer, detection alone will not have a great enough impact on maternal mortality unless women actually follow through on the referral and get facility-level care (Austad et al., 2020). A pathway from TBA's to facility-level care in conjunction with changing attitudes towards hospital care can lead to greater referral success and lower maternal mortality for Maya women.

Throughout this analysis, it has become clear that improving outcomes for Maya women will need a multi-faceted approach. Effecting maternal mortality for Maya women requires increased levels of detection of complications and increased trust in facility-level care. As such, it's recommended that the mHealth program and Obstetric Care Navigator program are both expanded but in phases.

It's recommended that the mHealth program is expanded first into all seven departments that MHA serves followed by the expansion of the OCN program. This slow roll-out of expansions would allow for TBA's to become more skilled at detecting complications and MHA's infrastructure to grow as well. The OCN expansion will allow for the increase in referral rates associated with the mHealth program to be built upon, with the expected increase in successful referrals along with the Care Navigators.

Implementation

The first step in implementing the expansion of the mHealth Program and the Obstetric Care Navigators program is to secure the necessary funds to support the increased technology and staffing costs.

Next, it's recommended that the mHealth program is expanded first. Setting up the infrastructure to recruit and train TBA's effectively and efficiently is advised. Investigating bulk buying discounts on technology is also advised as MHA purchases the necessary technology to equip 50 TBA's in every department it serves.

A worst-case scenario for the implementation of the expansion of the mHealth program could be an inability to find TBA's who are interested and willing to learn the mHealth program. If that did occur, it could be mitigated by alternating what departments are expanded to first – MHA should expand in departments where they can find TBAs interested in the technology. It is unlikely that the mHealth program will face risks with the technology as it was designed to

operate on little data and the telecommunications infrastructure is already in place to support the application.

Budgeting the Expansion of the mHealth Program

	Year 1	Year 2	Year 3	Year 4	Year 5
Chimaltenango	\$23,700	\$2,370	\$2,370	\$2,370	\$2,370
Quiché	\$0	\$23,700	\$2,370	\$2,370	\$2,370
Totonicapán	\$0	\$0	\$23,700	\$2,370	\$2,370
Sololá	\$0	\$0	\$0	\$23,700	\$2,370
Suchitepéquez,	\$0	\$0	\$0	\$23,700	\$2,370
Guatemala	\$0	\$0	\$0	\$0	\$23,700
Sacatepéquez	\$0	\$0	\$0	\$0	\$23,700
Annual Total:	\$23,700	\$26,070	\$28,440	\$54,510	\$59,250

Expanding the mHealth program can be done at an increasing pace. In Year 1, 50 TBA's from Chimaltenango will be equipped with the necessary equipment and then in Year 2, 50 TBA's from Quiché can receive the equipment. This rollout will continue with Totonicapán, and then in Year 4 50 TBA's from both Sololá and Suchitepéquez will be equipped in the same year followed by 50 TBA's from Guatemala and Sacatepéquez.

The budget in the years following the equipment of each department should include replacement funds for 5 of each technology in the case of missing or broken technology. The slow initial roll-out of the mHealth program expansion will allow for MHA to become accustomed to training and recruiting new TBA's on the technology so in the final two years of the roll-out the training capacity can support double the number of TBA's.

Following the expansion of the mHealth program, the OCN program can be expanded. To expand the OCN program, infrastructure for recruiting and training OCNs will need to be developed. As the OCN program expands into new hospitals, its necessary for MHA to build new relationships with hospital clinicians to support effective OCN's. It's imperative to build cordial and friendly relationships with hospital staff at the hospitals in the districts the program expands to, poor relationships with hospital staff could lead to the OCN program being ineffective.

The successful relationships that the OCN pilot program developed in the hospitals of Chimaltenango suggests that it is unlikely poor relationships will develop during the expansion.

If it becomes challenging to recruit bilingual Maya women to be OCNs, it may become necessary for MHA to recruit women who fit every other criterion for the position and teach them Spanish.

Budgeting the Expansion of the OCN Program

	Year 1	Year 2	Year 3	Year 4	Year 5
Chimaltenango	\$17,040	\$16,000	\$16,000	\$16,000	\$16,000
Quiché	\$0	\$17,040	\$16,000	\$16,000	\$16,000
Totonicapán	\$0	\$0	\$17,040	\$16,000	\$16,000
Sololá	\$0	\$0	\$0	\$17,040	\$16,000
Suchitepéquez,	\$0	\$0	\$0	\$17,040	\$16,000
Guatemala	\$0	\$0	\$0	\$0	\$17,040
Sacatepéquez	\$0	\$0	\$0	\$0	\$17,040
Annual Total:	\$17,040	\$33,040	\$49,040	\$82,080	\$114,080

Expanding the OCN program can be done at an increasing pace. In Year 1, two OCNs from Chimaltenango will be equipped with the necessary equipment and then in Year 2, two OCN's from Quiché will be added. This rollout will continue with Totonicapán, and then in Year 4, two OCN's from both Sololá and Suchitepéquez will be equipped in the same year followed by two OCN's from Guatemala and two from Sacatepéquez.

The budget for expanding OCNs should include their annual salaries every year after their first year. The first year of each add-in should include the necessary funds for their initial equipment. The slow initial roll-out will allow MHA to adjust to any potential growing pains, like turnover or resistance from new hospitals.

Avoiding Obstetric Care Navigator Burnout

A key feature of the OCN model is the ability for OCNs to make hospitals less abusive places to Maya women. However, between OCN's long work hours from supporting patients in addition to the travel required to assist patient's transportation needs from rural to urban areas, staff burnout is a concern. Particularly concerning is that some OCN's who are indigenous Maya and wear Maya clothing may face discrimination at health facilities despite their bilingual ability and medical knowledge. The stress of feeling responsible for a patient's well-being is also suspected to wear on OCN's over time (Chary et. al, 2018).

Supporting OCNs through flexible work hours, mindfulness, and advocacy to fight discrimination in hospitals could assist in diminishing the risk of staff burnout. Other methods to reduce burnout should also be provided depending on the needs of the OCNs over time.

Potential Concerns with Increasing Facility Deliveries

It is important to note that a concern of increasing successful referrals to “facility care” in Guatemala could unintentionally lead to an accompanying increase in caesarean delivery (Austad et al., 2020). This could lead to more necessary cesarean deliveries but potentially also more unnecessary deliveries – creating an increased risk to the women delivering of further complications. The OCN program will assist in avoiding such a scenario as they can advocate for the patient and have sufficient medical training to push for traditional deliveries over cesarean deliveries when cesarean deliveries are unnecessarily risky.

Appendix

Cost-Effectiveness

mHealth Program Cost-Effectiveness for Each Additional Successful Referral

Technology costs were calculated using the cost per phone from Martinez et al. (2018) at \$100 in addition to name brand matching to estimate equivalency pricing as described in Martinez et al. (2018). The pulse oximeter in the model Onyx, Model 9560 by Nonin Medical, Inc. was found to be \$186 full price at Concord Health Supply (2021), the hand-held 1-dimensional Doppler ultrasound device by AngelSounds in model Fetal Doppler JPD-100 s Jumper Medical Co., Ltd. was \$28 on BP Monitor Depot (2021), and the self-inflating oscillometric blood pressure cuff by OMRON Healthcare in the model Omron M7 was found to be \$160 full price (Amazon, 2021). There is no reason to expect the prices to be raised and so the estimated technology cost is liberal and the real costs are likely smaller.

Technology Costs: $\$100 + \$186 + \$28 + \$160 = \$474$

Using the referral rate increases as found in Martinez et al. (2018) gave the base rate assumed for year 1 of utilizing the mHealth program and then the subsequent years were estimated to be 10% less effective each year on increasing referrals as the overall rate increases.

Using the actual number increase in referrals as found in Martinez et al. (2018), each year's number of increased referrals was subsequently found by increasing the year before by the estimated year's increase.

To determine the success rate, each year's estimated increase was assumed to have the same success rate as displayed in Austad et al., (2020) at 91%.

	Yearly Referral Increase (as a percentage)	Estimated Yearly Referral Increase	Estimated Yearly increase in Successful Referrals
Year 1	69.41%	46.657	42.458
Year 2	62.47%	75.8025	68.9802
Year 3	56.22%	118.419	107.761
Year 4	50.60%	178.337	162.286
Year 5	45.54%	259.548	236.189

The technology costs were then assumed to be distributed by 50 TBA's.

$$(50)(\$474) = \$23,700$$

$$\$23,000 / (46.65 + 75.80 + 118.41 + 178.33 + 259.548) = \$38.37$$

Obstetric Care Navigators Cost-Effectiveness for Each Additional Successful Referral

Technology costs were from Martinez et al. (2018) for \$100 for each smartphone, Dell (2021) per laptop at \$300, and Amazon (2021) per GPS at \$120. The costs were all assumed at a full price despite discounts likely being possible.

$$\$100 + \$300 + \$120 = \$520$$

The salary for obstetric care navigators was found in Chary et al. (2018) at \$8,000 yearly.

The first-year increase in successful referrals for OCN's was estimated by taking the reported number in Austad et al. (2020) of women who received OCN care during the 12-month pilot at 276 and subtracting the sum of the pre-intervention median referral rate in Austad et al. (2020) times 12 (to produce an estimated year of referrals without the OCN intervention).

$$276 - (14)(12) = 108$$

Using the lower bound of the confidence interval of the increase of the total proportion of deliveries in the first month of the 12-month pilot in Austad et al. (2020) at 7.3% and the lower bound of the confidence interval of the reported monthly average increase during the following 11-months of the pilot at .08%. After calculating the average increase for each of the months during the pilot, those averages were then averaged to calculate the full year's average increase in referrals. The subsequent years were then assumed to have diminishing rates of return on the subsequent increase of referrals that OCN's effect.

	Estimated Increase in Referral Success	Estimated Increase OCN Referral Volume	Estimated Cost per year	Average cost per Referral
Year 1	12%	108	\$17,040	\$157.78
Year 2	10%	118.8	\$16,000	\$134.68
Year 3	8%	128.3	\$16,000	\$124.70
Year 4	5%	134.7	\$16,000	\$118.77
Year 5	5%	141.5	\$16,000	\$113.11

The overall costs for the analysis were calculated for two OCN's with recurring salaries and the one-time technology costs.

$$[\$520 + \$520 + (5)(2)(\$8,000)] / [108 + 118.8 + 128.3 + 134.7 + 141.1] = \$128.37$$

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