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UNCOVERING THE STORIES BEHIND THE NUMBERS: A CASE STUDY OF
MATERNAL DEATH SURVEILLANCE AND RESPONSE IN GOMA,
DEMOCRATIC REPUBLIC OF CONGO

By

Baraka Muvuka, MPH

B.Sc., Silliman University, 2013

M.P.H., Liberty University, 2015

A Dissertation

Submitted to the Faculty of the
School of Public Health and Information Sciences
of the University of Louisville
in Partial Fulfillment of the Requirements for the
Degree of

Doctor of Philosophy in Public Health Sciences

Department of Health Promotion and Behavioral Sciences
University of Louisville
Louisville, Kentucky

May 2019

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DEDICATION

To

All women whose lives have ended prematurely from pregnancy-related causes

For inspiring this study to prevent similar deaths in the future.

To

My beloved family

For believing in me, supporting me, upholding me in prayers, and investing in my

education.

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Above all, my deepest gratitude to God, my refuge, strength, and source of wisdom. He has blessed me with supportive mentors, family, and friends.

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My family and friends have been a special part of this journey. I am forever grateful to my dad, Dr. Kambale Karafuli; my mom, Dr. Muteho Kasongo; and my brother, Taji Vuruka, for all they have sacrificed for me to achieve this significant milestone. My parents have instilled in me the passion for learning and invested in my dreams, supporting me every step of the way. To my loving husband, Steven Nwaokolo “SJ”, who has shown me unconditional love, endless support, and extraordinary patience over the years. He has encouraged me to dream big and has always seen the glass half full when I saw it half empty. Finally, I am thankful for my friends and colleagues who have made this doctoral journey fun and unforgettable.

ABSTRACT

UNCOVERING THE STORIES BEHIND THE NUMBERS: A CASE STUDY OF
MATERNAL DEATH SURVEILLANCE AND RESPONSE IN GOMA,
DEMOCRATIC REPUBLIC OF CONGO

Baraka Muvuka

April 24, 2019

Globally, 303 000 women die each year from preventable causes related to pregnancy, with the Democratic Republic of Congo (DRC) having the tenth highest maternal mortality rate. Maternal Death Surveillance and Response (MDSR) is a surveillance-action cycle that aims to eliminate preventable maternal mortality by linking actionable data on maternal deaths with multi-level actions. While countries are increasingly adopting MDSR, there are research gaps on its implementation, outcomes, and best practices in developing countries including the DRC. This study assessed MDSR implementation in Goma Health Zone (HZ), DRC, specifically its structure, process, quality, outcomes, and influencing factors. A qualitative case study design was utilized, comprising semi-structured interviews with 15 key informants from seven sites, a review of 52 MDSR documents, and an observation of a maternal death review. Data analysis was conducted in Dedoose using the constant comparative method.

Findings suggest that MDSR integration into an existing Integrated Disease Surveillance and Response system in the DRC has facilitated its acceptability and institutionalization in integrated (i.e. government-affiliated) health facilities in Goma HZ, where it is sustained by existing organizational resources. However, the MDSR system had weak community and private health sector linkages. Additionally, this study revealed a systematic implementation of early MDSR phases (notification-review) but gaps in completing advanced MDSR functions such as response implementation. With respect to quality, the MDSR system's major strengths were its simplicity, acceptability, and timeliness in integrated health facilities, while its major challenges were its acceptability, data quality, and timeliness in communities and non-integrated facilities. The political commitment to MDSR and strong support from the HZ and facility leadership were key enablers of MDSR implementation, while unregulated private facilities and the links between MDSR and disciplinary action were the most prominent barriers.

While MDSR in Goma HZ has yielded some improvements in the quality of care at HZ and facility levels, its overall impact on maternal health outcomes remains reportedly weak due to limited response implementation at higher levels of the health system. To strengthen Goma's MDSR, this study suggests the need for a non-threatening MDSR environment, multisectoral partnerships, and mechanisms to follow-up on recommendations.

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CHAPTER I
INTRODUCTION
Background

“A pregnant woman has one foot in the grave” – a traditional African proverb

While pregnancy is a time of excitement and anticipation for many, it is a treacherous journey in several settings, particularly in developing countries (Lewis, 2008a; Moshabela et al., 2015). The WHO (2012, p. 9) defines maternal mortality as “the death of a woman while pregnant, or within 42 days of termination of pregnancy...from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.” Globally, 303 000 women die each year (830 per day) from preventable complications of pregnancy and childbirth, with 99% (302 000) of maternal deaths occurring in developing countries and 66% (201,000 per year; 500 per day) in Sub-Saharan Africa (SSA) (Alkema et al., 2016; Black, Walker, Laxminarayan, & Temmerman, 2016; WHO, United Nations Children's Fund [UNICEF], United Nations Population Fund [UNFPA], World Bank Group, United Nations Population Division, 2015). Nearly 60% of global maternal deaths in 2015 occurred in 10 countries including the Democratic Republic of Congo (DRC) (WHO et al., 2015). The DRC had a Maternal Mortality Ratio (MMR) of 693 per 100 000 livebirths in 2015 (22 000 maternal deaths), the 10th highest globally (WHO et al., 2015).

The majority of maternal deaths occur during labor, delivery, and in the immediate postpartum period (first 24 hours following delivery) (Merali et al., 2014; Ronsmans & Graham, 2006). Approximately 86% of global maternal deaths result from direct complications of pregnancy and childbirth, the leading causes being postpartum hemorrhage (PPH), pre-eclampsia and eclampsia (PE/E), sepsis, and unsafe abortion (GBD 2015 Maternal Mortality Collaborators, 2016; Say et al., 2014; WHO et al., 2015). The remaining 14% of maternal deaths result from pre-existing or new conditions that are aggravated by pregnancy (i.e. indirect causes) such as hypertension (GBD 2015 Maternal Mortality Collaborators, 2016; Graham, Foster, Davidson, Hauke, & Campbell, 2008; Say & Chou, 2011; WHO et al., 2015). While most obstetric complications cannot be predicted or prevented antenatally, 88 to 98% of maternal deaths are preventable with the timely delivery of evidence-based life-saving interventions, particularly skilled birth attendance and emergency obstetric care (EmOC) during the critical period surrounding childbirth (Gabrysch & Campbell, 2009; Knight, Self, & Kennedy, 2013; Lewis, 2003; Stenberg et al., 2014; WHO, 2013; WHO, UNICEF, UNFPA, 2017; WHO, UNFPA, UNICEF, Averting Maternal Death and Disability [AMDD], 2009). Skilled Birth Attendants (SBAs) are regulated health professionals who are educated to deliver evidence-based care to mothers and newborns throughout the pregnancy spectrum (WHO, 2018). Emergency obstetric care refers to a package of nine critical medical interventions or “signal functions” to manage common obstetric complications (WHO et al., 2009).

Despite global progress in increasing SBA coverage and deliveries in health care facilities, women still experience numerous barriers or delays in accessing life-saving

interventions, which Thaddeus and Maine (1994) summarized as: (Phase I) delays in deciding to seek care; (Phase II) delays in identifying and reaching an appropriate health facility; and (Phase III) delays in receiving appropriate and adequate care at the health facility. Emerging evidence largely attributes persistently high maternal deaths to poor quality of care (QoC) Phase III delays, calling for a repositioning of QoC on the maternal health agenda (African Union, 2017; Baker, 2017; Knight et al., 2013; Say et al., 2014; Stanton et al., 2009; WHO, 2016a). These delays along with other risk factors for maternal mortality stem from complex interactions between various social and structural determinants (UNDP, 2011).

Considering its preventability, high maternal mortality indicates health system dysfunctions (Bazile et al., 2015; Miller & Belizan, 2015) and reflects underlying structural, socio-economic, and human rights issues including women's low social status (Every Woman Every Child, 2015; Fathalla, 2006; Lewis, 2008a, 2008b; Miller & Belizan, 2015; Ronsmans & Graham, 2006; WHO, 2015). A substantial number of women do not receive the care they need over their life course and more critically, around pregnancy and childbirth (Fathalla, 2006; Lewis, 2008a). Fathalla (2006, p. 409) argues that women are dying "because societies have yet to make the decision that their lives are worth saving." Countries should be held accountable for addressing preventable maternal mortality (Fathalla, 2006; WHO, 2015).

The Societal and Economic Impacts of Maternal Mortality

Maternal mortality has complex intergenerational impacts on the family, community, and society (Knight & Yamin, 2015; Lewis, 2003; Miller & Belizan, 2015). A maternal death has direct impacts on child survival (survival convergence), growth,

development, health, and quality of life (Starrs, 2014). High mortality rates have been reported among children born to mothers who died of maternal causes (Houle, Clark, Kahn, Tollman, & Yamin, 2015; Molla, Mitiku, Worku, & Yamin, 2015; Moucheraud et al., 2015; Pande et al., 2015). Moucheraud et al. (2015) found that newborns whose mothers died within 42 days of delivery were 46 times more likely to die within their first month of life. Surviving children often face numerous vulnerabilities including nutritional deficits, diseases, poor access to health care, interrupted education, early marriage and/or pregnancy, and child labor (Bazile et al., 2015; Knight & Yamin, 2015; Molla et al., 2015). Female children are disproportionately affected as they experience gender discrimination, higher risks of school dropouts, abuse, sexually transmitted infections (STIs), or early marriage and pregnancy, which increase their risks for maternal mortality (Bazile et al., 2015; Knight & Yamin, 2015; Molla et al., 2015).

Maternal deaths have serious implications for social and economic wellbeing. In 2010, 45 African countries lost \$4.5 billion in non-health GDP to maternal mortality (\$30, 203 per maternal death) (Kirigia, Mwabu, Orem, & Muthuri, 2014). Maternal mortality pushes vulnerable families into extreme poverty as a result of decreased productivity and economic participation, high funeral costs, loss of supplemental income and income-generating assets, among others (De Brouwere, 2017; Kirigia et al., 2014; Knight & Yamin, 2015; Lewis, 2008a; Molla et al., 2015; Pande et al., 2015; Sullivan & Hirst, 2011). Ending preventable maternal mortality should remain a critical component of the global agenda for sustainable development (WHO, 2015).

Reducing Maternal Mortality: A Global Agenda

Millennium Development Goals. In 2000, heads of states from 189 countries officially committed to achieving eight Millennium Development Goals (MDGs) to improve quality of life in their respective countries by 2015 (Alkema et al., 2016; WHO et al., 2015). The MDG 5 aimed to improve maternal health and called for: 1) a 75% reduction in MMR between 1990 and 2015 (MDG 5A); and 2) universal access to reproductive health care by 2015 (MDG 5B) (Alkema et al., 2016; WHO et al., 2015). It generated global momentum to reduce maternal mortality, mobilized local and international resources, and accelerated reductions in MMR (3% annual reduction between 2000 to 2015 vs. 1.3% pre-MDG) (Alkema et al., 2016; WHO et al., 2015). As a result, global maternal mortality declined by 44% between 1990 and 2015, from 532 000 to 303 000 maternal deaths (Alkema et al., 2016; WHO et al., 2015). Despite remarkable progress, these achievements fell far short of the MDG 5A. Only nine formerly high-burden countries achieved at least a 75% reduction in maternal mortality, 30 countries achieved a 50% decline, 21 made insufficient progress (MMR reduction ≥ 25 but < 50), and 26 made no progress (MMR reduction $< 25\%$) (Alkema et al., 2016; Filippi, Chou, Ronsmans, Graham, & Say, 2016; WHO et al., 2015).

Underlying the aggregate figures are significant inequities in maternal mortality between and within regions and countries (Alkema et al., 2016), which widened between 1990 and 2015 and are now considered the greatest global public health inequities (GBD 2015 Maternal Mortality Collaborators, 2016; Lewis, 2003; Ronsmans & Graham, 2006). Sub-Saharan African women face the greatest lifetime risk (LFTR) of maternal mortality (1 in 36), which is nearly five times the average for developing regions (1 in 180) and

over 100 times greater than that of developed regions (1 in 4900) (Alkema et al., 2016; WHO et al., 2015). Between-country inequities are equally alarming. For instance, the DRC made “no progress” in MDG 5A (21% decline) and was among the top ten high-burden countries globally (WHO et al., 2015). In sharp contrast, Rwanda, its neighboring country, is the only SSA country that achieved MDG 5A (78% decline), with an MMR of 290 per 100 000 livebirths compared to 693 per 100 000 livebirths in DRC and an LFTR of 1 in 85 compared to 1 in 24 in DRC (WHO et al., 2015). Within countries, national figures mask internal inequities in maternal mortality by race/ethnicity, socio-economic status (SES), and geographic location, among others (Gulmezoglu et al., 2016; Ronsmans & Graham, 2006; UNDP, 2011). Maternal mortality is highest among the poorest women, rural residents, and those with less education (Alkema et al., 2016; GBD 2015 Maternal Mortality Collaborators, 2016; Roos & von XYlander, 2016; Sullivan & Hirst, 2011; WHO, 2015).

The MDG progress was slower in fragile and conflict-affected countries, accounting for 60% of global maternal deaths in 2015 (Every Woman Every Child, 2015). Women in such settings experience a disproportionately higher LFTR (1 in 54) (WHO et al., 2015), due to disruptions in health systems and infrastructure, sexual violence, and disease outbreaks (Alkema et al., 2016; GBD 2015 Maternal Mortality Collaborators, 2016; Requejo et al., 2015). Central SSA, a region that has experienced protracted conflict and humanitarian crisis, reported an increase in MMR between 1990 and 2015 and had the highest MMR (679 per 100 000 livebirths) (GBD 2015 Maternal Mortality Collaborators, 2016). The DRC has been crippled by decades of armed conflict and socio-political instability characterized by massive population displacement (4.5

million), loss of life (5.4 million excess deaths), and collapsed health systems (Casey et al., 2009; Kalisya et al., 2015; Moszynski, 2008; Naughton, Abramson, Wang, & Kwan-Gett, 2017; Zarocostas, 2018). Recurrent conflict in eastern DRC has had adverse impacts on women through its effects on health system and social institutions and the systematic use of sexual violence as a weapon of war (Brown, 2012; Harvard Humanitarian Initiative & Oxfam America, 2010; UN, 2010). This contributed to the DRC's poor performance in MDG 5 (Barroy, Andre, Mayaka, & Samaha, 2014; Naughton et al., 2017).

Sustainable Development Goals (SDGs). The global agenda of ending preventable maternal mortality remains unfinished (WHO, 2015). In 2015, heads of states reconvened and committed to 17 Sustainable Development Goals (SDGs) by 2030 (Scott & Danel, 2016; UN, n.d.). The SDG 3, target 3.1 calls for an absolute reduction of the global MMR to no more than 70 per 100 000 livebirths by 2030 (UN, n.d.; WHO, 2015; WHO et al., 2015). A supplementary target specifies that no country should have an MMR greater than 140 per 100 000 livebirths by 2030 (Scott & Danel, 2016; WHO, 2015; WHO et al., 2015). Meeting SDG 3.1 will require accelerated progress, where high burden countries triple their annual reduction rates (ARR) from 2.5% between 1990 and 2015 to 7.5% between 2016 and 2030 (Alkema et al., 2016; WHO et al., 2015). Achieving SDG 3.1 is projected to reduce maternal deaths by 60% in 2030, saving 2.5 million lives (Alkema et al., 2016; WHO et al., 2015).

The WHO and partners advocate for “improved metrics, measurement systems, and data quality” as a preliminary step and cross-cutting action towards achieving SDG 3.1 and ultimately ending preventable maternal mortality (WHO, 2015, p. 14). Quality

data on maternal mortality levels, causes, and contributing factors will inform strategies and priority-setting amid resource limitations and competing priorities, when maternal mortality can become neglected (Initiative on Methods Measurement and Pain Assessment in Clinical Trials [IMMPACT], 2007; WHO, 2015). However, producing good quality locally-owned data remains a significant challenge in the majority of developing countries (Danel, Graham, & Boerma, 2011; Hounton et al., 2013; Scott & Dairo, 2015). Graham and Campbell (1992) argue that we have reached a “measurement trap” characterized by limited information on maternal deaths due to weak health information systems (HIS) and measurement tools, inconsistent indicators, and narrow definitions (Filippi et al., 2016; Graham & Campbell, 1992).

Civil Registration and Vital Statistics (CRVS), the gold standard for producing reliable data on maternal deaths, are non-existent or dysfunctional in over 60% of countries, particularly in low and middle-income countries (LMICs) (Commission on Information and Accountability for Women's and Children's Health [CoIA], 2011; Mathai, Dilip, Jawad, & Yoshida, 2015; WHO, 2013). Alternatively, these countries rely on statistical models and population surveys, which have higher uncertainty, are not timely, are retrospective, and often aggregated (Danel et al., 2011; GBD 2015 Maternal Mortality Collaborators, 2016; Hounton et al., 2013; WHO, 2013; WHO, 2016b). Official MMR measures underestimate the magnitude of maternal mortality by up to 30% globally and 70% in some countries (WHO, 2016b). Some have questioned the quality of the DRC’s nationally-produced health data, raising concerns about systematic underreporting (Naughton et al., 2017). The DRC does not have a routine and reliable HIS, relying heavily on surveys and statistical models (Alkema et al., 2016; GBD 2015

Maternal Mortality Collaborators, 2016; Ministère du Plan et Suivi de la Mise en œuvre de la Révolution de la Modernité [MPSMRM], Ministère de la Santé Publique [MSP], ICF International, 2014; WHO et al., 2015). Its national census was last conducted in 1984 (Naughton et al., 2017), birth registration is less than 50% (25% in 2014) functional, and the death registration status is unknown (UNSD, 2017). Each unrecorded maternal death is a missed opportunity to prevent similar deaths in the future (WHO, 2016b). However, an important limitation of the common data sources is their focus on producing numerical estimates and limited ability to provide in-depth information on circumstances surrounding maternal deaths (Lewis, 2003; WHO, 2004a). While numerical estimates are crucial for monitoring, planning, and evaluation, they are limited in informing strategies to end preventable maternal mortality (Lewis, 2008b).

Going Beyond the Numbers: Maternal Death Surveillance and Response

“Whose faces are behind the numbers? What were their stories? What were their dreams? They left behind children and families. They also left behind clues as to why their lives ended early”.

—Dr. William M. Callaghan (Berg, Danel, Atrash, Zane, & Bartlett, 2001, p. 53)

Ending preventable maternal deaths will require going “beyond the numbers” to examine *why*, *when*, and *where* women are dying (Mathai et al., 2015; WHO, 2004a; WHO, 2013; WHO, 2016b). Understanding the underlying factors contributing to maternal deaths is critical for targeted actions at local and international levels (Mathai et al., 2015; Say et al., 2014; WHO, 2004a; WHO, 2013; WHO, 2016b). To generate better information on maternal deaths, a robust surveillance-action cycle known as Maternal Death Surveillance and Response (MDSR) was introduced by the WHO in 2012 (WHO,

2013). This tool responds to calls for improved metrics, accountability, and QoC, integrating all three elements into a continuous-action cycle comprising the following phases: 1) identifying and notifying maternal deaths; 2) reviewing maternal deaths to determine causes, contributing factors, and preventability; 3) analyzing findings and formulating actionable recommendations; and 4) taking action and evaluating response (WHO, 2013, 2016b). It builds on Maternal Death Reviews (MDRs), introduced in 2004 as “qualitative, in-depth investigations of the causes of, and circumstances surrounding maternal deaths” in health care facilities and communities (WHO, 2004a, p. 15). While MDRs remain the cornerstone of MDSR, MDSR adds several distinctive features. It requires an *active, ongoing, timely, and systematic* identification, *notification*, and review of *all* maternal deaths in facilities and communities (Scott & Danel, 2016; Smith, Ameh, et al., 2017b). Notably, MDSR underlines “response” as a necessary step for closing the surveillance loop and preventing future deaths (Scott & Danel, 2016; Smith, Ameh, et al., 2017b). It emphasizes the importance of data analysis, accountability for responses, and formalizes the provision of feedback to partners (WHO, 2013). Additionally, MDSR formally engages community stakeholders (family, neighbors, civil society) to highlight social and structural factors contributing to maternal deaths (WHO, 2013, 2016b). Overall, MDSR aims to eliminate preventable maternal deaths by linking actionable, real-time data with corresponding multi-pronged actions (WHO, 2013, 2016b).

There is a dearth of studies on the impacts of MDSR on maternal health outcomes given its recent origins and technical challenges in quantifying its impacts. The few studies available suggest that MDRs and MDSR produce significant reductions in the incidence of obstetric complications and maternal mortality even with limited coverage

and within short periods of implementation (Dumont et al., 2006; Kongnyuy, Leigh, & van den Broek, 2008; van den Akker et al., 2011; Zongo et al., 2015). Emerging literature from diverse contexts (e.g. Nigeria, Ethiopia, India, Kenya) reveals that MDRs and MDSR have prompted improvements in knowledge, workforce capacity, professional practice, availability of services and providers, accessibility of care, QoC, and resource mobilization (Abebe et al., 2017; Goswami et al., 2013; Hofman & Mohammed, 2014; Hussein et al., 2016; Mutsigiri-Murewanhema et al., 2017; Nyamtema, de Jong, Urassa, & van Roosmalen, 2011; Zongo et al., 2015). MDSR has been reported to decrease underreporting of maternal deaths and improve data quality (Abebe et al., 2017; Kalter, Mohan, et al., 2011; Moodley et al., 2014; Negandhi et al., 2016). In Malawi, community MDRs produced policy and community changes such as male partner engagement, community funds for emergency transportation, peer counseling for pregnant women, and policies prohibiting harmful traditional practices (Bayley et al., 2015). Considering its promise, the African Union endorses MDSR as a “low cost and high-impact” intervention to reduce preventable maternal deaths (African Union, 2014).

Statement of the Problem

While countries are increasingly adopting MDSR to meet SDG 3.1, gaps remain in its implementation (African Union Commission, UN Women, 2015; Hulton et al., 2014). Over 80% of LMICs have national policies to support MDSR functions (e.g. notification and review policies), however a policy-practice gap has been observed in over half of these countries (Kerber et al., 2015; WHO, 2016b). Some countries are still in pilot phases and many are yet to institutionalize and scale-up MDSR (Kerber et al., 2015; Lewis, 2014b; Mathai et al., 2015; Smith, Ameh, Roos, Mathai, & Broek, 2017).

Others are still limited to reviewing medical causes of maternal deaths and are yet to capture the social determinants (Gil-Gonzalez, Carrasco-Portino, & Ruiz, 2006; WHO, 2016b). More importantly, there has been little progress in implementing the later phases of the MDSR cycle, particularly the response phase (WHO, 2016b).

There is a dearth of published studies on MDSR outcomes and implementation experiences, particularly in developing countries. The evidence on MDSR is still limited in SSA and in conflict and post conflict settings such as eastern DRC (Abouchadi, Belghiti Alaoui, Meski, & De Brouwere, 2013; Lewis, 2014a; Mathai et al., 2015; Smith, Ameh, Roos, et al., 2017; WHO, 2016b). More specifically, little is known about transition experiences from MDR to MDSR; enablers and barriers to full MDSR implementation or scale-up; and on how MDSR findings are utilized (Kongnyuy & van den Broek, 2009; Mathai et al., 2015; Smith, Ameh, Roos, et al., 2017). In addition, there is a paucity of published studies on optimal models for MDSR implementation in under-resourced settings (Kerber et al., 2015). Lastly, the impacts of MDSR have not been adequately documented (Abouchadi et al., 2013; Evidence for Action, n.d.; Kerber et al., 2015; Lewis, 2014a).

The DRC has made partial progress in MDSR implementation (WHO, 2016b; WHO, n.d.-b). It has a national policy for maternal death notification and reviews but does not have a national MDR committee (Bandali et al., 2016; WHO, 2016b; WHO, n.d.-b). The WHO report suggests that MDSR is currently in its pilot phase at subnational levels in DRC (WHO, 2016b; WHO, n.d.-b). However, little is known about how MDSR is structured in the DRC, how it is being implemented, what factors influence its implementation, and its impacts on practice, policy, and maternal health. There is no

indication of who is involved or to what extent the community and civil society are engaged in MDSR (Countdown to 2030, 2017). Maternal mortality is a priority public health issue in Goma health zone (HZ), an urban health district located in the conflict-afflicted province of North Kivu (Equipe Cadre de la Zone de Santé Urbaine de Goma (ECZS) Goma, 2015, 2016, 2018). Yet there is little information on specific causes and contributing factors of maternal mortality at national or local levels in DRC. There is limited empirical data on the specific determinants of the increase in hospital-based maternal mortality, prompting calls by local authorities to examine determinants of the persistently high maternal mortality in Goma HZ (ECZS Goma, 2015, 2016, 2018). The progress reports from Goma HZ listed *maternal death audits* (used interchangeably with MDRs/MDSR in some settings) among the regularly implemented activities to this effect (ECZS Goma, 2015, 2016, 2018). However, these reports suggested suboptimal MDSR operations, revealing limitations in data collection, analysis, and follow-up of recommendations (ECZS Goma, 2015, 2016, 2018).

The failure to meet MDSR targets and persistently high MMR in the MDSR coverage area should trigger a comprehensive assessment or evaluation of the MDSR system (WHO, 2013). International scholars and practitioners have also issued calls for research and evaluation of local and national MDSR (Bandali et al., 2016, p. 368). More specifically, there is a need to identify enablers, barriers, best practices, and opportunities to scale-up and institutionalize MDSR (Bandali et al., 2016; Kalter, Mohan, et al., 2011; Kongnyuy & van den Broek, 2009; Lewis, 2014a; Mathai et al., 2015; UNFPA, 2017).

Purpose of the Study

The purpose of this dissertation was to describe and critically assess MDSR implementation in Goma HZ, focusing on its structural inputs, processes, quality/system attributes, outcomes, influencing factors, strengths, gaps, and opportunities for improvement. The specific aims of the proposed study were as follows:

- 1) To provide a rich description of the MDSR system in Goma HZ, detailing its structure, processes, outcomes (practice, policy, maternal health), and operating context;
- 2) To assess the quality of the MDSR system using the Centers for Disease Control and Prevention (CDC) attributes of a public health surveillance system, including simplicity, flexibility, timeliness, acceptability, stability, data quality, usefulness;
- 3) To assess stakeholder perceptions and experiences with MDSR implementation, highlighting enablers and barriers, successes, challenges, and lessons learned;
- 4) To provide practical and actionable recommendations for strengthening MDSR implementation and performance in Goma HZ.

Research Questions

This study sought to address the following research questions:

1. How is MDSR structured and implemented in Goma HZ?
2. How well does the MDSR system in Goma HZ meet the CDC's attributes of a surveillance system?
3. How has MDSR impacted practice, policy, and maternal health in Goma?
4. What factors influence MDSR implementation in Goma?
5. What are the recommendations to strengthen Goma HZ's MDSR system?

Nature of the Study

A qualitative case study design was utilized to explore MDSR implementation in Goma HZ. This study specifically adopted both descriptive and exploratory approaches, seeking to provide a detailed description of current MDSR processes while gaining deeper insights into internal and external factors influencing MDSR implementation in Goma. This design enabled an in-depth exploration of perspectives of diverse stakeholders involved in different aspects of MDSR in Goma HZ, thereby generating a rich understanding of the MDSR structure, process, outcomes, context, and experiences. Case study research is known for its ability to converge evidence from multiple sources—data triangulation (Baxter & Jack, 2008; Crowe et al., 2011; Yin, 2003). To elucidate MDSR processes in Goma, this dissertation drew from three sources: semi-structured key informant interviews, document reviews, and direct observations.

Conceptual Framework

The conceptual framework for this study (Figure 1) assembles critical elements from public health surveillance evaluation frameworks and the literature on MDSR implementation in LMICs, drawing substantially from work by German et al. (2001); WHO (2006); Donabedian (1988); and Zaharatos, St Pierre, Cornell, Pasalic, and Goodman (2017). This model situates MDSR within a broad context, characterized by complex interactions between multiple internal and external factors. More specifically, the *MDSR structure* (inputs, resources), *process* (core functions), *quality/attributes* (e.g. simplicity, acceptability, timeliness), and *outcomes* (short-term, intermediate, and long-term) are interdependent and are in turn influenced by multiple social, economic, political, and organizational factors (*contextual factors*). The elements within this

framework both influence and are influenced by each other through multiple pathways. Evaluating MDSR requires examining elements within each dimension, including their complex and dynamic interrelationships. Chapter II provides a more detailed explanation of each dimension.

Figure 1. The conceptual framework for assessing Maternal Death Surveillance and Response implementation in Goma Health Zone, Democratic Republic of Congo

Significance of the Study

Examining MDSR in Goma is intrinsically interesting and instrumental for understanding how this system functions and how it can be improved in a context characterized by competing socio-economic, humanitarian, and political priorities; resource limitations; cultural/ethnic diversity; and multiple development partners, all of which are not sufficiently explored in the MDSR literature. By highlighting current MDSR strengths, gaps, and opportunities for improvement, this study generated empirical evidence to support strategic actions to institutionalize, strengthen, and scale-up MDSR in Goma HZ. Strengthening the local MDSR system will in turn enhance its effectiveness and efficiency in identifying, notifying, reviewing maternal deaths, and generating data-driven actions to prevent maternal deaths (WHO, 2013, 2016b). This, as evidence suggests, will ultimately improve practice, policy, and maternal health. Given this HZ's strategic location within North Kivu's provincial capital, successful MDSR implementation in Goma can serve as a model for scaling-up MDSR within the province. At global levels, converging country-level evidence will enable identification of cross-cutting issues, best practices, construction of theoretical frameworks, and strengthening of the MDSR model.

General Assumptions

This study assumed that the selected data collection methods (key informant interviews, document reviews, and direct observations) would collectively yield comprehensive information to achieve the study's aims of understanding the MDSR structure, processes, outcomes, influencing factors in Goma HZ, and formulating practical and actionable recommendations for system strengthening.

Delimitations

Creswell (2013) suggests setting specific case boundaries to focus the scope of the study. The case boundaries for this study are set by place, participants, and activities. The study was restricted to MDSR in Goma HZ. The study participants were recruited based on their previous or current involvement as MDSR implementers, decision-makers, partners, or end-users (Payne & Payne, 2004; Salabarría-Peña, Apt, & Walsh, 2007).

Limitations

This study was conducted in light of two major limitations. The small number of observations and the unavailability of some relevant MDSR documents limited opportunities to validate data obtained from the KI interviews. Second, there was a possibility of translation bias as data were collected in French and translated into English, adding yet another layer of interpretation and a possible loss of meaning (Bailey, 2008; Halai, 2007, p. 345; Nikander, 2008; Torop, 2002). To minimize the loss of meaning, translation sought conceptual/cultural equivalence (Squires, 2008, 2009).

Definition of Terms

The key terms that are utilized throughout the study are defined below:

Civil Registration and Vital Statistics (CRVS): An ongoing and universal recording of vital and civil status events (e.g. births, deaths, marriages) in a country (UN, 2001).

Emergency Obstetric Care (EmOC): A package of nine critical medical interventions or “signal functions” to manage obstetric complications (WHO et al., 2009).

Health Zone (HZ): The basic operational unit in the DRC’s health system, serving an estimated 100 000 residents through a network of at least 10 health centers and hospitals, and at least one referral hospital. It is also known as a health district (Rajan et al., 2014).

Integrated Health Facilities: Government, religious, or private not-for-profit health facilities that are subject to agreements with the government and are therefore under the authority of the local Health Zone Office (Stasse et al., 2015).

Maternal Mortality: “The death of a woman while pregnant, or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes.” (WHO, 2012, p. 9).

Maternal Death Reviews (MDRs): “Qualitative, in-depth investigations of the causes of, and circumstances surrounding maternal deaths” (WHO, 2004a, p. 15).

Maternal Death Surveillance and Response (MDSR): A continuous surveillance-action cycle that aims to eliminate preventable maternal mortality through the systematic identification, notification, and review of every maternal death, accompanied by corresponding multi-level and multi-pronged responses/actions (WHO, 2013, 2016b).

Non-integrated Health Facilities: Health facilities (often for-profit) that are not subject to any official agreements with the government (Stasse et al., 2015).

Partograph or partogram: a patient monitoring form that graphically displays the progress of labor (WHO, 2014).

Preventable Maternal Death: It could have been averted “by one or more reasonable changes to patient, community, provider, facility, and/or systems factors” (Building U.S. Capacity to Review and Prevent Maternal Deaths, 2017, p. 22).

Skilled Birth Attendants (SBAs): Regulated health professionals that are educated to deliver evidence-based care throughout pregnancy and childbirth (WHO, 2018).

Three Delays: Three interrelated delays that contribute to maternal mortality: 1) delay in deciding to seek care, 2) delay in identifying and reaching an adequate health facility, and 3) delay in receiving adequate and appropriate care at the health facility (Thaddeus & Maine, 1994).

Organization of the Study

This study is organized into five chapters. Chapter I presents background information on maternal mortality and MDSR, concluding with an overview of the study. Chapter II summarizes the relevant literature on maternal mortality causes and contributing factors, interventions to address maternal mortality, current measurement approaches, and the evidence surrounding MDSR. Chapter III discusses the research methodology, including the design, data collection, and analysis methods. Chapter IV presents the findings of the study and Chapter V, the discussions, implications, recommendations, and conclusions in line with the research questions and finding

CHAPTER II

REVIEW OF THE LITERATURE

Overview of the Chapter

This chapter begins with a background on the DRC, followed by a discussion of causes and timing of maternal deaths. Next, key factors contributing to maternal mortality are summarized, followed by interventions to reduce maternal mortality. The subsequent section presents major approaches for generating maternal mortality measures, including their strengths and limitations. The chapter then discusses approaches that go *beyond the numbers* to investigate the underlying circumstances surrounding each maternal death, focusing on MDSR. Next, frameworks for evaluating MDSR are discussed, followed by the conceptual model and research questions for this dissertation.

Background on the Democratic Republic of Congo

Geographic and Demographic Profile

The Democratic Republic of Congo (DRC), located in Central Africa, is the second largest African country (2.345.410 km²) and the fourth most populated (83,301,151 inhabitants) (CIA, 2018; USAID, 2014). The DRC borders nine countries and is subdivided into 26 provinces (Barroy et al., 2014; Naughton et al., 2017). Its population is majority young (63% under 24 years old), female (53%), and rural (55.5%) (CIA, 2018; MPRM, 2015; Naughton et al., 2017; USAID, 2014). It has high total fertility (4.39) and birth rates (33.5 births/1000 population) (CIA, 2018; Usanov et al.,

2013), and low life expectancy (56.1 years for men/59.3 years for women) (CIA, 2018; WHO, n.d.-c). The DRC is ethnically and linguistically diverse, with over 200 ethnic groups and dialects, four national languages (Lingala, Swahili, Kikongo, and Tshiluba), and one official language (French) (CIA, 2018; DRC Government, 2005; Kalisya et al., 2015). While the DRC's literacy levels are high (77%), only 64% of women are literate and only 48% of women have a high school or higher education (CIA, 2018; ICF, 2012).

Historical and Political Context

The DRC has been crippled by a disruptive colonial history (Belgian occupation between 1908 and 1960) followed by decades of conflict and socio-political instability (Naughton et al., 2017; USAID, 2014). Despite multiple peace agreements, there is ongoing conflict in eastern DRC (e.g. North and South Kivu), rooted in complex geopolitical, economic, and institutional interests at local and international levels (Brown, 2012; Coghlan et al., 2006; Kalisya et al., 2015; Kongo, 2016; Naughton et al., 2017; United Nations Economic Commission for Africa [UNECA], 2015; Usanov et al., 2013). This protracted conflict has been dubbed a humanitarian “mega-crisis”, characterized by massive population displacement (4.5 million individuals), excess deaths (5.4 million deaths), collapsed health systems and public infrastructure, food insecurity (7.7 million individuals), and disease outbreaks (Casey et al., 2009; Kalisya et al., 2015; Moszynski, 2008; Naughton et al., 2017; Zarocostas, 2018).

A prominent feature of this conflict is the systematic and strategic use of rape/sexual violence as a weapon of war (Brown, 2012; Harvard Humanitarian Initiative [HHI] & Oxfam America, 2010; UN, 2010). One report suggests that approximately 1150 women are raped every day, 48 every hour, and four every five minutes in the DRC

(Peterman, Palermo, & Breidenkamp, 2011). Sexual violence against women and children has long-term physical, psychological, and social sequelae that extend beyond the victim or survivor to families, communities, and the society (Brown, 2012; HHI & Oxfam America, 2010). Some adverse effects include mental health issues, obstetric fistula, STIs, unwanted pregnancies, obstetric complications, maternal mortality, and stigma (Onsrud, Sjoveian, Luhiriri, & Mukwege, 2008; Wakabi, 2008).

Economic Context

The DRC has a strong economic potential (USAID, 2014), possessing over \$24 trillion worth of untapped mineral resources (Intel, n.d.; USAID, 2014; Usanov et al., 2013), abundant water sources, and a high agricultural potential (MPRM, n.d.; USAID, 2014). Despite its natural wealth, over 63% of the DRC's population lives below the international poverty line of \$1.25 per day (CIA, 2018; Kongo, 2016; USAID, 2017). The DRC derives 80% of its export revenues from the mining sector but is affected by fluctuations in global demand for raw materials, limited economic diversification, poor governance, and conflict (Kongo, 2016; MPRM & UN, 2015; World Bank, n.d.).

The Health System

The DRC has a decentralized health zone (HZ)/district system that links primary health care with referral services at three main levels (Figure 2): 1) the *central or national level* (Ministry of Health/MoH) regulates and oversees all health structures and programs in the DRC; 2) the *provincial or intermediate level* provides technical support and oversees activities within each province; and 3) the *peripheral level or the HZ* is the basic operational unit for health programs and health service delivery. This level includes the central HZ offices, district hospitals, health centers, and health posts with referral

links to provincial and national hospitals (Kalisya et al., 2015; Muyembe et al., 2013; Naughton et al., 2017; Rajan et al., 2014; Stasse et al., 2015; USAID, 2017).

Figure 2. The structure of the health care system in the Democratic Republic of Congo

A HZ serves approximately 100 000 inhabitants through a network of 10 to 20 health centers/hospitals and at least one referral district hospital, operated by the government, faith-based organizations (FBOs; operate 40% of HZs), and non-government organizations (NGOs)—all integrated into the government health system (Barroy et al., 2014; Bertone, Lurton, & Mutombo, 2016; Muyembe et al., 2013; Rajan et al., 2014; USAID, 2017). The HZ delivers a *Minimum and Complementary Package of Activities* including MCH services (Rajan et al., 2014). Each HZ is divided into *health areas* (HAs) with 10 000 residents and at least one health center or hospital (Bertone et al., 2016; Kalisya et al., 2015; Rajan et al., 2014). The DRC has a total of 516 HZs, 8,504 HAs, and 8,266 health centers (Likofata Esanga et al., 2017; Muyembe et al., 2013; USAID, 2017). In addition, it has 401 hospitals, 44% of which are government-operated,

45% by FBOs, and 11% by other entities (Kongo, 2016; Muyembe et al., 2013; World Bank, n.d.).

In 2014, the DRC allocated \$32 per capita to health, short of the WHO-recommended \$35 per capita minimum (Bertone et al., 2016; Kalisya et al., 2015; World Bank, n.d.). External aid accounts for 40% of DRC's total health financing, followed by household funds/direct out-of-pocket payments (39.3%), and the government (20%) (Barroy et al., 2014). The MoH's limited involvement in health financing results in unregulated, unpredictable, and unaffordable costs (Bertone et al., 2016; Kalisya et al., 2015). The lack of sustainable health financing mechanisms coupled with insecurity and poor governance, contribute to the poor availability, accessibility, and quality of care in the DRC (Naughton et al., 2017), characterized by health workforce shortages, poor infrastructure, and limited availability of essential equipment, supplies, and medications (Barroy et al., 2014; Casey et al., 2009; Kongo, 2016; Naughton et al., 2017).

Maternal Health in the DRC

Maternal mortality remains a significant public health issue in the DRC, accounting for approximately 35% of deaths among WRA (Barroy et al., 2014; Naughton et al., 2017). The DRC has one of the highest MMRs (693 per 100 000 livebirths; top 10) and LFTRs (1 in 24) globally, due to a confluence of high fertility, unmet need for contraception, and gaps in the health system, among others (Save the Children, 2013; UNICEF, n.d.-a; USAID, 2014). Adolescents aged 15 to 19 years old account for nearly 25% of maternal deaths in the country (Countdown to 2030, 2017; USAID, 2014). There are significant disparities in maternal health service uptake across settings and socio-economic status. Antenatal care (ANC) and postnatal care (PNC) uptake remain low in

the DRC, with only 48% of women receiving at least four ANC visits and 15% receiving PNC within 2 days postpartum (UNICEF, n.d.-b). Skilled birth attendance and facility deliveries have improved in the DRC as a whole, with 80% of women now delivering in health facilities and the same proportion assisted by SBAs. However, subgroup comparisons reveal lower SBA and facility utilization rates among rural women (74%), those in poorest households (66%), and those with no formal education (67.8%) (MPSMRM et al., 2014; UNICEF, n.d.-a). While maternal mortality is clearly a significant issue in the DRC, there is very little reliable information on its specific causes and determinants.

Timing and Causes of Maternal Mortality

The tenth revision of the International Statistical Classification of Diseases (ICD-10) defines maternal mortality as: “the death of a woman while pregnant, or within 42 days of termination of pregnancy, irrespective of the duration and the site of the pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes” (WHO, 2012, p. 9). This definition denotes a causal and temporal relationship between pregnancy and a woman’s death (Merdad, Hill, & Graham, 2013; Say et al., 2014; WHO, 2004a; WHO et al., 2015). Two related concepts capture pregnancy-related deaths that do not meet the standard definition (WHO, 2004a; WHO et al., 2015, p. 35): 1) a *death occurring during pregnancy, childbirth and the puerperium* (formerly known as pregnancy-related death) refers to “the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death”; and 2) a *late maternal death* captures maternal deaths

occurring beyond the standard 42 day period but within less than one year of the termination of pregnancy.

The majority of maternal deaths are clustered around labor, delivery, and the immediate postpartum period, when obstetric complications can rapidly develop even in previously uncomplicated or low-risk pregnancies (Chinkhumba, De Allegri, Muula, & Robberstad, 2014; Gabrysch & Campbell, 2009; Knight et al., 2013; Merali et al., 2014; Requejo et al., 2015; Ronsmans & Graham, 2006; Thaddeus & Maine, 1994). A literature review in 1996 found that over 60% of maternal deaths occurred in the postpartum period, 45% of which were within 24 hours postpartum (Li, Fortney, Kotelchuck, & Glover, 1996). While largely unpredictable, approximately 15% of pregnant women will develop life threatening obstetric complications (Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994; WHO, 2016a; WHO et al., 2009).

The causes of maternal deaths are classified as direct or indirect. Direct maternal deaths result from complications of pregnancy (e.g. hemorrhage, PE/E, sepsis, obstructed labor, and unsafe abortions), and the management of pregnancy and obstetric complications (e.g. omissions, incorrect treatment) (Say & Chou, 2011; WHO, 2004a; WHO et al., 2015). Direct causes accounted for 86% of global maternal deaths in 2015 (GBD 2015 Maternal Mortality Collaborators, 2016). Nearly 60% of global maternal deaths between 2003 and 2009 were caused by hemorrhage (27.1%), PE/E (14.1%), sepsis (10.7%), and abortion (7.9%) (Say et al., 2014). In the DRC, direct obstetric causes account for 85% of maternal deaths, with the leading causes being hemorrhage (42%), PE/E (19%), abortion (9%), and sepsis (4%) (GBD 2015 Maternal Mortality Collaborators, 2016).

In contrast, indirect causes of maternal deaths are pre-existing or newly developed conditions that do not result from direct obstetric causes but are aggravated by the physiologic effects of pregnancy (Graham, Foster, et al., 2008; Say & Chou, 2011; WHO et al., 2015). Indirect maternal deaths accounted for 14% of global maternal deaths in 2015 (GBD 2015 Maternal Mortality Collaborators, 2016). Pre-existing health conditions such as the Human Immunodeficiency Virus (HIV) and chronic hypertension were responsible for over 70% of indirect maternal deaths (Filippi et al., 2016; Say et al., 2014). In 2015, 0.84% of global maternal deaths and 1.6% in SSA were HIV-related (GBD 2015 Maternal Mortality Collaborators, 2016). As countries develop, achieve lower fertility levels, and increase facility deliveries, an obstetric transition occurs, characterized by gradual shifts from a predominance of direct causes to indirect causes, high to low MMR, culminating in the elimination of preventable maternal mortality (Souza et al., 2014; WHO, 2015). The clinical causes of maternal deaths are the tip of the iceberg as maternal deaths result from complex underlying factors.

Factors Contributing to Maternal Mortality

While women's individual attributes such as extreme age (≤ 18 and ≥ 35), high parity, and low education, have been associated with maternal mortality, broader socio-cultural, economic, environmental, health system, and political factors shape women's risks for pregnancy-related complications and their chances of survival once complications arise (Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994; UNDP, 2011). These factors are summarized using the Three Delay Model (Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994).

The Three Delays

Up to 98% of maternal deaths are preventable with evidence-based interventions during pregnancy and childbirth (Knight et al., 2013; WHO, 2013), however, women experience numerous barriers and delays in accessing life-saving interventions (Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994). Thaddeus and Maine (1994) describe three interrelated delays that occur from the onset of an obstetric complication and lead to maternal mortality: 1) delay in deciding to seek care by the woman, family, or both; 2) delay in identifying and reaching an adequate health facility; and 3) delay in receiving adequate and appropriate care (QoC) at the health facility.

Phase I: Delay in deciding to seek care. Decisions to seek care are largely delayed by the following factors: 1) knowledge and perceptions of pregnancy and illness (e.g. danger signs, traditional beliefs); 2) geographic accessibility of health facilities (e.g. distance, transportation, and roads); 3) perceived cost (transportation fees, health service fees, and opportunity costs); 4) socio-economic status; 5) perceived QoC; and 6) socio-cultural factors (e.g. women's social status) (Thaddeus & Maine, 1994).

In a recent systematic review of 39 studies in developing countries, Phase I delays were the second most important avoidable factors contributing to maternal deaths (Merali et al., 2014). In this review, delayed decision-making resulted from the failure to recognize danger signs, male dominated decision-making, childcare concerns, and mistrust of the health system (Merali et al., 2014). Women's low social status restricts their access to education and employment, financial and reproductive autonomy, mobility, decision-making power, and access to health-related resources (African Union Commission & UN Women, 2015; Gabrysch & Campbell, 2009; Jat, Deo, Goicolea,

Hurtig, & San Sebastian, 2015; Thaddeus & Maine, 1994; UNDP, 2011). As a result, many women are forced to rely on males or senior family members for health decisions (Firoz et al., 2016; Gabrysch & Campbell, 2009; Kyei-Nimakoh, Carolan-Olah, & McCann, 2017; UNDP, 2011; White, Dynes, Rubardt, Sissoko, & Stephenson, 2013). A study in India found that families of deceased women had spent on average seven hours in deciding to take the woman to a facility (Raj, Maine, Sahoo, Manthri, & Chauhan, 2013). Similarly, in Burkina Faso and Indonesia, male relatives of deceased women delayed health seeking until they were in critical condition (D'Ambruoso, Byass, Qomariyah, & Ouedraogo, 2010). Perceived costs have also been associated with Phase I delays and maternal deaths, especially when families are expected to cover the majority of costs (D'Ambruoso et al., 2010; De Brouwere, Delvaux, & Leke, 2014; Kongnyuy, Mlava, & van den Broek, 2009; Lee et al., 2009; Merali et al., 2014; Raj et al., 2013). Additionally, strong cultural preferences for traditional healers/traditional birth attendants (TBAs) and home deliveries are associated with Phase I delays (African Union Commission & United Nations Women, 2015; D'Ambruoso et al., 2010; Kyei-Nimakoh et al., 2017). In Malawi, TBAs did not acknowledge their limitations and delayed referrals in 11% of maternal deaths (Kongnyuy et al., 2009). Lastly, previous experiences of disrespectful maternal care such as poor staff attitudes and unethical behavior (e.g. arrogance, neglect) negatively influence family and community perceptions of QoC, affecting their decisions to seek care (Gabrysch & Campbell, 2009; Munabi-Babigumira, Glenton, Lewin, Fretheim, & Nabudere, 2017; UNDP, 2011). In Tanzania, deceased women had bypassed the nearest health facilities due to perceptions of poor QoC (Nyamtema et al., 2011).

Phase II: Delay in identifying and reaching an adequate health care facility

Once decisions to seek care are made, whether timely or delayed, women experience multiple delays in reaching an appropriate health facility due to the following: 1) uneven distribution and distance of facilities; 2) unaffordable or unavailable transportation; 3) difficult geographic terrain (e.g. poor road conditions); and 4) delayed referrals from lower-level facilities (Hussein, Kanguru, Astin, & Munjanja, 2012; Lee et al., 2009; Munabi-Babigumira et al., 2017; Thaddeus & Maine, 1994). In Phase II delays, these barriers are actual rather than perceived as they impede timely arrival at a health facility after the decision to seek care has been made (Thaddeus & Maine, 1994).

Access to health care during the critical period surrounding pregnancy and childbirth, is an important determinant of maternal mortality (Gabrysch & Campbell, 2009; Thaddeus & Maine, 1994; Tsawe & Susuman, 2014). While the WHO recommends at least five EmOC facilities per 500 000 population (WHO et al., 2009), facilities are inequitably distributed, leading to multiple referral chains, delays, and maternal deaths (D'Ambruso et al., 2010; Gabrysch & Campbell, 2009; Jat et al., 2015; Kyei-Nimakoh et al., 2017; Munabi-Babigumira et al., 2017; Sambo, Kirigia, & Ki-Zerbo, 2011; Thaddeus & Maine, 1994). In rural Tanzania and Malawi, deceased women traveled up to nine and 10 hours, respectively to reach an adequate health facility (Nyamtema et al., 2011; Vink, de Jonge, Ter Haar, Chizimba, & Stekelenburg, 2013). Reaching care is further delayed by unavailable, unaffordable, inefficient and irregular public, private, and emergency transportation (Hussein et al., 2016; Munabi-Babigumira et al., 2017). In rural Tanzania, women waited on average 83 minutes for emergency transportation at a referring facility and were charged up to \$150 for ambulance fuel

costs, forcing many to utilize alternative means such as motorcycles, bicycles, and foot (Nyamtema et al., 2011). Women incur further delays across multiple referral points before reaching an appropriate facility (Raj et al., 2013; Singh et al., 2015). Obstetric emergencies referred from lower level facilities are often poorly managed and delayed due to limited knowledge, skills, and capacity (Hussein et al., 2016; Munabi-Babigumira et al., 2017).

Phase I and II delays lead to maternal deaths en route (Goswami et al., 2013; Kongnyuy et al., 2009; Thaddeus & Maine, 1994; Vink et al., 2013). Those surviving the journey often arrive in critical condition (Thaddeus & Maine, 1994), increasing their risk for maternal mortality (Nyamtema et al., 2011). Some families exhaust their funds prior to arrival at an appropriate facility due to transportation and payments at each referral point (Raj et al., 2013). Many who survive the first two delays and those who arrive on time encounter the third delay (Goswami et al., 2013).

Phase III: delays in receiving quality care at the health facility

Upon arrival at a health facility, women experience fatal delays in receiving appropriate and adequate care due to various health system and service delivery factors including: 1) limited staff availability, competence, and motivation; 2) lack of essential equipment, supplies, and medications; 3) high costs of care; and 4) organizational factors (e.g. communication, information, protocols) (Goswami et al., 2013; Knight et al., 2013; Thaddeus & Maine, 1994). These factors constitute QoC, which Donabedian (1988) operationalizes as comprising the following interrelated dimensions: *structure* (organizational resources), *processes* (technical and interpersonal process of care), and *outcomes* (clinical and non-clinical consequences). There are two interrelated subtypes of

QoC: 1) technical QoC or the structural inputs and processes of care; and 2) perceived QoC based on women's perceptions and experiences (Hulton et al., 2016; WHO, 2016a). Technical factors related to human and material resources are the most commonly reported reasons for phase III delays (Knight et al., 2013). Health workforce-related issues such as inadequate skills, staff shortages, low motivation, noncompliance with guidelines, and delayed treatment are associated with maternal deaths (Knight et al., 2013; Kongnyuy et al., 2009; Moodley et al., 2014; Vink et al., 2013). However, these factors are shaped by the environments in which health workers operate.

Many health facilities in developing countries lack essential equipment, medications, and supplies, compromising their ability to deliver quality care (Knight et al., 2013; Kyei-Nimakoh et al., 2017; Munabi-Babigumira et al., 2017; Sambo et al., 2011). Deficiencies in blood transfusion capacity are among the most common contributors to Phase III delays in developing countries (African Union Commission & UN Women, 2015; D'Ambruoso et al., 2010; Goswami et al., 2013; Hussein et al., 2016; Knight et al., 2013; Kongnyuy et al., 2009; Merali et al., 2014; Moodley et al., 2014; Vink et al., 2013). A systematic review of Phase III delays concluded that health facilities in developing countries are often under-resourced, lacking the capacity to prevent severe obstetric complications (Knight et al., 2013).

Additionally, in countries with poor health financing, receiving care is contingent on out-of-pocket payments by families (D'Ambruoso et al., 2010; De Brouwere et al., 2014). Even when maternal health services are free, families are forced to pay for critical medications/supplies, resulting in further delays, withholding of life-saving care, and mortality (D'Ambruoso et al., 2010; De Brouwere et al., 2014; Homer et al., 2018; Kyei-

Nimakoh et al., 2017). Phase III delays influence perceived QoC and affect future health seeking (Phase I) (Knight et al., 2013).

Overall, maternal mortality is a product of social and political actions and decisions at global, national, and local levels, that shape the distribution of power and resources, women's access to resources, their physical and social environments, health risks, and health outcomes (Kickbusch, 2015; Solar & Irwin, 2010; UNDP, 2011). Poor governance and lack of political will undermine efforts to eliminate preventable maternal mortality (African Union Commission & UN Women, 2015; Kickbusch, 2015; Lan & Tavrow, 2017). Other socio-political factors such as child marriage, sexual and gender-based violence, harmful traditions, and armed conflict impact women's health over their life course and throughout pregnancy, often culminating in high maternal morbidity and mortality (African Union Commission & UN Women, 2015; Every Woman Every Child, 2015; Firoz et al., 2016; Pillai, Wang, & Maleku, 2017; Requejo et al., 2015; Roos & von Xylander, 2016; UNDP, 2011; UN High Commissioner for Refugees [UNHCR], n.d.). The complexity and multifactorial nature of maternal mortality requires multifaceted and multipronged strategies or interventions.

Interventions to Reduce Maternal Mortality

Given the unpredictability of obstetric complications and their often rapid progression during labor, delivery and in the immediate postpartum, EmOC and skilled birth attendance at delivery are considered the most critical interventions for preventing maternal deaths (Knight et al., 2013; WHO, 1999; WHO, 2004b; WHO et al., 2009).

Emergency Obstetric Care

Emergency obstetric care was introduced in 1997 by the WHO and partners as a package of life-saving medical interventions to prevent and manage major obstetric complications (Paxton, Maine, Freedman, Fry, & Lobis, 2005; WHO et al., 2009). It comprises nine interventions or “signal functions”, classified into basic (BEmOC) or comprehensive (CEmOC) EmOC (WHO et al., 2009). The BEmOC signal functions include: administration of parenteral antibiotics (for sepsis), anticonvulsants (for PE-E), and uterotonics (for PPH and obstructed labor); removal of retained products/ manual vacuum aspiration (for abortion, PPH, and sepsis); assisted vaginal delivery (for prolonged labor); and manual removal of the placenta (for PPH) (WHO et al., 2009). The CEmOC functions include blood transfusion and cesarean section in addition to all BEmOC signal functions (WHO et al., 2009). The WHO recommends the administration of EmOC and other critical interventions by SBAs (WHO, 2004b).

Skilled Birth Attendance

Skilled birth attendants (SBAs) are regulated health professionals (e.g. physicians, nurses, midwives) that are educated and trained to provide evidence-based preventive and life-saving interventions to mothers and newborns during pregnancy, childbirth and the postpartum period (WHO, 2018). The SBA strategy is based on strong evidence surrounding their ability to promptly identify, manage, and refer obstetric complications, and significantly reduce maternal mortality (Adegoke & van den Broek, 2009; Sullivan & Hirst, 2011). This strategy consists of two key components—an SBA and enabling environment with supportive elements (e.g. data, funds, medical equipment and supplies, leadership) that facilitate the provision of quality care (Adegoke & van den

Broek, 2009; Requejo et al., 2015; WHO, 2018). As discussed earlier, deficiencies in resources hinder SBAs' optimal functioning (Coeytaux, Bingham, & Langer, 2011; de Bernis, Sherratt, AbouZahr, & Van Lerberghe, 2003). Deliveries within health facilities are recommended for all women to reduce unnecessary delays and enable the optimal functioning of SBAs (Campbell & Graham, 2006; Hussein et al., 2012).

While interventions to avert the majority of maternal deaths are well established, there is limited evidence on best strategies to effectively deliver these interventions to those most in need (Adegoke & van den Broek, 2009; Alvarez, Gil, Hernandez, & Gil, 2009; Campbell & Graham, 2006; UNDP, 2011). Alvarez et al. (2009) argue that the challenge is strategic and organizational rather than technological. In 2015, the WHO and partners identified “improved metrics, measurement systems and data quality” as a preliminary step and cross-cutting action towards ending preventable maternal mortality (WHO, 2015, p. 14). This action specifically calls for better information on levels and causes of maternal deaths to inform local strategies for ending preventable maternal mortality (WHO, 2015). Approaches for generating information on maternal deaths are discussed below.

Approaches to Measuring Maternal Mortality

Robust data collection systems are needed to generate reliable information on the magnitude and causes of maternal mortality. Such information serves a variety of purposes including the following: 1) to quantify and monitor trends in maternal mortality; 2) to understand characteristics, causes, and contributing factors of maternal mortality; 3) to monitor national and global progress; 4) to inform practice and policy; 5) to evaluate

the effectiveness of strategies for reducing maternal mortality; and 6) to ensure accountability and equity (Graham & Campbell, 1992; Graham, Foster, et al., 2008; IMMPACT, 2007; Mgawadere, Kana, & van den Broek, 2017; Qomariyah et al., 2009; WHO, 2015). Quality information is particularly valuable for priority-setting in the context of resource limitations and competing national and global priorities, when maternal health can easily become neglected (IMMPACT, 2007; WHO, 2015).

The field of maternal health has undergone three major revolutions, the first being *metrics and evaluation*, followed by *accountability*, and *quality improvement* (Horton, 2014; Kerber et al., 2015; Kruk, Larson, & Twum-Danso, 2016). The approaches to measuring maternal mortality are discussed in relation to these three revolutions, culminating in MDSR which covers all three revolutions.

The Metrics Revolution in Maternal Health

The metrics revolution is traced back to the mid-1980s and the Safe Motherhood era, which marked the beginning of concerted international efforts to address maternal mortality (Graham, Ahmed, Stanton, Abou-Zahr, & Campbell, 2008; Otsea, 1992; WHO, 1991). This revolution peaked between 1998 and 2003, with WHO investments in developing measurement methods and tools to generate better data for decision-making (Horton, 2014). The MDGs and SDGs sustained political and technical momentum to address maternal mortality, reinforcing this revolution (Alkema et al., 2016; Graham & Hussein, 2006; Miller & Belizan, 2015; Ronsmans & Graham, 2006). This revolution focused on counting maternal deaths and evaluating interventions (Horton, 2014; WHO, 2016b), using the following key indicators: maternal mortality ratio (MMR), maternal mortality rate (MMRate), and lifetime risk of maternal death (LFTR) (Graham, Foster, et

al., 2008; WHO et al., 2015). Maternal mortality ratio, the key indicator for MDGs and SDGs, reflects the number of maternal deaths during a given time period per 100 000 live births in the same period (WHO et al., 2015). The MMR is categorized as low (<100 per 100 000 livebirths), moderate (100–299 per 100 000 livebirths), high (300–499 per 100 000 livebirths), very high (500–999 per 100 000 livebirths), and extremely high (≥ 1000 per 100 000 live births) (WHO et al., 2015). Alternatively, MMRate is defined as the number of maternal deaths in a given time period per person-years lived by women of reproductive age (WRA, 15–49 years old) within the same period (WHO et al., 2015). The LFTR reflects the probability that a 15-year old girl will die from a maternal cause over her lifetime (Ronsmans & Graham, 2006; Wilmoth, 2009).

Sources of Data on Maternal Mortality

Data on maternal deaths are derived from several sources including: 1) CRVS; 2) health facility data; 3) population or household surveys; 4) public health surveillance; and 5) statistical modeling (Graham, Ahmed, et al., 2008; Mgawadere et al., 2017).

Civil Registration and Vital Statistics Systems (CRVS). Civil registration is a government function that continuously captures all vital and civil status events (e.g. live births, deaths, marriages) as they occur (UN, 2001). Given its national scope and ability to produce real-time data on births and deaths, it is considered the gold standard for measuring maternal mortality (Blencowe, Calvert, Lawn, Cousens, & Campbell, 2016; Scott & Danel, 2016; WHO, et al., 2015). Maternal death identification via CRVS is facilitated by a pregnancy checkbox on the death certificate where implemented, indicating pregnancy status at death in addition to cause of death information (Davis,

Hoyert, Goodman, Hirai, & Callaghan, 2017; Horon & Cheng, 2011; MacKay, Rochat, Smith, & Berg, 2000).

However, two-thirds of the global population reside in countries where CRVS is absent, incomplete, or dysfunctional (CoIA, 2011; IMPACT, 2007; Mathai et al., 2015; Mathers, Fat, Inoue, Rao, & Lopez, 2005; UNSD, 2017; WHO, 2013). More specifically, 110 developing countries do not have functional CRVS and fewer than 40% of countries worldwide have complete CRVS with accurate data on maternal deaths (UNSD, 2017; World Bank & WHO, 2014; WHO et al., 2015). Death registration lags behind (Scott & Danel, 2016), as approximately two-thirds of deaths globally are left uncounted (World Bank & WHO, 2014). Additionally, CRVS has been reported to miss 50% of maternal deaths due to underreporting and misclassification (Alkema et al., 2016; WHO, UNICEF, UNFPA, & World Bank, World Health Organization, United Nations Children's Fund, United Nations Population Fund, & World Bank, 2012; WHO, UNICEF, UNFPA, World Bank, & UN Population Division, 2014). In the absence of complete and reliable CRVS, alternative sources such as surveys and statistical models are utilized (CoIA, 2011; Mathai et al., 2015; WHO, 2013; WHO, 2016b; WHO et al., 2015)

Health facility reporting. In many developing countries, health facilities are important sources of maternal mortality data since they routinely collect data on health events from health records, notifications by providers, or surveys (Graham, Foster, et al., 2008; Mgawadere et al., 2017). The usefulness of health facility data is largely limited by their inability to capture maternal deaths occurring outside of obstetric wards, within communities, and in private health facilities (Blencowe et al., 2016; Graham, Foster, et

al., 2008; IMMPACT, 2007). Additionally, poor-record keeping affects data quality (Graham, Foster, et al., 2008).

Population-based household surveys. In countries with non-existent or underdeveloped CRVS, population or household surveys (e.g. Demographic Health Surveys/DHS) are important sources of information on maternal deaths (Graham, Foster, et al., 2008; Mgawadere et al., 2017). They gather information on causes, timing, and place of death, and on health care utilization throughout pregnancy using *direct mortality questions* or *sisterhood methods* (direct and indirect) (Blencowe et al., 2016; Graham, Foster, et al., 2008). Direct mortality questions elicit information on the deaths of pregnant or recently delivered women (one to two years) within respondents' households, while sisterhood methods ask respondents about pregnancy-related deaths among their deceased sisters (Blencowe et al., 2016; De Brouwere, 2017; Mgawadere et al., 2017; UNSD, 2008). The indirect sisterhood approach asks respondents four questions related to deaths of their sisters of reproductive age born to the same mother, including each deceased sister's pregnancy status at the time of death (Graham, 1989; Graham, Brass, & Snow, 1989; Graham, Foster, et al., 2008; Mgawadere et al., 2017). The direct sisterhood method seeks a more detailed sibling history (11 questions) and covers a shorter reference period (less than six years) than indirect sisterhood (10-12 years) (Graham, Foster, et al., 2008; Mgawadere et al., 2017; Rutenberg & Sullivan, 1991; WHO & UNICEF, 1997). While these surveys are often representative and useful in poor-resource settings, they produce estimates with wide confidence intervals (25-30%) (De Brouwere, 2017; Rutenberg & Sullivan, 1991; WHO & UNICEF, 1997). In addition, they measure

pregnancy-related rather than maternal deaths given their limited ability to ascertain causes of death (Mgawadere et al., 2017), potentially overestimating maternal mortality.

Statistical modeling. Analytical approaches such as statistical modeling are currently used to produce MMR estimates in many developing countries with little or no reliable data (De Brouwere, 2017; WHO et al., 2015). However, their reliability has been questioned (Blencowe et al., 2016). Differences in statistical methods, specifications, and covariates yield different results, creating confusion (Abouzahr, 2011). For instance, the UN and WHO estimates are generally produced from multilevel regressions with selected covariates (WHO et al., 2015), while others utilize linear models and spatial-temporal models to account for variations not captured by the covariates (Abouzahr, 2011). As suggested by Abouzahr (2011, p. 121), rather than focusing on which statistical model is better, “the big problem that needs to be addressed is the absence of country level data which no amount of tinkering with statistical models can overcome.”

Surveillance of pregnancy-related and maternal deaths. Public health surveillance (PHS) is an ongoing and systematic data collection and analysis cycle that generates data on the distribution of health issues and links information with public health action (German et al., 2001; Groseclose & Buckeridge, 2017; Thacker & Berkelman, 1988). German et al. (2001) identified the following uses of PHS: 1) guide immediate public health action; 2) measure and monitor trends; 3) guide program and policy planning, implementation, and evaluation; 4) evaluate changes in practice, policy, and outcomes; 5) prioritize resource-allocation; 6) describe the epidemiology of the issue; and 7) inform research.

Three main surveillance approaches have been used to investigate maternal deaths: 1) demographic surveillance that retrospectively ascertains pregnancy status and cause of death among WRA, 2) prospective studies that follow women throughout pregnancy to assess pregnancy outcomes, and 3) active surveillance that involves the identification of maternal deaths and live births in real time and systematic collection of information on contributing factors and socio-demographic characteristics of deceased women (Blencowe et al., 2016; Graham, Foster, et al., 2008). Maternal Death Surveillance and Response (discussed later) is a form of active surveillance.

Limitations of Current Approaches for Measuring Maternal Mortality

Generating reliable data on maternal mortality is a significant challenge in developing countries due to technical issues, resource constraints, and lack of political will (Danel et al., 2011; Graham, 2002; Hounton et al., 2013; Scott & Dairo, 2015). A combination of misclassification (e.g. coding errors, errors in cause of death attribution), incomplete records, and underreporting, result in the underestimation of maternal deaths by up to 30% globally and 70% in some countries (Aa, Grove, Haugsja, & Hinderaker, 2011; Alkema et al., 2016; Blencowe et al., 2016; Ronsmans & Graham, 2006; Smith et al., 2001; WHO, 2016b; WHO et al., 2015). Maternal deaths in early and late pregnancy, among women of extreme age, and from indirect causes are prone to misclassification resulting in a missed opportunity to prevent similar deaths (Blencowe et al., 2016; Ronsmans & Graham, 2006; WHO, 2016b; WHO et al., 2015)

While the global community has been counting maternal deaths for decades, Graham and Campbell (1992) suggest we have reached the “measurement trap”, characterized by the lack of information on the true magnitude and causes of maternal

mortality due to limitations in indicators, data sources, measurement techniques, and definitions. As a result, the invisibility scandal prevails in over 60% of the world, where a large proportion of maternal deaths and underlying causes remain unreported and unrecorded particularly in developing countries (CoIA, 2011; Graham, 2002; Scott & Danel, 2016; Setel et al., 2007). Additionally, the metrics revolution has resulted in a focus on numbers and global comparisons (De Brouwere, 2017; Storeng & Behague, 2017), as evidenced by investments in costly surveys and statistical models (Storeng & Behague, 2017). While these sources have improved global measurements, they shift data production and analysis away from countries to global institutions and divert attention from strengthening national health information systems (NHIS) (Storeng & Behague, 2017). Until countries are empowered and equipped to produce quality local data, many women will remain invisible (Ronsmans & Graham, 2006). Numerical estimates are crucial for monitoring and evaluation (M&E), however, they do not provide sufficient information on underlying factors contributing to maternal deaths (Lewis, 2003; WHO, 2004a). As stated by Lewis (2008b, p. 449) “the numbers tell us nothing about why women continue to die in a world where the knowledge and resources to prevent such deaths are available or attainable.” In light of these limitations, global agencies, researchers, and practitioners have called for a paradigm shift from a focus on numbers to examining underlying factors contributing to each maternal death (CoIA, 2011; Hounton et al., 2013; Lewis, 2008b).

Going Beyond the Numbers: Approaches for Understanding Why, How, When, Where

Understanding the circumstances surrounding maternal deaths is critical for taking effective action towards preventing future deaths and ending preventable maternal deaths (Mathai et al., 2015; Mutsigiri-Murewanhema et al., 2017; Ronsmans & Graham, 2006; Say & Chou, 2011; Say et al., 2014; WHO, 2004a; WHO, 2013; WHO, 2016b). Maternal Death Reviews (MDRs) and Maternal Death Surveillance and Response (MDSR) are recommended for generating information on contributing factors of maternal deaths and their preventability (WHO, 2004a, 2013).

Maternal Death Reviews

“Whose faces are behind the numbers? What were their stories? What were their dreams? They left behind children and families. They also left behind clues as to why their lives ended early”.

—Dr. William M. Callaghan (Berg et al., 2001, p. 53)

In their 2004 publication entitled *Beyond the Numbers*, the WHO outlined approaches that unlock the story (e.g. why, when, where, how) behind each maternal death to ensure that practical lessons are learned and actions taken to prevent similar deaths in the future (Moshabela et al., 2015; Scott & Dairo, 2015; Scott & Danel, 2016; WHO, 2004a). The idea of reviewing maternal deaths is traced back to the 18th century in Sweden (Van Lerberge & De Brouwere, 2001; WHO, 2004a), however, it became more organized with the UK’s Confidential Enquiries into Maternal Deaths (CEMDs) established in 1928 and formalized in 1951 (Ngan Kee, 2005; Walker, Wrigley, Marston, Hirst, & Martin, 1957). Building on these early experiences to support MDG 5, *Beyond*

the Numbers standardized MDRs at global levels by offering a practical guide that outlined three main approaches for reviewing maternal deaths: 1) facility/hospital-based MDR (FBMDR); 2) community-based MDR (CBMDR)/verbal autopsy; and 3) Confidential Enquiries into Maternal Deaths (CEMDs) (Lewis, 2003; WHO, 2004a). These three approaches are collectively known as *maternal death reviews* (MDR) or *maternal death audits* in some settings, and defined as “qualitative, in-depth investigations of the causes of, and circumstances surrounding maternal deaths” in health care facilities and communities (Danel et al., 2011; WHO, 2004a, p. 15). Maternal death reviews involve the identification of maternal deaths, data collection, analysis, formulation of recommendations, action, and evaluation (WHO, 2004a). MDRs are guided by principles of confidentiality, anonymity, and non-threatening environments, and are thus not used for disciplinary or legal action (WHO, 2004a).

Facility-based maternal death reviews. Facility-based MDR is the oldest, simplest, most affordable, and most commonly implemented in developing countries (Combs Thorsen, Sundby, Meguid, & Malata, 2014; Scott & Dairo, 2015; WHO, 2004a). Using this approach, maternal deaths in health facilities and catchment areas are identified and qualitatively reviewed by a committee to examine facility and community-level factors associated with each death (WHO, 2004a). This process ideally traces a woman’s road to death to identify missed opportunities or avoidable factors that contributed to her death (Lewis, 2008b; WHO, 2004a). It is intended to highlight and address remediable factors within and outside the health system (African Union Commission & UN Women, 2015; Lewis, 2008b; WHO, 2004a). In many settings, facility MDRs have been integrated into routine practice and are among the

responsibilities of designated health providers (Kongnyuy & van den Broek, 2009; WHO, 2004a). A major limitation of FBMDRs, is their failure to review community-related factors due to logistical, cultural, and resource issues in interviewing community members (Hofman & Mohammed, 2014; Scott & Dairo, 2015; WHO, 2004a).

Community-based maternal death reviews (Verbal autopsies). The CBMDR, also known as verbal autopsy, provides a unique opportunity for identifying both medical and nonmedical factors leading to maternal deaths in settings with a high number of community maternal deaths or low quality medical certification (D'Ambruoso et al., 2010; Scott & Dairo, 2015; Scott & Danel, 2016; WHO, 2004a; WHO et al., 2015). Verbal autopsies involve interviews with key informants (e.g. family, neighbors, and CHWs) who are knowledgeable about a woman's pregnancy and death (WHO, 2004a). This approach generates comprehensive information on social determinants of maternal mortality and empowers communities to address local issues (Scott & Dairo, 2015; WHO, 2004a). A major limitation associated with CBMDRs is the reliability of information from lay informants. In the absence of medical records, misclassification of maternal deaths is common given a heavy reliance on informants' recall and perceptions (Scott & Dairo, 2015; Scott & Danel, 2016; WHO, 2004a; WHO et al., 2015).

Confidential Enquiry into Maternal Deaths. Confidential enquiries are anonymous reviews of aggregated data from all or samples of maternal deaths at regional or national levels to highlight major deficiencies and action points at multiple levels of influence (individual through policy level) (Kongnyuy et al., 2009; Scott & Danel, 2016; WHO, 2004a). They are considered the gold standard for investigating maternal deaths given their confidential and anonymous nature, national/regional scope, and their ability

to inform large scale actions (Scott & Dairo, 2015; WHO, 2004a). However, CEMDs are resource-intensive especially in high-burden countries, requiring substantial commitments at national and local levels (Scott & Dairo, 2015; WHO, 2004a). In many settings, CEMDs still lack community-level data (Scott & Dairo, 2015; WHO, 2004a).

Limitations of Maternal Death Reviews

While representing a paradigm shift from numerically-focused approaches, MDRs have received criticism for not sufficiently emphasizing action as a key component of the process; they often end in the review phase, with no further recommendations or actions as a result (Mathai et al., 2015; Scott & Danel, 2016; Smith, Ameh, Roos, et al., 2017; WHO, 2016b). Another major limitation is that MDRs, as described in *Beyond the Numbers*, do not emphasize the systematic investigation of every maternal death (Armstrong et al., 2014; WHO, 2004a). It is important that every maternal death is identified, counted, and reviewed to ensure that no woman is left invisible as each death tells a unique story that, when aggregated, can reveal patterns across maternal deaths and settings (WHO, 2004a). These factors along with the revolutions discussed below, have led to the development of MDSR, a more robust tool.

The Accountability and Quality Revolutions in Maternal Health

The accountability and quality revolutions grew out the following: 1) the agenda to end preventable maternal mortality; 2) the measurement trap and invisibility scandal (Graham & Campbell, 1992; Setel et al., 2007); 3) CoIA's calls for accountability to end preventable maternal mortality (CoIA, 2011); and 4) renewed momentum on QoC (Kruk et al., 2016; van den Broek & Graham, 2009).

The accountability revolution was triggered by insufficient progress towards improving MCH (MDGs 4 and 5) and the need to account for resources and results as the 2015 MDG deadline approached (Every Woman Every Child, 2015; Horton, 2014). It materialized with the launch of the Global Strategy in 2010 to accelerate progress towards the MDGs, resulting in the creation of the CoIA in 2011 to ensure global oversight, reporting, and accountability (Every Woman Every Child, 2015). The CoIA (2011) identified the need for better information and proposed an accountability framework that reflects continuous learning and improvement in three interconnected phases: monitor-review-act. *Monitor* yields critical information to track outcomes or performance; *Review* identifies gaps, best practices, and recommends remedial actions; and *Act* uses information to accelerate improvements in health outcomes (CoIA, 2011). Unlike the metrics revolution, where responsibility for data production was transferred to global agencies (Storeng & Behague, 2017), the CoIA placed accountability “soundly where it belongs: at the country level” (CoIA, 2011, p. 2). This is evidenced by its emphasis on strengthening national leadership, ownership, and evaluation capacity (CoIA, 2011). At the same time, the CoIA calls for the engagement of multiple stakeholders and strong links between accountability mechanisms from community to global levels (CoIA, 2011; Every Woman Every Child, 2015; Scott & Danel, 2016; Ten Hoope-Bender et al., 2016).

The most recent revolution in MCH is the quality revolution (Horton, 2014; Kruk et al., 2016). The increased coverage and accessibility of critical obstetric interventions (e.g. SBA, EmOC) have not been matched by commensurate declines in maternal mortality in developing countries, indicating multi-level gaps in QoC

(African Union, 2017; Baker, 2017; Knight et al., 2013; Mathai et al., 2015; Say et al., 2014). This has generated global momentum for a quality revolution to achieve SDG 3.1 (Graham & Varghese, 2012; Kruk et al., 2016; Mathai et al., 2015; UN, n.d.; van den Broek & Graham, 2009). Horton (2014) acknowledges that while maternal mortality indicates QoC issues, it does not provide information on how to address QoC. Underlying Horton's (2014) statement is the recognition that ending preventable maternal mortality requires a tool that integrates the principles of the metrics, accountability, and quality improvement revolutions. More specifically, it indicates the dire need for a tool that generates actionable information on maternal mortality and contributing factors and links this information with accountability and quality improvement mechanisms at local, national, and global levels. One such tool is MDSR (Hounton et al., 2013; WHO, 2013; WHO, 2016b).

Maternal Death Surveillance and Response

Maternal Death Surveillance and Response was introduced by the WHO and partners in 2012 and officially launched in 2013 with the release of the MDSR Technical Guidance (WHO, 2013). It integrates elements of the metrics, accountability, and quality improvement revolutions by building on well-established approaches such as PHS, MDRs, and the CoIA's accountability framework (monitor-review-act cycle) (WHO, 2013, 2016b). While the concept of surveillance is not new, adapting traditional PHS towards eliminating maternal mortality is more recent (Hounton et al., 2013).

The MDSR process is a continuous surveillance-action cycle comprising the following key phases: 1) identifying and notifying maternal deaths; 2) conducting MDRs to determine causes, contributing factors, and preventability; 3) analyzing MDR findings

and formulating recommendations to prevent future maternal deaths; and 4) taking action and evaluating response (WHO, 2013, 2016b). The goal of MDSR is to eliminate preventable maternal mortality, with specific objectives being: 1) to generate information that guides immediate and long-term public health actions; and 2) to count every maternal death to enable an assessment of the “true magnitude” of maternal mortality (WHO, 2013). Essentially, MDSR aims to end preventable maternal deaths by linking real-time, actionable information on maternal mortality levels, causes, and contributing factors with actions at local and national levels (WHO, 2013, 2016b). As such, it has been considered the “cornerstone” of accountability and is recommended as a quality improvement tool (Scott & Danel, 2016). While MDR remains a central component of MDSR (WHO, 2016b), the latter emphasizes the need for continuous active surveillance of all maternal deaths in facilities and communities, data-driven and tailored responses (“R” in MDSR), and evaluation of actions (World Health Organization, 2013). Based on strong emerging evidence in support of MDSR, the African Union has endorsed MDSR as a “low cost and high-impact” intervention to reduce preventable maternal deaths (African Union, 2014).

Structural elements for MDSR. The MDSR Guide identifies the following key legal, regulatory, and administrative prerequisites for full MDSR implementation: 1) a national policy to notify all maternal deaths within 24 hours for facility deaths and 48 hours for community deaths; 2) a national policy to systematically review all maternal deaths; 3) a policy establishing the MDSR system, which includes a national MDR committee that meets at least biannually, subnational committees at districts and facilities, and an annual national MDSR report; and 4) legal protections for

confidentiality and medical liability (WHO, 2013, 2016b). In addition, national MDSR guidelines are needed to standardize MDSR operations within countries (World Health Organization, 2013, 2016b). Furthermore, an MDR/MDSR coordinator is needed at district levels to oversee MDSR and ensure quality data production and immediate responses (WHO, 2013, 2016b). MDR committees comprising health professionals, administrators/managers, civil society, and community members should be established in facilities (at least referral and district hospitals), and at district and national levels to systematically review all maternal deaths within their jurisdictions and to issue corresponding recommendations (WHO, 2013). More importantly, sustainable and effective MDSR implementation requires adequate human, financial, and material resources (Smith, Ameh, et al., 2017b; Smith, Ameh, Roos, et al., 2017).

MDSR aims to maintain a non-threatening environment that ensures confidentiality, anonymity, and does not apportion blame—known as “no name, no shame, no blame” principle (Congo et al., 2017; Hofman & Mohammed, 2014; WHO, 2013). Additionally, MDSR should adhere to principles of accountability; QoC; and participatory learning, planning, and action (WHO, 2013).

The MDSR process. The MDSR cycle consists of four major processes (Figure 3), each of which are discussed below.

Figure 3. The Maternal Death Surveillance and Response cycle

Identify and notify maternal deaths. MDSR requires active and systematic identification and notification of all maternal deaths, with a “0” captured when no maternal death is identified (zero reporting) (WHO, 2013, 2016b). This process begins with the active identification and assessment of facility and community deaths among all WRA to determine whether they were pregnant or within 42 days of pregnancy (up to 3 months for community deaths) (WHO, 2013, 2016b). All suspected maternal deaths are notified to designated authorities at district levels within 24 hours for facility deaths and 48 hours for community deaths, and to national authorities (by the district) on a monthly or quarterly basis (WHO, 2013, 2016b). Additional information is collected on all suspected deaths to rule out incidental or accidental causes, at which point those with no clear indication of such causes are submitted for review (WHO, 2013, 2016b).

Review maternal deaths. The MDR committee conducts an in-depth investigation of the underlying causes and circumstances leading to each maternal death (WHO, 2013, 2016b). Prior to each MDR session, qualified data collectors/extractors collect relevant information on each probable maternal death from facilities and communities using standardized tools. A written qualitative case summary is prepared for

each death and presented to the MDR committee during the review session (WHO, 2013, 2016b). The committee reviews all evidence and discusses each case to: 1) establish medical cause of death, 2) confirm that it is a maternal death, 3) determine non-medical contributing factors, 4) assess QoC received, 5) determine if it was preventable, and 6) issue recommendations to prevent similar deaths in the future. The committee issues a report of MDR findings and recommendations (WHO, 2013, 2016b). MDRs should be conducted at the minimum at facility and district levels, and should ideally review all probable maternal deaths immediately (facility deaths) or within one month (community deaths) of occurrence (WHO, 2013).

Analyze and formulate recommendations. Analysis is vital for translating MDSR data into meaningful and actionable information to guide actions (WHO, 2016b). While individual facilities conduct descriptive analysis, aggregated data analysis is conducted at district and national levels (WHO, 2013). Data should be de-identified to protect individuals, families, and providers (WHO, 2013). The following common indicators can be generated: 1) measures of magnitude (e.g. MMR); 2) cause-specific maternal mortality; 3) proportions of contributing factors (e.g. Three delays); 4) preventability (e.g. proportion of avoidable deaths) (WHO, 2013). Advanced analysis can be conducted on larger samples to identify patterns across cases, settings, and time (WHO, 2013, 2016b). Aggregated data analysis informs the formulation of recommendations (Smith, Ameh, et al., 2017b). Recommendations should be Specific, Measurable, Attainable, Realistic and Timebound (SMART) and should be formulated in light of local capabilities, resources, and contexts. Ideally, they are issued in the form of detailed action plans, indicating specific targets or objectives, designated individuals/organizations,

evaluation indicators, and a detailed timeline (immediate, medium, and long term) (Smith, Ameh, et al., 2017b). A long-term strategic action plan (3–5 years) is often developed at the national level (WHO, 2013).

Respond and monitor response. Response is the most critical and distinctive feature of MDSR that is needed to close the surveillance loop (Hounton et al., 2013; Mathai et al., 2015; WHO, 2013). Findings must be linked with multi-level actions; they should stimulate immediate actions at community and facility levels, and strategic actions at higher levels (Tuncalp & Souza, 2014; WHO, 2013; WHO, 2016b). Responses are prioritized based on urgency, feasibility, resources, local capacity, and potential impact (Tuncalp & Souza, 2014; WHO, 2013; WHO, 2016b). Individuals are assigned to follow-up on responses to ensure accountability (Mathai et al., 2015).

Disseminate of results, recommendations, and responses. The MDSR findings and outcomes should be disseminated to various stakeholders in districts, facilities, and communities through appropriate feedback mechanisms (WHO, 2013, 2016b). The dissemination of results increases the visibility of maternal mortality and stimulates widespread advocacy, action, and commitment towards ending preventable maternal mortality (Bandali et al., 2016; Hulton et al., 2014; Mathai et al., 2015; WHO, 2013). MDSR reports at district and national levels are important dissemination tools, containing an overview of MDSR results, recommendations, and responses (WHO, 2013). Language and dissemination methods should be tailored to the target audiences' preferences and literacy levels (WHO, 2013).

The WHO recommends a phased approach to MDSR implementation in terms of coverage (e.g. urban areas, sample districts, national), places where deaths are identified

(e.g. facility, community, both), and the depth of the review (WHO, 2013). Countries can begin with a sample of districts, or facilities and gradually progress towards full scale, national MDSR that includes all maternal deaths in all districts (WHO, 2013).

Relationship between MDSR and other Data Sources

Maternal Death Surveillance and Response is implemented in parallel with other common approaches for assessing/measuring maternal mortality. The section below examines its relationship with other approaches.

While MDSR integrates MDRs, it adds several distinctive features and offers a more structured and comprehensive framework for reviewing maternal deaths. Full MDSR implementation requires an *active, timely, and systematic* identification, *notification*, and review of *all* maternal deaths (facilities and communities) on an *ongoing* basis, all of which were limitations of MDR (Scott & Danel, 2016; Smith, Ameh, et al., 2017b). MDSR advocates for maternal deaths to be included in countries' notifiable disease reporting systems and provides well-defined guidelines to this end (WHO, 2013). Maternal Death Surveillance and Response also explicitly requires active surveillance with zero reporting, thus generating real-time data (Mathai et al., 2015; WHO, 2013). It underlines "response" as a necessary step for preventing future deaths (Scott & Danel, 2016; Smith, Ameh, et al., 2017b). Additionally, it emphasizes the importance of data analysis, accountability for responses, and formalizes the provision of feedback to partners (WHO, 2013). The MDSR system is designed to strengthen links between community, facility, district, and national levels (WHO, 2013). While the older MDRs have been criticized for focusing on medical factors, MDSR corrects this by formalizing community participation (family, neighbors, civil society) to highlight social and

structural contributing factors (WHO, 2016b). There have been concerns that MDSR could potentially “sabotage” facility MDRs and shift action and accountability to national levels (Armstrong et al., 2014; De Brouwere et al., 2013). However, the very design of MDSR strengthens local capacity as it stimulates multi-level responses, immediate actions in facilities, and establishes feedback mechanisms to strengthen links between community, facility, district, and national levels (WHO, 2013, 2016b).

MDSR, CRVS, and HIS are mutually reinforcing systems. In countries with functional CRVS, MDSR improves the identification of maternal deaths by correcting underreporting, misclassification, and poor case finding—major limitations of CRVS (Abouchadi et al., 2013; Alkema et al., 2016; WHO et al., 2015). Conversely, robust CRVS and HIS facilitate maternal death identification for investigation through MDSR (WHO, 2013). Where CRVS or HIS are inexistent or weak, MDSR serves as a building block for national systems (WHO, 2013; WHO, 2016b; WHO et al., 2015). In such circumstances, MDSR produces reliable country-owned data on maternal mortality levels and causes (Blencowe et al., 2016; Hounton et al., 2013; WHO, 2013; WHO, 2016b).

The WHO recommends expanding existing surveillance systems to incorporate maternal deaths in order to avoid duplication and ensure efficient use of resources (WHO, 2013). Several SSA countries such as Malawi, Tanzania, Zimbabwe, and Eritrea have integrated MDSR into well-established Integrated Disease Surveillance and Response Systems (IDSR) (Scott & Danel, 2016). The IDSR was introduced by the WHO Regional Office of Africa (AFRO) in 1998 to improve the surveillance of priority infectious diseases (Franco, Setzer, & Banke, 2006). It is similar to MDSR as it enables multidisciplinary participation, production of information, and implementation of multi-

level responses (Franco et al., 2006; Scott & Danel, 2016). For countries that integrate MDSR into IDSR, specific adaptations are made such as adding maternal mortality to the national list of priority and notifiable conditions (Scott & Danel, 2016; WHO, 2013).

The Impacts of MDSR

While there is a growing literature on MDR and MDSR implementation, only a few studies have reported or quantified the impacts of MDR and MDSR on maternal health outcomes. Many have reported short-term and intermediate outcomes of MDR and MDSR. In summarizing the literature on MDRs and MDSR, the notation “MDR/MDSR” is used where it is unclear whether the system investigated is MDR or full MDSR or where findings are applicable to both.

Impacts on maternal health outcomes. The few studies available suggest that MDR and MDSR significantly reduce maternal mortality and obstetric complications even with limited coverage and short periods of implementation. For instance, facility-based MMR decreased by 55% (0.83%-0.41%) in a district hospital in Senegal largely due to organizational changes and improved delivery of life-saving interventions after three years of MDR implementation (Dumont et al., 2006). While the study design (non-controlled pre-post) does not establish causation, these effects were observed in multivariate analysis adjusted for potential confounders (e.g. patient characteristics) and MDRs were the only intervention implemented during the study period to reduce maternal mortality (Dumont et al., 2006). In Malawi, FBMDRs were associated with a significant decline in hospital-based MMR over a three-year period (250 to 182 per 100 000 livebirths; $p < 0.001$) due to significant improvements in the quality and utilization of EmOC and SBA (Kongnyuy et al., 2008). Another study in Malawi observed a 23%

decline in the incidence of direct obstetric complications (from 13.5 to 10.4 complications per 1000 deliveries; $p=0.01$), particularly uterine rupture (94% decline) and hemorrhage (60% decline) within two years of MDR implementation (van den Akker et al., 2011). While this study does not establish causation, these plausible changes increased support for MDRs (van den Akker et al., 2011). A four-year cluster-randomized controlled trial of MDRs in Mali and Senegal found a significant decline in hospital-based direct maternal deaths (1030 to 680 per 100 000 livebirths; $p<0.03$) among women in intervention hospitals that implemented MDRs due to improved EmOC availability (24 hours) and quality (Zongo et al., 2015). Subgroup analysis revealed a significant decline in maternal mortality among women with cesarean deliveries, demonstrating its effectiveness in high-risk women (Zongo et al., 2015).

Impacts on health service delivery. Evidence suggests that MDRs and MDSR produce effective and tailored responses, prompting significant improvements in workforce development and professional practice; accessibility, availability, acceptability, and QoC (AAAQ); referrals and communication; and resource mobilization (Abebe et al., 2017; Goswami et al., 2013; Hussein et al., 2016; Nyamtema et al., 2011).

Participation in MDR/MDSR is itself an intervention as it enhances analytical skills, peer learning, self-reflection, capacity-building, and motivation to take action (Hofman & Mohammed, 2014; Lewis, 2003; Mutsigiri-Murewanhema et al., 2017; WHO, 2004a). In Tanzania, participants cited direct learning as the primary motivator for participating in MDRs (van Hamersveld et al., 2012). Maternal Death Reviews and MDSR have been associated with improved workforce capacity and professional practice by stimulating in-service and pre-service EmOC training, supportive supervision,

continuing education, and dissemination of updated guidelines of care (Goswami et al., 2013; Hodorogea & Friptu, 2014; Hussein et al., 2016; Kongnyuy et al., 2009; Nyamtema et al., 2011; van den Akker, Mwagomba, Irlam, & van Roosmalen, 2009).

Maternal Death Surveillance and Response has improved the accessibility of care in several settings. In Malawi, bicycle and motorcycle ambulances, and a radio system were established to improve referrals in rural settings (Vink et al., 2013). Similarly, some remote districts in India established obstetric call centers linked with community and facility-operated emergency transportation (Kalter, Mohan, et al., 2011). In one setting, this ambulance service transported a total of 1153 women in its first six months (Kalter, Mohan, et al., 2011). Similarly, MDSR implementation in Zimbabwe prompted the assignment of a midwife to each ambulance to provide initial care (Om'Iniabo et al., 2017). Examples from Tanzania and Senegal demonstrate that MDR/MDSR can improve financial accessibility of care. In Tanzania, district authorities provided fuel for all ambulances that transported women from remote health centers, waiving the \$150 ambulance fee they were required to pay prior to MDRs (Nyamtema et al., 2011). In Senegal, community stakeholders mobilized funds and established an equitable cost-recovery system, reducing or waiving user fees (Dumont et al., 2006).

Maternal Death Surveillance and Response has also improved the availability of services and providers. In Tanzania, Senegal, and India, policies and measures were taken to ensure the round-the clock availability of qualified providers, EmOC services, and essential medications, supplies, and equipment to reduce delays in receiving care (Dumont et al., 2006; Kalter, Mohan, et al., 2011; Nyamtema et al., 2011). In Northern Nigeria, retired skilled midwives were redeployed to address workforce shortage and

ensure uninterrupted availability of care following FBMDRs (Hofman & Mohammed, 2014).

Maternal Death Surveillance and Response improves QoC through various mechanisms. By indicating specific areas of QoC deficiencies, it enables immediate quality improvement initiatives within facilities and communities (Abebe et al., 2017; Merali et al., 2014; Scott & Danel, 2016). The involvement of multiple stakeholders including senior administrators, community members, and health providers in MDSR increases awareness of QoC issues, accountability, and resource mobilization for quality improvement (Kongnyuy et al., 2009). A systematic review of quality improvement interventions in SSA concluded that MDR/MDSR is effective in improving QoC and reducing maternal morbidity and mortality in limited resource settings (Wekesah et al., 2016). More specifically, MDR/MDSR improved EmOC delivery, patient monitoring practices, diagnosis, and documentation of care (Wekesah et al., 2016). In Malaysia, CEMDs have produced gradual shifts from direct maternal causes to indirect causes (the obstetric transition), largely driven by national improvements in QoC (Ravichandran & Ravindran, 2014). A district hospital in Senegal renovated its laboratory, purchased a blood-bank refrigerator, recruited more health professionals, and ensured the 24-hour availability of essential drugs and supplies, leading to a 55% decline in maternal mortality (Dumont et al., 2006). Similarly, in Nigeria, multiple stakeholders (community, facility, government) mobilized resources to purchase a generator and a solar refrigerator for blood products (Hofman & Mohammed, 2014).

Maternal Death Surveillance and Response strengthens collaboration between multiple stakeholders. In Ethiopia, MDSR implementation has strengthened

communication across the health system, linking communities, health providers, and health authorities (Abebe et al., 2017). For instance, “liaison officers” were recruited to accompany referrals to higher level facilities in order to relay important information on each case (Abebe et al., 2017). In Malaysia, CEMDs improved data sharing between government sectors, thus reducing discrepancies and improving data quality (Ravichandran & Ravindran, 2014). More specifically, CRVS was linked with the CEMD system, both of which were operated by different departments (Ravichandran & Ravindran, 2014). In Tanzania, MDRs have created strong working relationships between health professionals, particularly nurses and physicians (van Hamersveld et al., 2012).

Impacts on data quality and availability. In various settings, MDR and MDSR have improved maternal death identification and notification, availability of quality data, and data-driven decision-making (Bayley et al., 2015; Kalter, Mohan, et al., 2011; Sayinzoga et al., 2016). While not statistically significant, MDR committees in Rwanda improved cause of death attribution, as evidenced by a decrease in the proportion of maternal deaths with unknown causes over a 5-year period (from 6.4% to 1.4%) (Sayinzoga et al., 2016). Maternal death identification and notification improves with high community coverage. A community-linked MDR (CLMDR) in Malawi improved maternal death identification by 52% compared to the national reporting system and doubled the number of maternal deaths being reviewed (Bayley et al., 2015). Similarly, MDSR has decreased underreporting of maternal deaths in Ethiopia, India, and South Africa by drawing data from multiple sources (Abebe et al., 2017; Kalter, Mohan, et al., 2011; Moodley et al., 2014; Negandhi et al., 2016).

Impacts on the community. In addition to changes in the health system, MDR/MDSR stimulates community-level actions. Malawi provides an example of community change as a result of MDR/MDSR, where active community participation in problem-solving around maternal deaths has led to community empowerment and increased implementation of recommendations (Bayley et al., 2015). The following solutions resulted from the community-linked MDR implementation in Malawi: community-wide discussions of traditional beliefs influencing maternal health, policies prohibiting harmful traditional practices, male partner education on pregnancy and delivery, mobile ANC clinics, community funds to support emergency transportation, and peer counseling for pregnant women (Bayley et al., 2015). This process has also enabled community members to hold health workers accountable through regular community feedback meetings on progress in response implementation (Bayley et al., 2015).

Cost and cost-effectiveness of MDSR implementation. The cost of MDSR implementation varies considerably, depending on the number of maternal deaths, MDSR structure and coverage, level of integration with other systems, salary levels, and other local realities (Hussein et al., 2009; Tapesana et al., 2017). In the studies reviewed, MDSR costs ranged widely from as little as \$29 to over \$300 per maternal death. In Bangladesh and Ghana, a little over \$51 and \$68, respectively, are spent on each maternal death for the entire MDSR cycle (Biswas, Halim, Rahman, Eriksson, & Dalal, 2016; De Brouwere et al., 2014; De Brouwere et al., 2013; Mutsigiri-Murewanhema et al., 2017). However, much higher costs have been reported in Burkina Faso (US\$154), Benin (US\$217), Zimbabwe (\$246), and Morocco (\$240-294) (Abouchadi et al., 2013; De Brouwere et al., 2013; Tapesana et al., 2017). In Zimbabwe, MDSR costs an estimated

\$246 per facility maternal death, accounting for the following: 1) nurse's monthly salary of \$300 per month, considering that MDSR activities are integrated into their duties; 2) time to complete notification, data collection, and reporting (60 minutes per case); 3) communication costs to convey information (USD\$0.09 per minute for 15 minutes); and 4) travel costs during notification and review (Tapesana et al., 2017). Electronic and computerized systems are under development and are expected to substantially curb costs by reducing travel, processing time, and communication costs, among others (Abouchadi et al., 2013; Tapesana et al., 2017).

The majority of the cost estimations were produced during pilot or establishment phases; MDSR establishment costs are significantly higher than field implementation costs, which decrease as the system is optimized (Abouchadi et al., 2013; Biswas et al., 2016; Tapesana et al., 2017). For instance, Cameroon invested \$1.5 million in MDSR training in ten regions, however, MDSR operating costs were only US\$ 800 per year in each region once the systems were established (De Brouwere et al., 2014). Based on early experiences, MDSR implementation costs are affordable even in low-resource settings (Biswas et al., 2016; De Brouwere et al., 2013). In such settings, costs can be covered by local/national funds with assistance from development partners or can be minimized by integrating MDSR into existing systems (Biswas et al., 2016; De Brouwere et al., 2013). Evidence suggests that MDR/MDSR is a cost-effective tool for reducing maternal mortality (Combs Thorsen et al., 2014). Its benefits outweigh the implementation costs. In Bangladesh, for every \$51 spent per case on MDSR, over \$2000 is saved for averting a similar maternal death (Biswas et al., 2016).

Factors influencing MDSR Implementation: Enablers and Barriers

Several factors have been reported to influence MDSR implementation and effectiveness including leadership and governance, administrative support and capacity-building, legal and ethical factors, multidisciplinary participation, community engagement, MDSR integration into existing systems, availability of resources, health workforce and service delivery factors, quality of documentation and record keeping, and socio-cultural factors. These factors are highlighted below, drawing from MDSR-related experiences in diverse settings.

Leadership and governance. Political will, ownership, and accountability are critical driving forces behind successful MDSR. Political commitment to MDSR is evident in policies, resource mobilization for MDSR, and technical support (Smith, Ameh, Roos, et al., 2017). In Malaysia, strong political commitment towards reducing maternal mortality and elevating women's status has led to the establishment of one of the strongest CEMDs with sustained reductions in maternal mortality for over 50 years (Ravichandran & Ravindran, 2014). Political will in Rwanda translated into the institutionalization of MDSR and establishment of supportive environments for MDSR (Ajayi et al., 2017; Sayinzoga et al., 2016). As a result, health providers did not encounter any major barriers in reviewing maternal deaths (Sayinzoga et al., 2016). India has demonstrated that MDSR can function optimally in low-resource settings with responsive, supportive, and accountable governments and partners (Kalter, Mohan, et al., 2011).

Local leadership and partnerships are equally crucial for effective and sustainable MDSR operations (De Brouwere et al., 2014; Kerber et al., 2015). Despite strong national

political support for MDSR in Ethiopia, its implementation is hampered by a lack of prioritization and insufficient resources at the regional level (Abebe et al., 2017; African Union Commission & UN Women, 2015). Weak health facility and district leadership destabilizes MDSR, whereas participation of senior management and decision-makers improves acceptability, stakeholder buy-in, response implementation, and creates a collaborative and non-threatening environment for MDSR (De Brouwere et al., 2014; Dumont, Tourigny, & Fournier, 2009; Nyamtema et al., 2011; Smith, Ameh, et al., 2017b; van den Akker et al., 2009; van Hamersveld et al., 2012). A top-down approach to MDSR implementation in India and Kenya compromised local coordination of MDSR operations, resulting in poor responses at lower levels (Kalter, Mohan, et al., 2011; Smith, Ameh, et al., 2017b). Therefore, MDSR development and sustainability requires both a top-down and bottom-up approach (Smith, Ameh, et al., 2017b). The critical role of national interest groups (e.g. professional organizations) in supporting MDSR operations has also been highlighted (Pearson, deBernis, & Shoo, 2009; Smith, Ameh, Roos, et al., 2017). For example, members of professional associations in Kenya spearheaded the development of national MDR guidelines without government funding (Pearson et al., 2009) and in the UK and South Africa, they participate in CEMDs at no cost and have been key drivers of successful CEMD implementation (Smith, Ameh, Roos, et al., 2017).

Leaders play a central role in shaping and transforming organizational cultures to support MDSR implementation. The following cultures create an enabling environment for MDSR: 1) accountability for resources, results, and people; 2) individual responsibility and ownership; 3) evidence-based practice; 4) responsiveness and

proactivity; and 5) openness and transparency (Lewis, 2014a; Smith, Ameh, Roos, et al., 2017; WHO, 2016b). Contrastingly, a culture of blame and punishment results in poor participation in MDSR and the non-disclosure of critical information (WHO, 2016b).

Administrative support and capacity-building. Effective MDSR implementation requires support functions such as training, supervision, and technical assistance, to build the capacity of MDSR implementers (Agaro et al., 2016; Combs Thorsen et al., 2014; Pearson et al., 2009). In their critical reflection of MDRs, Combs Thorsen et al. (2014) assert that the simplistic representation of MDR/MDSR in the literature overshadows the methodological challenges inherent in this process. They highlight complexities surrounding data collection such as extracting information from poor quality medical records or interviewing families (Combs Thorsen et al., 2014). Despite these challenges, several studies have reported inadequate administrative support in implementing MDSR, lack of training, and gaps in disseminating MDSR guidelines (Hofman & Mohammed, 2014; Pearson et al., 2009; Singh et al., 2015). Inadequate understanding of MDSR guidelines, goals, and objectives limit the system's functionality (Armstrong et al., 2014; Smith, Ameh, et al., 2017b). Conversely, MDSR is more productive when staff are supported by higher management (Lewis, 2014b). Supportive functions and exchange of experiences between national and local levels are crucial for MDSR implementation (Pearson et al., 2009). For example, in Zimbabwe, technical support from provincial levels in the form of orientations and tools enabled MDSR implementation within facilities and districts (Om'Iniabo et al., 2017). In addition to local support, technical assistance from other countries enhances the local capacity to implement and scale-up MDSR (Pearson et al., 2009; Smith, Ameh, et al., 2017b). For

instance, Kenya received technical assistance from the UK and South Africa in setting up its MDSR system (Smith, Ameh, et al., 2017b).

Maintaining staff motivation and morale is as important as providing training and support for MDSR. The loss of motivation and morale have been reported when recommendations are not implemented (Agaro et al., 2016; Kerber et al., 2015; Lewis, 2014b). Similarly, poor staff remuneration and the lack of financial incentives affect motivation and participation in MDSR. In Uganda, participants lacked the motivation to attend MDRs, which were often conducted during lunch breaks with no incentives for participation (Agaro et al., 2016). The formal and regular provision of feedback and updates about MDSR performance including success stories helps sustain participation (Ajayi et al., 2017; Armstrong et al., 2014; van Hamersveld et al., 2012). However, several settings including Zimbabwe, Senegal, Ethiopia, and Tanzania have no formal processes for documenting and disseminating success stories to MDSR stakeholders (Abebe et al., 2017; Ajayi et al., 2017; Dumont et al., 2009; Om'Iniabohs et al., 2017; Tapesana et al., 2017; van Hamersveld et al., 2012).

Legal and ethical factors. While MDR/MDSR is underpinned by the principle of “no blame, no shame, no name”, there are several inherent features and contextual factors that inadvertently perpetuate the fear of blame in several settings (Abebe et al., 2017; Supratikto, Wirth, Achadi, Cohen, & Ronsmans, 2002). Studies have consistently reported a lack of transparency and poor participation in MDR sessions in settings where the blame culture and fear of disciplinary action persist (Agaro et al., 2016; Armstrong et al., 2014; Kongnyuy et al., 2009; Lewis, 2014a; van Hamersveld et al., 2012). A qualitative study on Ethiopia's MDSR system found that despite the emphasis of “no

blame, no shame” in local MDSR guidelines, the slogan “no woman should die while giving life,” unintentionally perpetuated the fear of litigation among MDSR participants (Abebe et al., 2017). Examples from Burkina Faso, Malawi, and Kenya, suggest that anonymity tends to be the least observed principle partly due to the time required for a complete de-identification of all documents and the participation in MDR sessions of providers who attended to the deceased (Congo et al., 2017; Kongnyuy et al., 2009; Smith, Ameh, et al., 2017b). In Malawi, while provider and patient names were not included on case summaries, providers involved were often easily identifiable during MDR meetings (Kongnyuy et al., 2009).

Power imbalances or professional hierarchies inherent in the health system also contribute to the fear of blame. In Senegal, midwives were more likely to perceive audit meetings as threatening compared to other health professionals (Dumont et al., 2009). A discursive analysis of an MDR session in Nigeria revealed that MDR chairs and senior health professionals dominated discussions while lower level staff were disengaged despite explicit invocations of MDSR principles (de Kok et al., 2017). These studies demonstrate the challenges associated with having a multidisciplinary committee where the blame culture and power imbalances prevail.

Where legal frameworks and non-threatening environments are created, health workers’ perceptions of threat are minimized or eliminated. In India, private health facilities initially withheld information due to the fear of legal action and of damaging their reputation, however, the state’s commitment to anonymity and non-punitive action encouraged private facilities to share information (Negandhi et al., 2016). The following strategies have been reported to minimize perceptions of threats during MDRs: 1)

ensuring legal protections for MDSR participants and raising awareness on the existence of these protections; 2) discussing external contributing factors rather than solely focusing on service delivery; 3) highlighting strengths and positive aspects of care in addition to deficiencies; 4) maintaining mutual respect; 5) making explicit reminders of “no blame, no name, no shame” during MDRs; 6) reducing power imbalances; and 7) instilling a culture of peer-learning and self-reflection (de Kok et al., 2017; Hussein et al., 2009; Om’Iniabo et al., 2017; van den Akker et al., 2009). In Malaysia, the term “substandard care” has been replaced with a more positive concept– “remediable factors”, to reduce perceptions of blame or shame (Ravichandran & Ravindran, 2014). In South Africa, CEMD forms cannot be used for legal/disciplinary action (Moodley et al., 2014).

Multisectoral and multidisciplinary participation. The value of multi-sectoral and multidisciplinary participation in MDSR has been well documented. It enables comprehensive investigations, local ownership, accountability, responsiveness, joint learning, and the implementation of multifaceted actions (de Kok et al., 2017; Hofman & Mohammed, 2014; Kerber et al., 2015; Kongnyuy et al., 2009; Moshabela et al., 2015; Ravichandran & Ravindran, 2014; St Pierre, Zaharatos, Goodman, & Callaghan, 2017; World Health Organization, 2004a). In India, the partnership between the government and the civil society encouraged community participation and enhanced MDSR implementation where there was a weak public health system and low social status of women (Kalter, Mohan, et al., 2011). This partnership and collaboration improved maternal death notification and reviews, the dissemination of findings, and implementation of evidence-based interventions (Kalter, Mohan, et al., 2011). Maternal

Death Surveillance and Response systems can be successfully built from the ground up by committed change agents in the absence of national coordination (Kerber et al., 2015).

Diversifying the MDR committee is a critical ingredient for successful MDSR implementation as it enables comprehensive investigations and actions (Hussein et al., 2009; Smith, Ameh, et al., 2017b). In Indonesia, the active involvement of village leaders, religious figures, and policymakers in MDRs enabled the identification of contributing factors outside of the health sector and stimulated policy-level changes (Supratikto et al., 2002). Another study in Indonesia, found significant differences in MDR approaches between a panel of specialists in secondary and tertiary hospitals and a panel of community practitioners in primary health facilities (Hussein et al., 2009). The specialist panel had longer debates on controversial issues, were focused on medical factors, and evaluated care against their experiences/expertise while the community panel spent less time debating, discussed complex community-related factors, and evaluated care against national guidelines (Hussein et al., 2009). However, multidisciplinary participation in MDRs is challenging in some settings due to concerns about confidentiality, staff shortages, resource limitations, and traditional and professional hierarchies (Congo et al., 2017; de Kok et al., 2017; Dumont et al., 2009).

Community engagement. Evidence suggests that community participation and ownership are ingredients for effective and sustainable MDSR. The Dead Women Talking initiative (DWT) in India is one of the most recognized community-based MDSRs that involves the civil society, community members, and community-based organizations (Subha Sri & Khanna, 2014). It employs the social autopsy approach, a process for identifying behavioral, social, and health systems factors contributing to

maternal deaths (Kalter, Salgado, Babilie, Koffi, & Black, 2011). Within a two-year period, the DWT initiative identified and reviewed 124 maternal deaths through community members, trained grassroots activists, and field staff (Subha Sri & Khanna, 2014). In Bangladesh, social autopsy has also been beneficial in identifying maternal deaths in the most remote communities, producing reliable MMR measures, and exploring socio-cultural barriers and solutions (Biswas, 2017). The CLMDR in Malawi engages community members as active participants in a process that combines community and FBMDRs (Bayley et al., 2015). Largely driven by community motivation, this process has been self-sustaining and has doubled the number of maternal deaths reviewed since its implementation (86%), increased response completion rates, and shed light on previously ignored issues, such as disrespectful maternity care (Bayley et al., 2015). Contrastingly, community leader participation in MDRs in Indonesia hindered open discussions of deficiencies in health service delivery (Supratikto et al., 2002). Community engagement in MDSR in low resource-settings is challenged by geographical barriers, financial constraints, staff shortages, and low community buy-in (African Union Commission & UN Women, 2015; Kerber et al., 2015).

MDSR integration into existing systems or programs. Integrating MDSR into existing maternal health programs and systems ensures its acceptability, efficiency, routine practice, and sustainability. A survey in 46 SSA countries found that MDR was more sustainable when integrated into maternal and reproductive health programs rather than being a vertical or stand-alone program (Pearson et al., 2009). In Ethiopia, MDSR alignment with national MCH goals encouraged stakeholder commitment to MDSR (Abebe et al., 2017). In many settings, MDSR has been integrated into existing public

health surveillance systems. In Ethiopia, MDSR integration within the disease surveillance system improved data quality and communication within the health system (Abebe et al., 2017). Unsurprisingly, competing priorities such as Ebola preparedness, disease outbreaks, and vaccination campaigns in Ethiopia diverted attention and resources from MDSR operations, leading to frequent interruptions (Abebe et al., 2017).

Additionally, the integration of MDSR with existing technology and information systems enables more efficient and rapid MDSR processes (Moodley et al., 2014; Om’Iniabohs et al., 2017; WHO, 2016b). Countries with well-established MDSR, such as South Africa, Zimbabwe, Malawi, and Kenya, have developed electronic MDSR systems that have saved considerable resources, enabled advanced data analysis, and facilitated data sharing (Biswas, 2017; Moodley et al., 2014; Smith, Ameh, Roos, et al., 2017). In Senegal, equipping CHWs with mobile health applications to support verbal and social autopsy enhanced the timeliness of data collection and analysis in community settings (Moshabela et al., 2015). However, electronic systems require regular maintenance to ensure optimal functioning (Smith, Ameh, Roos, et al., 2017).

Availability of resources for MDSR. The availability of resources impacts MDSR implementation (De Brouwere et al., 2014). Generally, health information systems including MDSR tend not to be prioritized in national budgets (Kerber et al., 2015). Many countries rely on external funding from development partners to establish MDSR systems but are unable to sustain national funding to support MDSR implementation, institutionalization, and scale-up (African Union Commission & UN Women, 2015; Smith, Ameh, Roos, et al., 2017; WHO, 2016b). Maternal Death Surveillance and Response is less likely to be sustainable when dependent on external

funding (Congo et al., 2017; Om’Iniaboys et al., 2017). Where resources are low, response implementation and community-level MDSR are the most affected (African Union Commission & UN Women, 2015; Agaro et al., 2016; Nyamtema et al., 2011; WHO, 2016b). In some settings, MDSR implementation is sustained through public-private partnerships, support from professional organizations, communities, and civil society (Smith, Ameh, Roos, et al., 2017; Subha Sri & Khanna, 2014). In other settings, health workers have utilized their personal resources to complete MDSR tasks (Agaro et al., 2016).

Health workforce and health service delivery. The health workforce is integral for successful MDSR operations as both implementers and users of MDSR-generated information (Kerber et al., 2015). Health workforce-related factors that influence MDSR implementation include: 1) staff shortages; 2) heavy workload and burnout; 3) high staff turnover and poor handover; and 4) poor knowledge, skills, and attitudes related to MDSR (Agaro et al., 2016; Ajayi et al., 2017; Armstrong et al., 2014; Hofman & Mohammed, 2014; Om’Iniaboys et al., 2017; van Hamersveld et al., 2012; Williams et al., 2017). The limited knowledge of MDSR processes, guidelines, and operational definitions is still common among health workers, leading to ineffective MDSR implementation (Mutsigiri-Murewanhema et al., 2017; Smith, Ameh, Roos, et al., 2017). Understaffing, heavy workload, and competing priorities lead to frequent absences, cancellations, and postponements of MDR sessions, and consequently, the accumulation of cases for review (Agaro et al., 2016; Armstrong et al., 2014; Hofman & Mohammed, 2014; Kongnyuy et al., 2009). Integrating MDSR into job descriptions promotes accountability, participation, and routine implementation (Kerber et al., 2015). Maternal

Death Review meetings in Ghana and Indonesia took nearly 10% (3.5 hours per case) of a full-time work week (Hussein et al., 2009). However, high staff turnover disrupts MDSR operations, depletes resources (e.g. trainings), and compromises MDSR quality, continuity, and sustainability (Abebe et al., 2017; Hofman & Mohammed, 2014; Kongnyuy et al., 2009; Nyamtema et al., 2011).

Quality of documentation and record keeping. Poor data quality is one of the major technical challenges in implementing MDSR in LMICs (Ajayi et al., 2017; Kongnyuy et al., 2009). The following common errors compromise data quality in LMICs (Kongnyuy et al., 2009): 1) omission errors; 2) transcription errors; 3) interpretation errors; 4) errors of tallying and reporting; and 5) errors related to poor record keeping or file storage. Poor documentation and record keeping are major obstacles for data extraction, collection, and effective reviews (Ajayi et al., 2017; Dumont et al., 2009; Hofman & Mohammed, 2014; Hussein et al., 2009; Smith, Ameh, et al., 2017b). Incomplete or missing medical records, hospital registers, ANC records, and referral notes challenge the identification of maternal deaths (Ajayi et al., 2017; Hussein et al., 2009; Smith, Ameh, et al., 2017b). In Zimbabwe, MDSR stakeholders at district and provincial levels lacked trust in the quality of data obtained from health facilities (Om'Iniabohs et al., 2017). Hussein et al. (2009) argue that the unavailability of quality information, while a significant barrier to MDSR, should not deter teams from conducting MDRs. They recommend that teams devise context-specific strategies to proceed with the available data, since MDR/MDSR will eventually improve data quality (Hussein et al., 2009; Kongnyuy et al., 2009).

Socio-cultural factors. A few studies have found that cultural and religious beliefs and practices influence MDSR. For instance, in two states in India, women's low social status impeded efforts to notify maternal deaths, increase the visibility of maternal deaths, and mobilize communities to address mortality (Kalter, Mohan, et al., 2011). However, these issues were addressed by involving local NGOs in community sensitization on maternal health issues and on the importance of MDSR (Kalter, Mohan, et al., 2011). In Zimbabwe, maternal deaths were underreported among members of religious groups that discouraged health care seeking (Mutsigiri-Murewanhema et al., 2017; Tapesana et al., 2017). More specifically, religious beliefs of the Apostolic faith were cited as the main obstacle to MDSR given lower utilization of maternal health services and low reporting of community-based maternal deaths among members of this faith (Mutsigiri-Murewanhema et al., 2017). In Malawi, the seven-day mourning period delays maternal death notification and verbal autopsies (Konopka, n.d.).

Global Status and Gaps in MDSR Implementation

While countries are increasingly adopting MDSR, gaps remain in its full implementation (African Union Commission & UN Women, 2015; Hulton et al., 2014; WHO, 2016b). In 2015, the WHO and the UNFPA initiated a global survey to monitor progress in MDSR, with a total of 67 participating countries, including 64 LMICs and 3 high-income countries (WHO, 2016b). Significant gaps were observed between policy commitment towards MDSR and actual MDSR implementation in over half of the countries (Kerber et al., 2015; WHO, 2016b). For instance, 89% of countries had a national policy to notify and 88% to review all maternal deaths, however, only 48% had a national MDR committee that meets at least bi-annually and 67% a subnational MDR

committee (WHO, 2016b). National MDR committees are absent in large parts of northern and central Africa (WHO, 2016b). While several African countries have achieved full progress in MDSR implementation (e.g. Ethiopia, Tanzania, Kenya, Rwanda, Nigeria, South Africa, Botswana, Zimbabwe, Malawi), many have made only partial progress (Abebe et al., 2017; Scott & Dairo, 2015; Smith, Ameh, et al., 2017b; WHO, 2016b). For instance, MDSR has not been scaled up nationally in the DRC. The DRC has national policies to notify and review all maternal deaths and subnational MDR committees but has not established a national MDR committee (WHO, 2016b).

In addition, many are yet to fully transition from MDR to the more comprehensive MDSR (Smith, Ameh, Roos, et al., 2017). Where established, MDSR is largely in its early phases and yet to be institutionalized and scaled-up given several resource, leadership, and technical barriers (Kerber et al., 2015; Lewis, 2014b; Mathai et al., 2015; Scott & Dairo, 2015; Scott & Danel, 2016; Smith, Ameh, Roos, et al., 2017). Substantial progress has been made on the early phases of the MDSR cycle (notification-review), however, the implementation of the later phases (aggregate analysis, response, dissemination) lags behind (Bandali et al., 2016; Mathai et al., 2015; WHO, 2016b). The know-do gap remains a reality for many who fail to act on key recommendations (response phase), due to limited resources, poorly designed action plans (e.g. lacking indicators, timelines, or point persons), or lack of accountability (Moodley et al., 2014; Scott & Dairo, 2015; Smith, Ameh, Roos, et al., 2017; Williams et al., 2017; WHO, 2016b). Similarly, structured mechanisms for disseminating MDSR findings to various stakeholders have not been widely established, with only 26 of 62 countries issuing annual MDSR reports at national and subnational levels (Bandali et al., 2016; WHO,

2016b). Additionally, there are gaps in the systematic identification and review of maternal deaths in communities and private facilities (Abouchadi et al., 2013; Om’Iniabohs et al., 2017; Scott & Dairo, 2015; Williams et al., 2017). Community and civil society engagement in MDSR remain suboptimal; only 23 out of 67 countries in WHO’s (2016b) baseline survey had policies for community engagement in subnational MDSR. In the absence of community engagement, MDSR processes often focus on health system factors and fail to capture the social determinants (African Union Commission & UN Women, 2015).

Addressing Gaps in the Literature: Evaluating MDSR

While MDSR is increasingly being implemented, there is a dearth of published studies on its outcomes and implementation experiences in developing countries (Abouchadi et al., 2013; Mathai et al., 2015; Smith, Ameh, Roos, et al., 2017). More specifically, transition experiences from MDR to MDSR; enablers and barriers to full MDSR implementation or scale-up; and the implementation of the “response” component remain understudied (Kongnyuy & van den Broek, 2009; Mathai et al., 2015; Smith, Ameh, Roos, et al., 2017). There are limited reports of socio-cultural factors influencing MDR/MDSR implementation. In addition, there is a paucity of published studies on MDSR’s costs and cost-effectiveness and on optimal models for MDSR implementation in low-resource settings (Kerber et al., 2015). The impacts and performance of MDSR systems have not been adequately documented in the literature (Abouchadi et al., 2013; Evidence for Action, n.d.; Kerber et al., 2015; Lewis, 2014a). Research is limited in SSA, where maternal mortality and information needs are greatest, and particularly at local levels (e.g. districts)—the starting point for MDSR implementation (Lewis, 2014a).

Evidence on MDSR is even more limited in fragile or conflict settings. The scarcity of published studies on MDSR outcomes is largely attributable to the following:

1. MDSR's recent origins (WHO, 2016b);
2. Technical challenges in evaluating MDSR outcomes due to its complexity (Dumont et al., 2006; Smith, Ameh, Roos, et al., 2017);
3. Limited capacity (technical, resources) to conduct studies that can examine direct causative links (Abouchadi et al., 2013; van den Akker et al., 2011);
4. Inconsistent or limited documentation, follow-up, and reporting of MDSR-generated actions and impacts (Bandali et al., 2016; Lewis, 2014a, 2014b);
5. Difficulty obtaining statistically significant results with small sample sizes at subnational levels where immediate changes occur, because maternal mortality is a statistically rare event (Lewis, 2014a, 2014b; Mir et al., 2015);
6. Facility-based MDRs are part of routine clinical practices and not specifically documented for research or publication purposes (Dumont et al., 2009);
7. Limited time, resources, and capacity for health professionals to produce articles meeting the standards of peer-reviewed journals (Lewis, 2014a, 2014b)

Researchers have questioned the effectiveness and utility of MDSR due to the dearth of research on its outcomes (Koblinsky, 2017; Lewis, 2014a). In particular, Koblinsky (2017) discourages investment in MDSR given its resource demands/requirements, complexity, and limited evidence regarding its impacts and rather suggests investing in “known” interventions to address high maternal mortality. This argument largely ignores the recent origins of MDSR, the time required to establish full

MDSR, the complexity and diversity of country contexts, and the multifactorial nature of maternal mortality itself (Adegoke & van den Broek, 2009; Campbell & Graham, 2006; Smith, Ameh, et al., 2017a). With 830 women dying every day and many others left unaccounted for, it is a “retrograde step” to abandon MDSR on the grounds of limited evidence on its statistical impacts (Lewis, 2014b, p. 20; Smith, Ameh, et al., 2017a; Walshe & Freeman, 2002), when concrete and promising results are being reported in the emerging literature. As with any innovative health intervention or program, it will take time for countries to institutionalize MDSR depending on need and context. In light of strong global support for MDSR and its promising results thus far, the question should not be whether or not to implement MDSR, but rather how to ensure its optimal functioning in low-resource settings so that all maternal deaths are systematically captured, counted, reviewed, and acted upon (Kerber et al., 2015).

In recognition of MDSR’s promising contribution to ending preventable maternal deaths, scholars and practitioners have issued calls for further research and evaluation of country-level MDSR implementation to identify enablers, barriers, best practices, and opportunities to scale-up and institutionalize MDSR (Bandali et al., 2016; Kalter, Mohan, et al., 2011; Kongnyuy & van den Broek, 2009; Lewis, 2014a). Documenting country-level experiences will inform context-specific MDSR strengthening strategies, while converging evidence from diverse settings will enable the identification of cross-cutting issues and best practices, construction of theoretical frameworks, and strengthening of the generic MDSR model. The MDSR guide explicitly highlights the importance of assessments, routine monitoring, and periodic evaluation (M&E) in ensuring the timeliness, quality, efficiency, effectiveness, and sustainability of the system (WHO,

2013). An assessment of the current status of MDSR components, coverage, data quality, resources, and usefulness is recommended as a starting point for fully establishing or scaling-up MDSR coverage (WHO, 2013). The failure to meet MDSR targets and reports of persistently high MMR in the coverage area should trigger a comprehensive evaluation of the MDSR system (WHO, 2013).

The CDC recommends that evaluations of surveillance systems comprise the following (Baker & Fidler, 2006; German et al., 2001): 1) description of the system's objectives, components, processes, and resources; and 2) assessment of the system's key attributes such as simplicity, flexibility, acceptability, data quality, timeliness, stability, and usefulness, also highlighted in the MDSR Guide (WHO, 2013). *Simplicity* refers to the ease of implementing the surveillance system, considering its processes and structural inputs (German et al., 2001; Groseclose & Buckeridge, 2017). *Flexibility* is the system's ability to adapt to changing information needs and operation landscape with minimal additional resources (German et al., 2001; Groseclose & Buckeridge, 2017). *Acceptability* is manifested by stakeholder's willingness to participate in the surveillance system. *Data quality* refers to the completeness and validity of the data generated by the system. *Timeliness* denotes the time taken to complete each function against recommended standards. *Stability* refers to the consistent operation of the system with minimal interruptions (German et al., 2001; Groseclose & Buckeridge, 2017). Lastly, a system's *usefulness* refers to its contribution to understanding the public health issue under surveillance, addressing the issue, and informing evaluation (German et al., 2001; Groseclose & Buckeridge, 2017). German et al. (2001) define additional attributes.

The majority of studies on MDRs and MDSR make no reference to a specific evaluation, theoretical, nor conceptual framework. The MDSR technical guide itself suggests a rather broad/basic M&E framework (WHO, 2013), indicating the need for a more comprehensive framework. While several generic M&E frameworks for PHS exist, many generally fail to include detailed assessments of stakeholder perceptions (Calba et al., 2015; Drewe, Hoinville, Cook, Floyd, & Stark, 2012) and the influence of the external environment on PHS, resulting in narrow assessments and understanding of the pathways through which external/contextual factors affect surveillance (Calba et al., 2015; Drewe et al., 2012; Groseclose & Buckeridge, 2017). On this note, the conceptual framework for this dissertation is discussed.

The Conceptual Framework

A conceptual framework is a graphic representation or a narrative of a set of ideas, concepts, or variables, and relationships explored in a study (Miles & Huberman, 1994; Reichel & Ramey, 1987). Maxwell (2009) asserts that a conceptual framework is not “ready-made”, it is rather built by incorporating elements from theories and research, experiential knowledge, thought experiments, and pilot/exploratory studies. It guides the formulation of research questions and informs decisions on study methodology (Calba et al., 2015). The conceptual framework for this study is intended to guide the comprehensive assessment of MDSR in eastern DRC, including current MDSR processes, enablers and barriers, strengths, weaknesses, and opportunities for improvement. It assembles critical elements from PHS evaluation frameworks and the MDSR literature, drawing substantially from German et al. (2001); WHO (2006); Donabedian (1988); and Zaharatos et al. (2017). It outlines relationships between key

MDSR-related concepts, situating them within a broad context. These concepts are classified within the following dimensions: *MDSR structure* (inputs and resources), *MDSR process* (core functions), *MDSR quality* (e.g. simplicity, acceptability, etc.), *MDSR outcomes* (short-term, intermediate, long-term), and the *macro context*.

The proposed model situates MDSR within a context characterized by complex interactions between multiple factors internal and external to the system (Figure 4). This model stipulates that MDSR structure, process, quality/attributes, and outcomes are interdependent and are influenced by multiple social, economic, political, and organizational factors. Elements within this model both influence and are influenced by each other through multiple pathways. Assessing or evaluating MDSR will require examining elements within each of the above dimensions including their complex and dynamic interrelationships. This framework offers an opportunity to systematically capture critical MDSR components and the pathways through which contextual factors influence overall MDSR performance. In its current form, this conceptual framework does not fully capture the complexities surrounding MDSR but rather serves as a baseline tool that should be refined as more evidence is generated on MDSR.

Contextual factors influencing MDSR performance. The macro-context constitutes the socio-cultural, economic, structural, health system, and political environment exerting direct or indirect influence on MDSR structure, processes, and outcomes. These factors operate at multiple levels of influence and are interdependent and mutually reinforcing. Evaluations of MDSR should systematically investigate contextual factors and their interactions with MDSR processes.

MDSR structure. The *structure* of the MDSR system reflects the critical inputs required to establish and implement MDSR. Elements within this dimension include: MDSR policies and legislation (notification and review), presence of MDR committees (at national, district, or facility-levels), organizational resources (financial, human, and material), training and supportive supervision, partnerships, and MDSR implementation protocols/guidelines (Handler, Issel, & Turnock, 2001; WHO, 2006). This dimension is affected by elements within the macro-context such as economic policies, health financing, government structure, and political will (WHO, 2013, 2016b).

MDSR Process. The MDSR process refers to the continuous action-cycle comprising the following steps or core functions: 1) identification and notification of maternal deaths, 2) review of maternal deaths, 3) analysis and recommendations, and 4) response and monitoring of response. Given an enabling operating environment and structure, these components collectively generate actionable information and translate this information into concrete actions to prevent future maternal deaths (WHO, 2013, 2016b). The MDSR guide recommends a detailed assessment of the current status of the above components in terms of presence, coverage, quality of implementation, and outputs (e.g. data, reports, action plans, actions) to identify gaps and opportunities for improvement (WHO, 2013).

MDSR Quality/Attributes: The quality of the MDSR system is defined by the CDC's proposed attributes of surveillance systems such as acceptability, timeliness, data quality, simplicity, stability, and usefulness (German et al., 2001; WHO, 2006). These attributes should be assessed to inform system strengthening.

MDSR Outcomes. MDSR system *outcomes are short-term, intermediate, and long-term* changes that result from the synergistic effects of the MDSR structure, processes, quality, and the macro-context. Depending on the context, these changes can take various forms spanning from individual-level to country-level changes in maternal health outcomes, practices, and policies, with an ultimate goal of eliminating preventable maternal deaths. These MDSR outcomes are indicators of efficiency and effectiveness and should be evaluated in light of the system's goals and objectives, where established.

Figure 4. The conceptual framework for assessing Maternal Death Surveillance and Response implementation in Goma Health Zone, Democratic Republic of Congo

Guided by this conceptual model, this dissertation aimed to answer the following research questions:

1. How is MDSR structured and implemented in Goma HZ?
2. How well does the MDSR system in Goma HZ meet the CDC's attributes of a surveillance system?
3. How has MDSR impacted practice, policy, and maternal health in Goma HZ?
4. What factors influence MDSR implementation in Goma HZ?
5. What are the recommendations to strengthen Goma HZ's MDSR system?

CHAPTER III

METHODOLOGY

Overview of the Chapter

This chapter presents the research methodology that was utilized to address the research questions for this study. This chapter comprises 11 sections, beginning with an overview of the study setting. The social constructivist paradigm underpinning this study is described, followed by a discussion of the study design (qualitative case study). Next, the following aspects of the research methodology are presented: study participants, data collection, instrumentation and evaluation measures, data management, data analysis, and ethical considerations. The chapter concludes with a discussion of my positionality in relation to the study followed by measures to ensure the trustworthiness of findings.

Study setting

Goma HZ is an urban health district located in Goma, the capital city of North Kivu, eastern DRC. This HZ spans a total surface area of 33.4 km² and is home to 267 947 residents and nearly 40 000 households (ECZS Goma, 2015, 2016, 2018). Its population is majority female (51%), and young (48% under 15 years old), with WRA comprising 23% of the population in 2016. Goma HZ is culturally and linguistically diverse; Swahili and French are commonly spoken (ECZS Goma, 2015, 2016, 2018).

Health System and Service Delivery in Goma Health Zone

Goma HZ is subdivided into 10 health areas. The Chief Medical Officer, who heads the central office of Goma HZ, oversees all medical and public health activities

within the HZ. Goma HZ's network of integrated health facilities comprises four hospitals (one private and three faith-based), 10 health centers, two private medical centers, and collectively, 16 maternity units (ECZS Goma, 2015, 2016, 2018). Integrated health facilities are government, religious, or private not-for-profit health facilities that are subject to agreements with the government and are therefore under the authority of the Central Office of the HZ (Stasse et al., 2015). In addition, Goma has an estimated 77 non-integrated private health facilities (ECZS Goma, 2018). The health workforce in Goma HZ includes nurses (n=257; 42.5% of health workforce), physicians (n=78; 19.5%), laboratory technicians (n=30; 7.5%), and CHWs (n=400) (ECZS Goma, 2018). Nutritionists, pharmacists, dentists, physician specialists, and radiology technicians represent 0.3 to 0.6% of the workforce. Health data from integrated health facilities are compiled and entered by the HZ into the NHIS (ECZS Goma, 2018).

Maternal Health Profile of Goma Health Zone

North Kivu, where Goma HZ is located, has been the epicenter of armed conflict and political instability for over 20 years (Alberti et al., 2010; Kaboru et al., 2013; Kalisya et al., 2015; Wood & Richardson, 2013). Recurrent conflict coupled with other structural factors (e.g. poor governance), have adversely impacted health service delivery and maternal health (Kaboru et al., 2013; Wood & Richardson, 2013). For instance, facility-based MMR in Goma HZ is 138.4 per 100 000 livebirths, far short of the local target of reducing MMR to 25 per 100 000 livebirths. Additionally, ANC (four visits) and PNC utilization remain suboptimal at 64.9% and 66.5%, respectively (ECZS Goma, 2018).

Rationale for Selection of Goma Health Zone

Maternal mortality is a priority public health issue in Goma HZ, despite an increase in health facility deliveries (100%) and those attended by SBAs (70.2%) (ECZS Goma, 2015, 2016, 2018). Local authorities have expressed the need to identify the determinants of persistently high maternal mortality in Goma HZ (ECZS Goma, 2015, 2016, 2018). The Goma HZ progress reports list *maternal death audits* among activities conducted within the HZ (ECZS Goma, 2015, 2016, 2018). However, the same reports have also suggested suboptimal MDSR implementation, reporting limitations in data collection, analysis, follow-up of recommendations, and dissemination of audit findings (ECZS Goma, 2015, 2016, 2018). Prior to this study, there was limited information on how MDSR was structured and implemented in the HZ, what factors influenced its implementation, and whether it was affecting local practices, policies, and maternal health. Examining MDSR in Goma was intrinsically interesting and potentially instrumental for understanding how this system functions and can be improved in a context characterized by competing socio-economic, humanitarian, and political priorities; resource limitations; cultural diversity; and multiple development partners. Given its strategic location within the provincial capital of North Kivu, successful MDSR implementation in Goma can be used as a model for scaling-up MDSR within the province. The above-mentioned factors inspired this systematic, in-depth assessment of MDSR in Goma HZ.

Philosophical Assumptions and Interpretive Framework

The methodological approach for this study is grounded in the social constructivist worldview, which is premised on the notion that reality or meaning is socially, culturally, and historically constructed (Creswell, 2013). This worldview suggests a multiplicity of realities and interpretations rather than a single, observable reality—that is, individuals perceive, understand, experience, and attribute meanings differently (Merriam, 2009; Salazar, Crosby, & DiClemente, 2015). Using the social constructivist lens, this study attempted to capture diverse perceptions and experiences related to MDSR in Goma HZ by purposefully recruiting stakeholders with varying roles and responsibilities (Creswell, 2013). Social constructivism stipulates that “researchers do not ‘find’ knowledge, they construct it” (Merriam, 2009, pp. 8-9). This view supports a transactional and naturalistic method of inquiry, in which the researcher and participants co-create knowledge through direct interactions within their natural setting (Baxter & Jack, 2008; Creswell, 2013). The social constructivist paradigm supports a qualitative mode of inquiry which enables an in-depth exploration of meanings and lived experiences (Salazar et al., 2015). Researchers espousing a social constructivist worldview ask open-ended questions, listen carefully, observe closely, and interpret the findings based on participants’ experiences (Creswell, 2013). Additionally, social constructivism places the researcher and participants within a broad socio-cultural, historical, and political context that shapes their perceptions and experiences, thus, the study findings (Creswell, 2013; Merriam, 2009).

Research Design

A qualitative case study design was utilized to assess the current state of MDSR implementation and stakeholder experiences in Goma HZ.

Qualitative Research

A qualitative research design was deemed appropriate for this study given the lack of prior research on MDSR in Goma HZ and the complexity of the MDSR process itself, thus the need for an exploratory design that captures MDSR implementation and its dynamic interactions with various contextual factors. Qualitative research is focused on generating a deep understanding of participants' experiences, the meanings they ascribe to these experiences, and to uncover complex processes related to a phenomenon (Creswell, 2013; Merriam, 2009; Salazar et al., 2015). This design provided an opportunity to capture perspectives of multiple stakeholders involved at different levels of MDSR implementation in Goma HZ, enabling a holistic and multifaceted understanding of the MDSR structure, process, outcomes, context, and experiences. By situating the study within the natural socio-cultural and political context (Creswell, 2013; Denzin & Lincoln, 2011; Merriam, 2009), a qualitative design shed light on contextual factors influencing MDSR.

In qualitative inquiry, the researcher is the primary instrument for data collection and analysis (Creswell, 2013; Merriam, 2009), which is useful when investigating a complex and dynamic process such as MDSR. Merriam (2009) argues that the human instrument is able to: 1) respond and adapt immediately, 2) capture nonverbal and verbal communication, 3) process information immediately, 4) clarify and summarize materials, 5) check with respondents for accuracy of interpretation, and 6) explore unusual or

unanticipated responses. As with any form of research, researchers come with their own biases, worldviews, and experiences (Salazar et al., 2015). Qualitative researchers explicitly position themselves (positionality) in relation to the research, bringing their potential biases to consciousness in a written statement that discusses how their background potentially influences their findings (Creswell, 2013; Salazar et al., 2015). Creswell (2013) identifies the following approaches in qualitative inquiry: phenomenology, ethnography, grounded theory, narrative research, and case study research. This study will employ a case study approach.

Case Study Research

The case study research design was deemed appropriate for this study as it met the following conditions for a case study established by Yin (2003): 1) the study's focus was to answer "how", "why"; 2) participants' behaviors could not be manipulated; and 3) the study sought to explore contextual factors influencing the case. There are conflicting epistemologies or paradigms underpinning case study research, in which some prominent seminal authors such as Yin (2003) and Flyvbjerg (2006) have been viewed as espousing post-positivist worldviews, while others such as Merriam (2009) and Stake (1995) express constructivist or interpretivist paradigms (Baxter & Jack, 2008; Hyett, Kenny, & Dickson-Swift, 2014). This dissertation employed a qualitative case study with a constructivist underpinning.

A qualitative case study involves an in-depth investigation of a bounded system (a case) or multiple bounded systems (cases) drawing from multiple data sources (Creswell, 2013). The *case or* unit of analysis in a case study can be an individual, group, organization, community, event, program, policy, or process often bounded by time,

place, or event (Creswell, 2013; Merriam, 2009). The case/bounded system for this dissertation is MDSR in Goma HZ. By specifically asking “how”, “why”, and “what” questions, a case study enables a thorough investigation of complex issues within their natural contexts, capturing dynamic interactions between the case(s) and contextual factors (Baxter & Jack, 2008; Creswell, 2013; Crowe et al., 2011). This approach can generate powerful insights into public health programs, theories, policies, and interventions within their real-life context (Baxter & Jack, 2008; Crowe et al., 2011).

Yin (2003) categorizes case studies as explanatory, exploratory, descriptive, or a combination. Regardless of the purpose, good case study research should provide a detailed description of the case, an account of key themes or issues identified during the investigation, and conclusions or lessons learned from the study (Creswell, 2013). This study adopted both descriptive and exploratory approaches, as it sought to provide a detailed description of current MDSR processes, while gaining deeper insights into internal and external factors influencing MDSR performance. Additionally, case studies can involve a single case or multiple cases (Creswell, 2013). Stake (1995) identified three types of case studies: instrumental, intrinsic, and collective. Intrinsic and instrumental case studies involve single cases, while collective case studies involve multiple cases. In an intrinsic case study, the particular case itself is of primary interest to the investigation given its unique or unusual features (Stake, 1995). An instrumental case study examines a specific case to gain insights into a broader issue of interest (Stake, 1995). A collective case study examines multiple cases sequentially or simultaneously to gain insights into a broader issue (Creswell, 2013; Crowe et al., 2011; Stake, 1995). This study combined elements of both intrinsic and instrumental case studies. As a novel surveillance and

quality improvement tool for maternal health, MDSR in resource-limited and conflict or post-conflict contexts was intrinsically interesting to the researcher and the maternal health community. By shedding light on challenges and successes of MDSR in Goma HZ, this case study may be instrumental in illuminating the challenges in similar settings and in informing further research and MDSR scale-up efforts in the DRC.

Study Participants

Participant recruitment was conducted using purposive sampling. This sampling technique entails strategically selecting participants on the basis of their potential contribution to a holistic and rich understanding of the phenomenon being investigated (Merriam, 2009; Patton, 2002). Sampling consisted of two phases: selection of study sites and of participants.

Selection of Study Sites and Participants

The central office of Goma HZ and health care facilities that were implementing MDSR were purposively selected as study sites. All eligible health facilities were identified with assistance from Goma HZ's central office.

To uncover diverse perspectives and experiences in relation to MDSR, stakeholders were purposively recruited from these sites on the basis of their involvement with different aspects of MDSR. Participants therefore included current or previous MDSR implementers, decision-makers, and end-users (Salabarría-Peña et al., 2007). More specifically, the study participants consisted of MDSR point/focal persons at the provincial, HZ, and facility levels, and members of MDR review teams at the HZ and facility levels. These individuals served as key informants (KIs) for the study. Key

informants have special and extensive knowledge regarding a phenomenon of interest given their positions, experience, and involvement in a program (Payne & Payne, 2004).

Inclusion and exclusion criteria. Participants were eligible to take part in this study if they were: 1) adult (18 years and older); 2) French- or English-speaking; 3) able to give consent; and 4) currently or previously involved in oversight, implementation, and utilization of MDR/MDSR in Goma HZ. Those excluded were individuals who did not have any past or present involvement in any aspect of MDR/ MDSR in Goma HZ, who were under 18 years old, unable to speak French or English, and unwilling to give consent.

Sample size. Qualitative research is less focused on the sample size (breadth) and more concerned about the richness and depth of information collected (Merriam, 2009; Patton, 2002, p. 245). As such, participants were sampled until data saturation was achieved, where subsequent interviews no longer produced new insights or patterns and where relationships between categories had been established (Charmaz, 2014; Green & Thorogood, 2018). This study aimed to gain a deep understanding of MDSR and related experiences in Goma HZ with no intent of generalizing findings. A total of 15 KIs were purposively recruited for the study.

Recruitment process. Participant recruitment was conducted between December 7 and 24, 2018, simultaneously with data collection and analysis. Participants were identified through: 1) existing contacts within Goma HZ's central office, the North Kivu Provincial Division of Health (PDH), and the Université Libre des Pays des Grands Lacs (ULPGL)-Goma; 2) face-to-face outreach to eligible health care facilities; and 3) snowball sampling, where study participants identified others involved in MDSR.

Contact was initiated with all potential participants in person, by phone, or by email to assess their interest to participate in the study. To enable informed decision-making, potential participants were informed about the research study, its voluntary nature, confidentiality, rights to terminate participation at any time without consequences, and audio-recording of interviews (see recruitment script in Appendix B). Participants were selected based on their availability and willingness to participate in the study. Those expressing an interest were screened to ensure that they met the inclusion criteria. The researcher and participants who agreed to take part identified a mutually acceptable interview date, time, and location that ensured convenience, privacy, and safety. Some participants' names and telephone numbers were collected for recruitment and data collection purposes. Each participant was assigned a unique non-identifying ID. A master list linking participants to their assigned ID was stored in a password-protected Excel spreadsheet, separate from other research outputs (see ethical considerations).

Data Collection Procedures

Data collection for this study occurred between December 7, 2018 and December 24, 2018. Data collection in qualitative research is a systematic and iterative process that involves asking, listening, observing, and reviewing to gain insights into a phenomenon of interest (Merriam, 2009). Merriam (2009, pp. 85-86) asserts that data are not waiting to be collected, they are rather “noticed by the researcher, and treated as data” to achieve the purpose of the research. Rather than numerical data, qualitative data take the form of :

- 1) direct quotations of people's experiences, opinions, feelings, and knowledge, as elicited in interviews;
- 2) detailed descriptions of people's activities, behaviors, and actions from observations; and
- 3) excerpts or texts from documents (Patton, 2002, p. 4).

A key strength of case study research lies in its ability to triangulate data by drawing from a variety of data sources (Baxter & Jack, 2008; Crowe et al., 2011; Yin, 2003). Data triangulation is one way of validating the accuracy and credibility of study findings (Baxter & Jack, 2008; Creswell, 2013). Converging evidence from multiple sources enables a coherent understanding of the case and its context, as illustrated in the following statement by Baxter and Jack (2008, p. 554): “each data source is one piece of the ‘puzzle,’ with each piece contributing to the researcher’s understanding of the whole phenomenon.” Yin (2003) identified the following six data sources for case study research: documents, archival records, interviews, physical artifacts, and observations. Case studies also offer the opportunity to incorporate data from quantitative surveys (Baxter & Jack, 2008). This study drew from three sources of data: 1) semi-structured KI interviews with MDSR stakeholders, 2) reviews of relevant MDSR documents, and 3) a direct observation of an MDR session.

Semi-structured Key Informant Interviews

In-depth interviews were conducted with KIs involved in MDSR at provincial, HZ, facility, and community levels in Goma HZ. These interviews served as the primary source of data, supplemented by document reviews and an observation. The rationale for selecting interviews as the primary data collection method was linked to this study’s aim of gaining a rich, holistic understanding of MDSR in Goma, as primarily perceived and experienced by key stakeholders. Qualitative interviewing is an interactive and research-oriented conversation between a researcher and participants (Kvale & Brinkmann, 2015; Mason, 2006; Merriam, 2009), in which the researcher poses questions to understand participants’ perspectives, experiences, and meanings (Kvale, 1996). During the

interview, the researcher and the participant co-create knowledge by reconstructing behaviors, experiences, feelings, knowledge, and opinions that cannot be observed (Dicicco-Bloom & Crabtree, 2006; Merriam, 2009; Patton, 2002).

Interviews can take three major forms: structured (strictly adhering to predetermined questions), semi-structured (flexible, open-ended questions), and unstructured (no predetermined questions) (Creswell, 2013; Merriam, 2009; Salazar et al., 2015). This study employed semi-structured individual interviews, as this format enables participants to elaborate extensively on their experiences and perceptions while offering the flexibility to explore emerging questions related to the topic (Merriam, 2009; Salazar et al., 2015). Semi-structured interviews are suitable for exploratory studies or when there is a dearth of information on the topic being studied (Merriam, 2009; Salazar et al., 2015).

The interviews took place in mutually agreed upon settings including the respondent's office or a designated meeting space within a health care or administrative facility. On the day of the interview, I read the preamble consent (Appendix C) in its entirety, reminding them of the purpose of the study, confidentiality, the voluntary nature of participation, their right to withdraw at any time, and the potential risks and benefits of the study. A copy of the preamble consent was given to each respondent for their records. Each respondent's understanding of the consent document was assessed using a series of questions related to its content. Once participants suggested that they had no further questions and wished to continue, they were asked to formally indicate their verbal consent to participate in audio-recorded and confidential interviews. Audio-recording is

useful for data analysis as it generates portable data, preserves an accurate account of participants' experiences, and allows multiple hearings (Merriam, 2009; Nikander, 2008).

After obtaining consent, participants were asked questions related to their socio-demographic profile (e.g. professional qualifications, length of service) and/or health facility characteristics; this segment was not audio-recorded. Participants were notified before initiating the audio-recording so as not to capture any information they did not wish to be recorded. Participants were then interviewed in French for 30 to 60 minutes, using a combination of closed and open-ended questions (Appendices C to E). The interviews explored their knowledge, perceptions, and experiences with MDSR, particularly its history, structural capacity, process/core functions, outcomes, quality attributes (e.g. acceptability, simplicity), influencing factors, and recommendations for improvement. During each interview, I took hand-written notes to capture pertinent points, questions, and ideas. All interviews were transcribed verbatim by the researcher, translated in English by the researcher, and imported into Dedoose™, a qualitative and mixed-methods data management and analysis software (SocioCultural Research Consultants LLC, 2018). One KI, selected based on availability, willingness, and the need for clarification, was re-contacted at a later date to verify aspects of the preliminary analysis—a process known as respondent validation or member checking (Creswell, 2013; Merriam, 2009).

Document Review

Document review denotes a systematic and iterative process of reviewing, evaluating, analyzing, and interpreting documents related to a phenomenon of interest (Bowen, 2009). Documentation (e.g. public records, personal records) are a good source

of data in case study research as they are often easily accessible, less costly to retrieve, less obtrusive or unaltered by the research process, and take less time to collect (Bowen, 2009; Merriam, 2009; Yin, 2009). They provide rich insights when the phenomenon under study cannot be observed or when informants cannot fully recall the details (Bowen, 2009). I conducted document reviews to augment and corroborate evidence from interviews and the observation (Bowen, 2009; Merriam, 2009; Yin, 2009).

The documents provided background and contextual information on MDSR, illuminating changes in local processes and outcomes over time, activities that have been implemented, meeting proceedings and decisions, as well as the structural resources available for its operation (Bowen, 2009; Green & Thorogood, 2018). Additionally, documents shed light on the socio-economic, structural, and political context in which MDSR operates. Documents highlighted elements that warranted further exploration in subsequent interviews or observations (Bowen, 2009; Green & Thorogood, 2018; Merriam, 2009).

I began by systematically identifying and locating documents related to MDSR in Goma between 2015 to 2018, since MDSR policies were established in DRC in 2015 (WHO, n.d.-b). I remained open to discovering all documents that could potentially provide insights related to my research questions (Merriam, 2009). Only relevant and reasonably accessible documents were reviewed (Merriam, 2009). The documents that were requested from KIs are listed in Table 1.

Table 1

Maternal Death Surveillance and Response Documents

Maternal Death Surveillance and Response Documents	
☐ MDR/MDSR Guide/Protocol	☐ Action plan/recommendations

Maternal Death Surveillance and Response Documents	
☐ MDR/MDSR Policies	☐ MDR/MDSR meeting minutes
☐ MDR/MDSR Budget	☐ MDR/MDSR Report
☐ MDR/MDSR notification form	☐ Sample patient chart
☐ MDSR/Reporting Flowchart	☐ Sample death certificate
☐ MDSR History in Goma HZ	☐ Sample antenatal care register
☐ Case summary/data collection form	☐ Sample delivery register
☐ MDR committee worksheets	☐ MDR postnatal register

Additional documents were identified as I interacted with key stakeholders during data collection and field visits. Permission or authorization to access each document was secured from gatekeepers. Once granted, I gathered the documents and determined their relevance. A document review worksheet and a data collection form (Appendix D and E) facilitated preliminary assessments and summaries of each document's content and characteristics. In addition, I obtained copies of relevant documents that did not contain personally identifiable information.

Observation

This study included an observation of an MDR session to supplement data obtained from other sources. Observation in qualitative research is an interactive process in which the researcher uses their senses to explore a phenomenon of interest within its natural setting (Creswell, 2013; Merriam, 2009). It is recommended when the phenomenon under study is observable, participants are unable or unwilling to discuss the issue, or complementary data is needed (Merriam, 2009). Observation permits the researcher to experience firsthand a program's processes, interactions between stakeholders, activities, and the context (Creswell, 2013; Merriam, 2009).

The researcher can assume one of four major roles as an observer: complete participant, complete observer, participant as observer, nonparticipant/observer as participant (Creswell, 2013; Merriam, 2009; Salazar et al., 2015). A *complete participant* is fully integrated and engaged in the activity and conceals their identity as an observer/researcher (Creswell, 2013; Merriam, 2009; Salazar et al., 2015). A *complete observer* observes without being seen or noticed (Creswell, 2013; Salazar et al., 2015). In contrast, the *participant as observer* is actively involved in the activity and discloses his/her identity as an observer. The *nonparticipant/observer as participant* observes as a researcher without being directly involved in the activity. A qualitative researcher may shift roles during observations, as dictated by the study (Creswell, 2013; Merriam, 2009).

I assumed the position of a *nonparticipant/observer as participant*. I contacted MDSR focal persons to determine the dates and locations of ongoing MDSR activities during the data collection period and to seek permission to attend sessions. While I planned to observe multiple sessions to experience different MDSR core functions, only one MDSR activity occurred during the data collection period. This activity consisted of an MDR session conducted within a non-integrated private, secondary health center on December 21, 2018 to review a maternal death that occurred on December 18, 2018. This session was attended by two HZ delegates and the medical staff who attended to the deceased including two nurses, a general practitioner, an OB-GYN, and the hospital administrator. The MDR session concluded with an inspection of the facility by the HZ team to examine the facility's infrastructure. The activities collectively lasted two hours.

The observation was guided by an observation protocol (Appendix F) eliciting information on the physical setting, participants, activities and interactions,

conversations, subtle factors (e.g. unplanned/informal activities, nonverbal cues), and my behavior as a researcher, as set forth by Merriam (2009). During and immediately after the observation, I took detailed reflective and descriptive observation notes to provide a rich and vivid account of the activities observed (Creswell, 2013). Reflective notes captured my personal experience, reactions, and perceptions regarding the MDSR activities observed, while descriptive notes summarized key aspects of the MDSR process, setting, activities, interactions between personnel, and characteristics of stakeholders involved (Creswell, 2013; Merriam, 2009).

Reflective Field Notes

Throughout the study, I took reflective notes capturing my general experiences, observations, reactions, and methodological decisions. I initiated my reflective journaling on May 20, 2018, to capture key questions, decisions, and reflections as I conceptualized this study. The reflective entries augmented other data sources during data analysis and enabled transparency throughout the study.

Instrumentation and Measures

As previously stated, the researcher is the primary data collection and analysis instrument in qualitative research (Creswell, 2013; Merriam, 2009). While I maintained my position as the primary research instrument, I developed and adapted tools to guide and focus the interviews, observations, and document reviews.

Interview Guide

I developed three semi-structured interview guides (MDSR decision-makers, implementers, and end-users), comprising a combination of closed and open-ended questions, to facilitate meaningful and purposeful conversations with participants. These

interview guides were adapted from the Maternal and Child Survival Program's (MCSP) MDSR assessments in Nigeria, Tanzania, Zimbabwe, and Rwanda (Ajayi et al., 2017; Om'Iniabohs et al., 2017; Sunguya, Thapa, Kinney, Lemwayi, & Mwaitenda, 2018; Williams et al., 2017). These guides were also informed in part by the WHO's (2016b) global MDSR baseline survey, the MDSR technical guide (WHO, 2013), and earlier studies on MDSR (Congo et al., 2017; Nyamtema, Urassa, Pembe, Kisanga, & van Roosmalen, 2010).

The interview guides comprised questions within the following categories identified by Merriam (2009): experience and behavior; opinions and values; feelings; knowledge; sensory, and background (socio-demographic). More specifically, the interview guides assessed socio-demographic and health facility characteristics; MDSR's structural inputs; the history of MDSR implementation; the MDSR processes (identification-evaluation); and KIs' overall experiences and perceptions of MDSR including its strengths, limitations, barriers, enablers, outcomes, and recommendations. Questions assessing the MDSR context and its quality attributes are incorporated into the different sections of the interview guides.

The MDSR stakeholders assumed multiple roles as decision-makers, implementers, and end-users. As such, during the actual interviews I utilized the instrument corresponding to their primary role. MDSR decision-makers/focal persons provided more insights on the structure and history of MDSR (Appendix G), while all other KIs provided insights into the core MDSR functions they were involved in, as determined during recruitment (Appendix H). All KIs were asked general questions related to their

involvement in MDSR, its acceptability, usefulness, and influencing factors, drawing from the instrument originally intended for partners and end-users (Appendix I).

Translation and Validation. The interview guides underwent face and content validation, during which subject matter and methodology experts (the dissertation committee) reviewed and provided feedback on the interview questions. The interview guide development and validation was an iterative process consisting of the following phases: 1) review of existing literature on MDSR, particularly in SSA; 2) development of initial interview questions; 3) submission of initial interview guides to the dissertation committee for feedback on content, language, and clarity; 4) revision of interview guides based on committee feedback; 5) translation from French to English and verification of translation quality (see data management and preparation); 6) review of French interview guides by faculty members from ULPGL-Goma for language and local relevance; and 8) refinement of the interview guides based on expert feedback.

MDSR Observation Protocol

An observation protocol was developed to assist in guiding and targeting observations of MDSR activities (Appendix F). The protocol captured reflective and descriptive notes organized under the following categories proposed by Merriam (2009):

1. *Physical setting*: the physical environment in which MDSR activities were conducted, including the materials used during the activity;
2. *Participants*: roles and characteristics of stakeholders involved in the MDSR process being observed, including who was present and who was not;
3. *Activities and interactions*: the sequence and characteristics of the observed process including interactions between different actors;

4. *Conversation*: a summary of the nature of conversations between participants throughout the implementation of the activity;
5. *Subtle factors*: less obvious factors such as unplanned/informal activities, nonverbal cues, what did not happen during the observations;
6. *Researcher's behavior*: the researcher's role, thoughts, and reactions and how the researcher affected the activity.

Document Review Worksheet

The document review worksheet developed for this study (Appendix D) facilitated a preliminary assessment of each document's relevance to the research questions, key characteristics, and content to inform further analysis. More specifically, this guide elicited information on the document's source/author, date created, reasons produced, target audience, and a summary of its content.

Evaluation Measures

Drawing from this study's conceptual framework, the key evaluation measures for this study consisted of the following: 1) MDSR structure; 2) MDSR process; 3) MDSR quality; 4) MDSR outcomes; and 5) contextual factors. In addition, information on specific process indicators related to MDSR were collected for the reference period 2015 to 2018 (Appendix E). Table 2 below depicts the relationship between the evaluation measures, research questions, operational definitions, and data collection methods.

Table 2

Summary of Evaluation Measures, Research Questions, Operational Definitions, and Data Sources

Evaluation Question	Operational definition/description	Data source
MDSR Structure R1: How is MDSR structured and implemented in Goma HZ?	The resources (human, financial, material), policies/legislation, practices, and partnerships required to operate the MDSR system.	<ul style="list-style-type: none"> • Key informant interviews • Document reviews • Direct observations
MDSR Process R1: How is MDSR structured and implemented in Goma HZ?	The continuous action-cycle comprising: 1) identification and notification of maternal deaths, 2) MDR, 3) analysis and recommendations, and 4) response and monitoring of response	<ul style="list-style-type: none"> • Key informant interviews • Document reviews • Direct Observations
MDSR Quality R2: How well does the MDSR system in Goma HZ meet the CDC's attributes of a surveillance system?	The overall quality of the surveillance system and its processes, as defined by the following key attributes (German et al., 2001): <ul style="list-style-type: none"> • <i>Acceptability</i>: Stakeholder's willingness to participate in MDSR. • <i>Simplicity</i>: The ease of implementing MDSR • <i>Data quality</i>: The completeness and reliability of MDSR data • <i>Timeliness</i>: Time intervals/ speed between MDSR functions • <i>Flexibility</i>: The MDSR system's ability to easily adapt to changing operating context • <i>Stability</i>: The MDSR system's ability to function consistently, without failure • <i>Usefulness</i>: The utility/value of the MDSR system and data generated (e.g. informing practice, policy, and research). 	<ul style="list-style-type: none"> • Key informant interviews • Document reviews • Direct Observations
MDSR Outcomes R3: How has MDSR implementation impacted practice, policy, and maternal health in Goma HZ?	Short-term, intermediate, and long-term changes in policy, practice, research, community, and maternal health as a result of MDSR.	<ul style="list-style-type: none"> • Key informant interviews • Document reviews

Evaluation Question	Operational definition/description	Data source
Contextual Factors R4: What factors influence MDSR implementation in Goma?	The socio-cultural, economic, structural, and political environment that exert direct or indirect influence on MDSR structure, processes, quality, and outcomes, thus enabling or hindering effective MDSR implementation and performance.	<ul style="list-style-type: none"> • Key informant interviews • Document reviews • Direct Observations
MDSR Process Indicators (2015-2018) R1: How is MDSR structured and implemented in Goma HZ? R2: How well does the MDSR system in Goma HZ meet the CDC's attributes of a surveillance system?	<ul style="list-style-type: none"> • Presence of an MDR committee • Number of maternal deaths identified • Number of maternal deaths notified • Number of maternal deaths reviewed • Number of MDR meetings • Number of reviews that included community members • Number of community-based MDRs • Number of reviews that included recommendations • Proportion of committee recommendations implemented (WHO, 2013) 	<ul style="list-style-type: none"> • Key informant interviews • Document reviews

Data preparation and management

Transcription, Verification, De-identification

The transcription of audio-recorded interviews is an interpretive process that translates verbal interactions between researchers and participants into textual form for analytical purposes (Bailey, 2008; Kvale & Brinkmann, 2015). Transcription is an initial step in data analysis as it 1) involves judgments regarding data interpretation and representation; and 2) permits the investigator to gain intimate familiarity with the data through repeated listening (Bailey, 2008; Kvale & Brinkmann, 2015; Merriam, 2009). Researchers are encouraged to transcribe their own interviews to minimize transcription errors (Kvale & Brinkmann, 2015; Merriam, 2009). I transcribed all the interviews verbatim in Microsoft Word (MS Word), against their original audio-recordings. Transcribing the interviews myself enabled me to combine transcription with the verification process that identifies and corrects discrepancies, misinterpretations, and inaudible passages (Kvale & Brinkmann, 2015; MacLean, Meyer, & Estable, 2004). Ensuring the validity of transcripts enhances the quality of data analysis and study findings (MacLean et al., 2004). Finally, I removed personal identifiers such as names, and specific locations, and replaced them with general descriptions (e.g. local hospital) (Green & Thorogood, 2018).

Translation

Translation from one language to another adds another layer of interpretation and representation to the transcription process (Bailey, 2008; Nikander, 2008) since it involves operating between languages and socio-cultural contexts (Halai, 2007; Torop, 2002). Crystal (1991, p. 346) defines translation as a process in which “the meaning and

expression in one language (source) is tuned with the meaning of another (target) whether the medium is spoken, written or signed.” Given the centrality of interpretation and understanding of meaning in qualitative research (van Nes, Abma, Jonsson, & Deeg, 2010), translation should be carefully considered to minimize the loss of meaning and to enhance the validity of research findings (Halai, 2007; Regmi, Naidoo, & Pilkington, 2010; van Nes et al., 2010). Good translation ideally requires an understanding of the study’s terminology (Piazzoli, 2015), familiarity with the socio-cultural context (Green & Thorogood, 2018; Halai, 2007; Torop, 2002), fluency in both source and target languages (Green & Thorogood, 2018; Halai, 2007), and experience or training in translation (Piazzoli, 2015; Squires, 2009).

For this study, the majority of the interviews were conducted in French (source language) and translated to English (target language) by the researcher and two bilingual faculty members at ULPGL-Goma, who were briefed on the research purpose and terminology (Squires, 2008, 2009). Translations aimed to maintain conceptual equivalence (also known as cultural equivalence) across both languages and socio-cultural contexts (Squires, 2008, 2009). The translation process followed a two-phased approach adapted from Brislin’s (1970) classic model of translation: 1) forward translation of research documents (e.g. interview transcripts, data collection tools) from French to English and 2) verification of original documents against translated versions and corrections of discrepancies (Regmi et al., 2010). These measures generated translations of acceptable quality.

Data Handling, Storage, and Protection

Data management involved a combination of manual and computer-assisted techniques. All hand-written and printed research documents were verified for quality assurance, labeled and classified by content, and kept in sealable envelopes within locked cabinets. The research documents were converted into electronic files as they were collected in order to facilitate sorting, retrieval, and analysis (Merriam, 2009). More specifically, observation notes, reflective notes, and interviews were entered in MS Word, while paper documents were scanned or photographed and uploaded on a computer. Additionally, I transferred audio-recordings to a password-protected computer after each interview and erased them from the recorder. All electronic files were organized in folders on a password-protected computer. All documents to be used in data analysis such as interview transcripts and observation notes were uploaded onto Dedoose™, a qualitative and mixed methods data management software. The research data were processed, organized, stored, and handled in compliance with ethical standards discussed later in this chapter.

Data Analysis

Data analysis is a complex and systematic process of organizing, consolidating, reducing, and interpreting data from interviews, observations, or documents to understand the issue being investigated (Merriam, 2009). In qualitative research, data collection and analysis are interactive, simultaneous, and iterative processes (Charmaz, 2014; Creswell, 2013; Merriam, 2009). Data analysis begins with the first interview, observation, or document review, to enable refinement of data collection approaches and further exploration of emerging ideas (Merriam, 2009). I conducted data analysis

concurrently with data collection to inform subsequent rounds of data collection (Merriam, 2009). Data analysis became more intensive as the study advanced towards the end of data collection, when data saturation was reached (Merriam, 2009).

Data analysis for this study utilized the constant comparative method, an inductive process that involved identifying patterns across the data and developing categories or themes that are grounded in participants' construction of the phenomenon (Bowen, 2009; Charmaz, 2014; Merriam, 2009). This method was first introduced by Glaser and Strauss (1967) for constructing grounded theory but has been widely applied to other qualitative approaches (Merriam, 2009). This method's iterative, comparative, and interactive nature (Charmaz, 2014) enhanced my analytic understanding of perceptions, experiences, actions, and processes in relation to MDSR, while keeping me grounded in the data. Data analysis using this approach began with breaking down raw data into the smallest units (word, line, segment) of information that were relevant and meaningful on their own (known as codes) and labeling them during a process known as coding (Creswell, 2013; Lincoln & Guba, 1985; Merriam, 2009). Charmaz (2014) describes codes as the skeletal framework of the analysis. This inductive process ended with classifying codes into broad categories or themes that reflected recurring patterns across the data (Creswell, 2013; Merriam, 2009).

I specifically adapted the analysis approach outlined by Charmaz (2014) comprising three major phases: 1) an initial phase involving open line-by-line coding; 2) a focused phase that involved re-coding transcripts using the most salient and frequent initial codes; and 3) thematic analysis to identify patterns/themes. This analysis process is

not linear, it is rather an iterative process that requires moving back and forth through the data and making analytic adjustments accordingly (Charmaz, 2014).

I began the initial phase by immersing myself in the data, that is, closely reading and scrutinizing each interview transcript, document, and observation notes to re-experience my interactions with participants and gain deeper understanding of the data (Charmaz, 2014; Creswell, 2013; Merriam, 2009). Next, I performed open line-by-line coding of half of the interview transcripts (7 out of 15) and the observation notes using gerunds or words that reflect action, as recommended by Charmaz (2014). Open coding is particularly useful in the early analysis phase as it enables the researcher to capture all possible data segments that are potentially relevant to the research questions and to discern relationships between the data by making repeated comparisons (Charmaz, 2014; Merriam, 2009). Coding with gerunds (words ending in “-ing”) rather than topics (nouns), also known as process coding (Saldaña, 2009), permits the researcher to remain grounded in participants’ perspectives and to focus on processes in data (what is happening, how, why) rather than narrowly focusing on individuals (Charmaz, 2014; Saldaña, 2009). This process generated a comprehensive list of initial codes converged from the interview transcripts, document reviews, and observations (Appendix J) (Charmaz, 2014; Merriam, 2009).

Next, I engaged in the focused/selective phase. I first examined my initial codes, comparing them with the data and with other codes to assess their meanings and relationships with each other. I combined similar codes into larger conceptual categories and assigned new labels (Bowen, 2009; Charmaz, 2014). The codes/categories were elevated as focused codes (Appendix J) based on their frequency across the data and their

significance or relevance to the research questions (Charmaz, 2014). A codebook containing these focused codes and their respective descriptions was developed and uploaded in Dedoose™. Next, I applied the focused codes to all interview transcripts, documents, and observation notes. In keeping with the constant comparative method, I iteratively compared the focused codes with the data and refined them accordingly by merging them into other codes or creating sub codes (child codes).

Finally, I conducted thematic analysis to identify the major themes in the data (Merriam, 2009). In preparation for this task, the coded transcripts and documents were exported from Dedoose™ into MS Word and formatted as a two-column table (focused codes in one column and corresponding excerpts in another). Next, I carefully examined these focused codes, excerpts, and analytical memos to identify broad patterns (convergent or divergent) of meanings, perceptions, and experiences in relation to the research questions (Patton, 2002). The focused codes were grouped or classified by patterns, forming the study themes (Appendix J). These themes were iteratively reviewed against the data and refined to ensure that they accurately represented participants' perceptions and answered the research questions. Throughout the data analysis, I maintained analytic memos capturing my reflections, questions, tentative patterns, and decisions (Charmaz, 2014; Creswell, 2013; Merriam, 2009).

Additionally, descriptive statistics consisting of frequencies and proportions were generated in MS Excel to summarize information on respondents' socio-demographic characteristics, health facility characteristics, and MDSR process indicators.

Ethical Considerations and Human Subjects Protection Plan

IRB Application

Once approved by the Dissertation Committee on November 2, 2018, the study proposal and supporting documents were submitted for review by the University of Louisville (UofL) IRB (n.d.-a) on November 5, 2018 and to the Ethics Committee (Comité d’Ethique) at the Université Libre des Pays des Grands Lacs–ULPGL (2015) in Goma, DRC on November 7, 2018. This study met both committees’ requirements for expedited review and was approved by the UofL IRB [18.1195] on November 19, 2018 (Appendix K) and the ULPGL Ethics Committee on November 24, 2018 (Appendix L). The study therefore complied with the ethical guidelines established by these two committees.

Consent and Human Subjects Protection

As the researcher who conducted the interviews, accessed identifiable research information, or analyzed data, I had completed all necessary CITI and HIPAA training prior to this study. In compliance with the ethical principle of autonomy, I provided potential participants with general information about the study and its voluntary nature. Participants made informed decisions about whether or not to participate. On the day of the interview, I began by handing out a copy of the preamble consent document (Appendix C) in French and verbally administering this document in its entirety to each respondent. During this process, participants were informed about the following: overview of the study, its voluntary nature, potential risks and benefits, contact persons for complaints about the study, audio-recording of the interview, measures to ensure confidentiality, what participation entails, and how results will be utilized. More importantly, I highlighted the voluntary nature of the study and their right to discontinue

participation anytime for any reason without consequences. I ensured that respondents understood the consent document by asking questions regarding its content, after which, those who agreed to participate were asked to indicate their consent as required by the ethics committees.

Privacy, Confidentiality, and Data Handling

Throughout the research process, several safeguards were established to ensure confidentiality, privacy, and protection of identifiable research information. All interviews were conducted in private and secure locations (e.g. office) negotiated by the participant and the researcher. The Excel spreadsheet containing participants' names/titles, contact information, and uniquely assigned IDs were password-protected and stored on a password-protected computer, separate from other research documents to avoid a breach of confidentiality. Physical and electronic documents (e.g. interview transcripts) contained participants' assigned IDs but did not include any personally identifiable information. Furthermore, all research outputs were de-identified and replaced with general descriptions. Electronic research files were stored and transported on a password-protected computer accessible only to the researcher. Physical documents were stored in sealed envelopes kept in a locked cabinet, accessible only to the researcher. There were no breaches in data security or adverse events of data collection throughout this study, and if any such events occurred, I was aware of the requirement to immediately report to the UofL IRB and ULPGL Ethics Committee. All research outputs will be kept in secure locations for a minimum of 3 years, as required by UofL IRB (n.d.-b), after which paper documents will be shredded and electronic data erased.

Risks/Benefits Assessment

There are no known risks associated with this study. Participants were informed that participation is voluntary and that they can end their participation at any time without any consequences. The potential risk to the research participants was minimal and not more than they would encounter in everyday life. There are no direct benefits for participating in the study. The research may indirectly benefit MDSR stakeholders by informing MDSR system strengthening. Overall, the risk to study participants was minimal and the risk to benefit ratio was determined to be small enough to proceed with the study.

Permission/Authorization to Access Study Sites and Participants

Upon approval by the UofL IRB and ULPGL Ethics committee, an official letter (Appendix M, Appendix N) along with the IRB approval letters were sent to the Chief Medical Officer (CMO) of Goma HZ to provide an overview of the study and its ethical considerations, and to secure formal permission to access the study sites, documents, and participants for recruitment and data collection. This was followed by an in-person meeting with the CMO on November 7, 2018, during which he formally indicated his approval to access study sites, participants, and documents (Appendix N). Additionally, I scheduled meetings with each facility's leadership (medical directors or nurse administrators) during which I introduced the study and presented approval letters from the CMO and ethics committees, to obtain their approval to begin recruitment and data collection within their sites.

Researcher Positionality and Reflexivity

One of several distinctive features of qualitative research is the researcher's role as a primary data collection and analysis instrument, and co-creator of knowledge (Creswell, 2013; Merriam, 2009). The co-constructions of research processes and outputs are largely influenced by a researcher's background and experiences, which shape: 1) what they see, how, when, and to what extent, 2) what they do not see, and 3) how they interpret what they see or do not see (Charmaz, 2014). As such, the researcher is obligated to take a critical and reflective stance towards their position relative to the study (topic, research processes and outputs), participants, and the research context (Charmaz, 2014; Creswell, 2013; Holmes, 2014; Merriam, 2009). Reflexivity is an ongoing process of critical self-reflection in which the researcher brings to consciousness their biases, values, assumptions, and experiences, and their impact on the research (Charmaz, 2014; Creswell, 2013). Ongoing reflexivity enables researchers to construct and articulate their positionality in relation to the study (Holmes, 2014). Sultana (2007) argues that reflexivity and positionality are imperative to ensure ethical research, particularly in international contexts. Reflexivity and positionality are dynamic, unstable, and context dependent rather than fixed (Holmes, 2014; Sultana, 2007). That said, I engaged in critical self-reflection on an ongoing basis, re-examining my position as this study progressed. Below, I articulate my positionality in relation to the research, the participants, and the research context, and how it potentially impacts the study.

Researcher Positionality Statement

I approached this study with multiple positionalities, that were brought to consciousness so that I could engage in more meaningful and ethical research (Sultana,

2007). I begin by positioning myself in relation to the research subject/topic. Having originated from North Kivu, DRC, I have witnessed the toll of fragile socio-political contexts on women and children, who are often the most vulnerable and neglected in such contexts. This led to my passion for MCH as I felt compelled to pursue endeavors that improve their health, quality of life, and well-being amid competing socio-political priorities. My particular interest in investigating MDSR was prompted by persistently high MMR in DRC, specifically in Goma, and the dearth of research on MDSR in DRC. My motivation for pursuing this study was driven by the value I place on MDSR as a promising high impact and cost-effective quality improvement tool for reducing preventable maternal deaths. I entered this study with expectations that the findings will make important contributions to understanding and strengthening MDSR in Goma, which will ultimately improve practice, policy, and maternal health.

Being the primary research instrument in this qualitative study, my professional and research backgrounds were as important as my personal background in influencing the study (Charmaz, 2014; Merriam, 2009). I have developed competence in qualitative research throughout my experience as a Graduate Research Assistant and a Doctoral student (cumulatively 4 years) working on qualitative health equity-oriented research projects. This experience has shaped my approach to qualitative research into one that is inductive and firmly grounded in a social-constructivist paradigm, where the researcher and participants are co-constructors of knowledge. Consistent with this paradigm, I designed this study to capture a multi-layered and nuanced understanding of participants' diverse perceptions and experiences through the use of open-ended questions, multiple data collection tools, purposeful recruitment of diverse stakeholders, and an inductive

analysis approach. It is important to acknowledge that prior to this study, my qualitative research experience had been largely based in the United States and to a lesser extent, in Sub-Saharan Africa. I therefore continued to critically scrutinize my position as I engaged in fieldwork for this study. While I entered this study with no direct experience with MDSR, I had been immersed in the literature on MDSR in developing countries throughout the conceptualization and development of this study. Recognizing the potential influence of these preconceived ideas acquired from the literature, I remained open and grounded in my participants' unique experiences, perceptions, and context so as not to impose preconceived codes and patterns on my data (Charmaz, 2014).

Next, I convey my positionality relative to the research context and participants. Goma HZ was primarily selected as the setting for this study owing to: 1) my personal and professional connections in the area, through which I gained insights on priority issues within the health zone and access to the data collection sites; and 2) my familiarity with the socio-cultural context and language. My personal history in this setting placed me in a unique and complicated position that required deep reflections on my "insider-outsider" position. I acknowledge that my "insider-outsider" position was viewed through multiple lenses, negotiated (consciously and unconsciously) as I interacted with participants throughout the research process. I identified myself as an "insider" given my familiarity with the socio-cultural context and local dialects/languages, as well as my strong personal and professional networks in the area. Collectively, these factors evoked a sense of connectedness to the research context and participants. As expected, my personal history in the study setting aided in accessing the research sites, documents, and participants and in establishing trust and rapport with participants. In addition, my insider

status enabled me to culturally tailor my approach and to capture both verbal and non-verbal cues that were relevant to my overall understanding of MDSR. However, I acknowledge that my “insider” status did not automatically translate into shared experiences and understanding of participants’ meaning and experiences, as this requires purposeful and systematic interactions with participants beyond the scope of this study. Conversely, my personal assumptions about my “insider” position were likely challenged by some participants as it was processed through their lenses. For instance, being a researcher and an outsider to the local medical or public health community, or my affiliation with a foreign academic institution, overshadowed my “insider” status and positioned me as an “outsider”. That being said, my insider-outsider status was a dynamic process that was negotiated between participants and myself. As the study progressed and the dynamics evolved, the insider-outsider boundary began to blur (Sultana, 2007, p. 382).

Finally, I reflected on my positionality as a multilingual researcher, recognizing that this potentially influenced translation and interpretation of findings across languages—two crucial processes in constructing meaning. While meaning is inevitably lost as one operates across multiple languages and socio-cultural contexts (Bailey, 2008; Halai, 2007, p. 345; Nikander, 2008; Torop, 2002), the procedures described in the above sections guided me in seeking cultural and conceptual equivalence in an effort to minimize the loss of meaning. In conclusion, as the researcher, I was and am obligated to ensure that participants’ voices are accurately represented. I continually reflected on my dynamic relationships with the study and participants while implementing measures to ensure the trustworthiness of study findings.

Strategies for Ensuring Trustworthiness of Findings

Just as in quantitative research, qualitative researchers are responsible for ensuring that their studies meet standards of rigor (Creswell, 2013; Cypress, 2017). Qualitative research is often incorrectly evaluated against positivist criteria designed for quantitative research (Creswell, 2013; Flyvbjerg, 2006; Thomas & Magilvy, 2011). The concepts of reliability and validity in qualitative research have been highly debated, with some proposing distinct concepts for qualitative research such as trustworthiness, accuracy, or authenticity (Creswell, 2013; Cypress, 2017; Flyvbjerg, 2006). Depending on the specific qualitative approach used, there are numerous validation strategies to ensure accuracy and credibility of study findings (Baxter & Jack, 2008; Creswell, 2013; Crowe et al., 2011). This study adapted Lincoln and Guba's (1985) trustworthiness criteria of credibility, dependability, transferability, and confirmability.

Credibility refers to the plausibility of study findings in that they accurately represent participants' experiences (Anney, 2014; Thomas & Magilvy, 2011). To ensure credibility, this study utilized data triangulation, respondent validation, adequate engagement in data collection, and reflexivity (Creswell, 2013; Lincoln & Guba, 1985; Merriam, 2009).

1. *Data triangulation* involves the use of multiple data sources to corroborate findings (Creswell, 2013; Merriam, 2009). In this study, KI interviews, document reviews, and observations enabled data triangulation.
2. *Member checking/respondent validation* entails sharing preliminary findings and analysis with study participants for feedback (Creswell, 2013; Korstjens & Moser, 2018; Merriam, 2009). Given the limited availability of the KIs and the time

constraints related to data collection, respondent validation was tailored to the context. To minimize misinterpretations, I sought clarifications from KIs by probing and elicited immediate feedback from the majority of the participants following each interview by summarizing key points from the interview.

Additionally, one KI was re-contacted to clarify information and provide additional input (Creswell, 2013; Merriam, 2009; Thomas & Magilvy, 2011).

3. *Reflexivity*. I have articulated my positionality in relation to this research (see reflexivity and positionality) and maintained reflexive notes throughout the research process to document my personal assumptions and observations.
4. *Peer examination/peer review* involves inviting external peers to critically examine or scrutinize the research process, methods, data analysis, interpretation of findings, and conclusions (Anney, 2014; Creswell, 2013; Merriam, 2009). The dissertation chair and committee provided scholarly guidance and constructive feedback to strengthen the study (Anney, 2014; Merriam, 2009).
5. *Adequate engagement in data collection* refers to the researcher's active involvement in data collection and direct engagement with study participants to better understand their experiences and the study context (Creswell, 2013; Merriam, 2009). I conducted data collection myself, which required on-site visits and direct interactions with participants.

Dependability refers to the stability or consistency of study findings in relation to the data collected (Korstjens & Moser, 2018; Merriam, 2009). As stated by Merriam (2009, p. 221), “the question then is not whether findings will be found again but whether the results are consistent with the data collected”. Dependability can be

established using triangulation, peer examination, reflexivity, and audit trails (Anney, 2014; Merriam, 2009). An audit trail is a detailed account of the research process and decisions made throughout the inquiry (Merriam, 2009). This study's audit trail is built into the methodology chapter, where I maintained transparency about the research procedures to ensure that they are verifiable (Bowen, 2009). This was facilitated by a reflective journal capturing descriptions of events, reflections, questions, and decisions made throughout the research process (Lincoln & Guba, 1985; Merriam, 2009).

Transferability refers to the possibility that findings can be extrapolated or applied to similar settings based on the reader's judgment (Lincoln & Guba, 1985; Merriam, 2009; Patton, 2002). Transferability is problem-oriented rather than statistical, focused on applying lessons learned from one setting to a similar setting, while taking into careful consideration the contextual and heterogeneous nature of knowledge (Kvale, 1996; Merriam, 2009; Patton, 2002). The reader/user, not the researcher, assesses whether the findings are applicable to their contexts (Merriam, 2009), based on the researcher's description of the study setting, participants, context, boundaries, findings, and limitations (Lincoln & Guba, 1985; Merriam, 2009). The aforementioned elements are described in different sections of this study.

Confirmability is the extent to which findings can be confirmed by others (Anney, 2014; Lincoln & Guba, 1985). It is concerned with establishing that study findings do not reflect the researcher's preferences or imagination (Anney, 2014; Korstjens & Moser, 2018). It occurs when credibility, transferability, and dependability have been established (Thomas & Magilvy, 2011). Confirmability can be achieved

through previously described techniques, particularly triangulation, audit trail, and reflexivity (Anney, 2014).

CHAPTER IV

RESULTS

Introduction

This study aimed to describe and critically assess MDSR implementation in Goma HZ, focusing on its structure, processes, quality, outcomes, and influencing factors. The following research questions were addressed:

1. How is MDSR structured and implemented in Goma HZ?
2. How well does the MDSR system in Goma HZ meet the CDC's attributes of a surveillance system?
3. How has MDSR impacted practice, policy, and maternal health in Goma HZ?
4. What factors influence MDSR implementation in Goma HZ?
5. What are the recommendations to strengthen Goma HZ's MDSR system?

A qualitative case study design was utilized to explore MDSR implementation in Goma HZ given its ability to converge evidence from multiple sources and its capacity to uncover dynamic and complex processes related to a phenomenon or a program (Creswell, 2013; Merriam, 2009; Salazar et al., 2015). This study constitutes a step towards addressing the literature gaps on MDSR implementation experiences in SSA, particularly in the DRC. This chapter converges findings from 15 semi-structured KI

interviews, a review of 52 MDSR documents, and an observation of an MDR session in Goma HZ. The chapter first presents the characteristics of study sites, participants, and documents reviewed; followed by a detailed presentation of the research findings.

Characteristics of Study Sites, Participants, and Documents

Description of Study Sites

A total of seven sites involved in MDSR implementation in Goma HZ were identified and recruited into the study with assistance from the central office of Goma HZ. The study sites included: The North Kivu Provincial Division of Health (PDH)–National Reproductive Health Program Office, locally known and referred to in this study as *PNSR–Programme National de la Santé de la Reproduction*; the central office of Goma HZ; and five integrated health in Goma HZ (Table 3).

Table 3

Characteristics of Study Sites

Study Sites	Type/Level	Ownership	Number of Key Informants
Provincial Division of Health-PNSR	Provincial	Government	1
Central Office of Goma Health Zone	Health Zone	Government	4
Health Facility 1	Secondary Hospital	Faith-based	2
Health Facility 2	Health Center/ Secondary	Faith-based	2
Health Facility 3	Secondary Hospital	Faith-based	2
Health Facility 4	Tertiary Hospital	Private	2
Health Facility 5	Secondary Hospital	Faith-based	2
Total Study Sites: 7	Total Participants: 15		

Description of Study Participants

Within all eligible sites, a total of 15 key informants (KIs) participated in semi-structured interviews (Table 4), including one provincial-level KI, four HZ-level KIs, and 10 facility-level KIs (two from each facility). The sample included eight nurses and seven physicians. More specifically, KIs were a provincial-level coordinator of a national program, four zonal health administrators (CMO and nurse supervisors), medical directors (n=2), a chief of staff, a chief nursing officer, directors of nursing services (n=3), a head of a maternity unit, and an obstetrician and gynecologist (OB-GYN). Respondents assumed multiple roles in MDSR. All 15 KIs were MDSR implementers and end-users within their respective sites, seven of whom were also MDSR focal persons or decision-makers (one from each site). With the exception of one participant, all KIs had been involved in MDSR-related activities for five or more years.

Table 4

Demographic Characteristics of Key Informants

Key Informant (N=15)	Primary Role in MDSR ¹	Years of Involvement in MDSR
Provincial Division of Health		
Program Coordinator	MDSR Focal Person/Decision-maker	–
Central Office of Goma Health Zone		
Chief Medical Officer (CMO)	MDSR Focal Person/Decision-maker	>6
Nurse Supervisor #1	MDSR Implementer	1
Nurse Supervisor #2	MDSR Implementer	>10
Nurse Supervisor #3	MDSR Implementer	5
Health Facility 1		
Chief of Staff	MDSR Focal Person [Decision-maker]	15
Director of Nursing	MDSR Implementer	8
Health Facility 2		

Key Informant (N=15)	Primary Role in MDSR ¹	Years of Involvement in MDSR
Chief Nursing Officer	MDSR Focal Person [Decision-maker]	6
Physician-General Practitioner	MDSR Implementer	10
Health Facility 3		
Medical Director	MDSR Focal Person [Decision-maker]	11
Director of Nursing	MDSR Implementer	5
Health Facility 4		
Head of Service–Maternity Unit (Nurse)	MDSR Implementer	>8
Obstetrician-Gynecologist	MDSR Implementer	6
Health Facility 5		
Medical Director	MDSR Focal Person [Decision-maker]	15
Director of Nursing	MDSR Implementer	8

¹All KIs were implementers and end-users of MDSR-generated information

Characteristics of Documents Reviewed

A total of 52 MDSR-related documents were reviewed to supplement the KI interviews. These documents were identified during the KI interviews and were accessed in electronic or paper formats at the central office of Goma HZ, which compiles information from all integrated health facilities and community settings. Table 5 lists the documents reviewed for this study including the quantity and brief description of each.

Table 5

Description of Maternal Death Surveillance and Response Documents Reviewed

Document Reviewed	Number reviewed	Description
National MDSR guide	1	The DRC's national guidelines and tools for implementing MDSR [Electronic]

Document Reviewed	Number reviewed	Description
Maternal death notification form templates	2	Templates of notification forms for community and facility-based maternal deaths [Electronic]
MDR forms template	2	Templates of standard documents for reviewing facility and community-based maternal deaths (verbal autopsies) [Electronic]
Completed MDR forms	36	Completed MDR forms for cases reviewed between 2016-2018 [Hard copy]
Line listing of maternal deaths in the HZ	1	Spreadsheet summarizing MDR findings between 2017-2018 including socio-demographic characteristics, notification and review dates, causes and contributing factors [Electronic]
Goma HZ's annual reports	6	Annual status and evaluation reports of Goma HZ (2012-2017) [Electronic]
Patient's chart template	1	A template of a patient's chart containing the following sheets: initial exam, progress notes, vital signs, laboratory tests and results, and special procedures (e.g. surgery, blood transfusion) [Electronic]
ANC chart template	1	A template of the ANC form [Paper]
PNC chart template	1	A template of the PNC form [Paper]
Partograph template	1	A template of the partograph (labor monitoring form) [Paper and Electronic]
Total Reviewed: 52 Documents		

The Study Themes

The findings of this study are organized under the following major thematic areas that emerged from the analysis, each containing several subthemes: 1) structural capacity of the MDSR system in Goma HZ; 2) MDSR process in Goma HZ; 3) quality of the MDSR system in Goma HZ; 4) outcomes of MDSR implementation in Goma HZ; 5) factors influencing MDSR in Goma HZ; and 6) key informants' recommendations to improve MDSR in Goma HZ. Table 6 portrays the relationship between the research questions, study themes, and subthemes. Throughout this section the KIs' quotes are referenced using their uniquely assigned ID, followed by their site (HZ for health zone and HF for health facility).

Table 6

Research Questions, Study Themes, and Sub-themes

Research Question	Study Themes and Sub-themes
Research Question 1: How is MDSR structured and implemented in Goma HZ?	Theme 1: Structural Capacity of the MDSR System
	☐ National MDSR guidelines ☐ MDSR policies ☐ MDSR goals and objectives: "No woman should die while giving life!" ☐ MDSR support functions: Training, technical support, supervision ☐ MDSR Resources
	Theme 2: MDSR Process in Goma Health Zone
	☐ Identifying and notifying maternal deaths ☐ Reviewing maternal deaths ☐ Analyzing MDR findings and formulating recommendations ☐ Response and monitoring response ☐ Disseminating results and recommendations

Research Question	Study Themes and Sub-themes
	☐ Monitoring and evaluation of the MDSR system
Research Question 2: How well does the MDSR system in Goma HZ meet the CDC's attributes of a surveillance system?	Theme 3: Quality of the MDSR System <ul style="list-style-type: none"> ☐ Simplicity ☐ Acceptability ☐ Flexibility ☐ Timeliness ☐ Stability ☐ Data quality
Research Question 3: How has MDSR impacted practice, policy, and maternal health in Goma HZ?	Theme 4: Outcomes of MDSR Implementation <ul style="list-style-type: none"> ☐ Short-term and intermediate outcomes ☐ Impacts of MDSR on maternal health outcomes
Research Question 4: What factors influence MDSR implementation in Goma HZ?	Theme 5: Factors Influencing MDSR Implementation <ul style="list-style-type: none"> ☐ Leadership commitment and support ☐ Shifting paradigms: maternal death "audit" to maternal death "review" ☐ "No name, no blame, no shame" principle ☐ MDSR and disciplinary action: The MDSR paradox ☐ Fear, guilt, frustration ☐ Defensive behaviors ☐ Unregulated private health facilities and lack of community linkages ☐ Documentation and record keeping practices ☐ Organizational/workplace culture ☐ Socio-cultural factors
6. Research Question 5: What are the recommendations to strengthen Goma HZ's MDSR system?	Themes 6: Key Informants' Recommendations to Improve MDSR

Theme 1: Structural Capacity of The MDSR System in Goma Health Zone

The following were subthemes pertaining to the structural capacity of MDSR in Goma HZ: national MDSR guidelines, MDSR policies, goals and objectives, support functions, and resources.

National MDSR guidelines. The MDSR operations in Goma HZ are based on the current national MDSR guide which was published in November 2015 and entitled: *Surveillance, Maternal Death Reviews and Response Guide*. Appended to this guide are the following standard MDSR tools: 1) a notification form for facility-based maternal deaths; 2) a notification form for community-based maternal deaths; 3) a facility-based MDR form; 4) a community-based MDR (verbal autopsy) form; and 5) an instruction manual for completing the MDSR forms (issued as a separate document). This national guide adapts core MDSR principles and processes from the WHO (2013) MDSR technical guidance and tailors it to local priorities, hierarchical structures, and policies. The content of DRC's national MDSR guide is summarized in Figure 5 and discussed under the corresponding thematic areas in this chapter.

Introduction to MDSR in the DRC	<ul style="list-style-type: none"> •Historical Background of MDSR in DRC •Development of the MDSR Guide
Purpose and Objectives of MDSR	<ul style="list-style-type: none"> •Goal: To contribute to the reduction of maternal mortality in the DRC by 2030 •Main Objective: To improve the quality of maternal health services in the DRC
Overview of the MDSR Cycle and Structure	<ul style="list-style-type: none"> •Four steps of the MDSR cycle (identification-response/action) •Organizational structure of MDSR committees from health areas (HAs) to national level
Identifying and Notifying Maternal Deaths	<ul style="list-style-type: none"> •Identification (sources of information and case definitions) •Notification chain (community or facility to national level)
Investigating Maternal Deaths	<ul style="list-style-type: none"> •Approaches to reviewing maternal deaths •Maternal death review process (facility and community) and principles
Data Analysis, Aggregation, Interpretation	<ul style="list-style-type: none"> •Data transmission and feedback pathway •Methods and indicators for analyzing causes, contributing factors, and preventive strategies •Interpretation
Response	<ul style="list-style-type: none"> •Multi-level responses, prioritization of actions, response coordination, advocacy •Success and failure factors
Dissemination of Results, Recommendations, and Responses	<ul style="list-style-type: none"> •Reporting mechanisms, principles, audiences, dissemination method/channels
Monitoring and Evaluation of the MDSR System	<ul style="list-style-type: none"> •Identifying objectives, performance indicators, data sources •Evaluating the quality and performance of the MDSR system •Supervising MDSR activities and providing feedback on evaluations
Attachements/Forms	<ul style="list-style-type: none"> •Maternal death review and notification forms for facility & community-based maternal deaths

Figure 5. Summary of the Democratic Republic of Congo’s national MDSR guide

While there was no documented history of MDSR in Goma HZ, some KIs suggested that *maternal death audits* had been implemented in Goma HZ for over 10 years, closely matching the MDSR history described in the national MDSR guide (MSP, 2015). According to this guide, the DRC began implementing maternal death audits in 2005 as a pilot project, although this project received insufficient support for its sustainability and scale-up. A 2010 situation analysis by the PNSR and its development partners revealed that maternal death audits were irregular, unsystematic, non-responsive, and had a punitive connotation, leading to an underreporting of maternal deaths by health care providers (MSP, 2015). This report triggered decisions to revise and develop MDSR tools in 2014, followed by an official launch of MDSR in 2015 (MSP, 2015).

MDSR policies. Key informants suggested that given its magnitude, maternal mortality is a local priority in Goma HZ and at the national level. In the DRC, and in Goma HZ in particular, maternal mortality has been added to the existing Integrated Disease Surveillance and Response (IDSR) system as a reportable event requiring immediate notification and review. As such, MDSR in Goma HZ is integrated into the existing IDSR system. Results from the KI interviews revealed high levels of awareness and compliance with policies surrounding the immediate notification and review of all maternal deaths occurring within their respective jurisdictions or institutions.

When it occurs and as soon as the medical director is informed of a maternal death, he is required to immediately notify the health zone. That's known, these are the policies... This is known. If there is one case, we immediately inform the authorities within the health zone (KI 14, Health Facility (HF) 6)

Key informants' narratives revealed both legal and ethical obligations to notify maternal deaths based on premises that a maternal death is “unacceptable”, and lessons can be learned to prevent future deaths. However, some KIs voiced that these obligations are not

necessarily perceived, shared, or enforced in the community setting and in non-integrated private health facilities.

The obstacle is that there is no obligation for notifying cases. For example, a death at the family level—they can choose not to notify that...there is no obligation...Many people die without us knowing what they are dying of. People do not feel obliged to come and notify because there is no measure that obliges people. (KI 9, HF 4)

MDSR goals and objectives: “No woman should die while giving life!” All KIs demonstrated high levels of understanding of the goals and objectives of MDSR in Goma HZ, as intended and described in the national MDSR guidelines—to reduce preventable maternal mortality.

We need to reduce maternal deaths to zero. That's it. Therefore, the objective is to improve the quality of care. So, the review aims to improve quality of care for pregnant women. So, the ultimate goal is to reduce the risk of maternal death to zero. (KI 6, HF 2)

Many KIs aligned MDSR with the slogan “no woman should die while giving life”, linking this process with other national and international initiatives with similar goals such as the SDG 3.1, the Safe Motherhood Initiative, and the DRC’s National Reproductive Health Program. In reporting their understanding of the goals and objectives of MDSR, KIs highlighted its quality improvement and educational aspects, dissociating this process from blame or punitive measures.

The review by definition is not a trial...we are not pressuring people to explain themselves or it is not intended to show them that they are responsible for this death. The goal is to improve the quality of care. (KI 14, HF 6)

Other commonly cited MDSR objectives by KIs included the following:

- Identifying the circumstances surrounding a maternal death, including the underlying causes and contributing factors (financial, administrative, social, physical);

- Evaluating service delivery and quality of care against national guidelines: “what was not done, what was done, what should have been done?” ;
- Identifying strengths, gaps/weaknesses, and missed opportunities at community, facility, provider, and health system levels to inform remedial action; and
- Formulating recommendations based on the review to improve QoC and prevent similar deaths in the future.

MDSR support functions: training, technical support, supervision. Overall, support functions for MDSR were described by many as irregular and unsystematic. Key informants at the provincial and HZ-level reported that CMOs and selected nurse supervisors from six HZs, including Goma, were oriented to the MDSR process, principles, and tools through a train-the-trainers workshop organized in 2016 by the PNSR and the national MoH. However, some HZ KIs and the majority (8 out of 10) of facility-level KIs did not receive any formal training on MDSR, rather drawing their knowledge and skills from their academic training, self-directed learning, the MDR form, experiential learning, and briefings during MDR sessions.

At the higher administrative level, the health zone, Provincial Division of Health, they do not organize trainings. Trainings are rare. I have been the director of nursing services for two years; I have not received any training. By the way, there is no training for maternal death reviews or audits, I have not received any training on this... (KI 6, HF 2)

So far, personally, I have never been trained, but it's just self-directed learning as I call it and there are some documents that we read or while we are there with the director, we learn from those who are more experienced, we try to understand. And with the documents that we try to read, we are able to find our way...(KI 2, HZ)

While CHWs play a critical role in identifying community-based maternal deaths, one HZ KI suggested that they have not received any formal training on MDSR. In addition, some KIs reported irregularities in supportive supervision by the HZ.

Supportive supervisions from this [the HZ] level are not regular and yet supportive supervision is some form of training. Ideally, we are supposed to have a supervision schedule from the authorities since we've had a couple of maternal deaths. They need to see what is happening, how we take care of these women. But usually, we can spend 3 to 6 months without being supervised and it is difficult for us to self-evaluate. We always need someone from outside who comes to see what we do and say no, this shouldn't be done like this, consider doing this... It is this limitation in supervision—the irregularity of supportive supervision. (KI 14, HF 6)

A few KIs received occasional technical support from the PDH, most of whom mentioned the city-wide MDR meeting organized by the PNSR in mid-2018, which convened providers from various health facilities within Goma and Karisimbi HZs. Finally, with the exception of the HZ team, the majority of KIs were not aware of the national MDSR guide. All facility-based KIs identified the MDR form as the sole official document that guides them in implementing facility-based MDRs.

There is no protocol or guideline for [maternal death] reviews. They only give us a form that we complete when we do it... There are forms but no special framework. (KI 6, HF 2)

MDSR Resources. Key informants indicated that there are no designated resources for MDSR operations in Goma HZ and in individual health facilities. More specifically, there is no local or national budget line for MDSR. Similarly, while the national guidelines stipulate the establishment of MDSR committees and designated coordinators from the national level to HAs (units that make up the HZ), there are no formally established MDSR committees and coordinators at these levels. All MDSR

operations are integrated into routine IDSR activities and responsibilities within the HZ and facilities, thus sustained with existing organizational resources.

We have our partners who provide overall support to the health zone. All resources are covered through that; normally, it [MDSR] is part of our regular activities as supervisors. And we already have the forms... we have all that. It's already ready and when we have a situation, we are well-equipped, and everything is always ready for us to conduct the field visit. (KI 2, HZ 1)

Human resources. Key informants identified critical human and material resources for MDSR implementation. The following stakeholders are routinely involved in MDSR operations in Goma HZ:

1. *Health zone and provincial levels:* the CMO of Goma HZ who serves as the coordinator, three nurse supervisors of Goma HZ, and officers from the PDH-PNSR who occasionally participate in MDRs.
2. *Facility level:* hospital administrators, medical directors who serve as coordinators; chief of staff; heads of departments (e.g. OB-GYN, maternity, surgery); director of nursing services; specialists or subject matter experts; health care providers who attended to the deceased (e.g. midwives, nurses, physicians); and occasionally, anesthetists, laboratory technicians, and pharmacists.
3. *Community level:* CHWs (locally known as community relays–relais communautaires), community-level providers (e.g. nurses in health centers), and to a minimal extent, relatives and neighbors of the deceased as sources of information on the death.

In contrast with national guidelines, community engagement in MDSR in Goma HZ remains suboptimal. None of the study sites visited include community members,

CHWs, or members of civil society in MDRs. To a minimal extent, CHWs and representatives from community-based health centers are involved in the identification and notification of community-based maternal deaths, while family members or neighbors of the deceased are sometimes interviewed as informants during MDRs.

Material resources. The common material resources routinely used in MDSR operations in Goma HZ are depicted in Figure 6. These include standard MDSR forms, the patient’s current and previous medical records (commonly the chart and partograph), and organizational supplies and infrastructure such as vehicles for field visits during data collection and reviews. While limited, KIs mentioned the use of information technology and communication tools such as cellphones, computers (e.g. Excel MDSR spreadsheet and the NHIS platform), and occasionally, projectors for presentations.

National Guidelines and Forms	Medical Records	Office Supplies and Infrastructure
☐	☐	☐
☐ Notification forms	☐ Patient's chart	☐ Office space
☐ MDR forms	☐ Partograph	☐ Stationary
☐ Standards of care	☐ ANC records	☐ Printers/copiers
	☐ Delivery records	☐ Computers
	☐ PNC records	☐ Cell phones
	☐ Hospital registers	☐ Vehicles

Figure 6. Common material resources used in MDSR in Goma Health Zone

The majority of KIs suggested the regular availability of material resources for routine MDSR operations. In particular, the standard forms can be acquired from the HZ at minimal costs. However, some KIs noted that many non-integrated private health facilities do not utilize standard forms (e.g. ANC records, referral slips, patient charts), some of whom speculated on whether this could be due to the cost associated with

acquiring these forms or the fear of reporting to the HZ office since many such facilities are not regulated.

The private sector does not seem to have access to the ANC cards that are used in the faith-based and public health facilities. The faith-based and public health facilities utilize the ANC records from the health zone, thus the template of the Ministry of Health. This is not the case for private facilities. Do they have access to these, is it restricted at their level?...Or maybe they are not brave enough to go and purchase the forms from the central office of the health zone. We pay for the ANC form and the partograph. It's not much—an ANC form costs \$ 0.1 or \$ 0.2. It's really not much. We can call it a contribution. (KI 8, HF 3)

The lack of standard forms in the private sector was reported to affect data collection and data quality, as discussed later in this section.

Financial resources. There are no designated financial resources for MDSR in Goma HZ nor in individual health facilities since MDSR is sustained by their operating budgets. This lack of designated funds for MDSR was not perceived to affect the implementation of the earlier steps of the MDSR process (identification-review), given their integration into routine practice and duties of staff members and the minimal costs associated with these processes.

Firstly, there are human resources. We sometimes collaborate...with the Provincial Division of Health. The material resources... the papers—we take everything from our operating costs; the fuel we use when we travel is always included in the operating costs. Everything is covered by the operating costs. Financially there is none—finances are covered by the salary that the government gives us. (KI 1, HZ)

So, in relation to the financial aspect it does not require a lot of money, it is a scientific analysis that we do. A budget is not required for us to sit and discuss a case like this. No. So the resources are always available...at our level, the resources we have are first technical resources, the staff is there. So anytime there is a death, we get together and we work on it. (KI 14, HF 6)

However, some participants identified limited resources as one of several factors contributing to the delayed implementation of recommendations, and in many cases leading to inaction.

Theme 2: The MDSR Process in Goma Health Zone

This study shed light on the MDSR process as implemented in Goma HZ. The findings related to the MDSR process are organized under the following key subthemes corresponding to components of the MDSR cycle: identifying and notifying maternal deaths; reviewing maternal deaths; analyzing findings and formulating recommendations; following up on recommendations and taking action; disseminating results and recommendations; and monitoring and evaluating the MDSR system. Variations across sites are specified, if any.

Identifying and notifying maternal deaths. The national MDSR guide provides brief details on the identification of maternal deaths, emphasizing the mandatory notification policy and time frame for facility and community-based maternal deaths. This document also provides two case definitions: *suspected maternal death* (*i.e. community deaths*) and *confirmed maternal deaths*. While the former is consistent with the standard definition stipulated in the WHO guidelines, the proposed case definition for community death— “*any woman who died before, during or after childbirth*”, is locally tailored. The use of *childbirth* as a reference in this case definition makes an assumption that a woman was visibly pregnant and may fail to capture maternal deaths that occur when pregnancy or childbirth are not physically evident (e.g. abortion-related deaths). This is in contrast with a broader and ideal community definition that promotes the initial

identification of *any death of a woman of reproductive age* to capture all possible cases (WHO, 2013). Additionally, this national guide does not mention the use of active surveillance/active case finding nor does it describe in detail the potential sources for actively identifying maternal deaths in health facilities and communities.

This guide provides detailed guidance on the hierarchical pathway for notifying maternal deaths and includes two standard maternal death notification templates, one for facility deaths and another for community deaths. Both forms capture the following preliminary information on the death: the socio-demographic characteristics of the deceased, characteristics of the health facility (for facility deaths), details surrounding the death (e.g. time, timing in relation to pregnancy, place, cause), and additional comments (for community deaths). These standard notification forms do not include questions related to common risk factors for obstetric complications (e.g. anemia, HIV, history of caesarean section) nor do they include an assessment of the delivery history for those who died during or after delivery (e.g. type of delivery, duration of labor, delivery outcomes). However, such information is usually captured during MDRs.

Facility-based maternal deaths. Participants described a passive rather than active mechanism for identifying maternal deaths in health facilities, relying on reports from health care providers who witnessed the maternal death. One KI reported that active case finding was occasionally performed during supervisory visits to health facilities, where nurse supervisors verified the hospital registers, partographs, and other essential documents for information on live births and maternal deaths within the health facility.

Sometimes...when we go for supervisions, we also supervise the maternity units, the partographs, we check the number of deliveries... but if there is no death, there is no worry. (KI 3, HZ)

The lack of active case finding was not reported to compromise maternal death identification and notification within integrated health facilities, given the widespread knowledge and compliance with mandatory notification policies within these facilities. All participating facilities were reported and observed to follow standard maternal death notification procedures and complied with the national policies and guidelines for notifying facility-based maternal deaths within 24 hours. In most participating facilities, the medical director or the nurse in-charge/nurse administrator immediately notifies the CMO or a HZ nurse supervisor by phone during operating hours or the following day if it occurred after hours.

When there is a maternal death, immediate notification is required. You have to call the Chief Medical Officer of the health zone to tell him that there was a death. You must call or inform him immediately. (KI 10, HF 4)

This initial notification by phone is followed by a written notification in the weekly surveillance report submitted to the HZ by the nurse-in charge of the HA in which the facility is located. In addition, each facility submits a monthly report of health events that the HZ enters into the NHIS database. Similarly, the HZ immediately notifies the PDH-PNSR via phone call and submits the weekly surveillance report. Finally, the PDH submits a quarterly report of all maternal deaths and other health events to the national MoH.

Community-based maternal deaths. One KI at the HZ level noted that for local MDSR purposes, the operational definition of community-based maternal deaths includes deaths occurring within the community and in private health facilities that are not integrated into the HZ's health system.

Currently even a death in a private facility, we identify it as a death in the community because they [private facilities] are not in our [health]system. It's a death in the community (KI 1, HZ)

There was no active mechanism for identifying maternal deaths within the non-integrated private sector and the community. Community deaths are identified through formal reports by CHWs or informal alerts from community members. The official pathway outlined by the MDSR guide and described by participants primarily utilizes CHWs who are each assigned to 50 households within their particular HAs. Each CHW is responsible for reporting maternal deaths and other health events to a health center within their HA, which in turn notifies the HZ. However, KIs revealed that given the absence of active case finding for community deaths, the HZ is often notified of a community-based maternal death unofficial channels such as alerts from community members or relatives of the deceased, radio, informal conversations within the community or public transportation, and police reports in cases of legal complaints by the family. Some KIs noted that community-based maternal deaths sometimes go unnoticed since their identification and notification is complicated by culturally-derived explanations or beliefs surrounding causes of death (e.g. beliefs in witchcraft, malicious poisoning—“Karuho”).

There are challenges concerning maternal deaths in the community. There are times when there is no information—it goes unnoticed. People may believe it was witchcraft, they can believe in I do not know what in relation to the death and automatically it goes unnoticed to the point that the woman can be buried without knowledge of the cause of death. There have been several cases like this where the cause is unknown due to the lack of information about the case. (KI 5, HF 2)

Another important barrier to the notification of community deaths is the fear of litigation among providers in unregulated private facilities, which reportedly leads them to conceal information on maternal deaths.

They are afraid because they do not have necessary documents authorizing them to operate legally, so they choose not to pass on the information—that's an obstacle. But we always end up knowing because the family often complains and that way, we are always informed that there has been a maternal death. Sometimes the neighbors alert the police, the police in turn inform the appropriate authorities or technical services who then come to review the case. (KI 14, HF 6)

Figure 7 depicts the notification chain for facility and community-based maternal deaths as described by KIs, which is largely consistent with the national guidelines.

Figure 7. The maternal death notification chain in Goma Health Zone

Reviewing maternal deaths. The DRC's MDSR guide promotes two key approaches for reviewing maternal deaths: *facility-based MDRs* and *community-based MDRs* or *verbal autopsies*. These guidelines also propose a cyclical process for reviewing maternal deaths comprising the following steps: 1) assessment of the situation; 2) data collection and analysis of current practices; 3) definition of standards of care; 4) evaluation of care provided against set standards and formulation of an action plan; and 5) implementation of recommended actions. However, this national MDSR guide does not elaborate on each component of the cycle. The review cycle depicted in this guide is a reduced description compared to the actual review proceedings described by KIs. The national guide depicts a large focus on evaluating clinical practice—similar to a clinical audit, with little focus on assessing non-medical contributing factors. In reality, steps two through four of the review cycle proposed in the national guide constitute only one of several steps of the actual review proceedings described by KIs and depicted on the MDR form, where provider and health system contributing factors are assessed (Section III on the facility-based MDR form).

Attached to these guidelines are standard facility MDR and verbal autopsy forms, including an instruction manual for completing these forms. Both forms are concise, comprising mostly close-ended questions with pre-populated and/or pre-categorized responses from which to choose. Some sections also provide opportunities to specify additional responses that are not listed. These structured review forms have been designed to stimulate discussions on both medical causes of death and non-medical contributing factors (e.g. three delays) and solutions.

While these tools capture the most relevant details surrounding the deaths, they also lack some critical information. For instance, the verbal autopsy form lacks some key socio-demographic items including the woman's education level, occupation, parity, and religion. Neither form has a designated space for a case summary, or an indication to attach this case summary to completed forms. When assessing the health service utilization history, the facility MDR form does not elicit information on the place where the woman sought ANC, delivery, or PNC services and on the type of provider for these services. The verbal autopsy form also lacks these items but includes the provider who assisted in the delivery. Unlike the facility-based MDR form, the verbal autopsy form is missing a section for recommendations—a very critical aspect of MDSR and a prerequisite for action. Finally, both forms lack a section for the determination of the avoidability of the death (e.g. potentially avoidable, not avoidable, undetermined). Similarly, the national MDSR guide does not provide information to guide teams in determining the avoidability of a maternal death.

Facility-based maternal death reviews. The HZ and all participating health facilities had a systematic process for reviewing maternal deaths. Since the majority of maternal deaths in the HZ occur in health facilities, MDRs in Goma HZ are largely facility-based but sometimes combined with verbal autopsies to acquire supplemental information from the community, as recommended by the national guidelines.

All KIs emphasized that the primary objective of the review is to inform quality improvement efforts in the health care system, based on an assumption that women who died left behind stories from which lessons can be drawn to prevent similar deaths.

We have been told that the dead teach the living... We draw lessons and experiences from those who have died so that other women do not suffer the same fate. (KI 14, HF 6)

As described by KIs, facility-based MDRs are conducted in two rounds: 1) an internal MDR by the health facility; and 2) an external MDR within the facility by the HZ team.

So, many hospital teams have been trained. Sometimes they start with an internal audit, and we come to do some sort of counter-expertise review to see if it was well done or if there are things to correct. (KI 1, HZ)

One faith-based facility reported conducting a third review with an external body that oversees and investigates events within health facilities operated by this church.

The internal review, which many referred to as internal audit, is the preliminary review that is routinely conducted by facility-level stakeholders immediately following a maternal death. While none of the facilities had a designated MDR committee, the following were reported to routinely participate in internal reviews: 1) the hospital administration—the medical director/nurse administrator, the hospital administrator, chief of staff, and director of nursing services; and 2) the medical team that attended to the deceased woman—physicians, nurses, midwives, and occasionally, pharmacists, anesthetists, and laboratory technicians. One KI from a small health facility reported that they initially reviewed maternal deaths in their regular staff meetings rather than holding a special MDR session.

Similarly, there is no designated MDR committee at the HZ level, however, the external review is conducted within 48 hours by at least two representatives from the HZ team who conduct a field visit to the facility and convene the team of providers who attended to the deceased. The PDH-PNSR was reported to occasionally participate in external reviews, especially when alerted directly by family or community members. With the exception of the hospital administrator or manager in some facilities, non-

medical stakeholders and community members are not represented in MDRs at the HZ and facility levels.

This assessment revealed that the reviews cover all sections of the standard MDR form, which explains the minimal variations across participating health facilities. Medical records including the patient's chart, the partograph, hospital registers, and ANC records were identified as the primary data sources for MDRs. These are supplemented by verbal inputs from the medical team and family/community members (when available), and inspections/observations of the health facility in some cases. Maternal death reviews last on average two hours per session but KIs suggested that reviews take up to a whole day when data collection is extended into the community. The review proceedings described by KIs are depicted in Figure 8.

Figure 8. A summary of key informants' accounts of the sequence of MDR sessions

These reviews were reported and observed to critically trace a woman's path to death, focusing largely on her medical/obstetric history and contact with the health care

system at multiple referral points. The teams evaluate the care provided against national and local standards to identify strengths, gaps, and missed opportunities. In addition, all KIs reported that facility-based MDRs include discussions of multi-level contributing factors (individual/family, community, provider, and administrative), as recommended by DRC's national guidelines.

We seek to categorize factors by level of responsibility. So, we try to say a little along these lines: 'there are problems at community level, there are problems at the level of primary care facilities, there are problems at the level of secondary care facilities, there are communication problems, there are problems with transportation' ... that is how we try to categorize the problems. Or problems also at the administrative level, for example (KI 13, HF 6)

However, the scope and depth of the review of factors outside the health facility varied across sites and cases, depending on the availability of community-level information, the place of death (community, private facility, or integrated facility), and the availability of staff members for additional data collection at these levels, as described in the section below.

Community-based maternal death reviews/verbal autopsies. The DRC's MDSR guidelines describe three context-specific situations for a verbal autopsy:

1. A supplemental community-level review of a maternal death that occurred within or on the way to the facility;
2. A review conducted by the receiving facility to trace the woman's path to death in referring facilities and/or the community; and
3. A review of a home-based maternal death, which can be combined with information from facilities where the woman received care (e.g. ANC, delivery).

All three scenarios were described and performed by KIs to different extents, with the first two being more common. The HZ and KIs in three facilities that frequently received referrals from private facilities and the community reported extending their reviews to these settings to acquire additional information on the death (situations 1 and 2 above).

It sometimes requires going into the community to see her living environment, how she lived...was she in good terms with her husband? Did her husband help her? What are community factors? Social factors? (KI 1, HZ)

If the person who died was referred, we must have the means of transportation to go to that place as part of the counter-referral procedures and to talk about it. And we also see to it that those who have referred the case can also participate in the death audit, to build their capacity, to know if there were delays in relation to the referral, what wasn't done well. (KI 12, HF 5)

Maternal deaths occurring outside of health facilities (situation 3) are primarily reviewed by the HZ team through and/or in collaboration with the facility that notified the case.

The verbal autopsy tool is completed for MDRs outside of the facility.

When the death is identified in the community...we descend to the health area. We first pass through a health center; the health center directs us towards the facility that reported the death. And now we can begin our maternal death review. (KI 1, HZ)

Many KIs suggested irregularities in the implementation of verbal autopsies and the challenges with obtaining accurate information on causes and contributing factors for such cases.

There are still limitations in the area of verbal autopsy in the community, the teams don't go to the community. (KI 15, PDH)

It is easier for us to find data at the hospital level. But at the community level, certainly, there is still a lot to do because there are several factors that contribute to maternal deaths within the community...Now finding the cause in such cases is a problem. (KI 5, HF 2)

Analyzing MDR findings and formulating recommendations. Key informants did not report the use of any advanced coding or classification system for causes of death (e.g. ICD) but rather utilized the simpler system described in the national guidelines. Using this system, the review teams select from appropriate items listed within pre-determined categories of causes of death (direct and indirect) and contributing factors (individual/family/community, provider/facility, administrative) on the MDR form. Discussions of contributing factors during review meetings were generally guided by the Three Delay Model (seeking, reaching, and receiving care) and the four “toos” of high risk pregnancies—too early, too many, too close, too late. Key informants were satisfied with the simplicity and practicality of these mechanisms in meeting their information needs.

The national MDSR guide recommends descriptive analysis of the MDSR data by person, time, and place. More specifically, it recommends producing counts of maternal deaths in facilities and communities, as well as grouping and quantifying causes of death and contributing factors. The national guide does not provide a comprehensive list of potential indicators for the analysis. Additionally, none of the facility KIs reported or demonstrated evidence of conducting statistical analysis at their levels, some of whom believed it was the responsibility of the HZ.

That's [statistical analysis] at the level of the health zone because they have oversight... they present the situation of the whole health zone... And then they can disaggregate and say ‘there were two cases in this health facility...’ - this is done at their level (KI 14, HF 6)

A few facility KIs reported that frequencies of live births and maternal deaths at given time periods are sometimes manually extracted from hospital registers to report facility-level MMRs. All facilities submit weekly surveillance reports and monthly reports of

health events to the HZ, which enters and compiles findings into the NHIS as well as on Excel spreadsheets containing a line listing of maternal deaths.

One HZ KI suggested that aggregated analysis at the HZ level generally consists of descriptive statistics including frequencies and proportions to summarize key indicators (e.g. MMR, causes of deaths, three delays) by socio-demographic characteristics, time, and place, consistent with national guidelines.

We set up a database in Excel to try to follow-up. We record how many [maternal deaths] we had during the year, we can pull out information such as the average age of maternal death cases, the length of stay, the causes of death...we can categorize them and quantify them from our small database. (KI 1, HZ)

However, apart from an Excel spreadsheet containing raw data, there was no documentary evidence displaying data analysis results from MDRs.

Formulating recommendations. All sites visited formulated recommendations and provided immediate feedback during the MDR session using the standard recommendations template with the following items: implementation level (family/community, provider, facility administration, health system), implementation time frame, and a designated person.

We develop recommendations at different levels...For example, there may have been a lack of medical supplies or lack of funds—it all points to the administration. So, we develop recommendations related to providers, hospital administration, family, community, health officials and we finally conclude the review. (KI 14, HF 6)

The MDR findings and recommendations are aggregated by the HZ and used to inform parts of the HZ's annual strategic plan. However, a KI reported that the HZ is still in the process of collecting data to develop a comprehensive action plan based on these findings.

The action plan what we develop is based on our recommendations...we are in the second year, we are collecting information and after a number of years, we will do the analysis and draw the main recommendations (KI 1, HZ).

The document review of 36 completed MDR forms between 2016 and 2018, revealed that half (n=18) of the forms contained recommendations that were inadequate and/or poorly formulated, lacking specific actions, time frames, and individuals responsible for implementing or monitoring recommended actions. In addition, the recommendations were not comprehensive or directly linked with the contributing factors, with many lacking community-level recommendations.

Following up on recommendations and taking action. Facilities are expected to note the recommendations in their hospital registers for follow-up during supervisory visits. All sites reported some mechanisms for following up on recommendations, some of which included supervisory visits by the HZ team and the hospital management (medical director, chief of staff, director of nursing), inspections by the PDH, and follow-up of previous recommendations during the next MDR session.

Within our facility, the director of nursing and I, the chief of staff usually carry out supervisions in departments that are concerned, to address the issues that were identified. So, we participate in ANC, to evaluate whether women benefit from these recommendations. We can even participate in deliveries to assess how providers handle patients in this unit. (KI 5, HF 2)

However, none of the sites demonstrated written evidence of a systematic process for tracking and documenting the implementation status of these recommendations.

While many reported having designated individuals to follow-up on recommendations, these were not documented on completed MDR forms. Additionally, some HZ and facility KIs pointed to insufficient and delayed follow-up on recommendations particularly at higher levels of the health system.

There is no monitoring or follow-up at higher levels. It's not really enough. (KI 14, HF 6)

We do not often follow-up promptly. And when you're supposed to follow-up on someone and they notice you've slowed down, they slow down too. They think to themselves, 'well, there's no manhunt, so leave me alone then.' And that's often the case. It is an incentive for them not to improve their performance. So, it's on both sides. Sometimes it's on our end and other times it's on their end. (KI 2, HZ)

Moreover, there was no documentation of actions that have been implemented as part of the MDSR process in Goma HZ and within participating facilities. However, KIs provided some examples of actions that have been undertaken in their sites in response to MDSR. The KIs suggested that health facilities and the HZ promptly implement recommendations within their control while response implementation remains suboptimal at community, provincial, and national levels. Examples of actions that have been implemented as a result of MDSR are presented below.

1. In-service trainings for providers within participating facilities, some private facilities, and the community, covering key issues identified in the reviews:

We organize trainings or continuing education to reinforce providers' knowledge and skills on safe motherhood. And currently, we have realized that there are midwives who attend to deliveries within the community and that many maternal deaths occur in community settings. In response, we decided to organize trainings in community settings, where we invited midwives who attend deliveries in the communities so that we can recruit them to cooperate with us and they can understand their limitations in terms of interventions. (KI 5, HF 2)

2. Revision of the ANC content and provision of essential materials for ANC to health facilities to improve its quality:

We have required mandatory exams during antenatal care. We have added some exams in our antenatal care package in addition to those recommended by the Ministry of Health... Since hemorrhage is a leading issue, we have added a few elements to our antenatal care package

pertaining to hemorrhage to improve our transfusion capacity and ability to intervene quickly... Meaning, we identify the patient's blood group during ANC, we assess the bleeding and clotting time during antenatal care. (KI 8, HF 3)

3. The establishment of on-site blood banks in two facilities in an effort to reduce unnecessary delays and maternal deaths from hemorrhage:

We now have a blood bank available. So, our experience, the events we witnessed here, motivated us to establish a blood bank. It was extremely expensive but at least we have a blood bank that we now manage from here since hemorrhage is the leading issue. It used to take us so much time to leave our facility in search for blood elsewhere, thus one of the measures to avoid delays was to avail ourselves of a blood bank in our facility. (KI 8, HF 3)

Last year we had a death in [local hospital]—maternal death. Why, because the doctor who was operating needed blood but when he went to get the blood at the [higher-level hospital], he had the blood but when he returned, he found the woman already dead. We recommended that [local hospital] must make arrangements to have a blood bank...they already have a blood bank that is already available. (KI 1, HZ)

4. Restructuring of emergency transportation and communication systems in two facilities, including the 24h availability of an ambulance and provision of call credits and/or mobile phones to providers:

[Now] they always leave the ambulance with fuel, and airtime or call credits in each phone because these were all recommended. They bought the phones for each department/service and they give 10,000 units of call credits monthly, including the maternity unit. (KI 11, HF 5)

There were cases where we had found a communication problem and a communication system has been put in place such that all specialists and hospital managers are connected to a special network that does not charge the caller...There was also a problem related to the availability of the ambulance to pick up a doctor or to pick up a patient, and that too was resolved because the ambulance is operational 24 hours a day and the driver is available as well. (KI 13, HF 6)

5. Development of new guidelines surrounding the consistent use of a partograph in four sites, alert and notification of appropriate providers in cases of emergencies in three facilities, and authorizations for using operating rooms in one facility:

We place an emphasis on patient monitoring and on promptly alerting the designated health professional in case of complications. In the context of patient monitoring, we have to notify the medical professional on time when confronted with a situation. (KI 7, HF 3)

Here in our facility, midwives or birth attendants monitor the woman using the partograph and we are told that if there is a complicated case at night, we must not go to the operating room without authorization. Do not enter the operating room without informing the head of the department - the gynecologist if a serious case is brought during the night. (KI 11, HF 5)

6. Changes to staffing policies in two facilities to ensure the availability of providers on a regular basis and to reduce the workload, particularly during critical times, such as night shifts:

Before we were only two people on call, now they've added a third person for the on-call duty plus a supervisor, which makes it four. (KI 11, HF 5)

So, there was an organizational issue in the health facility...we were the only two doctors. It was difficult to assume on-call duty, so the physician on-call used to go home. So, the driver had to go back and forth between the hospital and the physician's home. So, the physicians were not reaching the facility on time... consider the time it takes to go home and return to the hospital, when it's a hemorrhage case...the patient can die...We recommended that if we were three physicians, we could start spending the night here [in the facility] when on-call. It took a long time for them to implement the recommendation, but it was finally implemented in 2016, so from 2010 to 2016, it is then that they finally hired a third physician. (KI 8, HF 3)

7. Health education organized by the HZ to sensitize women on family planning:

The health zone organizes trainings because we realized that most of the maternal deaths that we report are among multiparous women. So that's where the health zone comes in. They organize trainings on family planning. So, they organize these trainings to sensitize women to adhere to family planning. (KI 6, HF 2)

Conversely, the majority of KIs reported failures or delays in acting on recommendations particularly at the provincial and national levels and in the community, citing logistical or financial issues, limited dissemination of and follow-up on recommendations, weak support from the provincial and national levels, competing priorities at all levels, or simply the lack of willingness to act on recommendations.

Usually, these recommendations are just a formality. They are not materialized. So, the team formulates recommendations and then it's left there...just to meet the requirements for completing the audit but actually the recommendations are not acted upon, neither are they shared with everyone. The team recommends things and it's left at that. We do not publish/disseminate them. Generally speaking, it is rare that we publish or disseminate them. The recommendations are not even fed back, because there are recommendations that are addressed for example to the health zone, provincial division, or community but they are just stored/archived. (KI 9, HF 4)

One example mentioned by two KIs is the failure to provide ambulance services throughout the city despite repeated recommendations to reduce fatal delays in reaching an adequate health facility (Delay II).

The major recommendation that comes up every time—it was recommended that there be medicalized ambulances because we found that most women died due to the lack of transportation. This has been recommended, but has never been done (KI 10, HF 4)

Moreover, there was limited observed and reported evidence of community-level actions besides training community-level providers on the management and care of women and providing health education on family planning.

Disseminating results and recommendations to stakeholders. The national MDSR guide and the KIs outlined dissemination and feedback pathways from community to national levels (Figure 9). Specifically, the national guide recommends: 1) immediate reports from community to facility levels; 2) immediate, weekly, monthly, and

annual reports from the HZ and facility levels to the provincial level; 3) weekly, monthly, quarterly, and annual reports from the provincial to the national level; and 4) quarterly and annual reports at the national level. The HZ not only forwards reports from facilities and communities to the PDH but should ideally receive feedback from the PDH and provide feedback to health facilities and communities. Similarly, health facilities are expected to feedback information to catchment communities.

Figure 9. Dissemination and feedback mechanisms for MDSR in Goma Health Zone

While the national MDSR guide specifies reporting and dissemination time frames from lower to higher levels, the timing and frequency of feedback down the reporting chain are not specified. Additionally, this national guide does not specifically

mention a comprehensive MDSR report nor does it elaborate the contents of the reports. The document reviews and KI interviews revealed that Goma HZ does not currently produce comprehensive MDSR reports documenting MDSR findings, recommendations, and actions. Alternatively, the HZ forwards information to higher levels through immediate notification, weekly surveillance reports, and monthly NHIS reports and feeds back findings to lower levels by providing immediate verbal feedback and hard copies of completed MDR forms during external reviews; organizing workshops, trainings, or meetings with selected health providers in the HZ; and presenting summaries of MDSR findings during periodic HZ management meetings attended by various partners.

We are not there yet [producing an MDSR report], but sometimes we organize workshops where we integrate the policies from the Minister of Health and his delegate who wants to participate in the debate. (KI 1, HZ)

We even provide feedback after the review. We bring together the entire team of providers on duty in the facility and we show them the gaps, we show them what they should have done and so on... We provide recommendations and immediate feedback on site, along with a copy of this report [pointing to the maternal death review form]... It is not a secret, we share our findings with them. (KI 2, HZ 1)

Similarly, none of the facility-level KIs reported any defined method for disseminating MDSR findings. Participating facilities did not produce a comprehensive MDSR report but many reported sharing completed MDR forms with the hospital management, their partners, the HZ office, and in some cases, directly with the PDH and the MoH. This is in addition to the previously mentioned weekly surveillance reports and monthly NHIS reports submitted to the HZ.

There is an activity... a review of all primary health care activities, that all health care providers attend. During this meeting, data is shared, including data on maternal deaths. Today, there is a meeting of the Board of

Directors. During this meeting, we present these data and people from other facilities are present (KI 14, HF 6).

The national guide identifies medical and non-medical target audiences who are most likely to act on the information, including government agencies, professional organizations, media, CBOs, universities, and opinion or cultural leaders. It also specifies various dissemination methods that are appropriate for each audience. However, this assessment found no evidence of systematic and targeted dissemination of MDSR findings to non-medical stakeholders such as communities, civil society, policy makers, and NGOs in Goma HZ.

Monitoring and evaluating the MDSR system. The national MDSR guide recommends systematic and continuous monitoring and annual evaluation of the MDSR system, using key indicators including timeliness and completeness of reporting, number of maternal deaths notified versus number reviewed, proportion of maternal deaths to which responses were implemented, and MMR. This guide further outlines common data sources to facilitate data collection on these indicators. However, none of the sites included in this study reported performing systematic M&E of the MDSR system or producing M&E reports of the MDSR system. Given the lack of systematic M&E procedures, information on some MDSR process indicators were not available or were difficult to retrieve, such as information on the proportion of recommendations implemented or the timeliness of maternal death notifications over time.

Table 7 below presents data on key MDSR process indicators in participating health facilities from 2015 through mid-December 2018. Three out of five participating facilities and the HZ had designated teams (usually a medical director and director of nursing) to review maternal deaths in collaboration with attending providers between

2015 and 2018. Health facilities reporting the absence of such a team either reviewed maternal deaths in regular staff meetings or assigned individuals based on their availability at the time, thus did not designate specific teams. All participating facilities reviewed all maternal deaths that they notified to the HZ between 2015 and 2018, organizing distinct MDR sessions for each death. None of the facilities reported conducting community-based MDRs nor including community members in MDR sessions. None of the facilities provided information on the proportion of recommendations implemented between 2015 and 2018.

Table 7

MDSR Process Indicators in Participating Facilities from 2015 to mid-December 2018

Sites	MDR Team?	# MDs Identified	# MDs Notified	# MDs Reviewed	# of MDRs	# of MDRs w/ Recommendations	# of MDRs w/Community
2015							
HF 1	Yes	1	1	1	1	1	0
HF2	No	2	2	2	2	2	0
HF3	No	3	3	Unknown	—	—	0
HF4	Yes	1	1	1	1	1	0
HF5	Yes	1	1	1	1	1	0
2016							
HF 1	Yes	0	0	0	0	0	0
HF2	No	1	1	1	1	1	0
HF3	No	3	3	Unknown	—	—	0
HF4	Yes	2	2	2	2	2	0
HF5	Yes	3	3	3	3	3	0
2017							
HF 1	Yes	1	1	1	1	1	0
HF2	No	0	0	0	0	0	0
HF3	No	3	3	3	3	3	0
HF4	Yes	2	2	2	2	2	2
HF5	Yes	2	2	2	2	2	2
2018							
HF 1	Yes	0	0	0	0	0	0
HF2	No	0	0	0	0	0	0
HF3	No	6	6	6	6	6	0
HF4	Yes	2	2	2	2	2	0
HF5	Yes	2	2	2	2	2	0

Theme 3: Quality of the MDSR System in Goma Health Zone

The KI interviews, document reviews, and the observation collectively illuminated the quality attributes of the MDSR system, namely its simplicity, acceptability, flexibility, timeliness, stability, and data quality.

Simplicity. Findings from previous sections on the MDSR structure and processes indicate that the MDSR system in Goma HZ is relatively simple and inexpensive given its integration into the well-established IDSR, a system that is familiar to many stakeholders. While the MDSR system requires multiple reporting levels, the data flow pathways and responsibilities for maternal death notification and review are clearly defined, well known, and easy to implement. For instance, in integrated facilities, maternal deaths are reportedly immediately notified by each department to the senior staff on duty (medical director, chief of staff), who immediately notifies the HZ over the phone, followed by a written notification form. Notification is followed by an internal review by the hospital and external review by the HZ, with findings and recommendations submitted to and fed back by the HZ. None of the KIs reported any technical difficulties in completing the standard maternal death notification and review forms since these forms are concise and provide pre-categorized items.

However, some advanced aspects of MDSR were complex. Depending on the origin of the case, stakeholders reported varying levels of complexity in extracting data for MDRs. Case finding and MDRs in the private sector and communities are complicated by prolonged and/or multiple field visits; multiple sources of information (formal and informal) needed to identify and confirm maternal deaths and contributing

factors; a lack of clearly defined mechanisms; limited knowledge of MDSR; cultural/traditional beliefs about causes of death; and hiding/concealing information due to fear, among others. Additionally, advanced data analysis of MDSR data was not carried out in the sites visited given the technical and technological limitations. Moreover, response implementation was reported by some as being resource-intensive, thus remains suboptimal particularly at higher levels of the health system and within communities. The dissemination of MDSR findings and M&E mechanisms for responses and the MDSR system itself are not standardized or clearly established.

Finally, while many KIs relied on general knowledge and experience in maternal health and epidemiologic surveillance to perform their MDSR-related tasks, the majority pointed the need for specific training on MDSR to ensure optimal performance of more complex tasks.

Acceptability. There was a high level of acceptability and support for MDSR among participants in this study as evidenced by the timely notification of cases and their willingness to participate in MDRs.

We find that the teams are often willing to get involved in maternal death reviews. People are willing. We often find them having already completed an internal review. (KI 4, HZ 1)

While participants are obligated to notify and review cases, acceptability among HZ and facility stakeholders was reported and observed to be largely attributed to the following: 1) integration of MDSR into IDSR; 2) alignment with the national strategic plans to reduce maternal mortality and strengthen the health system; 3) increased knowledge and understanding of MDSR goals and objectives; 4) endorsement of MDSR and briefings by authorities and senior management at facility and HZ-levels; 5)

perceptions of ethical obligations to address this “unacceptable” tragedy, and personal commitments to the slogan: “no woman should die while giving life.”; and 6) a culture of self-reflection/self-evaluation that enables perceptions of MDSR as a quality improvement and learning tool.

Everyone is involved in the fight against maternal mortality. Everybody! So, when a maternal death occurs, it hurts everyone and everyone wants to improve or to know what happened, to look for causes—what are the underlying factors, so that it does not happen anymore. So, it is this motivation to avoid any case of maternal death that motivates us to participate in this audit to try to assess why it happened so that it does not happen again. (KI 13, HF 6)

The strengths are that providers know how to evaluate themselves in relation to the reviews. Because if you tell someone this is what you should do and what you did ... automatically it's like it's educational and it sticks in your head, so you won't do the same thing in the future. That's a strong point. But it also helps the health care provider understand his/her responsibilities in relation to each particular case in such a way that when presented with a similar case, he/she will take the case seriously and recall his/her duties. (KI 14, HF 6)

In contrast, MDSR has not reportedly received the same level of acceptability in community settings and in non-integrated private facilities. The KIs revealed that the fear of disciplinary action and the limited knowledge of MDSR goals and objectives are still highly prevalent in such facilities, resulting in defensive behaviors towards MDSR such as withholding or concealing important information on maternal deaths.

Flexibility. The MDSR process in DRC is standardized by the MoH, which issues national MDSR policies, guidelines, and forms. This centralization limits the system's flexibility at local levels, since major changes in processes and forms may require bureaucratic processes and higher-level approval.

We do not conceive anything, it's provided by the Ministry because what we do is a universal thing. What we do, the form we have here is what we have everywhere in the republic. Yes, it must be universal. (KI 2, HZ)

Conversely, the IDSR system, of which MDSR is a component, demonstrates an example of flexibility as it had been successfully adapted with minimal additional resources to enable the surveillance of and response to maternal deaths. Additionally, KIs discussed a few examples of the MDSR system's responsiveness to new demands, the most recent being the country-wide shift in terminology from maternal death "audit" to maternal death "review" in 2015 or 2016 to remove the disciplinary connotation of the term "audit". This change was officially communicated to focal persons within the HZ and reflected in the national guide and revised MDR forms. Similarly, one facility-level KI noted that the MDR forms had been shortened to reduce completion time and that additional documents (e.g. the case summary) are attached as appendices to the standard MDR forms when necessary.

Finally, some KIs indicated that this system is open to opportunities for improvement. For instance, some discussed plans or intentions to improve or expand MDSR processes into the community and private sector (e.g. direct information sharing with the HZ) by actively engaging community stakeholders. They acknowledged that this will require training or orienting these stakeholders on MDSR goals and objectives, principles, and processes. Additionally, various KIs were looking forward to receiving this study report to guide system strengthening. Overall, the simplicity of the MDSR system, its smooth integration into IDSR at national levels, and examples of past changes to the system suggest that this MDSR system can adapt to changes in information needs and operating context with strong political will at local and national levels.

Timeliness. The timeliness of MDSR processes varied by component and sources. The MDSR system generally produced timely basic information on maternal

deaths in integrated health facilities and less so in communities and private sector. For instance, maternal deaths in integrated facilities were observed and reported to be notified by phone within 24 hours, and those identified by CHWs within 48 hours, as recommended.

If it [the maternal death] happened at night, then we notify him [CMO] in the morning, if it is during the day, we inform him [CMO] directly. (KI 11, HF 5)

However, KIs reported delays in the notification of maternal deaths within communities and in unregulated private facilities, many of which go unnoticed by CHWs or the health system due to the fear of litigation in private facilities.

There are private health facilities, small health facilities around us... they do not notify maternal deaths on time because they are afraid. (KI 14, HF 6)

The majority of internal and external MDRs were implemented in facilities within the prescribed 48-hour time-frame. Many facility KIs commended the promptness, responsiveness, and readiness of the HZ team in conducting external reviews.

They [the HZ] often do their review even before our internal review. For example, if it's 9 a.m., you call at 9 a.m. and at 11 a.m. or 12 noon they're already here, while we have scheduled our team's meeting for tomorrow—they precede us. So, I often conduct the first review with the team from the Health Zone. They are very sensitive and responsive to this notification. (KI 8, HF 3)

Some KIs reported occasional delays in MDRs due to competing priorities (e.g. vaccination campaigns) and busy workloads in health facilities.

A more significant problem is the availability of people to participate in audits, because at the hospital-level, people seem to be too busy. Now convening the team that managed the woman...there are those who are on-call, there to those who are in consultations or rounds during the day, they do not have time to do it. And also, the availability of some supervisors, because supervisors such as the director of nursing, chief of staff, must be

present during audits. They are not always available; a case can sit there for even a week without being audited. (KI 9, HF 4)

I know there are reviews that are pending at [local hospital], we have 3 reviews pending. Since we've just come from implementing several activities, these reviews have not been conducted. The team...was faced with other priorities the day they were supposed to go. (KI 1, HZ)

These reports were corroborated by the data in the MDSR Excel document, which revealed that 24% of MDRs (7 out of 24) between 2017 until early November 2018 were delayed by an average of 5 days (standard deviation=5.196; range 1-15 days).

Finally, as previously reported, KIs suggested that response implementation was often delayed at higher levels of the health system and in communities likely due to resource constraints.

Stability. With the exception of the aforementioned delays due to competing priorities, no major interruptions were reported in the implementation of MDSR within the HZ and facilities. The lack of dedicated resources for MDSR was not perceived to affect the stability of the MDSR system, rather, the use of existing resources was reported and observed to facilitate its routine operation and viability. All sites visited had the minimum resources needed to carry out MDSR functions. For instance, all sites reported the regular availability and accessibility of maternal death notification and review forms as these were obtained from the HZ's central office. Similarly, the majority of KIs reported using their organizations' vehicles to conduct field visits to different sites for internal and external review purposes. None of the KIs reported issues with the availability of cellphones and call credits for MDSR-related communication as these were already accounted for in facility and HZ operating costs. In the absence of the CMO who spearheads external MDRs, the HZ nurse supervisors or a team from the general referral hospital conducted the external MDRs in health facilities, ensuring continuity.

Data quality. The national MDSR guide states that quality documentation of care is a critical element for effective reviews, underlining the assumption that care that is not documented was not provided. While four participants perceived the data collected on maternal deaths as generally of sufficient or reasonable quality for decision-making, the majority of KIs expressed dissatisfaction with the quality of the information. Many reported several instances of missing information in patients' medical records, such as information on the patient's socio-demographic characteristics, obstetric history, status on admission and at the time of death, and on the care provided.

There are always cases where the records were not properly completed. Every time we conduct the reviews, we notice that the file is not well completed, each time... We do not have all the information we need. It's missing some information. (KI 10, HF4)

Incomplete information was a barrier to reviewing maternal deaths with accuracy. In some cases, participants were forced to rely on hypotheses by piecing together patches of available information. In other cases, these reviews were simply inconclusive. The majority of KIs were particularly frustrated with the quality and availability of information in cases of referrals from unregulated private facilities. According to KIs, many such facilities lack the culture of documenting care and often refer cases without the required referral letters or medical records.

Unfortunately, sometimes the deceased woman started in a clinic where they have no records/charts. Sometimes they send us patients without giving us the medical records, in which case we don't have any information on what was done where she first sought care. This is the reason why we trace the patient's path when we conduct audits by asking where did she start? At least, the [family] members who come with the client tell us where they started so that we can visit the facility to collect information when conducting our audits. (KI 5, HF 2)

Data collection for referral cases was perceived to be time-consuming and resource-intensive since it requires multiple field visits to acquire additional information from the facility itself and from the family or community members.

The review sessions...it depends on the condition of the patient's chart. If all the patient's medical records and the team that attended to the woman are available, it takes between 1h30 minutes and 2 hours to complete. But if you do not have access to all the records and it is a referral, it goes beyond, up to an entire day because you have to go there until you collect good information. (KI 2, HZ)

In addition, the majority of the KIs revealed that providers in many unregulated health facilities sometimes modified the contents of patients' medical records out of fear of disciplinary action.

Sometimes they hide...there are some facilities that change the patient's chart. If they see that it may cause problems, they change the chart and they write something else. (KI 3, HF 1)

Theme 4: Outcomes of MDSR Implementation in Goma Health Zone

Key informants linked MDSR implementation with short-term and intermediate outcomes, and to a lesser extent, positive impacts on maternal health.

Short-term and intermediate outcomes. Key informants voiced that MDSR has primarily increased the availability of locally owned data on maternal death causes and contributing factors to support data-driven responses, decision-making, and quality improvement efforts at facility and HZ levels.

With the introduction of maternal death reviews, we have as much information as possible about deaths happening in our health zone, maximum information. (KI 1, HZ)

It helps us to better understand the problems within health facilities and even the problems at the community level. It also helps us to better organize the supervision and management of the health facilities. (KI 4, HZ)

Improved QoC was the most commonly reported outcome of MDSR, which KIs attributed to the small but substantial changes in knowledge, practices, and behaviors within health facilities and at the HZ-level. More specifically, some KIs have observed improvements in adherence to national standards of care for maternal health service delivery within their respective sites.

We've seen changes at our level...it helps improve our service delivery because we want to avoid similar events in the future, so we make an effort to meet national standards. It is among the advantages, where every day we refer back to the standards before acting. What should be done? So that everyone knows their limits in relation to service delivery—I can do this but I cannot do this. That's an advantage of the reviews. Everyone faces their responsibilities, and everyone knows 'I can do this, and I can leave this to someone else.' (KI 14, HF 6)

Additionally, two KIs reported improvements in the quality of ANC as a result of MDSR, where critical exams for PPH prevention were added to the ANC package in one site, and essential medications and supplies for ANC were provided to some facilities by the HZ.

We have ensured the availability of some materials or supplies that are needed for antenatal care in health facilities, for example. We have made the partograph available, as well as some essential medications. We gave some equipment to health facilities and we trained their staff. (KI 4, HZ)

Key informants revealed that lessons learned from MDRs have also encouraged providers to become more “cautious”, improving the quality of patient monitoring as a result. For instance, when asked about the impacts of MDSR, one facility KI stated that MDSR has helped her in the following ways:

To improve, to be cautious, to know how to monitor women and to be at the service of the woman when she is in labor, and to check the vital signs every 2 hours and every 30 minutes. Because during labor, the mother can have hypertension, if you're away, she may enter eclampsia without you being aware. That's why we monitor every 30 minutes. (KI 11, HF 5)

Another KI had a similar experience:

Here in our facility, there is really an impact.... People have started to be cautious, they say 'I better monitor the woman closely, I have to be next to the patient'... all that. There has really been a positive impact since we started doing reviews. Because we ask each time, what was not done that should have been done? It is from this that everyone learns, 'Huh! I won't do this next time.' It has a positive impact. (KI 10, HF 4)

Another example of an improvement in QoC is the decline in cesarean section rates in one health facility in response to MDR recommendations.

Because there had been many cesarean sections, we could even have up to 70 cesareans... the two months we had the deaths here, one of the recommendations was to avoid cesarean sections. Now we are at 41 instead of 70. We are at 41. During this month we had 41 cesareans. (KI 11, HF 5)

Additionally, the majority of KIs reported that MDSR has improved collaborations among health care providers. According to many, MDSR has instilled the spirit of teamwork, encouraging collective and multidisciplinary quality improvement and problem-solving efforts.

The other strong point is that when we conduct this review, staff can identify the areas for improvement in care delivery, as a team. Because we usually call everyone, even the person who placed the IV catheter on the woman, we must call them so we can discuss the case as a team. So, people understand that they work as a team. That's a highlight of maternal death reviews. That's what I see as a supervisor. (KI 14, HF 6).

Other less frequently reported but critical MDSR outcomes included improved documentation of care and increased uptake of family planning in two facilities. One KI reported that MDSR implementation has enhanced the practice of documenting care in his facility, as providers are now aware that patients' records may be reviewed any time.

It [MDSR] has helped us record or document care in all of the patients' charts because everyone knows that when there is a death, it must be audited. So, all the patients' charts are completed, with information regarding the providers, the hours, the time of interventions, all that. (KI 13, HF 6)

Additionally, MDR findings have guided the HZ in targeting health education interventions, resulting in an increased uptake of family planning, particularly among high-risk multiparous women in one of the beneficiary facilities.

Another strength pertains to the family planning training conducted by the health zone. Now, we have women enrolled in family planning, which has reduced their risk for maternal mortality; most of them are multiparous women (KI 6, HF 2)

Impacts of MDSR on maternal health outcomes. There were mixed findings regarding the effects of MDSR on maternal health. On the one hand, KIs from five sites observed a decline in the number of maternal deaths, which they attributed to specific actions implemented in response to MDRs such as training on the management of obstetric emergencies and improved QoC.

We have observed a reduction in maternal mortality rates in our facility. And that's really a step. And the fact that we conduct audits has really contributed to that ... because we constantly remind the people who monitor or who are really involved to do everything possible to prevent maternal deaths from happening. So, it's really a step. And also...trainings that help us improve the quality of care for women... (KI 12, HF 5)

There is a change because although we cannot sing victory just yet, we have had no deaths in this year, 2018 because we were able to follow the recommendations that were given to us and we took proper care of women so as not to have any deaths. Although we are not yet at the end of the year, this is still a step... a year without any maternal death. Everyone has taken seriously the monitoring of maternity patients, to manage them as recommended. (KI 7, HF 3)

The strengths of our audit process...we had maternal deaths in the year 2016 and the year 2017. The audits we conducted in 2016, 2017 have allowed us to improve the care of women in labor to the point that since 2018 we have not experienced any maternal death within our facility. (KI 6, HF 2)

However, five other KIs stated that the effect of MDSR on maternal health remains “weak” or “invisible”, citing the limited implementation of recommendations

and the weak community and private sector linkages. Some also attributed this weak effect to the persistence of social determinants of maternal mortality in the HZ including poverty, low literacy, and low educational levels. Key informants identified the private health sector as accounting for the majority of maternal deaths notified in the HZ.

The impact is weak. The impact is really low because... for the impact to be effective, it is important that this woman with low literacy understands that her health is a priority, but to make her understand that won't happen in the blink of an eye. Secondly, what makes the impact invisible is the level of poverty. Even if providers refer to higher level facilities, they go elsewhere, to facilities that are not well-equipped. Because a woman with low literacy/education...and because everybody is called doctor, she does not know that there are different levels, different qualifications...So, all these reduce the impact we expect to see. (KI 2, HF 1)

Yes, there are changes. Unfortunately, maternal deaths persist despite these reviews...there are still many maternal deaths...This issue is related to ignorance or lack of knowledge—which remains an issue, and that until now we do not know what is happening in private health facilities including churches and the community setting...the information is still not there. We can be informed, we can have the tools and the experience at the hospital level but if the sensitization does not penetrate into the community... because as long as there are three delays – delays at the community level, delay within lower level facilities/clinics, and delays within the hospital, maternal deaths will persist. Unfortunately, there are still delays (KI 5, HF 2)

The factors influencing the implementation and effectiveness of MDSR are discussed below in more detail.

Theme 5: Factors Influencing MDSR Implementation in Goma Health Zone

This study revealed the following sub-thematic areas related to the factors influencing MDSR in Goma HZ: 1) leadership commitment and support; 2) shifting paradigms from maternal death audits to review; 3) adherence to “no name, no blame, no shame” principle; 4) MDSR and disciplinary action; 5) fear, guilt, and frustration; 6)

defensive behaviors; 7) unregulated private health facilities and lack of community linkages; 8) documentation and record keeping practices; 9) organizational culture; and 10) socio-cultural factors.

Leadership commitment and support. Commitment and support for MDSR from national and local leadership emerged as critical elements for MDSR implementation and effectiveness. The degree of leadership commitment and support in MDSR varied by health system level. National-level support for MDSR was primarily evident through the national maternal death notification and review policies, the integration of MDSR into IDSR, issuance of national MDSR guidelines and forms, and financing of HZ operations. However, links between national and local level MDSR activities were not visible to several KIs, who reported limited support and coordination from the national level. Some KIs particularly pointed to the poor regulation of private health facilities, which are major contributors to the persistently high MMR and are barriers to effective MDSR implementation.

The provincial level, through the PNSR, supported local MDSR processes by occasionally participating in external reviews with the HZ team and by organizing city-wide workshops or trainings on maternal health. While a few KIs reported receiving technical support and training on MDSR from the provincial level, many were frustrated with the overall lack of training, limited feedback on their reports, and limited response to recommendations.

There is no feedback on our reports at the level of the Provincial Division of Health. But just recently, in one case, the head of division wrote to us saying that he took into account all of our recommendations. But it does not happen in a systematic way. (KI 1, HZ)

This is what we ask every day, the support of our health division because they do not support us. There are some recommendations that are addressed to them, but we see no reactions at their level. (KI 10, HF 4)

Overall, strong buy-in and support from the HZ and facility leadership enabled the routine implementation of MDSR processes at local levels. The HZ management team coordinates MDSR activities within Goma HZ but is also actively involved in MDSR implementation. In this study, HZ leadership support was evident through the following: time commitments to MDSR; allocation of resources (e.g. vehicles, staff) towards MDSR activities; dissemination of standard MDR forms and other relevant forms (e.g. partographs) in integrated facilities; responsiveness to maternal death notifications; organization of external MDRs; and technical support provided to facilities.

The health zone level, they support us. So, whenever there is a death, we notify the health zone, they are always ready to support us. (KI 10, HF 4)

Similarly, facility leaders including medical directors, hospital administrators, chief of staff, director of nursing services, and heads of departments were identified as regular and active participants of MDRs, some of whom were also in charge of notifying maternal deaths and submitting relevant reports to the HZ.

I have to do the field visit [to referring facilities] myself because I am responsible for providing the report and the patient's chart/records to the health zone. If I send someone else, they may not obtain all the elements we need. (KI 5, HF 2)

However, many KIs highlighted deficiencies in some support functions from the HZ and facility leadership including the lack of training on MDSR, limited dissemination of MDSR guidelines, and limited follow-up of recommendations to ensure their translation into action.

Shifting paradigms: maternal death “audit” to “review”. Key informants’ narratives revealed attempts at shifting the paradigm related to MDSR at national and subnational levels, the hallmark being an official change in terminology from maternal death “audit” which had a punitive or disciplinary connotation, to maternal death “review” that promotes a non-punitive approach to MDSR. They revealed that the term “audit” evoked fear, discomfort, and frustration among stakeholders, some of whom were reluctant to notify maternal deaths and withheld information from review teams.

The maternal death review means we review what happened to the deceased. Before we used the term maternal death audit, but people were afraid. Audit for them means that there is going to be sanctions after the audit. That’s why we decided to use the term “review” because we review what happened to the deceased. (KI 10, H 4)

Before, it was a little complicated because people thought that audits were going to be followed by sanctions...So they felt uncomfortable when discussing the case because they were going to be held responsible. So back then, people did not express themselves properly; each person withheld information on their end to avoid being held responsible for what happened (KI 5, HF 2)

While it was unclear when this change in terminology became effective, the 2015 national guide suggests that it was established at the national level prior to 2015. However, the majority of KIs reported awareness of this change in 2017 through revised MDR forms that reflected this change. This shift has reportedly had a positive influence on MDSR implementation since it has improved individual perceptions of MDSR, notification of maternal deaths, willingness to participate in MDRs, and transparency during reviews, particularly in integrated health facilities.

So, people do not hide information because of this reminder... they give the information as it was to help us move forward. We know that before this was not the case because before people tried to hide, to omit what was done and to even hide the patient’s chart/records. And now it's different, we're moving forward. I know that there might still be people

who hide to protect themselves, but the information is such that it is done to improve and not to punish. (KI 12, HF 5)

We have omitted the punitive characteristic. It facilitates access to information. And people speak freely. Even if they are affected, they still express themselves quite freely, at ease without being afraid. (KI 1, HZ)

Since we've changed the word audit to review, everyone participates. So, we ask everyone questions. The whole team participates. People are not as scared as they used to be. (KI 10, HF 4)

Contrastingly, two KIs noted that the fear of punishment and defensive behaviors persist despite this change in terminology.

Despite this [change in terminology], people have not yet made it [maternal death review] a habit; people are still afraid. The staff are afraid to open up and to clearly explain the problem because they believe that revealing their weaknesses will lead to sanctions. That's the problem we have today (KI 9, HF 4)

Interestingly, this assessment found that the term “review” is not yet engrained in MDSR stakeholders. Many KIs only used the terms “review” or “maternal death review” when referring to external reviews by the HZ team and persistently used “audit” or “internal audit” when referring to their initial reviews with the health facility team. Others still refer to both as audit.

So, in other words, what we do internally we call it audit and what we do on the other side [health zone] is what we call review. (KI 6, HZ 2)

Well, it is a review when we do it with the Chief Medical Officer of the health zone. But here at [name of the hospital] we do an internal audit (KI 11, HZ 5)

Adherence to “no name, no blame, no shame” principle. The national MDSR guide clearly stipulates that confidentiality, anonymity and a non-punitive approach to MDSR (i.e. no name, no blame, no shame) are fundamental principles for successful MDSR implementation. However, this assessment found low adherence to the “no name, no blame, no shame” principle in the study sites visited, with the exception of one. Only

one participating facility ensured confidentiality during MDRs and anonymized all review documents (e.g. patient's file, case summaries) to protect the staff's identity. This KI noted that providing an enabling and supportive environment has enhanced stakeholder participation and disclosure during MDRs in this facility.

So, first, the audits are anonymous, and we also ensure that the patient's file is also anonymous. We do not mention the names of the people—not the patient's, nor that of the provider who attended to the patient. (KI 13, HF 6)

Key informants from the remaining sites and the document reviews revealed that patient and provider names are not obscured from medical records (e.g. patient's charts, partograph, ANC and postpartum records) prior to the reviews and are therefore accessible to individuals participating in MDRs. Similarly, the MDR forms contain personal identifiers such as the patient's name and address, as well as the names and signatures of all participants of the review session, including the attending providers.

The identity of the patient is there, including the names of individuals who participated in the review, name, number, position and a signature. Everyone has to sign. (KI 14, HF 6)

The KI from the facility that maintains anonymity recounted the challenges in promoting anonymity and confidentiality during reviews as it requires changing individual and organizational cultures and practices.

It's a common challenge, really getting people to respect anonymity, not to point fingers at this or that person. It is still a challenge because people always tend to think, "it is such who did that, it is this other person who did this", and yet this is not the purpose of reviews. The goal of these reviews is to discuss the issues in a general way while maintaining anonymity. So, now it's really a challenge to get that into people's heads that we should not mention the people, we should not point fingers at the people, but we must see the system as a whole. (KI 13, HF 6).

The observation and the KI interviews corroborated this difficulty of ensuring anonymity, especially since attending providers were often easily identifiable during the reviews when they provided further details on the case.

MDSR and disciplinary action. The national MDSR guide stipulates a non-punitive approach to MDSR but does not provide details on what such an approach entails, nor on legal protections for MDSR stakeholders and documents. Similarly, with the exception of one site, none of the KIs mentioned any protections against disciplinary or legal actions in their sites. This study revealed a paradox with regards to the link between MDSR and disciplinary action. All KIs supported and insisted on utilizing a non-punitive and non-threatening approach to MDSR, through various statements including the following:

The review by definition is not a trial...we are not pressuring people to explain themselves or it is not intended to show them that they are responsible for this death (KI 14, HF 6)

At our level we already know already that an audit is not a court trial, rather it is done to help us improve and to avoid maternal deaths. (KI 12, HF 5)

We are not a police force to arrest people, but we always try to understand the underlying causes of the death. (KI 2, HF 1)

Paradoxically, these statements contradicted their reports of disciplinary actions undertaken in the context of MDSR. Many expressed an ethical dilemma that rests on the premise of protecting future lives from harm and felt that it was necessary to impose sanctions when MDRs revealed serious errors on the part of the providers or organizations. The quotes below summarize the ethical dilemma expressed by many KIs:

It is not to punish people. But one day we may arrive at a sanction if we notice a glaring error, if we notice that you have operated in conditions that do not allow you to operate. Should we watch you, look at you when

you have caused the death of a loved one? So, at some point... when we have evaluated everything, we may have to sanction people. Someone comes and yet you know that you do not have a functional operating room, yet you allow yourself to operate in conditions that do not meet the minimum standard. No! We cannot accept that... The first case may pass but if the second case occurs, we stop you. (KI 1, HZ).

If we see that there is negligence involved, if someone violated ethical standards, we may impose sanctions. It can happen... We don't go in with the intention to sanction. No, unless we find that the actions did not comply with ethical standards or voluntarily violated known guidelines or standards of care. (KI 14, HF 6)

Nearly all KIs (n=13) revealed links between MDSR and professional and/or legal action in their sites. Sanctions were commensurate to the degree of severity, with more stringent sanctions imposed in cases of negligence, malpractice, violation of ethical and professional standards, illegal/unauthorized operations, voluntary actions, and repeat offenses. Some examples of disciplinary action cited by participants included service reassignments, temporary suspensions without pay, termination, and permanent closure of unauthorized facilities.

We have also closed a health facility with the assistance of the health zone. We went to the facility with the health zone team and we decided to close the facility. Those are some actions that have been undertaken as a result of maternal death audits in our health facility. (KI 5, HF 2)

A doctor was terminated in 2010, there was a case of service re-assignment in 2014. There was a reassignment, we found that one of the nurses did not perform her assigned tasks... she did not know when to call or alert [a physician], as a result she was transferred to a different service. (KI 8, HF 3)

There were reported and observed instances where the police and/or the DRC's National Intelligence Agency (locally known as Agence National de Renseignement-ANR) were involved in the investigation of maternal deaths, in response to complaints from the family or community. For instance, during an observation of an MDR session with the

HZ team at a private health center, two members of the medical team (a nurse and the OB-GYN) were called to report to the police station half-way through the meeting due to complaints from the family of the deceased. Other KIs recounted similar instances.

When they (the ANR) find out that there has been a maternal death in such a [private] facility, they go there and sometimes the providers run away when they notice their presence. They abandon their facility. (KI 1, HZ)

Only one participating facility ensured that MDRs were not linked with disciplinary action. In this facility, MDRs and investigation processes in cases of negligence are not interdependent, they follow separate procedures. This facility also maintains anonymity and confidentiality throughout the process to ensure staff protections. A KI from this facility made the following statement regarding links between MDRs and sanctions:

Not at all. And if there is disciplinary action, it is done in another context, not in the context of maternal death audits. (KI 13, HF 6)

Fear, guilt, frustration. Participants revealed a variety of interrelated emotions and behaviors during MDSR, some of which are related to the maternal death itself and others to the MDSR process. First, a maternal death has psychological effects not only on the family but also on providers who attended to the woman. Yet, MDSR activities are often conducted shortly after such an event to collect fresh details on the case. As such, feelings of guilt, tensions, and frustration related to the death are common, sometimes affecting full disclosure or the objective review of maternal deaths.

Well, actually, there are different emotions in the room. Those who participated in the care, those who witnessed the moment seem to have a sense of guilt that does not allow them to feel comfortable during the review session. And that's really the same. There is a psychological aspect. Even if families believe that we health professionals cannot sympathize, we are usually the first ones to suffer in the event of a maternal death... we are very much affected psychologically. So,

the team that witnessed the event seems to be a little... not comfortable. They seem to be defensive. They are often defensive (KI 8, HF 3)

However, fear and defensive behaviors related to perceived or actual disciplinary consequences of MDSR were more prominent barriers to effective MDSR implementation. The fear of litigation was reportedly more prevalent in non-integrated private facilities, where many are afraid or reluctant to notify maternal deaths, disclose information, provide access to documentation, and interact with external review teams.

Normally, when we receive information, even if it is in a private health facility, we visit the facility, but those people often hide the information. They hide more information because they are private facilities...they are not as aware, they think we are coming to arrest them, to cease their operations or to tell them to stop offering maternity services. They always tend to hide (KI 2, HZ)

One KI from the HZ reported observing higher levels of fear of blame among nurse-midwives compared to other providers, since they spend more time monitoring the patient and are therefore more likely to witness a facility-based maternal death.

Especially the midwives. Because sometimes it happens when the doctor is not there, the midwife monitors and calls the doctor if she notices any issues. So, they fear that we might say 'no, the nurse did not call on time, she delayed the mother (KI 3, HZ 1)

Overall, fear was found to be largely perpetuated by: 1) limited awareness of the objectives of MDSR, 2) lack of legal permits to operate (e.g. unregulated private sector) and thus fear of more severe sanctions, 3) potential damage to the facility's reputation (private facilities), 4) persistent use of the term "audit", 5) lack of confidentiality and anonymity, and 6) inconsistencies between MDSR principles of a non-punitive approach and the actual enforcement of disciplinary actions.

One KI noted that providing a non-threatening environment during reviews eased tensions and frustrations among providers, enabling them to contribute effectively to these reviews.

It is obvious that some participants are already frustrated when they come, perhaps due to the case and all that, but after they sense a welcoming environment in the room, relaxed and all that, they loosen up and then they feel free to participate. So, upon arrival there are some frustrations and all that but those who are used to it are now a little relaxed and as we move forward in the meeting, they begin to really feel at ease. (KI 13, HF 6)

Defensive behaviors. Fear and guilt reportedly triggered various defensive behaviors among providers in an effort to protect themselves, their colleagues, and/or their facility, particularly among those in unregulated private facilities. All KIs had observed a high tendency in many such facilities to withhold relevant information and to hide patients' medical records from external MDR teams. Such behaviors delay the notification of maternal deaths, require multiple field visits, and affect the quality of MDRs.

I do not know if I can call it propaganda for the hospital, they can hide the data at the hospital level in an effort to protect the hospital. So, the information won't be available. Unfortunately, today there are so many private hospitals and clinics everywhere and there so that's the challenge we have—obtaining the information... it can go unnoticed. (KI 5, HF 2)

Key informants also recounted instances where patients' records were modified/falsified by medical staff in some unregulated facilities in an attempt to hide the true story behind the woman's death. One KI emphasized that the likelihood of modifying medical records is higher when MDRs are delayed as it gives sufficient time to modify the details surrounding the case.

This fear often forces them to modify the patient's chart/records instead of leaving it as is ... they hide the original file, they make-up something else

that will correspond, and they make it up in such a way that it corresponds with the stage that the woman was in when she died... And that's a challenge we encounter in this kind of work. It's not easy. (KI 2, HZ)

Key informants reported a few strategies for assessing or maintaining the integrity of medical records. One HZ KI stated that falsified records are easily detected through critical examinations of the physical features and the contents of a patients' chart, as they usually appear rushed, are inconsistent with other records, and contain missing information.

We try to understand, because for example, something that you did in a rush, especially a document that you have...some things won't seem right because when we analyze the chart, we start way way back... there's a difference between a paper that we have just written on now and a paper that we've written on for 2 months and that we've touched so many times ... it's dirty, it's really dirty... And also, when you read deeply, you notice that there is something strange. Sometimes you find that they skipped some sections, they did not complete them. So, you may find strange things and when you analyze deeply, you may find that it was made-up. (KI 2, HZ)

One facility KI reported a more proactive measure taken in her facility to maintain the integrity of the patient's records, where the deceased woman's medical records are immediately taken by the hospital administration for storage in a secure, limited access location until the review is completed.

Other common defensive behaviors identified by KIs included: blaming the family and community for the death of the woman; attempting to justify or cover up for self and colleagues; and avoiding interactions or contact with external review teams—literally “running away” or “disappearing” from the review team, as described by the majority of KIs.

Unregulated private health facilities and lack of community linkages. Key informants identified weak private sector and community linkages as important barriers

to MDSR implementation and effectiveness. They particularly voiced concerns regarding the rapid proliferation of unregulated private health facilities in Goma, noting that these facilities offer a significant proportion of maternal health services, particularly to vulnerable women, despite their limited capacity or lack of legal permits to operate.

We have several facilities that are sprouting like mushrooms and are thirsty for money like shops ... they try to manage the case even when they are not qualified to assist her...but since they are thirsty for money, they say 'I will perform a surgery, I will do this.' And these are the challenges we have always encountered, and we keep on talking but it's as if we are talking in the desert. We are talking to try to reduce the problem, but the problem persists (KI 2, HZ)

All KIs reported that the majority of maternal deaths notified by integrated health facilities are late referrals from small unregulated private facilities. They noted that these facilities account for a large proportion of facility-based maternal mortality in the HZ given their suboptimal care, nonadherence to standards, poor infrastructure, and the lack of qualified personnel and appropriate equipment.

And besides at least 85% of cases of maternal deaths that we notify come from private health care facilities, where they did not manage the case properly...They often refer the woman only when they realize that the case is already too complicated. Most do not wait for the woman to die in their facility. When they see that it is already very complicated, that's when they refer the woman. (KI 2, HZ)

Many suggested that the QoC, provider competence, and numbers of maternal deaths in such facilities remain largely unknown to the government. While maternal deaths in such facilities are considered community deaths and ideally captured using the mechanism for identifying community-based maternal deaths, KIs noted that such facilities are often reluctant to notify maternal deaths. Additionally, while integrated facilities and the HZ are required to review maternal deaths referred to them from unregulated private facilities, this task proves to be challenging. First, many cases are

referred without referral letters or medical records, complicating MDRs. Second, private facilities are often reluctant to cooperate with the MDR teams, forcing stakeholders to rely on indirect sources including the family and the community.

They are guilty of something...When they are confronted with national standards, they hide because they know they can face sanctions. That's why they don't tell the truth. (KI 14, HF 6)

A few exceptions emerged, where some KIs have established working relationships with private facilities that frequently refer cases to them, enabling the exchange of information and expertise in the context of MDRs.

So, if we have been referred several maternal death cases without referral letters, we have to visit this health facility to ask them about the cases we received, their history, and progress. Then, we discuss with them the areas to improve and we also discuss elements for improvement on our end. Meaning our health facility shares information with other facilities that refer these cases to us. That's how it goes. And then we mail the files to the health zone. (KI 6, HZ 2)

On the other hand, this study found weak community linkages for MDSR. The lack of active case finding mechanisms in communities and private facilities, lack of formal MDSR training for CHWs, and the lack of community representation in MDRs were identified as barriers to the timely notification of community-based maternal deaths, and to identifying, reviewing, and addressing the social determinants of maternal mortality. The community remains a largely untapped resource in MDSR in Goma HZ.

Documentation and record keeping practices. Good quality documentation is critical for effective and evidence-based rather than hypothetical MDRs. Complete and easily retrievable medical records were reported to reduce the duration of MDRs while enabling thorough discussions. Conversely, deficient or incomplete documentation and poor record keeping practices were key barriers to MDSR identified by KIs. This

assessment revealed that the culture of documenting care is inadequate in some health facilities. When conducting MDSR tasks, KIs frequently encountered medical records with missing entries or insufficient details regarding the case. It was common for them to find that facilities had not documented care nor produced any single record/chart for the patient.

There was a case that presented to this [private] clinic around 10 p.m. and they referred the case to us at 5 a.m. but they never produced a patient's chart or any records for the patient. As soon as we arrived, we asked them to show us the patient's chart or records they created and there was nothing. (KI 6, HF 2)

In addition, record-keeping and archiving systems are largely paper-based in health facilities. Key informants reported the poor storage and maintenance of hospital registers and medical records, describing missing or lost files, and detached or “scattered” pages.

We have a serious problem of record-keep or archiving. Sometimes we can't find the file or chart within just a few days following the death— it is sometimes lost by someone. But also, the other problem related to record-keeping is that we often lose the charts.... If you see the patient's chart it's really messy, messy... there's small papers scattered everywhere...sometimes the patient kept it...whatever. Here we do not really have a good measure for archiving or keeping patients' records both within departments and at the level of the office in charge of record-keeping, so the archiving service. (KI 9, HF 4)

Under these circumstances, relevant information is not always easily retrievable and even when retrieved, is insufficient to support consensus building and decision-making regarding causes and contributing factors during MDRs. In some cases, such decisions are primarily based on hypothesis and verbal information, which are less reliable than documentary evidence. In addition, in the context of poor documentation and paper-based records, MDSR activities can extend up to several days for a single case as stakeholders search for information at multiple referral points.

Organizational/workplace culture. Key informant interviews highlighted organizational norms and practices that influence MDSR operations including teamwork and collaboration, shared accountability and individual responsibility, and the blame culture and transparency.

Teamwork and collaboration. Working in multidisciplinary teams was identified as a key strength for facility-based MDRs as it enabled richer discussions and captured multiple perspectives to uncover causes of death and complex contributing factors. It was also perceived to facilitate ownership of recommendations in different departments.

Shared accountability, and individual responsibility and ownership. All KIs, most of whom occupied senior management positions, were personally committed to the common goal of reducing maternal mortality within their respective sites. Many promoted MDSR as a self-evaluation, learning, and quality improvement tool to reduce maternal mortality. This was reported and observed to encourage buy-in from various stakeholders within health facilities. In many participating facilities, multidisciplinary teams held themselves accountable to improving QoC and were reportedly proactive in notifying maternal deaths, organizing their internal reviews, and addressing facility-level contributing factors. Some faith-based facilities had an added layer of accountability, often reporting to an intermediate administrative body besides the HZ.

However, one KI expressed contrasting views, suggesting that notions of accountability and individual responsibility are not yet widespread throughout the health care system, as evidenced by the limited implementation of MDSR recommendations addressed at different levels.

It's a cultural problem...So, people work for the mere fact of completing their assigned tasks, but they do not commit themselves to performing

better. They are here to be paid and that's it... So, people do not work to offer the best of themselves or to invest something in the society, so people work to accomplish the tasks in order to please the employer, get paid and that's it. Even they get home, they do not care how about how they can make things better. It does not exist. (KI 9, HF 4)

This KI held the health system responsible for failing to instill a culture of accountability and individual responsibility, given the lack of incentives for local initiatives.

You get discouraged somewhere because the system is such that those who make an effort are not encouraged. For example, I may have an initiative of conducting research on something, but I won't be supported by management. The ministry does not even include anything in the budget for research for example. So, initiatives are not really encouraged. (KI 9, HF 4)

Blame culture and transparency. Despite efforts at shifting the paradigm from “audit” to “review”, the blame culture persists and remains a significant barrier to effective MDSR implementation in Goma HZ. The blame culture was reported to inhibit full participation of critical stakeholders and transparency during MDRs. Conversely, creating a blame-free environment for MDSR by maintaining anonymity and confidentiality has been reported to ease tensions and promote full disclosure during MDR sessions in one facility.

Socio-cultural factors. Socio-cultural factors including cultural and religious norms and practices, low literacy and education levels, and poverty emerged as barriers to MDSR implementation. Some KIs acknowledged that community-based maternal deaths were more difficult to identify, notify, and review given the complexity of cultural beliefs and practices surrounding these deaths. For instance, beliefs that women's deaths were caused by “witchcraft” or “Karuho” (intentional poisoning) are still prevalent in communities. Such deaths are often not identified as maternal deaths, and therefore not notified by families and communities to designated individuals. When notified, it is

challenging to ascertain cause of death during MDRs or verbal autopsies given the lack of reliable information.

Another obstacle is the cultural problem where people think that people are dying of witchcraft or poisoning called “Karuho” here ... they do not think of a regular illness. These are things that are difficult to notify at the official level. (KI 9, HF 4)

For instance, one participant recounted an instance where a woman repeatedly refused blood transfusions for religious reasons and subsequently died from PPH despite the team’s attempt to save her. Some cultural and religious norms were reported to encourage home births, vaginal births, and/or births in other settings (e.g. “chumba cha maombi”—prayer room in English) even for high-risk women, countering MDSR efforts to reduce community-based maternal deaths, while also complicating the attribution of causes of death.

It can be customs or traditions saying that if a lady has never given birth vaginally, she is not valued in the community—as a result she may choose to give birth at home with no idea that there are consequences. Now finding the cause in such cases is a problem. But if it's in a hospital environment, then we can have the probable causes that are responsible for a maternal death. (KI 5, HF 2)

In addition, some KIs attributed the limited impacts of MDSR to women’s low literacy and education levels and high poverty rates, which contribute to the three fatal delays and force many to deliver in more affordable, unregulated private health facilities. They insisted that as long as these broader determinants are unaddressed, MDSR impacts on maternal health outcomes will remain weak. The major barriers and enablers to MDSR implementation identified in this study are summarized in Figure 10.

Figure 10. Summary of enablers and barriers to MDSR implementation in Goma Health Zone

Theme 6: Key Informants' Recommendations to Improve MDSR in Goma Health Zone

The KIs provided several recommendations to improve MDSR implementation and effectiveness in Goma HZ, drawing from the strengths, gaps, threats, and opportunities they identified.

Echoing stipulations in the national guidelines, some KIs pointed to the need for a *designated multidisciplinary MDSR committee* that meets regularly to review all maternal deaths within the HZ. They suggested that this committee comprise both clinical and non-clinical participants including maternal and reproductive health experts (e.g. OB-GYN), community representatives, diverse health providers, and HZ stakeholders.

So, we call all the leaders or all the gynecologists from different health facilities so we can sit together for a review and discussion so that each person shares their experiences from their respective facility. That, for me, can improve this process. For example, when there is a maternal death in any health facility, we can all go there to discuss ... I suggest that there be opportunities for gynecologists, and other providers– skilled birth attendants, midwives, to come together ... when we get together and discuss, even those who are not concerned can learn how to prevent similar events (KI 14, HF 6)

Key informants also recommended *standardizing and institutionalizing MDSR* processes in all health facilities including the private sector, by disseminating MDSR guidelines and standard forms, and training stakeholders.

The suggestion I can give is standardization. Meaning, maternal death review should be standardized across all health facilities to make them more effective. If everyone can do the same thing it can help us move forward. (KI 8, HF 3)

What would be useful is...the organization of the internal reviews everywhere and the counter-expertise/review of the health zone in the health facilities to establish common/uniform processes and concrete actions. So, all actors are involved. (KI 1, HZ)

Many specifically called on the HZ and the PDH to provide *formal training* on MDSR to various facility and community-based stakeholders in an effort to improve their perceptions of MDSR, capacity to implement MDSR, and to ultimately enhance MDSR quality and coverage.

Actually, it's a step that we have not done yet...we should train community health workers since they are the ones who know everything that happens in the community. They should be trained on how to report/notify maternal deaths. (KI 4, HZ)

To improve MDSR coverage and impacts, some KIs proposed *establishing or strengthening linkages* between the HZ, integrated facilities, non-integrated private facilities, and communities. One KI specifically suggested fostering collaborations and *formalizing or mandating joint reviews between receiving and referring health facilities* as part of the referral and counter-referral policies. Another KI proposed a similar but

alternative option where external reviews or field visits for referred cases or community-based deaths are jointly conducted by the HZ and the receiving facility, with the participation of the community and/or the referral facility. If standardized, these actions are expected to extend opportunities for learning and quality improvement in these settings, improve buy-in for MDSR among community and private sector stakeholders, and establish positive working relationships that encourage the widespread notification and review of maternal deaths.

So, to involve people from the referring facility or in the community from which women come... This is not completely or officially done yet, but we really do it... It's not official yet, we are advocating that the PDH gives us this authorization so that it really becomes an official procedure in relation to counter-referrals—so that we can go to them or they can come to our facility to participate in the audit. It will really be a great action that will also help the community and the health facilities within the community to progress... (KI 12, HF 5)

Additionally, KIs indicated the need to *enforce national policies for notifying and reviewing maternal deaths* within the HZ as whole, meaning in integrated facilities, non-integrated private health facilities, and the community setting. Similarly, in response to concerns regarding the influence of unregulated private health facilities on MDSR, some participants recommended *regulating the establishment and operations of private health facilities* within the HZ, to ensure compliance with national standards of care and MDSR reporting mechanisms.

There are many health facilities that do not have the capacity to attend to deliveries nor qualified medical teams but who have official documentations authorizing their operation. Authorities at the health zone level should be aware of this. They must make extra efforts to standardize the establishment of health facilities in order to help the population. (KI 5, HF 2)

Additionally, KIs suggested *reinforcing response implementation at all levels*, particularly at the provincial and community levels where actions lag behind. To support

the translation of recommendations into action, they proposed allocating sufficient resources towards implementing MDSR recommendations at all levels; ensuring the regularity of supportive supervision in facilities and communities; and establishing formal/systematic mechanisms for following-up on recommendations at all levels.

There has to be follow-up because it is the follow-up of recommendations that is problematic. There must be a mechanism for monitoring the implementation of these recommendations. We should create this mechanism because it does not exist. (KI 9, HF 4)

Two KIs provided recommendations to address poor data quality and availability. One recommended instilling a culture of documenting care and improving record-keeping in all health facilities to enhance the quality, availability, and reliability of data for MDRs and to reduce the heavy reliance on verbal reports and hypotheses.

Care not documented in the patient's chart is care not provided...we need to discipline people to document any observations made on patients and all actions taken and we can base our analysis on what is documented rather than verbalizations. (KI 9, HF 4)

Both KIs suggested considering the use of technology (computers) to improve record-keeping and MDSR-related data transmission between facilities and the HZ.

At our level to improve the audit process, as you can see, we do not have Internet in this hospital. So that means that all files in the hospital are not computerized. We do not have the Internet. If we had Internet, it could facilitate the management of things within the hospital. (KI 6, HF 2)

Finally, some KIs perceived the necessity to reinforce each organization's overall capacity to ensure optimal MDSR implementation by: 1) ensuring that all stakeholders involved are adequately trained, competent, and available to effectively and efficiently carry out MDSR activities; and 2) allocating financial resources to enhance MDSR processes. One KI explicitly noted that it would be worthwhile to allocate specific financial resources to refine current MDSR mechanisms.

We should have specific or defined resources for the death audit. If there are resources, we can develop mechanisms to facilitate the audits ... the financial resources to improve their implementation. (KI 12, HF 5)

In light of MDSR's goals and objectives, and its promising results, and despite its shortcomings, all KIs interviewed support its continued implementation and efforts to strengthen the system in Goma HZ.

CHAPTER V

DISCUSSION, RECOMMENDATIONS, AND IMPLICATIONS

Overview of the Chapter

The purpose of this study was to describe and critically assess the implementation of MDSR in Goma HZ, focusing on its structure, processes, quality, influencing factors, and outcomes. This study utilized a qualitative case study design consisting of 15 KI interviews, a review of 52 MDSR documents, and an observation of an MDR session. This chapter discusses the key findings of this study in the context of the literature on MDSR. The chapter concludes with a discussion of the study limitations as well as the implications for practice, policy, and future research.

Discussion of Research Findings

Research Question 1: How is MDSR Structured and Implemented in Goma Health Zone?

The first research question examined the structural elements and processes of MDSR in Goma HZ, shedding light on its strengths and limitations.

Overall, this study found a formal and standardized approach to MDSR at the HZ level and within participating health facilities. The major strength of Goma's MDSR system was its integration into the Integrated Disease Surveillance and Response (IDSR) system, consistent with national guidelines (MSP, 2015). Integrated MDSR systems have also been established in other SSA countries such as Malawi, Tanzania, Zimbabwe, Ethiopia, and Eritrea (Abebe et al., 2017; Pearson et al., 2009; Scott & Danel, 2016). The present study highlighted that MDSR's integration into IDSR permits an efficient use of existing organizational resources, reporting and feedback pathways, and coordination mechanisms, facilitating its acceptability and routine implementation within the study sites. These findings support previous reports that MDSR integration into existing systems is an efficient and suitable model for limited-resource contexts, where a stand-alone system is more costly to operate (Abebe et al., 2017; Biswas et al., 2016; De Brouwere et al., 2013; Pearson et al., 2009). In limited-resource settings, a standalone MDSR system may not be sustainable since it is often not prioritized in national health financing (Pearson et al., 2009).

This study also identified gaps in meeting some critical stipulations of global and national MDSR guidelines, including limited community engagement and gaps in implementing advanced MDSR components. These implementation gaps are not unique

to Goma HZ as over half of the LMICs that have adopted MDSR struggle with translating some critical policies into practice due to a combination of resource, leadership, and technical barriers (Kerber et al., 2015; WHO, 2016b).

The community remains a largely untapped resource in Goma HZ's MDSR system, as MDSR is still largely driven by clinical or medical stakeholders. This limits the scope and potentials of the current MDSR system. First, the limited community engagement coupled with inadequate active surveillance in community settings affect the systematic and timely identification, notification, and review of maternal deaths in the community, consistent with reports from other countries such as Morocco, Nigeria, and Zimbabwe (Abouchadi et al., 2013; Om'Iniabohs et al., 2017; Scott & Dairo, 2015; Williams et al., 2017). Experiences from India (Subha Sri & Khanna, 2014), Bangladesh (Biswas, 2017), and Malawi (Bayley et al., 2015) have demonstrated that active community engagement in MDSR increases the number of maternal deaths identified, reported, and reviewed. Second, this study revealed a narrow focus on identifying and addressing medical causes and health system contributing factors and less attention to community-level factors and social determinants, which previous studies have attributed to the lack of community representation in MDSR (African Union Commission & UN Women, 2015). Conversely, the inclusion of community members and civil society in MDSR enables the exploration and solutions to previously ignored socio-cultural, health system, and individual factors (Bayley et al., 2015; Biswas, 2017; Kalter, Salgado, et al., 2011; Subha Sri & Khanna, 2014). Building strong community partnerships is therefore crucial in strengthening and scaling-up MDSR in Goma HZ.

This study also revealed limitations in closing the MDSR surveillance-action loop in Goma HZ. While the earlier phases of the MDSR cycle (notification-review) were routinely implemented in the study sites, there were gaps in implementing more advanced MDSR functions including follow-up on recommendations, “response”, dissemination of MDSR findings, and M&E of the MDSR system. This echoes global reports that have seen more substantial progress in the first half of the MDSR cycle compared to the later phases (Bandali et al., 2016; Mathai et al., 2015; WHO, 2016b). More importantly, “response” was a weak component of the cycle, confirming previous reports of a “know-do” gap or failure to act on recommendations in other LMICs (Moodley et al., 2014; Scott & Dairo, 2015; Smith, Ameh, Roos, et al., 2017; Williams et al., 2017; WHO, 2016b). While the HZ and health facilities immediately implemented recommendations that were within their control, there was limited implementation of potentially high impact recommendations addressed to higher levels of the health care system and the community level.

Suboptimal response implementation can be partly attributed to other limitations in the local MDSR components. First, the majority of the formulated recommendations were not Specific Measurable, Attainable, Realistic, Time-bound (SMART) and lacked specific point persons, thus were not actionable (Moodley et al., 2014; Scott & Dairo, 2015; Smith, Ameh, Roos, et al., 2017; Williams et al., 2017; WHO, 2016b). Second, weak response implementation can be traced to the absence of systematic and formal mechanisms for following up on recommendations, documenting the status of these recommendations, and coordinating responses at different levels, which are critical mechanisms for translating recommendations into action (MSP, 2015; WHO, 2013).

Third, the lack of structured mechanisms for the wide dissemination of MDSR findings (e.g. an annual MDSR report) in Goma HZ is a missed opportunity to increase the visibility of maternal mortality and to stimulate widespread advocacy and action among diverse stakeholders (Bandali et al., 2016; Hulton et al., 2014; Mathai et al., 2015; WHO, 2013). In addition, limited multisectoral and community participation in MDSR implementation affects the ability to reach influential stakeholders who are likely to take action. Conversely, multi-sectoral and multidisciplinary participation in MDSR enables joint ownership, accountability, responsiveness, and the implementation of multifaceted actions (de Kok et al., 2017; Hofman & Mohammed, 2014; Kerber et al., 2015; Kongnyuy et al., 2009; Moshabela et al., 2015; Ravichandran & Ravindran, 2014; St Pierre et al., 2017; World Health Organization, 2004a). For instance, a community-linked MDR in Malawi has generated community-level solutions such as policies prohibiting harmful traditional practices and community emergency funds, and has enhanced accountability through regular community feedback meetings on response implementation (Bayley et al., 2015).

Suboptimal response implementation also points to the much broader socio-political and macro-economic context within which MDSR operates. The overall responsiveness and accountability of the health system, economic status of the country, and the national financing mechanisms are implicated in poor response implementation. The chronic underfunding of the DRC's health care system as a whole (Naughton et al., 2017) may limit the availability of resources to address potentially high impact but costly recommendations such as the purchase of equipment or changes in infrastructure. The "response" phase and community-level processes have been reported to be the most

affected MDSR components when resources are insufficient (African Union Commission & UN Women, 2015; Agaro et al., 2016; Nyamtema et al., 2011; WHO, 2016b).

Another critical gap identified in this study was the lack of M&E mechanisms to track and evaluate the local MDSR system itself. This is in contrast with national and global guidelines which explicitly highlight the importance of assessments, routine monitoring, and periodic (annual) evaluation to enhance the system's timeliness, quality, efficiency, effectiveness, and sustainability (MSP, 2015; WHO, 2013). Monitoring and evaluation inform context-specific MDSR strengthening and scale-up strategies and the lack thereof limits such opportunities—a critical gap that this study intended to address.

Research Question 2: How Well Does the MDSR System in Goma HZ Meet the CDC's Attributes of a Surveillance System?

The CDC's *Updated Guidelines for the Evaluation of Surveillance Systems* (German et al., 2001) enabled an assessment of the MDSR system's performance against key quality attributes outlined in these guidelines. Overall, the MDSR system in Goma HZ was reported to perform adequately against the majority of the attributes in integrated health facilities but less so in non-integrated private facilities and the community. The system's major strengths were its overall simplicity, acceptability, and timeliness in integrated health facilities, while its main weaknesses were its simplicity, acceptability, data quality, and timeliness in communities and non-integrated health facilities.

Simplicity. Goma HZ's MDSR system was relatively simple as evidenced by the use of well-defined notification pathways, existing organizational resources, and structured MDR proceedings guided by concise MDR forms. Notably, the national

MDSR guide provides a system for classifying maternal death causes that is less complex than the WHO-recommended ICD system which requires trained coders, technology, and high levels of details (WHO, 2012). However, the non-utilization of the ICD system may limit accuracy in assigning cause of death and in making regional and global comparisons, thus it may be necessary to convert the categorized items into the ICD format at higher levels of the health system with advanced analytical capacity (WHO, 2012). The WHO is developing tools that will guide MDR teams with applying ICD groupings (WHO, 2012). In particular, the ICD-11, which will be effective in January 2022, is expected to provide further guidance to this effect (GBD 2015 Maternal Mortality Collaborators, 2016; WHO, n.d.-a).

Community-level and private sector MDSR processes were found to be an exception to the system's simplicity since they are not as well defined and require data collection from multiple sources and across multiple referral points. The complexities surrounding data collection for MDRs such as extracting information from poor quality medical records or interviewing family and community members has been recognized (Combs Thorsen et al., 2014).

On another note, while the system's simplicity facilitates its routine implementation, the local MDSR system, in its current form, may be too simplistic to achieve its ultimate goal given the absence or underdevelopment of some critical components required for optimal MDSR including the following: 1) support functions for stakeholders involved, 2) community and multisectoral linkages, 3) defined mechanisms for disseminating findings and recommendations, 4) defined mechanisms for response monitoring, 5) advanced data analysis, and 6) M&E of the MDSR system.

Acceptability. This study highlighted the high acceptability of MDSR among KIs given its alignment with national goals for health system strengthening and maternal mortality reduction, its integration into IDSR, and its simplicity. In Ethiopia, MDSR alignment with national MCH goals and its integration into IDSR have both enhanced stakeholder buy-in and commitment to MDSR (Abebe et al., 2017). While the slogan “no woman should die while giving life” motivated KIs’ participation in MDSR in Goma, the opposite was observed in Ethiopia where the same slogan unintentionally perpetuated the fear of litigation among MDSR participants (Abebe et al., 2017).

Conversely, the acceptability of the MDSR system remains reportedly low in non-integrated health facilities due to the fear of disciplinary action. The low acceptability of MDSR in such facilities can also be attributed to the lack of official linkages between the HZ and such facilities, the limited awareness of MDSR goals and objectives, and more importantly, the actual links between MDSR processes and disciplinary action. Studies have consistently reported a lack of transparency and poor participation in MDR sessions in settings where the blame culture and the fear of disciplinary action persist (Agaro et al., 2016; Armstrong et al., 2014; Kongnyuy et al., 2009; Lewis, 2014a; van Hamersveld et al., 2012). Where legal frameworks and non-threatening environments have been created, health workers’ perceptions of threats have been minimized or eliminated, enhancing the acceptability of MDSR (Moodley et al., 2014; Negandhi et al., 2016; Ravichandran & Ravindran, 2014).

Timeliness. Overall, the MDSR processes in the majority of integrated health facilities and at the HZ level were reported to produce actionable information within the recommended time frame. Occasional delays in MDRs during peak periods were reported

in Goma HZ but not to the extent reported in other settings that have experienced frequent postponements and cancellations of MDR meetings due to understaffing, heavy workload, and competing priorities (Agaro et al., 2016; Armstrong et al., 2014; Hofman & Mohammed, 2014; Kongnyuy et al., 2009). The use of mobile phones for maternal death notification in Goma HZ certainly promotes timely notification by facility teams and CHWs. In Senegal, CHWs equipped with mobile health applications for verbal and social autopsy enhanced the timeliness of data collection and analysis in community settings (Moshabela et al., 2015). Technology and information systems enable more efficient and rapid MDSR processes (Moodley et al., 2014; Om'Iniabo et al., 2017; WHO, 2016b) and could be leveraged for enhancing other MDSR functions in Goma HZ.

Not all aspects of MDSR in Goma HZ were timely. The timeliness of response implementation remains a challenge particularly at higher levels of the health care system due to resource constraints and lack of accountability mechanisms. Additionally, KIs noted delays in the notification of maternal deaths in communities and non-integrated facilities, owing to the absence of active surveillance mechanisms in these settings, the lack of formal linkages or partnerships, and the fear of disciplinary action.

Data quality. Poor data quality was one of the most prominent barriers to effective MDRs. The completeness and reliability of the data obtained on maternal deaths in Goma HZ is challenged by poor documentation and record keeping practices and the lack of electronic data management and transmission systems in health facilities. This is not surprising as several studies in other LMICs have reported challenges in identifying and reviewing maternal deaths due to issues surrounding incomplete or missing medical records and hospital registers (Ajayi et al., 2017; Dumont et al., 2009; Hofman &

Mohammed, 2014; Hussein et al., 2009; Smith, Ameh, et al., 2017b). Participants highlighted that issues related to poor data quality were reportedly more prevalent in non-integrated private facilities, leading to longer than usual data collection and MDRs for referral cases from such facilities. On a brighter note, MDSR in Goma HZ was reported to gradually improve clinical documentation practices, data quality, and availability, corroborating reports from other countries (Abebe et al., 2017; Kalter, Mohan, et al., 2011; Moodley et al., 2014; Negandhi et al., 2016).

Research Question 3: How has MDSR Impacted Practice, Policy, and Maternal Health in Goma HZ?

The third research question examined KIs' perceived and observed impacts of MDSR on practice, policy, and maternal health. Key informants indicated that MDSR has stimulated considerable improvements in knowledge, practices, and policies at HZ and facility levels.

This study specifically highlighted MDSR's value as a capacity-building tool for the stakeholders involved. The KIs perceived MDSR as an educational and self-evaluation tool and reported increased awareness and knowledge of maternal health issues as a result. This corroborates previous reports that participation in MDSR is itself an intervention as it enhances analytical skills, peer learning, self-reflection, capacity-building, and motivation to take action (Hofman & Mohammed, 2014; Lewis, 2003; Mutsigiri-Murewanhema et al., 2017; WHO, 2004a). Additionally, some study sites have reinforced providers' skills and knowledge through trainings, workshops, and the dissemination of guidelines, which have yielded improvements in professional practice.

In diverse settings, MDSR has been linked with improved workforce capacity and professional practice as a result of in-service and pre-service EmOC training, regular supportive supervision, continuing education, and dissemination of updated guidelines of care (Goswami et al., 2013; Hodorogea & Friptu, 2014; Hussein et al., 2016; Kongnyuy et al., 2009; Nyamtema et al., 2011; van den Akker et al., 2009).

This study also affirmed the value of MDSR as a quality improvement tool. For instance, some facilities have established blood banks to improve PPH management. This is a potentially high-impact action since deficiencies in blood transfusion capacity are among the most common contributors to Phase III delays in developing countries (African Union Commission & UN Women, 2015; D'Ambruoso et al., 2010; Goswami et al., 2013; Hussein et al., 2016; Knight et al., 2013; Kongnyuy et al., 2009; Merali et al., 2014; Moodley et al., 2014; Vink et al., 2013). Others have ensured the 24/7 availability of emergency transportation and communication systems to reduce Phase II delays since the majority of cases notified in these facilities were reportedly late referrals from non-integrated private facilities and the community. Similar actions have been reported in Malawi (Vink et al., 2013) and India (Kalter, Mohan, et al., 2011), where community and facility-operated ambulances and communication systems (e.g. obstetric call center and radio system) were established to improve referrals from remote settings. Other study sites have developed new guidelines and policies related to patient monitoring and staff assignments in response to gaps identified in MDRs, consistent with experiences from Tanzania, Senegal, and India (Dumont et al., 2006; Kalter, Mohan, et al., 2011; Nyamtema et al., 2011).

There were mixed perceptions of the impacts of MDSR on maternal health. Some participants observed a decline in the number of maternal deaths within their facilities, which they attributed to capacity building activities and improvements in QoC. Studies in Senegal (Dumont et al., 2006), Malawi (Kongnyuy et al., 2008), and Mali (Zongo et al., 2015) have found significant associations between MDRs and declines in facility-based maternal mortality as a result of improved EmOC availability and quality. However, the overall impacts of MDSR on maternal health outcomes remains reportedly “weak” or “invisible”, as evidenced by persistently high MMR in the HZ and in facilities. This reflects the broad literature on MDSR where many have reported short-term and intermediate MDSR outcomes and only a few studies have reported significant reductions in maternal mortality and morbidity as a result of MDR/MDSR (Dumont et al., 2006; Kongnyuy et al., 2008; van den Akker et al., 2011; Zongo et al., 2015).

The limited impacts on maternal health could be attributed to a combination of previously identified gaps in the local MDSR implementation and technical challenges in quantifying its impacts. First, given MDSR’s recent origins and establishment in Goma HZ, it will take time to observe substantial impacts on maternal health outcomes. In addition, suboptimal response implementation at higher levels of the health care system coupled with the MDSR system’s low private sector and community coverage limit the ability to address broader determinants of maternal mortality. Finally, the absence of systematic mechanisms for monitoring, documenting, and disseminating MDSR findings in Goma HZ can influence the visibility of success stories (Bandali et al., 2016; Lewis, 2014a, 2014b). This lack of formal processes for documenting and disseminating success stories has also been observed in various settings including Zimbabwe, Senegal, Ethiopia,

and Tanzania (Abebe et al., 2017; Ajayi et al., 2017; Dumont et al., 2009; Om’Iniabohs et al., 2017; Tapesana et al., 2017; van Hamersveld et al., 2012).

The literature has also identified some relevant technical challenges in evaluating MDSR outcomes that limit the ability to capture its impacts on maternal health outcomes. For instance, low resource settings may experience technical and resource constraints in conducting studies that enable direct causative links between MDSR and maternal health outcomes (Abouchadi et al., 2013; van den Akker et al., 2011). Additionally, facility-based MDRs are part of routine clinical practices and may not be specifically documented for research or publication purposes (Dumont et al., 2009). As such, there may not be sufficient elements or data to support impact evaluations or rigorous studies, as evidenced by the lack of some relevant M&E data for this study. Finally, some studies have reported the difficulty obtaining statistically significant results with small sample sizes at local levels where immediate changes occur, because maternal mortality is a statistically rare event (Lewis, 2014a, 2014b; Mir et al., 2015).

Research Question 4: What Factors Influence MDSR Implementation in Goma Health Zone?

This study identified several factors influencing MDSR implementation in Goma HZ and revealed various mechanisms by which these factors enable or hinder MDSR operations. Leadership commitment and support; unregulated private facilities; and the *name, shame, and blame* culture were prominent influencing factors.

Leadership commitment and support. Strong political commitment to MDSR and support from the HZ and facility leadership were key enablers of MDSR

implementation in Goma HZ, while limited technical support were barriers to its optimal implementation. The national commitment to MDSR was evidenced by: 1) MDSR's integration and alignment with national goals and programs; 2) the national MDSR policies, guidelines, and tools; and 3) financial support to the HZ. These actions have ensured MDSR's routine implementation at the HZ and in integrated health facilities. Similarly, strong political will has enabled the institutionalization of MDSR in Rwanda (Ajayi et al., 2017; Sayinzoga et al., 2016), and the establishment of one of the strongest CEMDs in Malaysia that has sustained reductions in maternal mortality for over 50 years (Ravichandran & Ravindran, 2014).

Despite political commitments to MDSR, national and provincial level support were perceived to be weak during its local implementation, which was largely driven and sustained by the HZ and facility leadership. The value of local leadership and partnerships in ensuring effective and sustainable MDSR operations has been recognized (De Brouwere et al., 2014; Kerber et al., 2015). For instance, in Ethiopia, despite strong national political support for MDSR, its implementation was hampered by a lack of prioritization and insufficient resources at the regional level (Abebe et al., 2017; African Union Commission & UN Women, 2015). However, in the present study, both national and local leadership fell short in ensuring the consistency of support functions in the form of training, supervision, and technical assistance to facilities and communities. Inadequate technical support in implementing MDSR limits understanding and optimal performance of MDSR tasks, affecting the system's quality and effectiveness (Armstrong et al., 2014; Hofman & Mohammed, 2014; Pearson et al., 2009; Singh et al., 2015; Smith,

Ameh, et al., 2017b). Thus, the present study confirmed the value of *a top-down and bottom-up approach* for optimal MDSR implementation (Smith, Ameh, et al., 2017b).

Unregulated private facilities. The proliferation of unregulated private health facilities emerged as a prominent barrier to MDSR implementation in this study, in a manner that has not been sufficiently described in the MDSR literature. In addition to its network of integrated health facilities (n=16), Goma HZ has an estimated 77 non-integrated private health facilities (ECZS Goma, 2015, 2016, 2018). The majority of KIs revealed that many such facilities do not have official authorizations to operate and account for the majority of maternal deaths notified in the HZ. While there was no official report to support these claims, this is not surprising since other studies in developing countries have demonstrated that the most vulnerable or high-risk women are more likely to utilize unregulated private facilities given their affordability (More, Alcock, et al., 2009; More, Bapat, et al., 2009).

Despite their significant role in maternal health service delivery, the systematic and timely identification, notification, and review of maternal deaths in non-integrated health facilities remains challenging. Participants reported a higher tendency to conceal information in such facilities due to fear of legal action or of damaging their facility's reputation, as also observed in India (Negandhi et al., 2016). This is compounded by the lack of direct information sharing between the HZ and non-integrated private facilities. The present study highlighted some local solutions, where some sites have established informal working relationships with private facilities that refer most of the cases to them. These relationships have enabled them to extend their MDRs to such facilities. Many would like to see more government support in formalizing and standardizing such joint

MDR processes across facilities. The inclusion of the private sector should be a top priority for strengthening MDSR in Goma HZ, given its role in the delivery of MCH services in the HZ and its large contribution to the local burden of maternal mortality.

The *name, shame, and blame* culture. This study found attempts at promoting a non-punitive approach to MDSR, the hallmark being a change in terminology from “audit” to “review”. According to KIs, this change in terminology has gradually improved participation in MDSR among stakeholders in integrated health facilities. A similar observation was made in Malaysia, where the term “substandard care” was replaced with a more positive concept– “remediable factors”, to reduce perceptions of blame or shame (Ravichandran & Ravindran, 2014). However, a paradigm shift in MDSR has not been achieved given the persistent links between MDSR and disciplinary action and non-adherence to the “no blame, no name, no shame”, both of which perpetuate fear and defensive behaviors towards MDSR.

This study revealed a paradox characterized by inconsistencies between KIs’ support of a non-punitive approach to MDSR and their reports of disciplinary actions when MDRs revealed provider errors. Participants were faced with the dilemma of violating the MDSR principle of non-punishment on the grounds of preventing similar occurrences and saving future lives. To my knowledge this paradox or dilemma has not been explicitly discussed in the MDSR literature thus far and is not sufficiently addressed in global or national guidelines. Many studies and MDSR guidelines have repeatedly promoted a non-punitive approach to MDSR, advocating for separate process for MDSR and disciplinary action, but the specific strategies or policies regarding how this separation can be or has been achieved has not received sufficient attention. For instance,

In South Africa, CEMD forms cannot be used for legal/disciplinary action (Moodley et al., 2014) but what legal frameworks are put in place to ensure this? What happens when serious errors are identified during reviews, especially in settings with laws requiring mandatory reporting of such instances? The question is, how exactly is MDSR separated from disciplinary actions?

This punitive approach to MDSR is compounded and fueled by non-adherence to the “no blame, no shame, no name” principle of MDSR in Goma HZ. The principle of anonymity remains the least observed in Goma HZ, consistent with reports from Burkina Faso, Malawi, and Kenya (Congo et al., 2017; Kongnyuy et al., 2009; Smith, Ameh, et al., 2017b). The lack of anonymity could be linked with the lack of formal MDSR training, thus the limited awareness or understanding of MDSR principles; the lack of clear instructions on maintaining anonymity and confidentiality in the national MDSR guidelines; and the time required for complete anonymization of all documents as reported in other studies (Congo et al., 2017; Kongnyuy et al., 2009; Smith, Ameh, et al., 2017b). Ensuring anonymity is even more critical but was also challenged by the fact that providers who attended to the deceased are present during MDRs. Similarly, while provider and patient names were not included on case summaries in Malawi, attending providers were often easily identifiable during MDR meetings (Kongnyuy et al., 2009). The lack of anonymity fuels the blame culture as access to providers’ names makes it easy to apportion blame.

The links between MDSR and disciplinary action, and the lack of anonymity and confidentiality create a threatening environment for MDSR and perpetuate fear and guilt, which in turn trigger defensive behaviors. In the present study, fear was related to actual

or perceived threats. Actual threats included the link between MDSR and disciplinary action, litigation by relatives, and the involvement of the police or the National Intelligence Agency when alerted by family members of the deceased. Perceived threats could emanate from the presence of the senior management, the persistent use of the term “audit” rather than review, the lack of awareness of MDSR goals and objectives, and the lack of legal permits to operate (for unregulated private facilities). Experiences from the present study and from other settings have confirmed that the terminology used in MDSR can evoke fear of blame such as the term “audit” rather than “review as seen in the present study, the slogan “no woman should die while giving life” that unintentionally perpetuated the fear of litigation among MDSR participants in Ethiopia (Abebe et al., 2017), or the term “substandard care” which was later changed to “remediable factors” in Malaysia (Ravichandran & Ravindran, 2014). While not explicitly seen in this study, the literature suggests that power imbalances or professional hierarchies inherent in the health system could also trigger perceptions of fear. Power imbalances emerged more implicitly in this study. For instance, review sessions were spearheaded by senior management in facilities (internal review) and the HZ (external review), which unintentionally triggered perceptions of blame and defensive actions among some stakeholders.

Key informants revealed common defensive behaviors that were caused by fear particularly in the private health sector, the most common being concealing or withholding information and avoiding contact with review teams. Some of these behaviors have also been reported in other settings. For instance, prior to the current CEMD in Moldova, some health workers falsified medical records to conceal sensitive

information since the previously utilized system was designed to enforce disciplinary action (Hodorogea & Friptu, 2014). Where legal frameworks and non-threatening environments are created, health workers' perceptions of threat are minimized or eliminated. For instance, in India, private health facilities initially withheld information due to the fear of legal action and of losing their reputation and began sharing information when the state committed to anonymity and non-punitive action (Negandhi et al., 2016). Both fear and defensive behaviors were reportedly more common in private/peripheral unintegrated health facilities, where MDSR currently has limited coverage, and which account for a large proportion of maternal deaths in Goma HZ.

Collectively, the aforementioned behaviors lead to suboptimal MDSR implementation, characterized by an underreporting of maternal deaths, poor data quality, limited availability of data for comprehensive reviews, and missed opportunities to achieve substantial impacts on maternal health outcomes. In addition to creating legal protections, instilling a non-punitive approach to MDSR will require changing individual perceptions and organizational cultures. The *name, blame, and shame* culture influencing MDSR in Goma HZ is summarized in Figure 11.

Figure 11. The “name, blame, and shame” culture influencing MDSR implementation and effectiveness in Goma Health Zone

In light of its goals and objectives, and its promising results thus far, and despite its shortcomings, all stakeholders interviewed support its continuation in Goma HZ. As pointed out by Kerber et al. (2015), KIs in the present study agreed that the question is not whether or not to implement MDSR, but rather how to ensure its optimal functioning in Goma HZ so that all maternal deaths are systematically captured, counted, reviewed, and acted upon to ultimately reduce maternal mortality. As such, building on the strengths, weaknesses, and opportunities for improvement, the next section provides practical recommendations to improve MDSR implementation in Goma HZ.

Research Question 5: Recommendations for Improving MDSR implementation in Goma Health Zone

This study has elucidated the strengths, gaps, and opportunities for strengthening the MDSR system in Goma HZ. These findings form the basis for 14 cross-cutting recommendations to strengthen MDSR in Goma HZ. Table 8 depicts 14 key recommendations related to the MDSR structure, process, and operating context, along with specific actions and levels responsible for each recommendation.

Table 8

Recommendations for Improving Maternal Death Surveillance and Response in Goma Health Zone

Recommendation	Specific Action	Responsible Level/Unit
MDSR STRUCTURE		
1. Establish the key structural and administrative MDSR elements that are stipulated in the national MDSR guide	<ul style="list-style-type: none"> ▪ Designate MDSR coordinators/focal persons at national, provincial, HZ, HA, facility, and community levels, as stipulated in the national guidelines ▪ Form multidisciplinary MDR committees at national, provincial, and HZ levels comprising diverse stakeholders including health care professionals, CHWs, the Civil Society for Health (Société Civil de la Santé), and community members/leaders/organizations ▪ Produce quarterly and/or annual MDSR reports summarizing MDSR findings, recommendations, actions/responses, strengths and challenges, and performance indicators 	<ul style="list-style-type: none"> ▪ National, provincial, and HZ, Facility ▪ National, provincial, HZ ▪ National, provincial, HZ, Facility
2. Revise the national MDSR guidelines and standard forms to provide more detailed guidance	<p>MDSR Guidelines</p> <ul style="list-style-type: none"> ▪ Describe in more detail the ideal composition of MDSR committees at each level ▪ Elaborate more extensively on mechanisms for maternal death identification <ul style="list-style-type: none"> – Consider adding the process for active surveillance and zero reporting – Describe potential data sources for the active identification of maternal deaths in facilities and communities ▪ To enhance the identification of community deaths, consider expanding the case definition for community deaths to: “<i>death of any woman of reproductive age (15-49 years old).</i>” Pregnancy may 	<ul style="list-style-type: none"> ▪ National/PNSR

Recommendation	Specific Action	Responsible Level/Unit
	<p>not always be identifiable during early phases, thus using pregnancy or childbirth as a reference may lead to underreporting. (WHO, 2013)</p> <p style="text-align: center;">MDSR Forms</p> <ul style="list-style-type: none"> ▪ Develop an anonymized case summary template that can be attached to the original MDSR form. Refer to Appendix 5 of the WHO (2013) MDSR Guide ▪ On the facility MDR form, consider adding the option “<i>other, please specify</i>” to capture other contributing factors that are not listed on the form ▪ On the facility MDR and verbal autopsy forms, add an entry for the determination of preventability/avoidability: “<i>potentially avoidable</i>”, “<i>not avoidable</i>”, and “<i>undetermined</i>” (Building U.S. Capacity to Review and Prevent Maternal Deaths, 2017, p. 22; WHO, 2013) ▪ On the facility MDR form, consider adding a column for <i>Specific Target/Objective/Indicator</i> to the recommendations template to enable the formulation of Specific, Measurable, Attainable/Achievable, Realistic, Time-bound (SMART) recommendations ▪ Add a “recommendations” section or table to the verbal autopsy form 	<ul style="list-style-type: none"> ▪ National/PNSR
<p>3. Enhance the capacity of all MDSR stakeholders in Goma HZ</p>	<ul style="list-style-type: none"> ▪ Provide basic training to all HZ, facility, and community-level MDSR stakeholders on MDSR goals and objectives, policies, principles, and standard processes ▪ Disseminate the national MDSR guide to all health facilities (including private facilities) and community partners 	<ul style="list-style-type: none"> ▪ Provincial, HZ, Facility ▪ National, Provincial, HZ, Facility

Recommendation	Specific Action	Responsible Level/Unit
	<ul style="list-style-type: none"> ▪ Develop and disseminate detailed job descriptions for each MDSR task (identification & notification, review, analysis and report writing, and M&E). ▪ Invest in innovative and cost-effective training strategies that facilitate wide dissemination and easy access to training materials: <ul style="list-style-type: none"> – Develop standard MDSR training modules in PowerPoint or PDF format – Audio and/or video-record MDSR training sessions and produce them on electronic media (e.g. DVDs or flash drives) for wide dissemination – Consider consulting MDSR resources from the MDSR Action Network website (http://mdsr-action.net/) and Mamaye website (https://mamaye.org/), both of which serve as global one-stop-shops for MDSR resources, publications, and training materials ▪ Adhere to the schedule for supportive supervisory visits to health facilities implementing MDSR and document these visits. ▪ Reinforce the involvement of the Provincial Division of Health - National Reproductive Health Program in providing technical support to the HZ 	<ul style="list-style-type: none"> ▪ National, Provincial, HZ, Facility ▪ National, Provincial, HZ, Facility ▪ HZ ▪ Provincial
4. Create a non-threatening environment and ensure a non-punitive approach to MDSR	<ul style="list-style-type: none"> ▪ Standardize and promote the use of the term “review” rather than “audit” for both internal and external MDRs ▪ Develop policies and strategies that separate the MDSR process from standard investigations that are conducted in cases of medical negligence by considering the following: <ul style="list-style-type: none"> – Ensure legal protections for MDSR stakeholders – Establish legal mandates that protect MDSR documents and information from being used for legal and disciplinary purposes 	<ul style="list-style-type: none"> ▪ HZ, Facility ▪ National, Provincial

Recommendation	Specific Action	Responsible Level/Unit
	<ul style="list-style-type: none"> – Consider assigning MDRs to existing quality improvement (QI) teams in health facilities and ensure that MDR participants are not members of teams that conduct investigations in cases of medical negligence ▪ Anonymize/de-identify documents used in the reviews by obscuring patient and attending providers' names from medical records and case summaries for review purposes. ▪ Establish a code of conduct for MDSR that specifies clauses on confidentiality, anonymity, and no blame ▪ Consider using the following additional strategies to minimize perceptions of threats during MDRs: <ul style="list-style-type: none"> – Discuss external contributing factors rather than solely focusing on service delivery factors; – Highlight strengths and positive aspects of care in addition to deficiencies; – Maintain mutual respect; – Make explicit reminders of “no blame, no name, no shame” during MDRs; – Reduce power imbalances; – Instill a culture of peer-learning and self-reflection (de Kok et al., 2017; Hussein et al., 2009; Om’Iniabo et al., 2017; van den Akker et al., 2009) 	<ul style="list-style-type: none"> ▪ HZ, Facility ▪ HZ, Facility ▪ HZ, Facility
5. Establish formal partnerships or alliances with the community and the private health sector in MDSR implementation	<ul style="list-style-type: none"> ▪ Train stakeholders from the community and private sector and ensure their representation on MDR committees (see recommendations 1 and 6) 	<ul style="list-style-type: none"> ▪ HZ, Facility

Recommendation	Specific Action	Responsible Level/Unit
MDSR PROCESS		
6. Strengthen the process for identifying and notifying maternal deaths in all health facilities and in communities	<ul style="list-style-type: none"> ▪ Establish and describe clear procedures for active surveillance in public and private health facilities, and communities <ul style="list-style-type: none"> – Describe how maternal deaths can be identified using the standard case definitions. – Require “zero reporting” in all health facilities and communities, where a 0 is notified in the weekly epidemiologic surveillance submitted to the HZ when no maternal death is identified. ▪ Establish formal partnerships with community leaders, faith leaders, teachers, traditional birth attendants/healers, CBOs, pharmacists, and civil society organizations to identify and notify maternal deaths within their communities and in the private sector. <ul style="list-style-type: none"> – Train community stakeholders on MDSR, including the case definitions of a maternal death, active surveillance, maternal death notification pathways – Consider providing non-monetary incentives to MDSR partners such as certificates of completion of training, certificate of participation in MDSR, or public recognition as MDSR partners. ▪ Enforce mandatory reporting/notification policies in private, non-integrated facilities 	<ul style="list-style-type: none"> ▪ National, Provincial, HZ ▪ Provincial and HZ ▪ Provincial, HZ
7. Scale up and standardize routine maternal death reviews in all health facilities (including private health facilities) and in the community	<ul style="list-style-type: none"> ▪ Enforce the mandatory review of all maternal deaths in all health facilities and communities ▪ Require all health facilities and communities to utilize the standard MDR forms for internal MDRs within their respective sites ▪ Establish standard procedures for joint MDRs between receiving and referring facilities as part of counter-referral policies 	<ul style="list-style-type: none"> ▪ HZ, Facility ▪ National, Provincial, HZ, Facility ▪ National, Provincial, HZ

Recommendation	Specific Action	Responsible Level/Unit
	<ul style="list-style-type: none"> – Institute policies promoting data-sharing across facilities (e.g. referral letters, medical records) – Issue official authorizations enabling providers in a receiving facility to visit teams in the referring facility for MDSR purposes ▪ Consider adopting a two-step MDR approach in communities, where initial verbal autopsies are conducted by community stakeholders (e.g. CHWs, first-level health professionals, civil society, CBOs, community members) followed by an external review by the HZ team in collaboration with the community team. ▪ Expand the depth and scope of the reviews <ul style="list-style-type: none"> – Trace a woman’s path to death across the continuum of care and across referral points – Provide equal attention to non-medical contributing factors and social determinants of maternal mortality during facility and community-based MDRs – Consider utilizing common and simple frameworks including the <i>three delays</i>, <i>pathway to survival</i>, the 5 “whys”, <i>root cause analysis</i>, or the <i>socio-ecological model</i> to guide the analysis of contributing factors 	<ul style="list-style-type: none"> ▪ HZ, Facility, Community ▪ HZ, Facility, Community
8. Formulate recommendations and/or action plans that are Specific, Measurable, Attainable, Realistic, and Time-bound (SMART)	<ul style="list-style-type: none"> ▪ Formulate actionable and SMART recommendations with the following components: <ul style="list-style-type: none"> – Specific recommendations/desired actions – Measurable targets, objectives, and/or indicators (where appropriate) – Designated individuals/units/organizations responsible for implementing the recommendations – A detailed and realistic timeline (immediate, medium, and long term) ▪ Ensure that all recommendations correspond with the priority avoidable factors identified during the MDR 	<ul style="list-style-type: none"> ▪ HZ, Facility ▪ HZ, Facility

Recommendation	Specific Action	Responsible Level/Unit
	<ul style="list-style-type: none"> Develop an annual action plan at the HZ level on the basis of MDSR findings. Alternatively, a designated section for MDSR can be integrated into the current annual strategic plans for the HZ 	<ul style="list-style-type: none"> HZ
9. Improve data analysis at HZ and facility levels to translate MDSR data into meaningful information for various stakeholders	<ul style="list-style-type: none"> Provide training or technical support to reinforce data analysis skills of designated MDSR stakeholders at HZ and facility levels Perform descriptive analysis using manual techniques or simple software or applications such as Excel and Epi InfoTM <ul style="list-style-type: none"> At the minimum the HZ and all health facilities should produce data on the following indicators: 1) measures of magnitude (e.g. MMR); 2) cause-specific maternal mortality; 3) proportions of contributing factors (e.g. Three delays); 4) proportion of avoidable deaths (MSP, 2015; WHO, 2013) Conduct aggregated data analysis monthly, quarterly, and/or annually to identify patterns and trends by socio-demographic profiles, time, and place <ul style="list-style-type: none"> Generate simple charts, graphs, tables, or maps to facilitate data visualization 	<ul style="list-style-type: none"> Provincial, HZ, Facility HZ, Facility National, Provincial, HZ, Facility
10. Establish formal and systematic procedures for following up on recommendations and coordinating responses	<ul style="list-style-type: none"> Integrate the monitoring of MDSR recommendations into the monthly supervisory visits conducted by the HZ's nurse supervisors into health facilities rather than waiting for the next MDR in the facility <ul style="list-style-type: none"> Maintain a master checklist to record the status of MDSR recommendations/responses in each site Require an internal monitoring of recommendations in each site <ul style="list-style-type: none"> Designate individuals responsible for following up on recommendations Each site should report the status of recommendations to the HZ when submitting monthly reports 	<ul style="list-style-type: none"> Province, HZ, Facility HZ

Recommendation	Specific Action	Responsible Level/Unit
11. Ensure the targeted dissemination and feedback of MDSR findings, responses, and outcomes, as stipulated in the national guidelines	<ul style="list-style-type: none"> Produce a quarterly and/or annual MDSR report summarizing MDSR findings, recommendations, actions, and outcomes/success stories, and M&E indicators Disseminate MDSR reports to diverse stakeholders targeting individuals with the capacity to act on recommendations including policy makers, civil society organizations, community leaders and members, the media, health professionals, professional organizations, and MDSR stakeholders 	<ul style="list-style-type: none"> HZ, Facility HZ
12. Conduct regular monitoring and periodic evaluation of the MDSR system and its outcomes	<ul style="list-style-type: none"> Select standard M&E indicators and establish mechanisms to monitor selected indicators in each MDSR implementation site: <ul style="list-style-type: none"> Refer to the national and global MDSR guides (WHO, 2013), CDC Updated Guidelines for Evaluation Surveillance Systems (German et al., 2001) Consider developing an MDSR scorecard that tracks key MDSR indicators in various sites, similar to the one developed by Evidence for Action (E4A) and state health authorities in Nigeria. It is described by Bandali et al. (2016) Systematically document specific actions, responses, or success stories generated by MDSR activities Include M&E findings in the annual MDSR report 	<ul style="list-style-type: none"> National, Provincial, HZ HZ, Facility HZ
MDSR OPERATING CONTEXT		
13. Develop and/or enforce policies and measures to regulate the establishment and operations of private health facilities	<ul style="list-style-type: none"> Identify and inspect all unregulated peripheral health facilities in the HZ <ul style="list-style-type: none"> Extend supervisory visits to these health facilities Explore opportunities for public-private partnerships or alliance, training, immediate data-sharing with the HZ for MDSR purposes 	<ul style="list-style-type: none"> National, Provincial, HZ National, Provincial, HZ HZ

Recommendation	Specific Action	Responsible Level/Unit
	<ul style="list-style-type: none"> ▪ Reinforce community-level surveillance and sensitization of pregnant women to promote deliveries in officially recognized or regulated health facilities <ul style="list-style-type: none"> – Disseminate a list of officially recognized health facilities within communities and health facilities through the media and community outreach 	
14. Improve the health system's capacity to respond to MDSR recommendations	<ul style="list-style-type: none"> ▪ Improve national health financing for public health in general and IDSR in particular to optimize response implementation at all levels of the health system <ul style="list-style-type: none"> – Explore public and private financing schemes ▪ Establish inter-sectoral linkages or buy-in for MDSR, as stipulated in the national guidelines ▪ Strengthen accountability and quality improvement mechanisms at different levels of the health system 	<ul style="list-style-type: none"> ▪ National ▪ National, Provincial, HZ ▪ National, Provincial, HZ, Facility

Limitations

Findings from this study should be interpreted in light of several limitations. First, the limited observations and the unavailability of some relevant MDSR documents in health facilities and at the HZ limited opportunities to validate some data obtained from the KI interviews. Second, the study design does not allow judgements regarding causal associations of MDSR impacts reported by KIs with MDSR processes. Third, the interviews, document reviews, and observation provided insights on provincial and national level MDSR processes to the extent that they influenced Goma HZ's MDSR implementation but were not designed to speak to national and provincial-level MDSR, which could be the focus of future studies. Finally, there is a possibility of translation bias as data were collected in French and translated into English. Translation can result in a loss of meaning as one operates between languages and socio-cultural contexts (Bailey, 2008; Halai, 2007, p. 345; Nikander, 2008; Torop, 2002). To reduce potential translation bias, the research documents and raw data were translated and verified by the researcher and two faculty members at ULPGL, all of whom were proficient in both English and French and familiar with the socio-cultural context in which this study was conducted.

Implications

This study critically assessed MDSR implementation in Goma HZ, focusing on its structural inputs, processes, quality, outcomes, and influencing factors. This was done by interviewing KIs involved in MDSR implementation in Goma HZ, reviewing key MDSR documents, and observing an MDR session. Being the first of its kind in Goma HZ, this research generates the much-needed baseline empirical evidence on the local MDSR implementation, specifically highlighting strengths, gaps and opportunities for improving

MDSR practice, policy, and research. The lessons learned from this study can be applied or extrapolated to other settings based on each reader's judgments of similarities in contexts or challenges (transferability) (Lincoln & Guba, 1985; Merriam, 2009; Patton, 2002). This information is crucial to practitioners, policy-makers, researchers, and community stakeholders given MDSR's promising contribution to accelerating progress towards meeting local, national, and global targets of reducing or eliminating preventable maternal mortality.

Implications for Practice

By identifying current strengths, gaps, enablers and barriers to MDSR practice, this study will enable MDSR stakeholders in Goma and in similar settings to reflect on and develop strategies or mechanisms to optimize its implementation and effectiveness.

The first major contribution of this study stems from findings that MDSR's integration into IDS in Goma HZ may be an efficient and reasonable model for a limited-resource setting provided that relevant legal and administrative frameworks are added to accommodate MDSR. This study confirms previous studies that MDSR integration into existing maternal health programs or systems ensures its acceptability, efficiency, routine practice, and sustainability (Abebe et al., 2017; Pearson et al., 2009). A standalone MDSR system may not be given priority in national health financing in low-resource settings and as such, may not be sustainable (Pearson et al., 2009).

Another major implication derives from findings of poor adherence to the "no name, no shame, no blame" principle and the persistent fear of participating in MDSR in parts of Goma HZ. This study provides practical recommendations for creating a non-threatening MDSR environment but also highlights lingering questions and dilemmas

related to MDSR and disciplinary actions that practitioners should reflect on. These findings will inform strategies to resolve the *MDSR Paradox* or ethical dilemmas described in this study, and to drive a paradigm shift towards a non-punitive/non-threatening approach to MDSR, which is expected to achieve widespread acceptability, buy-in, and participation from diverse stakeholders.

Third, the private and community sectors are largely untapped and critical MDSR resources that should be prioritized in efforts to strengthen MDSR system performance. The findings from this study suggest a need to formally scale-up MDSR to communities and the private health sector by strategically building the much-needed alliances or partnerships with diverse stakeholders who can champion or support its implementation in these sectors.

Fourth, this study has shown that poor documentation and recordkeeping practices in health facilities complicate MDRs, suggesting the need to standardize clinical documentation across health facilities and to enhance providers' capacity in clinical documentation through pre and in-service training. The findings also highlight opportunities to explore innovative, efficient, and low-cost strategies or technologies for recordkeeping. On the other hand, this study also points to MDSR's contribution towards instilling a culture of documenting care in Goma HZ.

Finally, this study highlights that response implementation remains suboptimal in Goma HZ, confirming findings from several other studies that have described a “know-do” gap in MDSR (Moodley et al., 2014; Scott & Dairo, 2015; Smith, Ameh, Roos, et al., 2017; Williams et al., 2017; WHO, 2016b). While largely related to the lack of critical MDSR components such as response monitoring mechanisms, this issue also points to the

much broader socio-political and macro-economic context within which MDSR operates. The overall responsiveness and accountability of the health system, economic status of the country, and the national financing mechanisms are implicated in poor response implementation, indicating that successful and sustainable MDSR implementation requires responsive health systems and intersectoral commitment and collaboration.

Stakeholders should build on the strengths and opportunities identified in this study, and address the persistent barriers and threats experienced in MDSR implementation on the ground.

Implications for Policy

This study also underlines opportunities to develop and enforce policies related to MDSR and maternal health in general. While national policies requiring the notification and review of maternal deaths were generally adhered to in integrated health facilities, their implementation in community settings and private health facilities remains challenging. This study demonstrates the need to step-up enforcement mechanisms for these policies in community settings and in non-integrated private health facilities through community, civil society, and public-private partnerships.

Additionally, this study identified a policy-practice gap described in the WHO's (2016b) global MDSR survey, where policy commitments to some MDSR legal and administrative frameworks have been articulated in the national MDSR guidelines but not translated into law or action. For instance, there are no diverse committees nor annual reports at the national, provincial, HZ, and HA levels. These policy commitments should be translated into law or action so that resources can be allocated towards their establishment. Similarly, no legal protections for MDSR stakeholders or documents were

identified by this study and instances of disciplinary actions related to MDSR were reported to perpetuate fear. This indicates a window of opportunity to ensure legal protections for MDSR activities and documents by separating this process from litigation or disciplinary actions. Lessons can be learned from other countries that have managed to separate these processes, such as South Africa (Moodley et al., 2014).

A third major policy implication pertains to the unregulated private health sector, which hampers MDSR implementation through various mechanisms described in this study. National and local policy-makers should revise and/or strengthen existing mechanisms for regulating the establishment and operations of private health facilities, which anecdotal evidence from this study suggest currently accounts for a large proportion of maternal health service delivery and maternal mortality. This recommendation does not necessarily refer to punitive measures but also points to the possibility of working with these facilities so they can meet requirements for accreditation or integration, knowing that this will eventually facilitate the government's regulation of their operations.

Implications for Future Research

This case study provides baseline evidence for understanding the strengths, gaps, barriers, and enablers of MDSR in Goma to strengthen its implementation and inform scale up efforts. Given its exploratory nature, this study revealed several opportunities for further research.

Future studies should seek to validate these findings in larger samples of MDSR stakeholders in Goma HZ, including stakeholders from community settings and the private health sector. Further research is needed to link MDSR processes in Goma HZ

with the various outcomes reported by KIs. Additionally, given MDSR's recent origins in the DRC and the dearth of studies on its implementation in this setting, comprehensive studies are needed to understand the MDSR structure, processes, quality, and outcomes at provincial and national levels. At global levels, the DRC and other countries would benefit from empirical evidence on MDSR best practices or lessons learned from diverse innovators or early adopters to understand how they have tailored MDSR to their unique contexts.

This study revealed poor adherence to the core MDSR principle of “no blame, no name, no shame” as well as an *MDSR paradox* that has not been previously described. This indicates the need for further research examining mechanisms for creating non-threatening environments for MDSR, dispelling fear, and promoting acceptability of MDSR among diverse stakeholders—essentially, what works and what does not work? This study also found that the “R” (response) in MDSR remains a weak component in communities and at higher levels of the health system, echoing findings from global MDSR implementation. Further evidence is needed regarding response implementation, particularly the mechanisms for ensuring that MDSR recommendations are translated into action. Such process studies should also be conducted in conjunction with impact evaluations of MDSR's short-term, intermediate, and long-term outcomes. Some other important methodological considerations to generate useful evidence on MDSR include mixed methods studies, systematic reviews or meta-analysis of existing studies, evaluation studies, and implementation research.

Finally, with the proliferation of unregulated private health facilities and their impact on MDSR in Goma HZ, it will be worthwhile to generate empirical evidence on

the role of the private health sector in maternal health service delivery, including the QoC in such facilities, women's reasons for utilizing this sector, and maternal health outcomes of women utilizing the unregulated private health sector.

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APPENDICES

Appendix A: List of Abbreviations

AAAQ	Acceptability, Availability, Accessibility, Quality
AMDD	Averting Maternal Death and Disability
ANC	Antenatal Care
ARR	Annual Reduction Rate
BEmOC	Basic Emergency Obstetric Care
CBMDR	Community-based Maternal Death Review
CBO	Community-based Organization
CDC	United States Centers for Disease Control and Prevention
CEMD	Confidential Enquiries into Maternal Deaths
CEmOC	Comprehensive Emergency Obstetric Care
CHW	Community Health Worker
CLMDR	Community Linked Maternal Death Review
CMO	Chief Medical Officer of the Health Zone
CoIA	Commission on Information and Accountability for Women's and Children's Health
CRVS	Civil Registration and Vital Statistics
DRC	Democratic Republic of Congo
DWT	Dead Women Talking Initiative

ECZS	Equipe Cadre de la Zone de Santé Urbaine de Goma
EmOC	Emergency Obstetric Care
FBMDR	Facility-based Maternal Death Review
FBO	Faith Based Organization
GBD	Global Burden of Disease
HA	Health Area
HZ	Health Zone
IRB	Institutional Review Board
ICD	International Classification of Diseases
PDH	North Kivu Provincial Division of Health
PE-E	Pre-eclampsia and Eclampsia
PHS	Public Health Surveillance
PNSR	Programme Nationale de la Santé de la Reproduction
PPH	Postpartum Hemorrhage
LFTR	Lifetime risk of maternal death
LMIC	Low and Middle-Income Countries
MDG	Millennium Development Goals
MDR	Maternal Death Review
MDSR	Maternal Death Surveillance and Response
MMR	Maternal Mortality Ratio
MMRate	Maternal Mortality Rate
MoH	Ministry of Health
MPSMRM	Ministère du Plan et Suivi de la Mise en œuvre de la

Révolution de la Modernité

NGO	Non-government Organization
PNC	Postnatal Care
UN	United Nations
UNDP	United Nations Development Programme
UNECA	United Nations Economic Commission for Africa
UNHCR	United Nations High Commission for Refugees
UNICEF	United Nations Children's Fund
UNFPA	United Nations Population Fund
USAID	United States Agency for International Development
SBA	Skilled Birth Attendant
SSA	Sustainable Development Goals
SSA	Sub-Saharan Africa
TBA	Traditional Birth Attendant
UofL	University of Louisville
ULPGL	Université Libre des Pays des Grands Lacs
QoC	Quality of Care
WHO	World Health Organization

Appendix B: Participant Recruitment Script

UofL Institutional Review Boards
IRB NUMBER: 18.1195
IRB APPROVAL DATE: 11/17/2018

Participant Recruitment Script

Dear _____,

My name is Baraka Muvuka. I am a student in Public Health at the University of Louisville. I am conducting a research study to understand how maternal death audits are being done in Goma health zone. You are invited to participate in this study. You may participate if you have been or are currently involved in any activity related to maternal death audits in Goma Health Zone, if you are over 18 years old, and are comfortable communicating in French or in English.

Participation in this study is voluntary. You may choose not to take part at all. If you agree, you will be asked to take part in an audio-recorded interview. Your involvement is anticipated to take approximately 60 minutes. Your identity will remain confidential, meaning your identity and the name of your workplace will not be revealed during or after the study.

If you participate, you do not have to answer any questions that make you uncomfortable. You may stop taking part at any time. If you decide not to be in this study or if you stop taking part at any time, without losing any benefits for which you may qualify.

Do you have any questions? If you would like to participate in this research study, please let me know. If you have questions later, please contact me at: +243998688632 or baraka.muvuka@louisville.edu.

Thank you for your time!

Sincerely,

Baraka Muvuka
Doctoral Candidate
Department of Health Promotion and Behavioral Sciences
University of Louisville, Kentucky

Appendix C: Preamble Consent

UofL Institutional Review Boards
IRB NUMBER: 18.1195
IRB APPROVAL DATE: 11/17/2018

Preamble Consent

Uncovering the Stories Behind the Numbers: A Case Study of Maternal Death Surveillance and Response in Goma, Democratic Republic of Congo

Date:

Dear _____,

You are being invited to participate in a research study that seeks to understand how maternal death audits are being done in Goma Health Zone. This study is conducted by Baraka Muvuka of the University of Louisville. Your participation will include an individual interview. For this study, you will be asked about your experiences with maternal death audits. There are no known risks for your participation in this research study. The information collected may not benefit you directly. The information learned in this study will inform activities to improve maternal death audits. The information you provide will be used in a report which may be shared with the Provincial Health Division of North Kivu, Goma Health Zone Central Office, faculty and staff of the University of Louisville (UofL) and the Université Libre des Pays des Grands Lacs (ULPGL)-Goma. Your completed survey and the audio-recording will be stored at a secure location in the University of Louisville. Your participation will take approximately 60 minutes to complete. The interviews will be audio-record to capture all your insights for data analysis purposes. With your permission, I may contact you again after the interview to clarify some of the information you have provided.

Individuals from the UofL Department of Health Promotion and Behavioral Sciences at the School of Public Health, the UofL Institutional Review Board (IRB), the UofL Human Subjects Protection Program Office (HSPPO), ULPGL-Goma, and other regulatory agencies may inspect these records. In all other respects, however, the data will be held in confidence to the extent permitted by law. Should the data be published, your identity and the name of your health facility or workplace will not be disclosed.

Taking part in this study is voluntary. By answering the socio-demographic questions you agree to take part in this research study. You do not have to answer any questions that make you uncomfortable. You may choose not to take part at all. If you decide to be in this study you may stop taking part at any time. If you decide not to be in this study or if you stop taking part at any time, you will not lose any benefits for which you may qualify.

If you have any questions, concerns, or complaints about the research study, please contact: **Dr. Muriel Harris**, email address mjharr08@louisville.edu or Tel: +1502-644-0474; **Baraka Muvuka**, email address baraka.muvuka@louisville.edu or Tel: +243998688632; or the **Ethics Committee**, ULPGL-Goma, Tel: +243998688631/+243850200554.

If you have any questions about your rights as a research subject, you may call the UofL Human Subjects Protection Program Office at +15028525188 or the ULPGL-Goma Ethics Committee at

(+243) 850200554. You can discuss any questions about your rights as a research subject, in private, with a member of the University of Louisville Institutional Review Board (IRB) or the ULPGL Ethics Committee. You may also call these numbers if you have other questions about the research, and you cannot reach the research staff, or want to talk to someone else. The IRB is an independent committee made up of people from the University community, staff of the institutions, as well as people from the community not connected with these institutions. The UofL IRB and the ULPGL-Goma Ethics Committee have reviewed this research study.

If you have concerns or complaints about the research or research staff and you do not wish to give your name, you may call +1-877-852-1167. This is a 24-hour hot line answered by people who do not work at the University of Louisville.

Sincerely,

Signature of the Investigator

Signature of the Co-Investigator

Appendix D: Document Review Worksheet

Maternal Death Surveillance and Response Documents		
☐ MDR/MDSR Guide/Protocol ☐ MDR/MDSR Policies ☐ MDR/MDSR Budget ☐ MDR/MDSR notification form ☐ MDSR/Reporting Flowchart ☐ MDSR History in Goma HZ ☐ Case summary/data collection form ☐ MDR committee worksheets ☐ Others: _____	☐ Action plans/recommendations ☐ MDR/MDSR meeting minutes ☐ MDR/MDSR Report ☐ Patient chart template ☐ Death certificate template ☐ Antenatal care register template ☐ Delivery register template ☐ Postnatal register template ☐ Others: _____	
Document Title	Document Source/Author	Document Description
		Type of Document: Date produced: Date retrieved: Prepared by: Purpose created: Intended Audience: Summary of Content:

Appendix E: Data Collection Form

<u>Data Collection Form</u>				
Site:				
Date of visit:				
MDSR Indicator	2015	2016	2017	2018
Presence of an MDR committee				
Number of maternal deaths identified				
Number of maternal deaths notified				
Number of maternal death review meetings				
Number of community-based maternal death review meetings				
Number of maternal deaths reviewed				
Number of reviews that included recommendations				
Number of reviews that included community members				
Proportion of committee recommendations implemented				

Appendix F: Observation Protocol

MDSR Activity Observed: Date: Time:	
DESCRIPTIVE NOTES	REFLECTIVE NOTES
<u>PHYSICAL SETTING</u>	
<ul style="list-style-type: none"> What is the physical set-up like? What is the context? What kinds of behavior is the setting designed for? How is space allocated? What objects, resources, technologies are in the setting? 	
<u>PARTICIPANTS</u>	
<ul style="list-style-type: none"> Describe who is in the scene, how many people, and their roles. What brings these people together? Who is allowed here? Who is not here who would be expected to be here? What are the relevant characteristics of the participants? What are the ways in which the people in this setting organize themselves? 	
<u>ACTIVITIES AND INTERACTIONS</u>	

<ul style="list-style-type: none"> • What is going on? • Is there a definable sequence of activities? • How do the people interact with the activity and with one another? • How are people and activities connected? • What norms or rules structure the activities and interactions? • When did the activity begin? • How long does it last? • Is it a typical activity, or unusual? 	
<p style="text-align: center;"><u>CONVERSATION</u></p> <ul style="list-style-type: none"> • What is the content of conversations in this setting? • Who speaks to whom? • Who listens? • Quote directly, paraphrase, and summarize conversations • Note silences and nonverbal behavior that add meaning to the exchange 	
<p style="text-align: center;"><u>SUBTLE FACTORS</u></p> <ul style="list-style-type: none"> • Informal and unplanned activities • Symbolic and connotative meanings of words • Nonverbal communication such as dress and physical space • Unobtrusive measures such as physical clues 	

<p style="text-align: center;"><u>OBSERVER'S OWN BEHAVIOR</u></p> <ul style="list-style-type: none"> • How is your role, whether as an observer or an intimate participant, affecting the scene you are observing? • What do you say and do? • What thoughts are you having about what is going on? 	

Adapted from Merriam, S. B. (2009). *Qualitative research: A guide to design and implementation*. San Francisco, CA: Jossey-Bass

Appendix G: Key Informant Interview Guide for MDSR Decision-Makers/Managers (District and Facility Levels)

Guidelines for the interviewer

Use local terminology for the equivalent of MDSR (audit, review, surveillance and response)
Request to make photocopies or take photographs of written documents related to MDR/MDSR while being mindful of ethical considerations (privacy, confidentiality).

Date completed (dd/mm/yyyy): ____/____/____

A. SOCIO-DEMOGRAPHIC CHARACTERISTICS

Participant ID: _____

Sex: ☐ Male ☐ Female

Position/Medical qualifications: _____

Length of employment in current position: _____

Unit/Department: _____

Sector: ☐ Public ☐ Faith-based ☐ Private-for-profit ☐ Private-not-for-profit ☐ Community

Level of involvement in MDSR: ☐ National ☐ Provincial ☐ District ☐ Facility

☐ Community

Length of involvement in MDSR: _____

B. MDSR HISTORY AND STRUCTURE

1. Please tell me about the system you use for reviewing maternal deaths in your health zone/facility.
 - Is it integrated with other structures or systems such as health information systems, civil and vital registration system, integrated disease surveillance system, and quality improvement systems?
 - How are maternal death audits in the health zone/facility linked at different levels of the health system (e.g. community, facility, provincial, and national)? What are the identification, reporting, or feedback pathways between these levels?

[Interviewer: Assess knowledge of MDSR and provide brief definition of MDSR before asking question 2]

2. Has the health zone/facility adopted the Maternal Death Surveillance and Response (MDSR) process recommended by the World Health Organization? Why or why not?
3. Please tell me how the maternal death audits (MDAs) came to be in your health zone/facility.
 - Probe: Why, when were MDAs started in the health zone/facility? By whom (community, facility, district, provincial, national)?
 - Probe: Have there been any major interruptions since its start? When and why?
4. Before starting MDAs, how did the health zone/facility document the number and causes of maternal deaths?
5. Who is the designated maternal coordinator in the health zone/facility?
 - What are the tasks of the MDA coordinator(s)?
6. Who is currently involved in different aspects of MDAs (from identification-evaluation) in the health zone/facility?
 - Does the health zone/facility have an MDA committee?
 - What are the committee members specifically assigned to do?
 - Are they incentivized or compensated for participating in MDAs?
7. Tell me about your role in MDAs in the health zone/facility.
 - Probe: How much of your time is spent on MDAs per week/month?
8. How are/were individuals involved in MDAs prepared to take on their assigned tasks?
 - Probe: Are/were there any training activities to introduce MDAs? (in-service, pre-service training?)
 - Probe: Who provides training? What about technical support?
9. How are MDAs regulated or standardized in your health zone/facility?
 - Are there any written policies, guidelines or protocols?
 - If yes, please describe each of the above, including who issued them (e.g. facility, district, provincial, national government)
10. What are the goals and objectives of MDAs in your health zone/facility?
11. What resources (e.g. financial, material, technical) are available to support MDAs in your health zone/facility?
 - What support or resources are provided by the facility, community, district, provincial and national government, and international organizations?

- How often are these resources available?
- Which communication and/or information technologies are used?

12. What are the costs for operating the MDA system (include start-up and operation costs)?

- Is there a budget line for MDAs? Under whose budget?

13. How are MDA findings shared with others?

C. OVERALL EXPERIENCES AND PERCEPTIONS

In this last section, I would like for you to reflect on your overall experiences and perceptions regarding maternal death audits

14. From you experience, what are the strengths of the MDA system in your health zone/facility?

- Probe for each component (identification-response)

15. What factors facilitate the implementation of MDAs in your health zone/facility?

16. What are the barriers/challenges associated with conducting MDAs?

- Probe: How easy has it been to implement maternal death audits/MDSR in the health zone/facility? [level of complexity of the process]?

17. In your opinion, what is the quality of data or information on maternal deaths in your health zone/facility?

- Is the information complete, reliable, accurate?

18. From your experience, how stable or consistent has the MDA system been?

- Probe: How often have there been interruptions in MDAs within the past 6 months (e.g. times data was not collected, analyzed, reported due to outages of information system used, limited resources, other priorities)? Why?

19. From your experience, how flexible has the MDA system been in accommodating changes in information needs or operating context?

- Probe: please provide examples of adaptations made due to changes in personnel, availability of funding, availability of data on maternal deaths, new technology, or new requirements by the provincial or central government?

20. How are MDA findings used by the health zone/facility?

- How has maternal death audit influenced practice, policy, and health? (Provide examples of changes)

21. How has participating in MDAs impacted you in your current position?
- Based on your experience, are you willing to continue or reduce/stop your involvement in MDAs if given a choice? Why?
22. How can maternal death audits be improved in your health zone/facility?
- What changes would be most helpful?

Those are the questions I had for you today. Is there anything else you would like to discuss about MDA/MDSR?

- *Is it alright to contact you in the future if there is a need to clarify some of the information you have provided?*
- *Would you be interested in receiving findings about the study?*

Thank you so much for your time and willingness to share your experience and insights with me!

Interviewer request copies of the following documents:

☐ MDSR Guide/Protocol	☐ Action plans/recommendations
☐ MDSR Policies	☐ MDSR meeting minutes
☐ MDR/MDSR Budget	☐ MDR/MDSR Report
☐ MDSR notification form	☐ Patient chart template
☐ MDSR reporting Flowchart	☐ Death certificate template
☐ MDSR History in Goma HZ	☐ Antenatal register template
☐ Case summary/data collection form	☐ Delivery register template
☐ MDR committee worksheets	☐ Postnatal register template
☐ MDSR training materials	

☐ *Documents with the following information at district and facility levels (2015-2018):*

Numbers of maternal deaths notified and number reviewed
Number of MDAs conducted and number with community involvement
Proportion of reviews with recommendations
Proportion of recommendations implemented
Hospital and district maternal mortality ratios or numbers

Ensure that all personally identifiable information is removed or obscured before making copies or taking photographs of the document

Note: This interview guide has been adapted from the Maternal and Child Survival Program (MSCP) of the United States Agency for International Development

Appendix H: Key Informant Interview Guide for MDSR Implementers

Guidelines for the interviewer

Use local terminology for the equivalent of MDSR (audit, review, surveillance and response)

MDSR implementers will be asked all questions in sections A, B, D

*In section C, **MDSR/MDR implementers will only answer questions corresponding to the components (e.g. identification, review, response, evaluation) they are involved in** as determined prior to each interview.*

Request to make photocopies or take photographs of written documents related to MDR/MDSR while being mindful of ethical considerations (privacy, confidentiality).

Date completed (dd/mm/yyyy): ____/____/____

A. SOCIO-DEMOGRAPHIC CHARACTERISTICS

Key Informant Information

Participant ID: _____

Sex: ☐ Male ☐ Female

Position/Medical qualifications: _____

Length of employment in current position: _____

Unit/Department: _____

Sector: ☐ Public ☐ Faith-based ☐ Private-for-profit ☐ Private-not-for-profit ☐ Community

Level of involvement in MDSR: ☐ National ☐ Provincial ☐ District ☐ Facility

☐ Community

Length of involvement in MDSR: _____

Health Facility Profile (For Facility Informants Only)

Type of Facility: ☐ Hospital ☐ Health center ☐ Clinic

Facility Ownership: ☐ Public ☐ Faith-based ☐ Private-for-profit ☐ Not-for-profit

☐ Community

B. MDR/MDSR STRUCTURE

1. What do maternal death audits (MDAs) mean to you?

2. What are your assigned tasks in MDAs?

3. How are/were you prepared to take on your assigned tasks?
 - Probe: Did (do) you receive training or technical support? When (pre-service, in-service?) From whom?
 - Are you aware of any policies, guidelines or protocols related to maternal death audits?
4. What are the goals and objectives of the MDAs in your health zone/facility?
5. Approximately how much of your time is spent per month on activities related to MDAs?
6. What resources (e.g. financial, material, technical) are available to you to support the MDA tasks you are involved in?
 - Who provides these resources?
 - Are they constantly available?
 - What communication and/or information technologies do you use for your assigned tasks?

C. IMPLEMENTATION OF MDSR PROCESS

Interviewer: Ask questions corresponding to each interviewee's role or assigned tasks as determined prior to the interview.

Identifying and Notifying Maternal Deaths

7. How are maternal deaths identified in the health zone/facility/community?
 - Probe for different areas of facility if not already mentioned (e.g. ANC register, emergency care area, general adult inpatient ward, labor and delivery register, outpatient department register, postnatal register)
 - Probe: How are maternal deaths identified in the community?
 - Probe: Who identifies maternal deaths at the health zone/facility/community?
8. How are maternal deaths notified and reported?
 - Probe: Please describe the notification chain (from community/facility to national level) –who notifies who at different levels?
 - Probe: How often and how soon are deaths notified?
 - Probe: Do you practice “zero-reporting”? [*Explain that zero reporting is an active process of reporting maternal deaths whether or not any occurred, that means reporting a “0 (zero)” when no maternal deaths occur*]
 - Are there specific notification forms/tools used?
On average, how much time is spent gathering necessary information to notify a maternal death?

9. What factors facilitate maternal death identification and notification?
10. What are the barriers to maternal death identification and notification?
11. What are your suggestions for improving maternal death identification and notification?

Maternal Death Reviews

In this section, I will be asking you questions related to maternal death audit sessions

12. How often do MDA meetings take place?
 - Probe: How soon after a woman's death? How soon after notification of the death?
 - Probe: When was the last committee meeting?
13. Who (positions/job titles) participates in a typical MDA meeting?
 - Probe: What are their roles and responsibilities during the session?
 - Probe: Are non-medical personnel such as the community represented?
 - Probe: Are attendees incentivized or compensated for their participation?
14. What information on maternal deaths is collected in preparation for the MDA meeting?
 - Probe: Are case summaries prepared before the meetings?
 - Probe: Where do you extract the information on maternal death cases in preparation for MDA (*e.g. patient charts / case notes, registers, maternal death notification form, post-mortem report*)
15. In your opinion, what is the quality of information contained in data sources/documents you use to obtain information on maternal deaths?
 - Probe: Do the medical records and registers capture the necessary information for assessment of cause of death and contributing factors?
 - How can these documents/sources be improved?
16. What happens during a typical MDA meeting?
 - Probe: What are the steps followed (sequence of events)?
 - Probe: What information is presented at the meeting (e.g. case summaries)? Is it identifiable?
 - Probe: On average how long are the meetings?
 - Probe: Does the MDA include every maternal death notified or a sample of deaths? (If a sample of deaths is selected, what criteria are used to decide which cases?)

- Probe: From your experience, how are the group dynamics—Are all participants given an equal opportunity to contribute? Are they motivated to take part in these meetings?
17. How do committee members reach consensus about causes of death, contributing factors, and preventability?
 - Probe: What system is used to classify cause of death on audit forms? (e.g. International Classification of Disease, designated doctor, special committee)
 - Probe: What system/framework is used to classify avoidable factors contributing to maternal deaths? (e.g. Three delay model, root cause analysis, pathway to survival)
 - Does the mortality review process ever result in a change to the cause of death as compared to the cause of death recorded in the facility records (e.g. vital statistics report, maternity register, maternity monthly report, etc.)?
 - Probe: Are non-medical contributing factors of deaths also discussed?
 18. How does the MDA team identify and prioritize recommendations?
 - Are community factors (e.g. social determinants) also addressed by recommendations?
 19. Is an action plan developed as part of the MDA process?
 - If yes, what does the action plan include?
 20. How and with whom are MDA recommendations/action plans shared?
 21. How are health provider and patient information handled throughout and after the MDA process?
 - Are the names of individual staff members and patients included in case summaries and audit reports?
 - Do MDAs result in disciplinary action?
 22. What factors facilitate the review (audit) of maternal deaths?
 23. What are the barriers to reviewing (auditing) maternal deaths?
 24. What are your suggestions for improving MDAs?

Analysis

25. How are data from MDAs analyzed?
 - Probe: What type of analysis is done on the audit data and by whom?
 - Probe: What indicators or measures are included in the statistical analysis?

26. What measures are taken to assess the quality, completeness, and accuracy of data obtained?

- Probe: Is information from MDAs verified against other information?
- How are discrepancies in data addressed?

27. What factors facilitate analysis of data from MDAs?

28. What are the barriers or challenges associated with the analysis of data from MDAs?

29. What are your suggestions for improving data analysis?

Response

30. How are MDA findings translated into action?

- What is the structure/process/advocacy/leadership required for this to occur?
- Who are the primary end-users of MDA findings and recommendations?

31. What actions have been taken in your health zone/facility/community as a result of MDAs?

- Probe: Tell me about a time when the recommendations made during the audit process resulted in a change in how care was provided, in the availability of resources, or in policies and guidelines.

32. How do you ensure that recommended actions are implemented?

- Probe: Are individuals assigned to monitor or follow up on specific recommendations (e.g. A response coordinator)?

33. In your opinion, which factors facilitate/limit the successful implementation of actions at community, facility, health zone, and provincial levels?

34. What do you think should be done to improve translation of MDA recommendations into concrete actions?

Reporting

35. How and with whom are the MDA findings and outcomes shared?

- Are there official channels through which these findings are reported?

- Is a report produced? (Who issues the report? What kind of information is included? Who receives this report? When was the most recent report issued?)
- Are success stories shared with stakeholders?
- On average, how long does it take from receiving/collecting data on maternal deaths and sharing reports with stakeholders?

Evaluation and Monitoring

36. How is the MDA system in Goma Health Zone monitored and evaluated?

- Probe: what indicators are tracked and by whom?
- When was the last evaluation conducted?

D. OVERALL EXPERIENCES AND PERCEPTIONS

In this last section, I would like for you to reflect on your general experiences and perceptions of MDAs

37. From you experience, what are the strengths of the MDA system in your health zone/facility?

- Probe for each component (identification-response)

38. What factors facilitate the implementation of MDAs in your health zone/facility?

39. What are the barriers/challenges associated with conducting MDAs?

- Probe: How easy has it been to implement MDAs in the health zone/facility? [level of complexity of the process]?

40. From your experience, how stable or consistent has the MDA system been?

- Probe: How often have there been interruptions in MDAs within the past 6 months (e.g. times data was not collected, analyzed, reported due to outages of information system used, limited resources, other priorities)? Why?

41. From your experience, how flexible has the MDA system been in accommodating changes in information needs or operating context?

- Probe: please provide examples of adaptations made due to changes in personnel, availability of funding, availability of data on maternal deaths, new technology, or new requirements by the provincial or central government?

42. How have MDAs influenced practice, policy, and health outcomes for women in your health zone/facility/community?
- Provide examples of changes that have resulted from MDAs
43. How has participating in MDAs impacted you in your current position?
- Based on your experience, are you willing to continue or reduce/stop your involvement in MDAs if given a choice? Why?
44. How can MDAs be improved in your health zone/facility?
- Probe: What changes would be most helpful?

Interviewer request copies of the following documents:

☐ MDSR notification forms	☐ MDSR action plan/recommendation
☐ MDSR reporting forms	☐ MDR/MDSR Report
☐ MDSR notification forms	☐ Patient chart template
☐ Death certificate template	☐ Case summary/data collection
☐ Antenatal care register template	☐ MDR committee worksheets
☐ Delivery register template	
☐ Postnatal register template	

Those are the questions I had for you today. Is there anything else you would like to discuss about MDA/MDSR?

- *Is it alright to contact you in the future if there is a need to clarify some of the information you have provided?*
- *Would you be interested in receiving findings about the study?*

Thank you so much for your time and willingness to share your experience and insights with me!

Note: This interview guide has been adapted with permission from the Maternal and Child Survival Program (MSCP) of the United States Agency for International Development

Appendix I: Key Informant Interview Guide for MDSR Community Partners/End-Users

Date completed (dd/mm/yyyy): ____/____/____

A. SOCIO-DEMOGRAPHIC CHARACTERISTICS

Key Informant Information

Participant ID: _____

Position: _____

Sex: ☐ Male ☐ Female

Length of employment in current position: _____ ☐ Non-applicable

Unit/Department : _____ ☐ Non-applicable

Sector: ☐ Public ☐ Faith-based ☐ Private-for-profit ☐ Private-not-for-profit ☐ Community

Level of involvement in MDSR: ☐ National ☐ Provincial ☐ District ☐ Facility
☐ Community

Length of involvement in MDSR: _____ ☐ Non-applicable

B. OVERALL EXPERIENCES AND PERCEPTIONS

1. What do maternal death audits (MDAs) mean to you?
2. Please tell me about your role in MDAs in Goma.
3. How have MDAs been received by the community and/or civil society organizations?
4. How has the community or civil society been engaged in MDAs?
5. In your experience, what factors facilitate MDAs/MDSR?
 - Probe: What factors facilitate maternal death identification, review, actions?
6. In your experience, what are the barriers to implementing MDAs?
 - Probe: What factors hinder effective maternal death identification, review, actions?
7. How are MDA findings used by your community/organization?
8. What are your thoughts about the quality of information from MDAs?

9. How has your participation in MDAs impacted you?
10. How have MDAs impacted the community?
 - What changes or actions have resulted from MDAs?
11. Overall, how well does the current MDA system meet the community's needs?
12. How can MDAs be improved to better serve the community?
 - Probe: What changes would be most helpful?
 - Probe: What involvement would you wish to have in MDAs?
 - Probe: What can be done to overcome the barriers you mentioned?

Those are all the questions I had for you today. Is there anything else you would like to discuss about maternal death audits?

- *Is it alright to contact you in the future if there is a need to clarify some of the information you have provided?*
- *Would you be interested in receiving findings about the study?*

Appendix J: List of Initial Codes, Focused Codes, and Themes from Extracted from the Data

Theme I: Structural Capacity of the MDSR System [Research Question 1]		
Sub-themes	Focused Codes	Initial Codes
☐ National MDSR guidelines ☐ MDSR policies ☐ MDSR goals and objectives: “No woman should die while giving life!” ☐ MDSR support functions: Training, technical support, supervision ☐ MDSR Resources	☐ Learning about maternal death reviews <ul style="list-style-type: none"> • Informal learning/orientation (experiential learning, self-directed learning, briefings) • Formal training/technical support on maternal death reviews • Limited training on maternal death reviews ☐ National/local guidelines, standards, and policies ☐ Goals and objectives of maternal death reviews ☐ Data collection forms/instruments for maternal death reviews ☐ Integrating maternal death reviews into existing programs/activities ☐ Resources for maternal death reviews <ul style="list-style-type: none"> • Human [includes their workload] • Material/Technological • Financial ☐ Lacking specific resources for maternal death reviews ☐ Stakeholders involved in maternal death reviews	☐ Knowledge related to maternal death reviews ☐ Lacking guidelines or protocols related to maternal death reviews ☐ Having guidelines or protocols related to maternal death reviews ☐ Policies related to maternal death reviews ☐ Goals and objectives of maternal death reviews ☐ Availability of resources for maternal death reviews <ul style="list-style-type: none"> • Human resources • Material resources • Financial resources • Insufficient resources ☐ Having multidisciplinary teams ☐ Integrating MDRs ☐ Lacking training on maternal death reviews ☐ Receiving training on maternal death reviews ☐ Receiving support for maternal death reviews ☐ Availability of staff members

Theme II: MDSR Process in Goma Health Zone [Research Question 1]		
Sub-themes	Focused Codes	Initial Codes
☐ Identifying and notifying maternal deaths ☐ Reviewing maternal deaths ☐ Analyzing MDR findings and formulating recommendations ☐ Response and monitoring response ☐ Monitoring and evaluation of the MDSR system ☐ Disseminating results and recommendations	☐ Identifying and notifying maternal deaths <ul style="list-style-type: none"> Identifying and notifying maternal deaths in the community Identifying and notifying maternal deaths in private facilities Identifying and notifying maternal deaths in public/integrated facilities Immediate notification ☐ Reviewing maternal deaths <ul style="list-style-type: none"> Describing the review process Collecting data in the community/private sector Duration and timeliness of maternal death reviews Assessing non-medical contributing factors Focusing on strengths or weaknesses ☐ Analyzing and synthesizing maternal death review findings ☐ Formulating recommendations/developing an action plan ☐ Translating recommendations to action <ul style="list-style-type: none"> Acting on recommendations Failing to act on recommendations Monitoring and evaluating implementation of actions/recommendations ☐ Disseminating results and recommendations to stakeholders ☐ Community engagement/involvement	☐ Identifying and notifying maternal deaths ☐ Immediate notification of maternal deaths ☐ Describing the process for reviewing and analyzing maternal deaths ☐ Internal vs. external review ☐ Utilizing the maternal death review form ☐ Utilizing frameworks in maternal death reviews ☐ Formulating recommendations ☐ Receiving limited feedback on recommendations ☐ Implementing actions/response <ul style="list-style-type: none"> Poor response implementation ☐ Evaluating response <ul style="list-style-type: none"> Not following up on recommendations ☐ Sharing findings ☐ Limited private facility coverage in maternal death reviews ☐ Limited community involvement in maternal death reviews

	<ul style="list-style-type: none"> The role of community health workers in maternal death reviews 	
Theme III: Quality Attributes of the MDSR System [Research Question 2]		
Sub-themes	Focused Codes	Initial Codes
<ul style="list-style-type: none"> ☐ Simplicity ☐ Acceptability ☐ Flexibility ☐ Timeliness ☐ Stability ☐ Data quality 	<ul style="list-style-type: none"> ☐ Acceptability of maternal death reviews (Stakeholders' willingness to participate in MDSR, as evidenced by their commitment to and support for MDRs) ☐ Sources of information for maternal death reviews <ul style="list-style-type: none"> Data Quality (The completeness and reliability of MDSR data) ☐ Deficiencies in documentation and record keeping ☐ Flexibility of maternal death review system (adapting to change in operating context and needs) 	<ul style="list-style-type: none"> ☐ Committing to maternal death reviews ☐ Obtaining information for the maternal death review <ul style="list-style-type: none"> Sources of information on maternal death Poor documentation practices Poor record keeping and archiving Hiding information
Theme IV: Outcomes of MDSR Implementation [Research Question 3]		
Sub-themes	Focused Codes	Initial Codes
<ul style="list-style-type: none"> ☐ Short-term and Intermediate Outcomes ☐ Impacts of MDSR on maternal health outcomes 	<ul style="list-style-type: none"> ☐ Perceived impacts of maternal death reviews 	<ul style="list-style-type: none"> ☐ The impacts of maternal death reviews
Theme V: Factors Influencing MDSR Implementation [Research Question 4]		
Sub-themes	Focused Codes	Initial Codes
<ul style="list-style-type: none"> ☐ Leadership commitment and support ☐ Shifting paradigms: maternal death "audit" to maternal death "review". ☐ "No name, no blame, no shame" principle 	<ul style="list-style-type: none"> ☐ Shifting paradigms: audit to review <ul style="list-style-type: none"> Changing the terminology–audit to review Ensuring a non-threatening environment ☐ No name, no shame, no blame principle ☐ Deficiencies in documentation and record keeping 	<ul style="list-style-type: none"> ☐ Political factors influencing maternal death reviews ☐ Changing the terminology ☐ Perceiving maternal death review as a quality improvement tool ☐ Perceiving Maternal death review as an educational/capacity-building tool

☐ MDSR and disciplinary action: The MDSR paradox ☐ Fear, Guilt, Frustration. ☐ Defensive Behaviors. ☐ Unregulated private health facilities and lack of community linkages. ☐ Documentation and record keeping practices ☐ Organizational/workplace culture ☐ Socio-cultural factors	☐ Cultural factors influencing maternal death reviews <ul style="list-style-type: none"> • Institutional/organizational culture • Community culture ☐ Emotional responses to maternal death reviews <ul style="list-style-type: none"> • Being defensive • Frustration • Guilt ☐ Fear ☐ Maternal death reviews and disciplinary action <ul style="list-style-type: none"> • Contradictory statements regarding reviews and punishment • Involvement of law enforcement or judicial system ☐ Hiding/concealing/modifying information (includes intentionally withholding information, modifying the truth, protecting self and colleagues, falsifying medical records, creating fake charts or diagnosis) ☐ Leadership commitment and support ☐ Working in teams/ collaboration	☐ Working as a team ☐ Collaborating with team members ☐ Lacking collaboration ☐ Emotional response <ul style="list-style-type: none"> • Fearing disciplinary action • Being defensive • No name, no shame, no blame principle • Maintaining anonymity and confidentiality ☐ Cultural factors influencing maternal death reviews
Theme VI: Recommendations to Improve MDSR (Research Question 5)		
Sub-themes	Focused Codes	Initial Codes
☐ Recommendations to improve MDSR	☐ Recommendations for improving maternal death reviews	☐ Recommendations <ul style="list-style-type: none"> • Involving partners in external reviews • Ensuring comprehensive reviews • Involving the private sector

		<ul style="list-style-type: none"> • Establishing monitoring and evaluation mechanisms • Focusing on written rather than verbal information • Ensuring the availability of participants for reviews • Improving documentation and record keeping practices • Involving community stakeholders • Providing training on maternal death reviews • Utilizing technology
	N= 31 Main (parent) Focused Codes	N=38 Main (parent) Initial Codes

Appendix K: University of Louisville IRB Ethics Review Outcome Letter

Human Subjects Protection Program Office
MedCenter One – Suite 200
501 E. Broadway
Louisville, KY 40202-1798
Office: 502.852.5188 Fax: 502.852.2164

DATE: November 19, 2018
TO: Muriel J Harris, PhD, MPH
FROM: The University of Louisville Institutional Review Board
IRB NUMBER: 18.1195
STUDY TITLE: Uncovering the Stories Behind the Numbers: A Case Study of Maternal Death Surveillance and Response in Goma, Democratic Republic of Congo
REFERENCE #: 673822
IRB STAFF CONTACT: Barbara Dearing 852-5987 badear01@louisville.edu

This study was reviewed on 11/17/2018 by the Chair/Vice Chair of the Institutional Review Board and approved through the Expedited Review Procedure, according to 45 CFR 46.110(b), since this study falls under Category 7: Research on individual or group characteristics or behavior (including, but not limited to, research on perception, cognition, motivation, identity, language, communication, cultural beliefs or practices, and social behavior) or research employing survey, interview, oral history, focus group, program evaluation, human factors evaluation, or quality assurance methodologies.

This study was also approved through 45 CFR 46.116 (D), which means that it has been granted a waiver of informed consent because it meets the following criteria:

- The research involves no more than minimal risk to the subjects.
- The waiver or alteration will not adversely affect the rights and welfare of the subjects.
- The research could not practicably be carried out without the waiver or alteration.
- Whenever appropriate, the subjects will be provided with the additional pertinent information after participation.

This study was also approved through 45 CFR 46.116 (C), which means that an IRB may waive the requirement for the investigator to obtain a signed informed consent form for some or all subjects if it finds either:

- That the only record linking the subject and the research would be the consent document and the principal risk would be potential harm resulting from a breach of confidentiality. Each subject will be asked whether the subject wants documentation linking the subject with the research, and the subject's wishes will govern; or
- That the research presents no more than minimal risk of harm to subjects and involves no procedures for which written consent is normally required outside of the research context.

The following items have been approved:

Title	Version Date	Outcome
Data collection form	11/05/2018	Approved
Observation protocol/guide	11/04/2018	Approved
Interview Guide for MDSR end-users_French	11/04/2018	Approved
Interview Guide for MDSR end-users_English	11/04/2018	Approved
Interview Guide for MDSR implementers_French	11/04/2018	Approved
Interview Guide for MDSR implementers_English	11/04/2018	Approved
Interview Guide for MDSR decision-makers_French	11/05/2018	Approved
Interview Guide for MDSR decision-makers_English	11/04/2018	Approved
Authorization letter_French	11/04/2018	Approved
Authorization letter_English	11/04/2018	Approved
Recruitment script_French	11/04/2018	Approved
Recruitment script_English	11/04/2018	Approved
Document review worksheet	11/04/2018	Approved
Research Protocol	11/15/2018	Approved
Preamble Consent_French	11/04/2018	Approved
Preamble Consent_English	11/04/2018	Approved

This study now has final IRB approval from 11/17/2018 through 11/16/2019.

For guidance on using iRIS, including finding your approved stamped documents, please follow the instructions at <https://louisville.edu/research/humansubjects/iRISSubmissionManual.pdf>

Please note: Consent forms no longer have an expiration date stamped on them. The consent will only expire if the study lapses in IRB approval. Enrollment cannot take place if a study lapses in approval. For additional information view Guide 038.

Site Approval

If this study will take place outside of the University of Louisville Campuses, permission from the organization must be obtained before the research may begin (e.g. Jefferson County Public Schools). Failure to obtain this permission may result in a delay in the start of your research.

Privacy & Encryption Statement

The University of Louisville's Privacy and Encryption Policy requires such information as identifiable medical and health records; credit card, bank account and other personal financial information; social security numbers; proprietary research data; dates of birth (when combined with name, address and/or phone numbers) to be encrypted. For additional information:
<http://security.louisville.edu/PolStds/ISO/PS018.htm>.

Implementation of Changes to Previously Approved Research

Full Accreditation since June 2005 by the Association for the Accreditation of Human Research Protection Programs, Inc.

Prior to the implementation of any changes in the approved research, the investigator will submit any modifications to the IRB and await approval before implementing the changes, unless the change is being made to ensure the safety and welfare of the subjects enrolled in the research. If such occurs, a Protocol Deviation/Violation should be submitted within five days of the occurrence indicating what safety measures were taken, along with an amendment to revise the protocol.

Unanticipated Problems Involving Risks to Subjects or Others (UPIRTSOs)

In general, these may include any incident, experience, or outcome, which has been associated with an unexpected event(s), related or possibly related to participation in the research, and suggests that the research places subjects or others at a greater risk of harm than was previously known or suspected. UPIRTSOs may or may not require suspension of the research. Each incident is evaluated on a case by case basis to make this determination. The IRB may require remedial action or education as deemed necessary for the investigator or any other key personnel. The investigator is responsible for reporting UPIRTSOs to the IRB within 5 working days. Use the UPIRTSO form located within the iRIS system to report any UPIRTSOs.

Continuation Review Requirements

You are responsible for submitting a continuation review 30 days prior to the expiration date of your research study. Investigators who allow their study approval to expire have committed significant non-compliance with federal regulations. Such lapses may require reporting to federal agencies, a program audit by compliance auditors to ensure that subjects were not enrolled during the expired period, and may lead to findings of serious and continuing non-compliance if expiration were to occur a second time.

The committee will be advised of this action at a regularly scheduled meeting.

If you have any questions, please contact the IRB analyst listed above or the Human Subjects Protection Program office at hspofc@louisville.edu.

Sincerely,

Peter M. Quesada, Ph.D., Chair
Social/Behavioral/Educational Institutional Review Board

We value your feedback. Please let us know how you think we are doing: <https://www.surveymonkey.com/r/CCLHXP>

Full Accreditation since June 2005 by the Association for the Accreditation of
Human Research Protection Programs, Inc.

Appendix L: Université Libre des Pays des Grands Lacs-Goma Letter of Ethical Approval

Université Libre des Pays des Grands Lacs-Goma
ULPGL – Goma ; B.P. 368 Goma
République Démocratique du Congo
COMITE D'ETHIQUE

LETTER OF ETHICAL APPROVAL

The Comité d'Ethique de l'Université Libre des Pays des Grands Lacs (ULPGL Ethics Committee) in Goma hereby certifies having Ethically reviewed the research proposal entitled " UNCOVERING THE STORIES BEHIND THE NUMBERS: A CASE STUDY OF MATERNAL DEATH SURVEILLANCE AND RESPONSE IN GOMA, DEMOCRATIC REPUBLIC OF CONGO, that will be conducted by MUVUKA BARAKA of the University of Louisville.

The ethical review focused on the title, the research methodology and tools for data collection. After reviewing this final proposal, the Ethics Committee members have found that this project and research study comply with the ethical standards and regulations for conducting research and evaluation study in social and behavioral health studies, specifically in relation to Maternal Death Surveillance and Response.

Therefore, the Ethics Committee recommend Ms.MUVUKA BARAKA to pursue her research in the chosen Health Zone of Goma following the procedure stated in her protocol with respect to all methodology and research tools as described.

Issued in Goma, on November 24, 2018

Reviewers:

1. Professor Dr. NTABE NAMEGABE
2. Professor MUMBERE MBASSA

Professor Dr. MUTEHO KASONGO Marina

Coordinator

Please contact:

COORDINATOR OF THE COMITE D'ETHIQUE ULPGL GOMA

Prof. Dr. MUTEHO KASONGO MARINA (Ethique Sociale)

< kambur@yahoo.com >

Phone: (+243) 998688631

Appendix M: English Template of Authorization Letter for Research in Goma Health Zone

UofL Institutional Review Boards
IRB NUMBER: 18.1195
IRB APPROVAL DATE: 11/17/2018

Authorization Letter

Date: _____

Dr. _____
Chief Medical Officer
Goma Health Zone

Dear Dr. _____,

I am writing to request permission to conduct a research study on maternal death audits in selected health facilities and administrative offices in Goma Health Zone. I am a student in the Public Health program at the University of Louisville in Kentucky, USA. I am working on my dissertation entitled: "Uncovering the Stories Behind the Numbers: A Case Study of Maternal Death Surveillance and Response in Goma, Democratic Republic of Congo", which aims to understand how maternal death audits (MDAs) are implemented in Goma Health Zone.

This study will comprise interviews with stakeholders involved in MDAs, observations of MDA activities, and review of documents used in MDAs. As such, I am requesting your permission to contact individuals involved in MDAs in your health zone for recruitment into the study, to observe MDA activities, and to access and review relevant documents. All participants will be provided a consent form with information about this study and will be asked to indicate their consent before participating. Taking part in this study will be voluntary and participants will be informed that they can withdraw their participation any time without consequences. The names of participants, patients, or health facilities will not be disclosed nor included in the final report.

This study has been reviewed and approved by the University of Louisville Institutional Review Board and the Université Libre des Pays des Grands Lacs-Goma (see enclosed approval documents).

Your permission to conduct this study in Goma Health Zone will be greatly appreciated. I will be happy to answer any questions or concerns you may have about the study. You may contact me at baraka.muvuka@louisville.edu or +243998688632. If you grant permission, kindly complete the section below with your name, signature, title/position, and approval date.

Thank you for considering my request.

Sincerely,

Baraka Muvuka, MPH
Doctoral Candidate
Department of Health Promotion and Behavioral Sciences
University of Louisville, Kentucky

Muriel Harris, PhD
Associate Professor/ Dissertation Chair
Department of Health Promotion and Behavioral Sciences
University of Louisville, Kentucky

Permission granted by:

Name and Signature:

Position/Title:

Date Approved:

Appendix N: Signed Authorization Letter for Research in Goma Health Zone

UofL Institutional Review Boards
IRB NUMBER: 18.1195
IRB APPROVAL DATE: 11/17/2018

Lettre d'autorisation

Date: November 26, 2018

Dr. Robert Vutsopire
Médecin Chef de Zone
Zone de Santé de Goma

Cher Dr. Vutsopire,

Je vous écris pour demander la permission de mener une étude de recherche sur les audits de décès maternels dans certains établissements de santé et bureaux administratifs de la zone de santé de Goma. Je suis un étudiant du programme de santé publique de l'Université de Louisville dans le Kentucky, aux États-Unis. Je travaille sur ma thèse intitulée: «Découvrir les histoires derrière les chiffres: une étude de cas de la surveillance de la mortalité maternelle à Goma, République démocratique du Congo», qui vise à comprendre comment les audits de décès maternels sont mis en œuvre dans Goma Health Zone.

Cette étude comprendra des entretiens avec les parties prenantes impliquées dans les audits des décès maternels, des observations sur les activités des ces audits et l'examen des documents utilisés dans les audits des décès maternels. En tant que tel, je vous demande la permission de contacter les personnes impliquées dans les audits des décès maternels dans votre zone de santé afin de les recruter dans l'étude, d'observer les activités des audits des décès maternels et d'accéder aux documents pertinents. Tous les participants recevront un formulaire de consentement contenant des informations sur cette étude et devront indiquer leur consentement avant de participer. La participation à cette étude sera volontaire et les participants seront informés qu'ils peuvent retirer leur participation à tout moment sans conséquences. Les noms des participants, des patients ou des établissements de santé ne seront ni divulgués ni inclus dans le rapport final.

Cette étude a été examinée et approuvée par le Comité d'éthique de l'Université de Louisville et par l'Université libre des Grands Lacs-Goma (voir les documents d'approbation ci-joints).

Votre approbation de mener cette étude dans la zone de santé de Goma sera grandement appréciée. Je me ferai un plaisir de répondre à vos questions ou préoccupations concernant l'étude. Vous pouvez me contacter à baraka.muvuka@louisville.edu ou au +243998688632. Si vous accordez l'autorisation, veuillez remplir la section ci-dessous en indiquant votre nom, votre signature, votre titre / poste et votre date d'approbation.

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Merci d'avoir pris en compte ma demande.

Cordialement,

Baraka Muvuka, MPH
Candidate au Doctorat
Département de la Promotion de la Santé et des Sciences du Comportement
University of Louisville, Kentucky

Muriel Harris, PhD
Professeur Agrégé / Directeur de Thèse
Département de la Promotion de la Santé et des Sciences du Comportement
University of Louisville, Kentucky

Permission accordée par:

DR Robert VUTSOPIA

Nom et signature.

Position / Titre:

Date d'approbation:

7 Décembre, 2018

CURRICULUM VITAE

Baraka Muvuka

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Home Address: 2310 Crittenden Drive, Apt. 119, Louisville, KY 40217

EDUCATION

University of Louisville, Kentucky, USA (2015-2019)

- Doctor of Philosophy in Public Health–Health Promotion and Behavioral Sciences; May 2019; GPA: 3.98/4.00
- Doctoral dissertation: Uncovering the stories behind the numbers: A case study of Maternal Death Surveillance and Response (MDSR) in Goma, Democratic Republic of Congo

Liberty University, Lynchburg, Virginia, USA (2013-2015)

- Master of Public Health- Global Health; May 2015; GPA: 3.98/4.00
- Practicum Project: An Impact Evaluation of the Nutrition and Maternal Education Development (NAMED) Project Implemented by Samaritan's Purse in Nyankunde, Democratic Republic of Congo
- Graduated with high distinction

Silliman University, Dumaguete, Philippines (2009-2013)

- Bachelor of Science in Nursing; March 2013; GPA: 3.27/4.00
- Thesis: Medication Error Contributing Factors as Perceived by Nurses Working in Tertiary Hospitals in Negros Oriental, Philippines

RESEARCH EXPERIENCE

Graduate Research Assistant, Commonwealth Institute of Kentucky, School of Public Health and Information Sciences, University of Louisville (October 1, 2015-January 2019)

- Assisted with participant recruitment, and qualitative data collection and analysis for Health Literacy projects designed to examine the development, use, applicability, and design of health insurance, health systems, and health behavior literacy materials in Louisville, Kentucky
- Assisted with developing and administering data collection instruments (e.g. surveys and interview/focus group guides)

- Coordinated and performed qualitative data analysis for a CDC-funded project, the Youth Violence Prevention Research Center's (YVPRC) Community Discussion Groups and Louisville Youth Interviews (2017-2018)
- Contributed to technical reports for the YVPRC Community Discussion Groups and Louisville Youth Interviews
- Provided administrative support and served as an academic member of a Community Based Participatory Research (CBPR) to improve health literacy and health outcomes on depression, childhood asthma, and HIV in Louisville, Kentucky; this project employs a novel Community-Based Participatory Research approach known as Boot Camp Translation
- Engaged with community members and various community stakeholders (Federally Qualified Health Center and hospital management, health providers, council members, Louisville Metro Department of Public Health and Wellness, health insurance companies, etc.) in an effort to identify community resources and address priority public health issues in West Louisville
- Presented at scientific conferences
- Developed and submitted manuscripts for publication in peer-reviewed journals
- Developed research protocols for review by the Institutional Review Board (IRB)

PhD Dissertation, (Fall 2017-Spring 2019)

- Developed and conducted a qualitative case study examining the implementation of Maternal Death Surveillance and Response (MDSR) in Goma, Democratic Republic of Congo

Independent Study, Ghana, Summer 2017

- Developed and conducted an independent, qualitative study examining the impacts of gold mining operations on women's health and quality of life in Anyinam, Ghana, Summer 2017

Collaborative Study, Ghana, Summer 2017

- Participated in a collaborative photo-elicitation study examining the health impacts of gold mining among residents of a mining community (Anyinam) in Ghana, Summer 2017

College of Nursing, Silliman University (2012-2013)

- Co-developed a quantitative study examining factors that contribute to medication errors among nurses working in three tertiary hospitals in the Philippines

TEACHING EXPERIENCE

Instructor, Department of Health Promotion and Behavioral Sciences, University of Louisville, Spring 2019

- *Advanced Program Evaluation* [Graduate course]
- Assisted course director in revising course syllabus; co-lectured

- Assisted in providing guidance and support with semester long collaborative evaluation project entitled: Early Entry into Prenatal Care: An Evaluation of Family Health Center's Process and Outcomes

Instructor, Department of Health Promotion and Behavioral Sciences, University of Louisville, Fall, 2018

- *Critical Thinking, Programming Planning, and Implementation* [Graduate course]
- Co-lectured; developed class content, discussion board prompts, and in-class learning activities.

ADDITIONAL EXPERIENCE

Global Public Health Internship-Maternal and Child Health (MCH), Samaritans Purse, Democratic Republic of Congo, January 2015-May 2015

- Assisted the Health Sector Manager and the Program Development Officer in community health research, needs assessment, coordination of program activities and program evaluation
- Conducted quantitative data analysis for year-end evaluations of health programs
- Prepared and submitted monthly progress and year-end evaluation reports for health projects
- Represented Samaritan's Purse in monthly Health and Nutrition Cluster meetings convening all Non-government Organizations in Bunia, DR Congo
- Conducted field visits to project sites for monitoring and evaluation purposes
- Conducted an impact evaluation for Samaritan's Purse NAMED project, DR Congo, 2015
- Prepared year-end evaluation reports for Samaritan's Purse health projects in DR Congo, 2015

Intensive Practicum for the Bachelor of Science in Nursing, Negros Oriental Provincial Hospital, Philippines, 2012-2013

- Handled patient care, documentation, and health education in the medical-surgical ward of a tertiary hospital

Community Health Nursing, Dumaguete City, Philippines, 2010-2013

- Developed, implemented and evaluated action plans in collaboration with local community officials and community members
- Performed community needs assessment
- Conducted health education on disease prevention and environmental sanitation
- Developed health educational materials
- Prepared and presented case reports on various chronic conditions

PROFESSIONAL AND LEADERSHIP ACTIVITIES

Abstract reviewer, American Public Health Association Annual Conference, 2018-present

- Reviews abstracts submitted to the International Health, Maternal and Child Health, and Student Assembly sessions.

Commonwealth of Kentucky Region IV Public Health Training Center, May 2017

- Developed and presented a training module for public health professionals in the State of Kentucky entitled “Understanding Health Literacy in African American Populations”

President, Overseas Student Fellowship (OSF) 2011-2013, Silliman University, Philippines

- Coordinated planning and implementation of community outreach programs in partnership with the Silliman University Church

Secretary and Public Relations Officer, Overseas Student Fellowship (OSF) 2009-2011, Silliman University, Philippines

- Handled OSF communications and reports
- Facilitated partnerships between OSF and external organizations

INTERNATIONAL EXPERIENCE

- Doctoral dissertation on Maternal Death Surveillance and Response in Goma, Democratic Republic of Congo, December 2018
- Public Health Educational and Cultural Exposure Trip and Independent Research in Ghana: May 16-June 6th, 2017
- Global Public Health Internship-Maternal and Child Health (MCH), Samaritans Purse, Democratic Republic of Congo, January 2015-May 2015
- Intensive Practicum, Negros Oriental Provincial Hospital, Dumaguete City, Philippines, 2012-2013

PROFESSIONAL TRAINING AND CERTIFICATIONS

- Training and certification in HIV Testing and Counseling, January 30, 2015; Louisville, Kentucky

SCIENTIFIC CONFERENCES AND PRESENTATIONS

Oral Presentations

Muvuka B, Harris, M. “Gold mining has brought problems in our community”: Assessing the impacts of gold mining practices on women’s health and quality of

life in Anyinam, Ghana. Oral presentation at the 2018 American Public Health Association Annual Conference and Exposition in San Diego, California.

Combs R, Ali N, **Muvuka B**, Kakar R, Hoepf Malea. Boot Camp Translation: A promising method for collaborating with underserved communities to address health disparities. Oral presentation at the 2018 American Public Health Association Annual Conference and Exposition in San Diego, California.

Ali N, Combs R, Kakar R, **Muvuka B**, Porter J. Promoting interdisciplinary, participatory approaches to address childhood asthma disparities in an urban African American community. Oral presentation at the 2018 American Public Health Association Annual Conference and Exposition in San Diego, California.

Diana Stojda, Jackson T, Niyongabo D. **Muvuka B**, Harris M. Advocating for effective mining policies: A study of health effects of gold mining in Anyinam, Ghana. Oral presentation at the 2018 American Public Health Association Annual Conference and Exposition in San Diego, California.

Muvuka B, Combs R, Ali N, Ayangeakaa S. Developing health insurance literacy interventions in an urban African American community: Process, lessons learned, and future directions. Oral presentation at the 2017 American Public Health Association Annual Conference and Exposition in Atlanta, Georgia.

Ali N, Combs R, **Muvuka B**. Promoting health through novel community-based participatory research methods: Using Boot Camp Translation to improve depression literacy among urban African American populations. Oral presentation at the 2017 American Public Health Association Annual Conference and Exposition in Atlanta, Georgia.

Whembolua G-L, **Muvuka B**, Tshiswaka DI, Conserve D. Socio-cultural and structural factors influencing the prevention of mother-to-child transmission of HIV in the Democratic Republic of the Congo: A systematic review. Oral presentation at the 2017 American Public Health Association Annual Conference and Exposition in Atlanta, Georgia.

Combs R, Ali N, **Muvuka B**, Brown K, Mitchell C. Addressing health literacy in an African American population. Oral presentation at the 2017 Kentucky Public Health Association Annual Conference, Owensboro, Kentucky.

Muvuka B, Gray A, Aramburu C, Kakar RM, Ayangeakaa SD, Leslie KF, Krigger KW, Spencer C. Increasing access to HIV pre-exposure prophylaxis: An assessment of physician barriers to administration. Roundtable presentation at the 2016 American Public Health Association Annual Conference and Exposition, Denver, Colorado.

- **Poster Presentations**

Muvuka B, Harris M. The impact of gold mining on women's health and quality of life in Obuasi, Ghana: Exploring women's perceptions. Poster presentation at Research!Louisville 2017, Louisville, Kentucky.

Kakar R, Combs R, Ali N, **Muvuka B**. "Every child with asthma needs an Asthma Action Plan": Developing a community campaign to reduce childhood asthma disparities in West Louisville. Poster presentation at Research!Louisville 2017, Louisville, Kentucky [Research and Practice in Public Health Award; 2nd Place Excellence in Health Disparities Research Award]

Tshiswaka DI, Nduka U, Whembolua G-L, **Muvuka B**, Inungu J, Conserve D. Factors associated with HIV testing among Congolese men. Poster presentation at the 2017 American Public Health Association Annual Conference and Exposition, Atlanta, Georgia.

Muvuka B, Combs RM, Ayangeakaa SD, Ali NM, Wendel ML, Jackson T. Factors contributing to inadequate health literacy among African Americans: A literature review. Poster presentation at Research!Louisville 2016, Louisville, Kentucky.

Ali N, Combs R, **Muvuka B**, Ayangeakaa S, Wendel M. Promoting health through the utilization of novel community-based participatory research methods: Using Boot Camp Translation to improve depression literacy in West Louisville. Poster presentation at Research!Louisville 2016, Louisville, Kentucky [3rd Place Excellence in Health Disparities Research Award]

Ayangeakaa S, Combs R, **Muvuka B**, Ali N. Health literacy in West Louisville: Examining the development, use, applicability, and design of health insurance, health systems, and health behavior literacy materials to West Louisville residents. Poster presentation at Research!Louisville 2015, Louisville, Kentucky. [2nd Place Excellence in Health Disparities Research Award]

Rogers WT, Young BA, Chaney CL, Jones Jr G, Ayangeakaa SD, **Muvuka B**, LaJoie SA. Redesigned medication messaging to better communicate information to patients. Poster presentation at Research! Louisville 2015, Louisville, Kentucky.

PEER-REVIEWED PUBLICATIONS and TECHNICAL REPORTS

- **Published**

Muvuka B, Harris MJ. A rapid assessment of the impacts of gold mining on women's health and quality of life in Ashanti Region, Ghana. *J Pub Health Issue Pract.* 2019 March 23. doi: <http://dx.doi.org/jphip/2019/138>.

Whembolua GS, **Muvuka B**, Tshiswaka DI, Conserve DF. Socio-cultural and structural factors influencing the prevention of mother-to-child transmission of HIV in the Democratic Republic of the Congo: A systematic review. *Matern Child Health J*. 2019 Jan 2. doi: 10.1007/s10995-018-2688-6.

Ali N, Combs R, **Muvuka B**, Ayangeakaa S. Addressing health insurance literacy gaps in an urban African American population: A qualitative study. *J Community Health*. 2018 Jun 20. doi: 10.1007/s10900-018-0541-x.

- **Manuscripts under review/revise & resubmit**

Muvuka B, Combs R, Ali N, Ayangeakaa S. Health literacy in African American communities: Barriers and strategies. *Health Literacy Research and Practice* [revise and resubmit]

Muvuka B, Combs R, Ali N. Depression is Real: Using community-based participatory research to address depression in an urban African American community. *Progress in Community Health Partnerships: Research, Education, and Action* [under review]

Kakar RM, Combs R; Ali N, **Muvuka B**, Porter J. Enhancing the design and utilization of asthma action plans: Lessons from community-based participatory research. *Journal of Asthma*. [under review]

Tshiswaka DI, Nduka U, Whembolua G-L, **Muvuka, B**. Joseph N. Inungu, & Donaldson F. Conserve. Correlates of HIV testing among Congolese men: An analysis of the 2014 Demographic Health Survey. *International Journal of STD & AIDS*. [under review]

- **Technical Reports**

Center for Health Equity. (2017). 2017 Louisville Metro Health Equity Report 2017: Uncovering the root causes of our health. Retrieved from https://louisvilleky.gov/sites/default/files/health_and_wellness/che/health_equity_report/health_equity_report.pdf. [Contributed to the Childhood Asthma section]

SCHOLARSHIPS, AWARDS, and HONORS

- Delta Omega Honorary Society in Public Health, Beta Pi Chapter (May 10, 2019)
- Graduate Dean's Citation Award (May 10, 2019)
- Dissertation Completion Award (Spring 2019), University of Louisville
- School of Public Health and Information Sciences Travel Fund (August 2018): \$500, University of Louisville

- October Student Spotlight 2017, University of Louisville School of Interdisciplinary and Graduate Studies
- Non-Resident Tuition Differential Award (April 2016-August 2017): \$6000 per semester, University of Louisville
- Roberson Travel Fund Award (May 2017): \$290, University of Louisville
- Graduate Student Council Travel Funds (November 2016; May 2017): \$550, University of Louisville
- HSC Office of Diversity and Inclusion Travel Fund (November 2016): \$400, University of Louisville
- Department of Health Promotion and Behavioral Sciences Travel Fund (November 2016): \$500, University of Louisville
- Graduate with High Distinction, Liberty University, May 9, 2015
- Exceptional Student Award, Liberty University on May 9, 2015
- 2012 University International Student of the Year, Silliman University, Dumaguete City, Philippines
- Most Outstanding International Student in the Philippines 2011, 42nd National Search for Three Most Outstanding International Students in the Philippines–Philippine International Friendship and Understanding Association, Baguio City, Philippines

PROFESSIONAL AFFILIATIONS

- Kentucky Public Health Association-Member (February 2017-present)
- American Academy of HIV Medicine-Member (February 2016-present)
- American Public Health Association-Member (October 2015-present)
- Philippine International Friendship and Understanding Association (2012-present)

PROFESSIONAL SKILLS & INTERESTS

- **Research**
Qualitative and quantitative research; Community-Based Participatory Research; instrument design; manuscript development
- **Teaching**
Advanced Program Evaluation [Graduate course]; Critical Thinking, Programming Planning, and Implementation [Graduate course]
- **Leadership**
Coordinating, delegating, planning, collaboration, problem-solving
- **Administrative**
Administrative support for the Health Literacy-Boot Camp Translation Project through the Commonwealth Institute of Kentucky, School of Public Health and Information Sciences, University of Louisville
- **Program Planning and Evaluation**

Early Entry into Prenatal Care: An Evaluation of Family Health Center's Process and Outcomes; Impact Evaluation of the Nutrition and Maternal Education Development (NAMED) Project in Nyankunde, Democratic Republic of Congo)

- **Computer proficiency**

Proficient in Microsoft Office (Word, Excel, PowerPoint, Outlook), SPSS (quantitative data analysis software), Atlas. Ti and Dedoose (qualitative data management software); experience with SAS (quantitative data analysis software)

- **Linguistic proficiency**

Fluent in English, French, Swahili (Native), Cebuano; Tagalog (Intermediate)