

From Passive Surveillance to Response: Suriname's Steady Efforts to Implement Maternal Death Surveillance and Response (MDSR)

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Abstract

Background Maternal death surveillance and response (MDSR) is essential in preventing avoidable maternal deaths. The cycle starts by accurately capturing maternal deaths with a surveillance system, followed by an audit to give insight into the underlying causes and "lessons learned." Subsequently, recommendations are formulated and targeted multisectoral responses such as quality of care improvement strategies, including clinical guidelines update, health promotion interventions, research to fulfill knowledge gaps, enabling policies and legislation and interventions addressing social determinants. Finally, continuous evaluation and monitoring close the MDSR cycle. We aim to describe the MDSR implementation process in Suriname to share valuable lessons with other countries.

Methods We provide an overview of the evolvement from improved maternal death surveillance, toward review, response, and monitoring to fulfill the MDSR cycle in Suriname.

Findings Middle-income country Suriname called for many years for improved surveillance and review, and in 2000 the first action was commenced by extension of maternal death case capturing from death certificates to active hospital surveillance. Consequently, the maternal mortality ratio increased in the following years. However, not the full MDSR cycle was completed in 2015, and local health care providers initiated the next step of the MDSR cycle with the installation of a national maternal death review committee (MaMS). Since then, the committee reviews each maternal death applying the "no blame, no shame" culture, formulates, and disseminates recommendations. Collaboration with the Ministry of Health (MOH), Bureau of Public Health (BOG), and the Pan American Health Organization (PAHO) should ensure progress to the sustainable implementation of MDSR. Committee MaMS demonstrates that maternal death review and recommended high impact interventions can only be effectively implemented and sustained, through strong professional and government commitment and practical, solution-oriented responses.

Conclusions Crucial elements for a successful MDSR implementation are Commitment, "no blame, no shame" Culture, Coordination, Collaboration, and Communication (5 C's).

We hope that describing this process toward successful nationwide MDSR implementation, with its facilitators and barriers, is helpful for other countries with similar ambitions.

Introduction

The reduction of maternal deaths was the focus of Millennium Development Goal 5 in 2000, and remained a priority in the Sustainable Development Goals established in 2015 [1–3]. It is essential to identify underlying causes and contributing factors to gain more insight into the gaps in care next to solely counting maternal deaths to prevent avoidable deaths [4]. A maternal death review is a medical audit consisting of an in-depth qualitative investigation of the causes and circumstances of the death [5]. By performing audits, an attempt is made to understand the "how and why" of the death, analyze substandard care, and formulate "lessons learned" to initiate steps for improvement. Combining audits with national guideline development, training, and monitoring of implementation could improve guidelines adherence [6,7]. The different types of medical audits are verbal autopsy (at community level), clinical audit (at facility level, by involved healthcare workers), and confidential enquiry (at national level, by an independent committee) [5].

The Maternal Death Surveillance and Response (MDSR) cycle is a continuous action cycle that provides information on maternal mortality surveillance and audit and on the actions needed to improve care and avert avoidable maternal deaths [5,8]. The WHO introduced the MDSR in 2012 to establish accurate data collection and translate lessons learned to action plans and national policies, followed by monitoring to capture the effects [9]. In Latin America and the Caribbean (LAC), MDSR was implemented in 2015 in six countries: Brazil, El Salvador, Columbia, Jamaica, Mexico, and Peru, which serve as an example for other countries [10]. Integrated maternal deaths reviews in Suriname were not performed until the installation of a national Maternal Mortality (MaMS) Committee in 2015. This paper aims to describe the process toward implementation of MDSR in Suriname and share valuable "lessons learned" in this middle-income country.

Methods

We discuss the evolvement of MDSR in Suriname by comparing the situation before and after the installation of a maternal death committee in 2015 and by describing the progress toward closing the MDSR cycle and ending preventable maternal death in the future.

Suriname is a middle-income country in South America with 583.200 inhabitants [11]. There are, on average, 10.000 deliveries in a year, of which 86% in the major hospitals and 6% in primary care [12]. The Ministry of Health (MOH) coordinates the health care systems in Suriname. General practitioners provide primary health care through the Medical Mission (MZ) in the interior (51 facilities), the Regional Health Service (RGD) in the coastal areas (54 facilities), and over 200 private clinics. Of the five major hospitals, four are located in Paramaribo, the capital, and one in Nickerie, on the Western border. The smaller hospitals in the interior and the coastal areas are not operational yet. The Bureau of Public Health (BOG, its Dutch acronym) is responsible for the public health programs and manages the surveillance and analysis of health data. However, no comprehensive national health information system exists, including for data collection on maternal health key indicators.

Findings And Discussion

History of (maternal) death surveillance and safe motherhood initiative before 2015

Suriname has a civil registration system since 1917 [13]. The Central Bureau of Civil registration (CBB, its Dutch acronym) is responsible for the civil registration. Even in the 19th century, there was a procedure to register the death of inhabitants of Suriname who were not slaves [14]. Notification of death is obliged by law and must occur within 24 hours in the capital and within seven days in the districts [15]. Death notification is through a death certificate consisting of an A-form with personal information, a C-form with medical information about the cause and circumstances of the death filled in by the doctor. This C-form is sealed in an envelope (B). The Bureau of Public Health (BOG) registers the C-form [16]. However, in practice, the C-form is often completed after a much longer time, often after the burial [17]. In 2000 the Bureau of Public health received 85% of the of C-forms, which is higher than the 58% in 1995 [18]. The first confidential enquiry in maternal mortality, conducted in 1991–1993, reports that 53% of the maternal deaths were not certified, which is in contrast with the 15% non-certification of the general deaths [19]. These problems with C-forms leads to underreporting or late reporting of maternal deaths.

Figure 1 presents a timeline of the initiatives carried out to improve maternal health care in Suriname. The reports of 1930–1942 and 1963–1970 did not provide information on the identification procedure of maternal deaths [20]. Maternal death reviews in Suriname were performed for the first time in 1991–1993 as part of a confidential enquiry conducted by Mungra et al [21]. This study highlighted substantial underreporting (63%, n = 41/63) and entailed several recommendations [19, 22]:

1. use various methods and sources to improve maternal death surveillance (such as Reproductive Age Mortality Surveys (RAMOS) and active case detection instead of only the C-forms (i.e., capture and recapture), and
2. perform maternal death audits to identify substandard care factors and provide recommendations [21].

Considering the underreporting in a 1995–1999 BOG survey (31%, n = 11/36), for the first time action followed and active maternal death surveillance was initiated in 2000 by a monthly enquiry for deaths in all hospital obstetric units [18]. However, the attending physicians determined the cause, since these deaths were not reviewed nor classified. Every death in pregnancy, including coincidental and accidental, was counted as a maternal death [17]. To reduce maternal and perinatal mortality, the MOH performed a situation analysis in 2007: safe motherhood needs assessment [23]. This analysis concluded several gaps in the surveillance system and recommended to:

1. create more awareness about the definition of maternal deaths, so that accidental and incidental deaths are excluded when determining MMR;
2. add information to the C-form about (recent) pregnancy/delivery when a woman of childbearing age dies;
3. create a central notification point for possible maternal deaths;
4. make confidential enquiry mandatory and introduce maternal and perinatal death audit for a continued process of identification, analysis, and action to improve maternal care and prevent avoidable deaths.

Following a situation analysis in 2007, the National Safe Motherhood and Newborn Health Action Plan, commenced in 2013 and was evaluated in 2017 [24, 25]. In 2014, Suriname's progress of the regional "Plan to accelerate Maternal Mortality Reduction and Serious Maternal Morbidity" was published [26, 27]. The abovementioned reports demonstrated the same gaps assessed in 2007 and the 1991–1993 study [23, 28]. Remarkably, health care providers and other stakeholders were unaware and unfamiliar with the safe motherhood and regional plan and had no active role in implementation [25, 26]. Besides a lack of communication, no coordination mechanism existed to monitor these plans, which may also explain the poor implementation. Surveillance did not improve since the active hospital case detection in 2000, and no maternal death audits were performed structurally until the end of 2015.

Maternal mortality surveillance between 2015 and 2019

In 2015, a reproductive age mortality survey (RaMOS) was performed by health care providers to retrospectively identify and audit all maternal deaths between 2010 and 2014 [17]. Various methods were used to identify pregnancy-related deaths, as described in previous publications [17, 21, 22]. Different medical experts determined the maternal death causes and analyzed substandard care. Recommendations were to: (1) improve maternal death surveillance; (2) install a maternal mortality committee to audit all pregnancy-related death; (3) implement national guidelines, early warning scores; and (4) improve postnatal care strategies.

To prevent the recommendations not being pursued, the study investigators sought collaboration with the MOH, BOG, PAHO, midwifery, and gynecology/obstetric organizations. Consequently, a maternal mortality committee (MaMS, Dutch acronym) was established in November 2015 [29]. Committee MaMS members gather voluntarily (bi)monthly and audit every pregnancy-related death in the nation. The committee consists of four gynecologists/obstetricians, one midwife, one internal medicine specialist, one BOG representative, two medical students, and several external consultants [29]. Most members are specialists from four of the five hospitals where most of the births take place; however, the primary health is not represented. Figure 2 depicts the activities currently conducted by the committee MaMS in the MDSR cycle:

1. Active case detection by various sources: (in)formal notification, notification by BOG (C-forms or active surveillance);
2. Sharing of cases (exchange of data) with BOG/Epidemiology and vice versa; however, this is not performed regularly yet.
3. Composition of a case summary
4. Collecting additional case information if necessary, e.g., laboratory results, interview with the health care provider
5. Verbal autopsy with family members if this may contribute to gain more insight into the circumstances of the death
6. Maternal death review/audit, classification using the International Classification of Diseases for Maternal Mortality (ICD-MM), and substandard care analysis according to the three-delay model [30]
7. Dissemination of recommendations with relevant institutions and the MOH and BOG, however, this is not yet consistently done.

Some hospitals perform a facility-based review of maternal deaths and report to the committee MaMS. All audits are conducted, ensuring no blame, no shame culture [5, 31]. Committee MaMS ensures that no litigation of healthcare workers is initiated.

Figure 3 summarizes facilitators and barriers encountered by committee MaMS in the completion of the MDSR cycle. Maternal deaths are still not structurally identified and depend on informal notification of health care workers, family, or news sites. Death certificates do not have a pregnancy box, and notification is not obliged [17]. Active surveillance of all deceased women of reproductive age is not yet completely incorporated in BOG's surveillance. Medical students are responsible for a part of the surveillance, data acquisition, case presentation at the audit, and summarize the analysis and recommendations. However, for sustainability, the abovementioned tasks, should be the responsibility of an established institution.

The recommendations on quality of care improvement, such as the development of national guidelines, was followed by a response initiated by committee MAMS (Fig. 4). The "bottom-up" guideline development of the most important causes of maternal deaths, postpartum hemorrhage (PPH), and hypertensive disorders of pregnancy (HDP), was completed in November 2016 [32]. Non-Pneumatic Anti Shock garments were provided by PAHO, followed by training in 2018 and 2019 to reduce and treat PPH. Subsequently, the evaluation of the previous guidelines and the development of guidelines on postnatal and antenatal care, sepsis, sickle cell anemia, emergency obstetrics, and early warning scores followed in April 2019. Facility-based trainings, guided by BOG and PAHO and the recently installed maternal health quality of care committee, were conducted to enhance guideline implementation and adherence, as advised in earlier studies [6, 7]. In addition to quality of care improvement projects, committee MaMS was involved in conducting nationwide studies on maternal morbidity and near-miss (2017–2019), childbirth outcomes, and ethnic disparities in maternal health care and stillbirths [33, 34]. To improve perinatal and maternal health, we need to focus on the specific gaps in care identified by these studies.

Steps toward improved implementation of MDSR in Suriname

Similar to Suriname, other countries in the region have made insufficient progress in improvement in maternal and reproductive health care [35]. Subsequently, the PAHO and its Latin American Centre of Perinatology women and reproductive health (CLAP) called for awareness-raising and accountability.

Several barriers are yet to overcome to incorporate MDSR in the health system in Suriname fully. To progress from insufficient surveillance, incidental facility-based audits, and voluntary-based national audits to a well-established MDSR, strong government commitment, professionals' involvement, and external support of organizations like PAHO are essential [7, 36]. Successful and sustained implementation now requires delineation of roles for surveillance and audit, responsibilities for action, and monitoring to track implementation progress. MOH/BOG and PAHO presented an advocacy paper in April 2020 to call for a multisectoral effort to reduce maternal deaths [37]. They also created an organogram to reinforce the coordination of the maternal health program in Suriname. This organogram includes a national steering committee for maternal health and mortality reduction, overseeing the following working groups (Fig. 5):

1. MDSR working group: responsible for improving *surveillance* and maternal death audit, dissemination of *recommendations* and delineation of roles for *response* by specifying specific tasks and responsibilities;
2. Quality of Care (QoC) working group: responsible for the development and monitoring of national standards of care, update and validate national guidelines facility-based and support national trainings.
3. Perinatal data working group: based on PAHO Health Information System (SIP, its Spanish acronym) is responsible for introducing, collecting, synchronizing, and analyzing data on maternal health in Suriname. This is crucial for evidence-based decision making for maternal health and the fundament of maternal and perinatal studies.
4. Health Promotion working group: responsible for the development of a health promotion plan, execute recommendations following maternal death reviews, public maternal health education, family planning, and contraception in the communities.

The steering committee, installed by the MOH in February 2020, guides, advises, and closely monitors planned interventions of the working groups and reinforces accountability and multisectoral coordination. MOH has identified multisectoral focal points in non-health ministries and institutions and currently prepares the national Maternal and Neonatal Health Strategy (2021–2025) and Operational Plan (2021–2023).

Table 1 summarizes the MDSR steps (yet to be) established in Suriname by 2020. A process of institutionalization of MDSR has started in collaboration with MOH/BOG, MAMS, and PAHO. The established MDSR steps include improved surveillance by the designation of MDSR focal points (midwives/doctors) in each institution (five hospitals, Medical Mission, and Regional Health Services). The MOH issued instructions on MDSR, including early reporting and active case detection, to health facilities and burial agencies. The PAHO/CLAP organized a training in MDSR, including training of MDSR focal points in active case detection and verbal autopsy. The primary care MDSR focal points assess community deaths. The MDSR focal point in a hospital is responsible for active case detection by monthly medical file investigation of deceased women of reproductive age starting in 2020. Subsequently, notification follows of every possible maternal death in a health institution or the community to BOG via a hotline number and an anonymized password protected online database. The focal point is responsible for the coordination of the facility-based review and reports to BOG and committee MAMS. Also, zero maternal deaths must be reported. Specialized nurses or medical doctors of BOG will be responsible for performing an external case assessment with the assistance of committee MAMS. The monthly audits to determine underlying causes and classification on the national level by committee MaMS should continue. Committee MAMS formulates the recommendations and disseminates them to the relevant institutions and the MOH/BOG, responsible for an adequate response. Evaluation and monitoring of the proposed measures are essential to judge its impact, namely maternal death reduction.

Table 1
Summary of the steps in Maternal Death Surveillance and Response (MDSR) planning established in 2020

Already established	To be established
1. Installation of national Maternal health/mortality reduction steering committee	1. Official installation of the committee MAMS and the four working groups for maternal health, reinforce the health promotion and perinatal data working group ¹
2. Coordination framework and terms of references	2. MDSR Focal points supervising facility-based audits
3. Institutional MDSR Focal points located and trained in surveillance and active case detection	3. MDSR Focal points reinforce performing verbal autopsies
4. Quality of care working group operational	4. Specialized assessors for facility audit preparation (nurses, doctors) and external audits (BOG)
	5. Timely dissemination of recommendations
	6. Monitoring and evaluation
1 perinatal data working group was installed, but only sporadically active	

The following steps after the institutionalization of MDSR implementation will be the inclusion of perinatal deaths to the cycle, the Maternal and Perinatal Death Surveillance and Response (MPDSR). (Fig. 6). Maternal conditions often influence perinatal outcomes. Additionally, gathering perinatal data and perform perinatal mortality audits in the future, extend the MDSR cycle, linking maternal and perinatal care. Besides focusing on maternal and perinatal deaths, maternal morbidity and near-miss data gathering and audit will be another essential step. Table 2 summarizes several recommendations for MDSR strengthening in Suriname. Critical next steps in completing the MDSR cycle in Suriname (action and response) are the delineation of roles and responsibilities for action, establishment of accountability mechanisms for results, and influencing those in a position to act. Several barriers challenge the fulfillment of this cycle, such as a lack of financial and human resources, legislation, and inadequate government enabling policies.

Table 2
Summary of specific recommendations needed to strengthen Maternal Death Surveillance and Response (MDSR) in Suriname

Legislation
Ensure no disciplinary / litigation measures
Notification of maternal death within 24 hours ¹
Include pregnancy checkbox in death certificate ²
Timely completion of death certificate
Oblige autopsy for maternal deaths of unknown cause
Finances and human resources
Empower BOG by capacity strengthening
Support committee MaMS (administrative personnel, logistics)
Capacity building institutional MDSR focal points
Include MDSR in preservice training curricula
Involve healthcare workers and create awareness (bottom-up approach)
Involve and educate the community
Funding
Enabling policies
Ensure structural facility-based review
Install special secretariat for MDSR at BOG/MOH
Enable communication and dissemination of findings and recommendations
1 institutions and funeral agencies were recently requested to report maternal deaths within 24 hours.
2 as a temporary solution, a pregnancy checkbox slip is attached to the "C form."

Conclusions

A strongly committed government, enabling clear policies and laws to improve maternal health with concomitant dedicated professionals, is crucial for success in MDSR implementation. For decades, several attempts by the MOH alone were insufficient to institutionalize maternal death audits. Structural national maternal death audits in Suriname were introduced after a time consuming and complicated process. Dissemination of the "lessons learned" and recommendations and ensuring no litigation against healthcare workers is essential. Stakeholders' involvement and ownership were essential to step up in the

MDSR cycle from insufficient surveillance to structural audits in 2015. In summary, the key elements for successful MDSR implementation are Commitment, "no blame, no shame" Culture, Collaboration, Coordination, and Communication (5 C's). Although institutionalization of MDSR is in progress in Suriname, more is needed to embed MDSR in the national health system. Legislation framework, funds, leadership, and capacity building are still issues Suriname needs to address.

Abbreviations

MDSR: Maternal Death Surveillance and Response

MDPSR: Maternal and Perinatal Death Surveillance and Response

MaMS: Maternal Mortality Suriname

RAMOS: Reproductive Age Mortality Survey

MOH: Ministry of Health

BOG: Bureau of Public Health, Dutch acronym Bureau voor Openbare Gezondheidszorg

PAHO: Pan American Health Organization

CLAP: Latin American Centre of Perinatology Women and Reproductive health

WHO: World Health Organization

CBB: Central Bureau of Statistics, Dutch acronym Centraal Bureau voor Burgerzaken

HDP: hypertensive disorders of pregnancy

PPH: postpartum hemorrhage

Declarations

Ethics approval and consent to participate

Not applicable

Consent for publication

Not applicable

Availability of data and materials

Not applicable

Competing interests

The authors declare that they have no competing interests.

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Author's contributions

All authors approved the manuscript. Study conception and primary initiators: LK and KV. First draft manuscript: LK. Edit and layout tables and figures: LK, KV, LB. Supervision and revision: GB, RM, SM, LO, IG, KB. Revisions and final draft: all authors.

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References

1. Say L, Chou D, Gemmill A, Tunçalp Ö, Moller A-BB, Daniels J, et al. Global causes of maternal death: A WHO systematic analysis. *Lancet Glob Heal*. 2014 Jun;2(6):323–33.
2. Stanton ME, Kwast BE, Shaver T, McCallon B, Koblinsky M. Beyond the safe motherhood initiative: Accelerated action urgently needed to end preventable maternal mortality. *Glob Heal Sci Pract*. 2018;6(3):408–12.
3. World Health Organization. Trends in Maternal Mortality: 2000-2017. Estimates by WHO, UNICEF, UNFPA, World Bank Group and the United Nations Population Division [Internet]. 2019 [cited 2020 Jan 15]. Available from: <https://www.who.int/reproductivehealth/publications/maternal-mortality-2000-2017/en/>
4. Lewis G. Beyond the numbers: reviewing maternal deaths and complications to make pregnancy safer. *Br Med Bull*. 2003;67(830):27–37.
5. Brouwere V De, Zinnen V, Delvaux T. How to conduct Maternal Death Reviews (MDRs) Guidelines and tools for Health Professionals. [Internet]. International Federation of Gynecologists and Obstetricians, FIGO LOGIC. 2013 [cited 2020 Jan 22]. Available from: [https://www.figo.org/files/figo-corp/Edited MDR Guidelines final 2014.pdf](https://www.figo.org/files/figo-corp/Edited%20MDR%20Guidelines%20final%202014.pdf)
6. Siddiqi K, Robinson M. Getting evidence into practice in developing countries. *Int J Qual Healthc*. 2005;17(5):447–53.
7. Smith H, Ameh C, Roos N, Mathai M, van den Broek N. Implementing maternal death surveillance and response: A review of lessons from country case studies. *BMC Pregnancy Childbirth*. 2017;17(1):1–11.
8. World Health Organization. Time to Respond, a report on the global implementation of Maternal Death Surveillance and Response [Internet]. 2016 [cited 2020 Jan 22]. Available from: <https://apps.who.int/iris/bitstream/handle/10665/249524/9789241511230-eng.pdf?sequence=1>
9. World Health Organization. Maternal Death Surveillance and Response. Technical Guidance. Information for action to prevent maternal death [Internet]. 2013 [cited 2020 Jan 28]. p. 38. Available from: https://apps.who.int/iris/bitstream/handle/10665/87340/9789241506083_eng.pdf;jsessionid=4468B088F37504154939965B0202688A?sequence=1
10. Regional Task Force for Maternal Mortality Reduction (GTR). Guidelines for Maternal Death Surveillance and Response (MDSR): Region of the Americas [Internet]. 2015 [cited 2020 Feb 2]. p. 124. Available from: https://www.msh.org/sites/msh.org/files/mdsr_guidelines_lac_2015_english.pdf
11. General Bureau of Statistics. Demographic Data Suriname 2015-2018 [Internet]. Vol. 345. 2019 [cited 2020 Mar 2]. Available from: <https://statistics-suriname.org/wp-content/uploads/2019/09/DEMOGRAFISCHE-DATA-2015-2018-website-info.pdf>
12. Ministry of Social Affairs and Public Housing. Suriname Multiple Indicator Cluster Survey 2018, Survey Findings Report. [Internet]. 2019 [cited 2020 Mar 10]. Available from: <https://statistics-suriname.org/wp-content/uploads/2019/08/Suriname-MICS-6-Survey-Findings-Report.pdf>
13. Fernand Jubithana A, Queiroz BL. Quality of death counts and adult mortality registration in Suriname and its main regions. *Rev Bras Estud Popul*. 2019;36:1–20.
14. Nijgh H. Gouvernementsbladen van de kolonie Suriname [Internet]. 1856 [cited 2020 Mar 10]. p. 158. Available from: <https://books.google.sr/books?id=mmAMAAAYAAJ&pg=PA185&lpg=PA185&dq=hoe+een+sterfte+aan+te+geven+in+Suriname&source=bl&ots=XD7UTHRP98&sig=ACfU3U3KIQ7vja4EVAKHxOBS8Q6AEwCXoECAoQAQ#v=onepage&q=hoe+een>
15. Nieuw burgerlijk wetboek van Suriname [Internet]. Vol. 8. 2008 [cited 2020 Mar 15]. p. 1–58. Available from: http://200.2.185.15/media/59670/boek_1_tekst_dna.pdf
16. Punwasi W. Death causes in Suriname 2010-2011 [Internet]. 2013 [cited 2020 May 30]. Available from: https://www.verloskundesuriname.org/uploads/7/5/4/5/75459511/deathcauses_in_suriname_2010-2011.pdf
17. Kodan LR, Verschueren KJC, Roosmalen J Van, Kanhai HHH, Bloemenkamp KWM. Maternal mortality audit in Suriname between 2010 and 2014, a reproductive age mortality survey. *BMC Pregnancy Childbirth*. 2017;17(275):1–9.
18. Ori R, Punwasi W. Maternal and Perinatal deaths 2000-2001. Surveillance data from the 4 hospitals in Paramaribo. 2002.
19. Mungra A. Under-reporting of maternal mortality in Surinam. In: *Safe Motherhood. Confidential Enquiries into Maternal Deaths in Surinam*. 1999;75–85.
20. Kuyp van der E. Infant and Maternal Mortality in Surinam. *Surinaams Medisch Bulliten*. 1978.
21. Mungra A, van Kanten RW, Kanhai HHH, van Roosmalen J. Nationwide maternal mortality in surinam. *BJOG An Int J Obstet Gynaecol*. 1999;106(1):55–9.
22. Mungra A, Van Bokhoven SC, Florie J, Van Kanten RW, Van Roosmalen J, Kanhai HHH. Reproductive age mortality survey to study under-reporting of maternal mortality in Surinam. *Eur J Obstet Gynecol Reprod Biol*. 1998;77(1):37–9.
23. Haverkamp W. Safe Motherhood Needs Assessment, 2007-2008 [Internet]. 2009 [cited 2020 May 30]. Available from: https://www.verloskundesuriname.org/uploads/7/5/4/5/75459511/safe_motherhood_needs_assessment_2007-2008.pdf
24. Ministry of Health Suriname. National Safe Motherhood and Neonatal Health Action Plan 2013-2016 [Internet]. 2017 [cited 2020 May 30]. Available from: https://www.verloskundesuriname.org/uploads/7/5/4/5/75459511/national_safe_motherhood_and_neonatal_health_action_plan_2013-2016.pdf
25. Caffé I. Evaluation of Safe Motherhood and Neonatal Health Plan of Action 2013-2016 [Internet]. 2017 [cited 2020 May 30]. Available from: https://www.verloskundesuriname.org/uploads/7/5/4/5/75459511/evaluation_of_safe_motherhood_and_neonatal_plan_of_action_2013-2016.pdf
26. Gajadien I, Mohamed R. Progress report of the Plan to accelerate Maternal Mortality Reduction and Serious Maternal Morbidity [Internet]. 2013 [cited 2020 May 30]. Available from: https://www.verloskundesuriname.org/uploads/7/5/4/5/75459511/progress_report_of_the_plan_to_accelerate_maternal_mortality_reduction_and_serious

27. PAHO/Latin American Centre of Perinatology women and reproductive health. Plan to accelerate Maternal Mortality Reduction and Serious Maternal Morbidity. [Internet]. 2012 [cited 2020 May 20]. Available from: https://www.paho.org/clap/index.php?option=com_docman&view=list&slug=salud-de-mujer-reproductiva-materna-y-perinatal&Itemid=219&layout=default&lang=en&limit=20&limitstart=20%0D
28. Mungra A. Safe Motherhood. Confidential Enquiries into Maternal Deaths in Surinam. 1999.
29. Obstetrics in Suriname. Committee MaMS. [Internet]. [cited 2020 Mar 25]. Available from: <https://www.verloskundesuriname.org/commissiemams.html>
30. World Health Organization. ICD-10 to deaths during pregnancy, childbirth and the puerperium: ICD-MM [Internet]. Vol. 129. 2015 [cited 2020 Mar 25]. p. 30–3. Available from: https://apps.who.int/iris/bitstream/handle/10665/70929/9789241548458_eng.pdf?sequence=1
31. De Brouwere V, Zinnen V, Delvaux T, Leke R. Guidelines and tools for organizing and conducting maternal death reviews. *Int J Gynecol Obstet*. 2014;127(S1):S21–3.
32. Verschueren KJC, Kodan LR, Brinkman TK, Paidin RR, Henar SS, Kanhai HHH, et al. Bottom-up development of national obstetric guidelines in middle-income country Suriname. *BMC Health Serv Res*. 2019;19(1):1–12.
33. Verschueren KJC, Kodan LR, Paidin RR, Rijken MJ, Browne JL, Bloemenkamp KWM. Maternal near-miss and performance of the WHO, Sub-Saharan African and Namibian criteria: a nationwide surveillance study in Suriname, South America. Submitted. 2020;
34. Verschueren KJC, Prust RD, Paidin RR, Kodan LR, Bloemenkamp KWM, Rijken MJ, et al. Childbirth outcome and ethnic disparities in Suriname: a nationwide registry-based study in a middle-income country. *BMC Reprod Heal*. 2020;17(62).
35. PAHO/Latin American Centre of Perinatology women and reproductive Health. Plan to accelerate Maternal Mortality Reduction and Serious Maternal Morbidity-final report. 2018; Available from: <https://iris.paho.org/bitstream/handle/10665.2/49652/CD56-INF-14-e.pdf?sequence=1&isAllowed=y>
36. Smith H, Ameh C, Godia P, Maua J, Bartilol K, Amoth P, et al. Implementing maternal death surveillance and response in Kenya: Incremental progress and lessons learned. *Glob Heal Sci Pract*. 2017;5(3):345–54.
37. Ministry of Health Suriname. Maternal deaths in Suriname - advocacy report [Internet]. 2020 [cited 2020 May 30]. Available from: https://www.verloskundesuriname.org/uploads/7/5/4/5/75459511/advocacy_report_maternale_sterfte_-_maart_2020.pdf
38. Ministry of Health Suriname. National Maternal Health and Mortality Reduction Priority Plan. July 2019 - September 2020. [Internet]. 2020 [cited 2020 May 30]. Available from: https://www.verloskundesuriname.org/uploads/7/5/4/5/75459511/national_maternal_health_and_mortality_reduction_priority_plan_-_suriname_-_july-sep_2020_.pdf

Figures

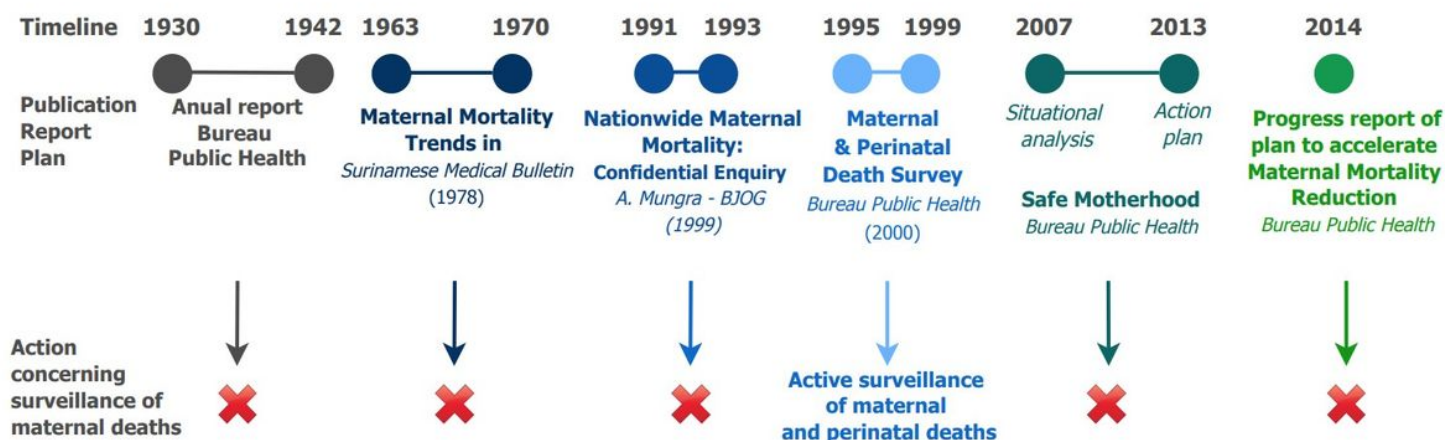


Figure 1

Overview of local plans of action on maternal mortality in Suriname until 2015

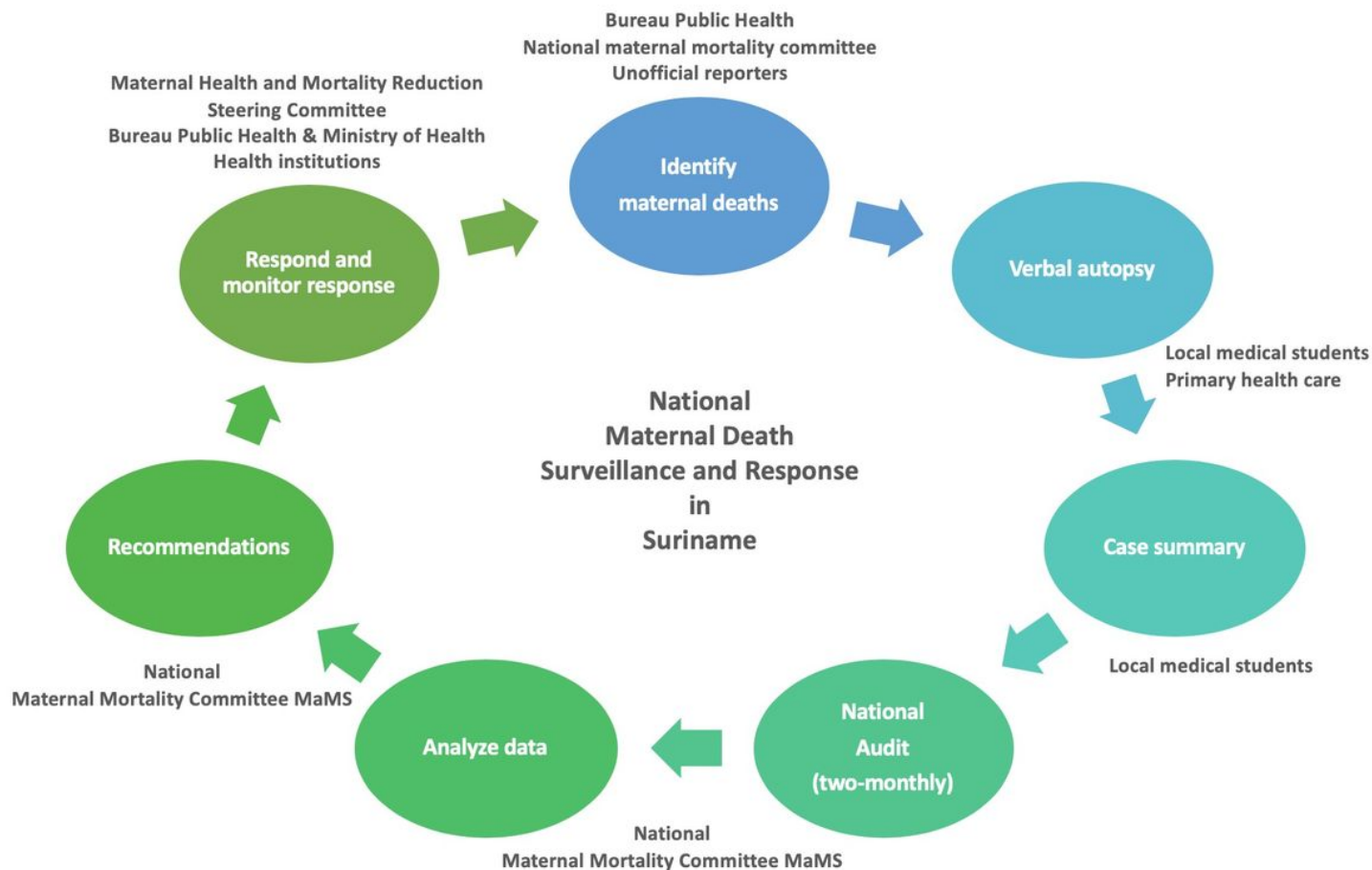


Figure 2

Maternal Death Surveillance and Response (MDSR) in Suriname in 2020, adapted from the WHO [10]

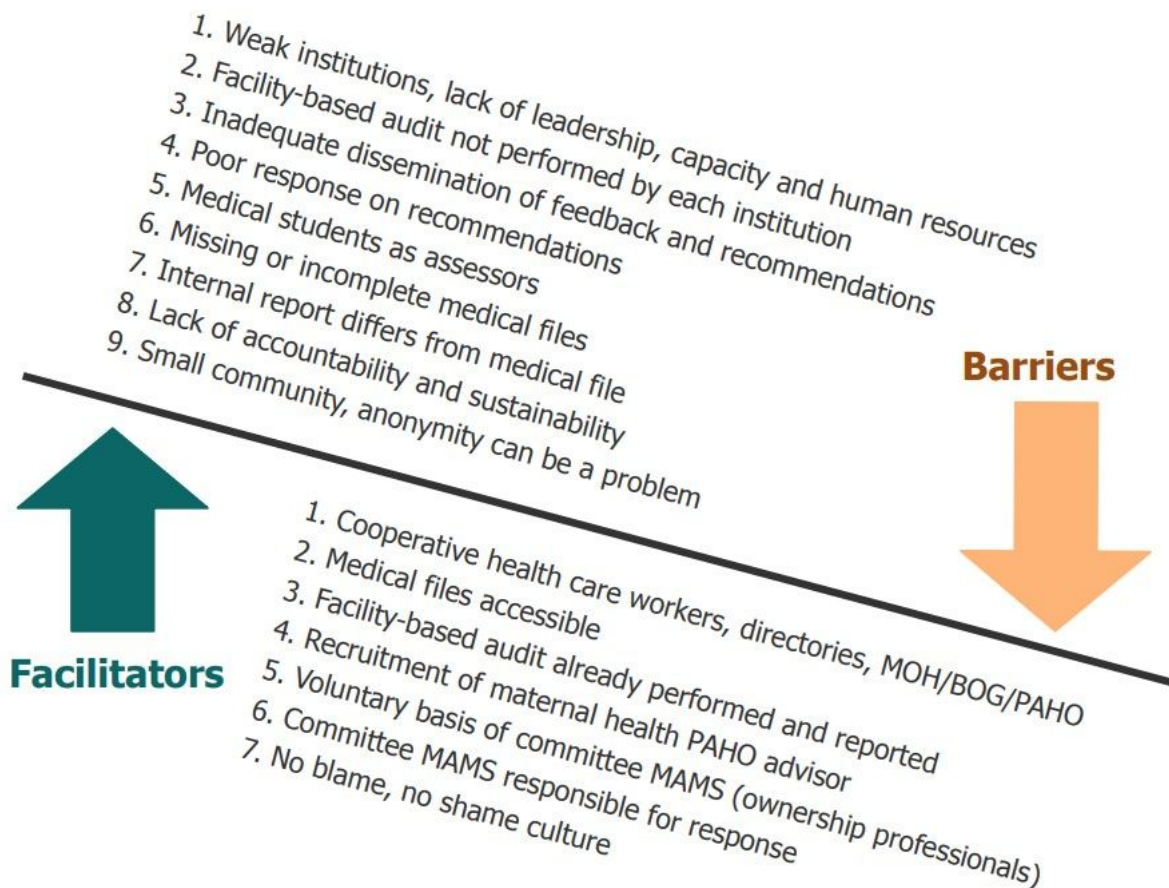


Figure 3

Facilitators and barriers in setting up Maternal Death Surveillance and Response (MDSR) in Suriname

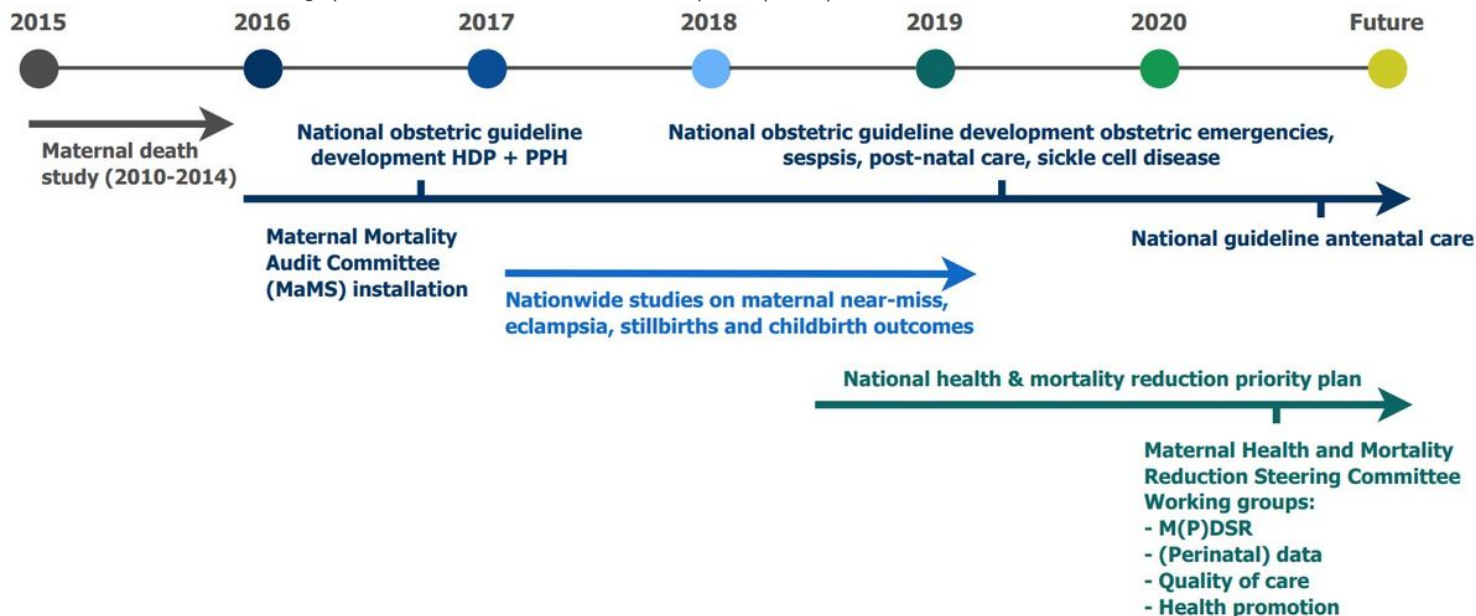


Figure 4

Timeline of maternal health initiatives in Suriname, 2015 to present Legend: HDP: hypertensive disorders of pregnancy, MaMS: Maternal Mortality Suriname, M(P)DSR: maternal (& perinatal) death surveillance and response, PPH: postpartum hemorrhage

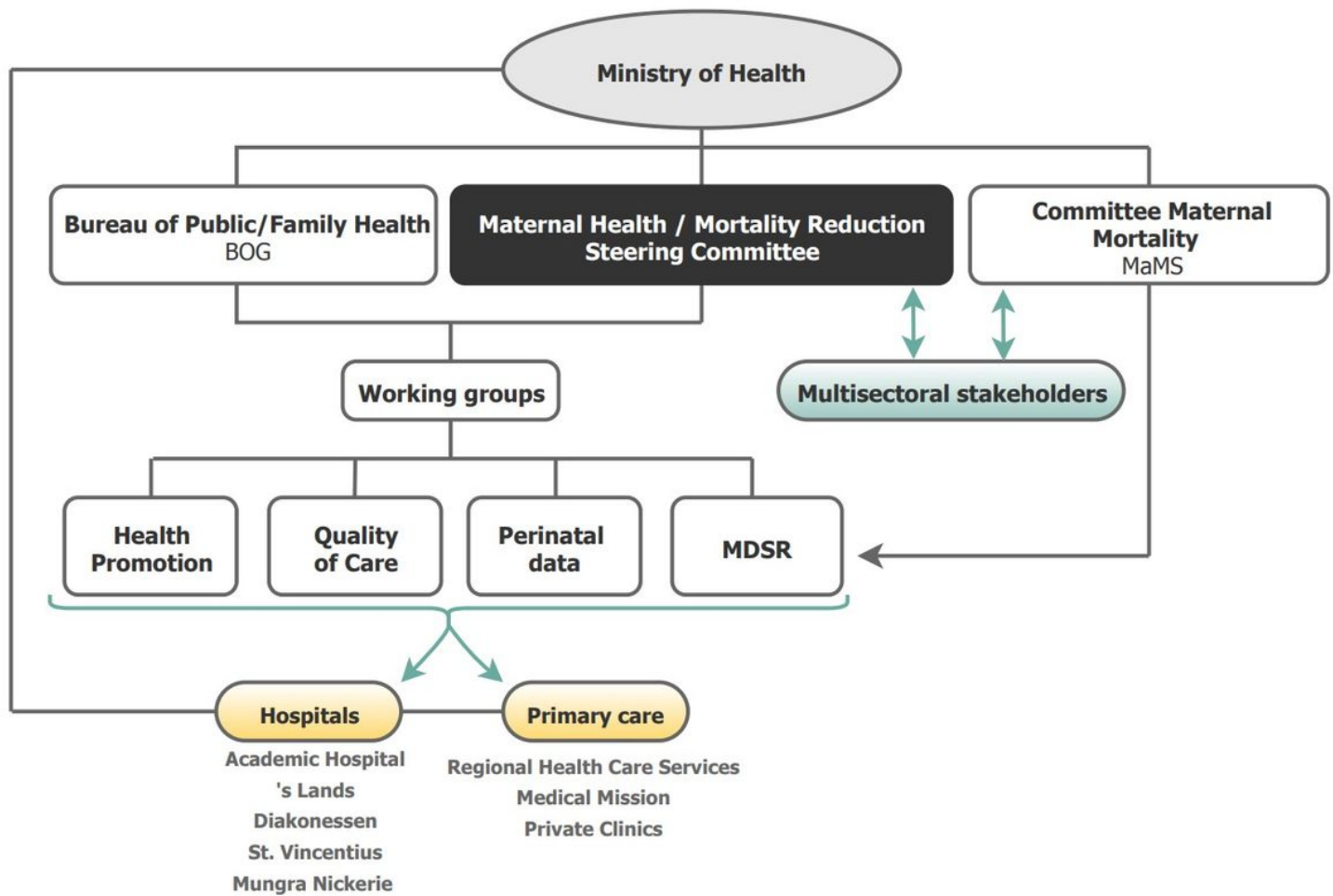


Figure 5

Flowchart of organization of maternal health in Suriname, adapted from the National Maternal Health and Mortality Reduction Priority plan 2019-2020 [38]

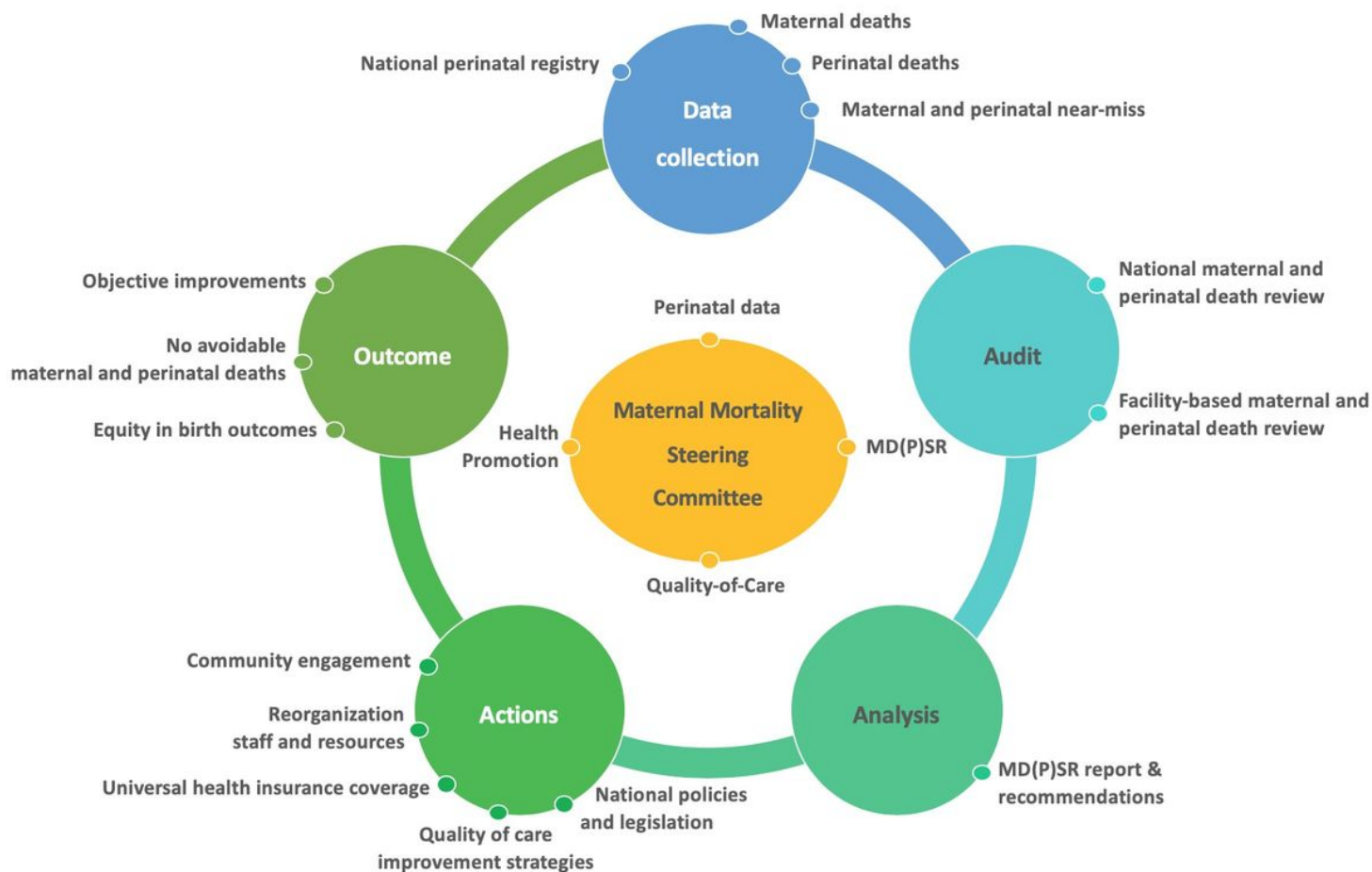


Figure 6

The plan-do-action maternal, obstetric and perinatal health cycle aimed for Suriname