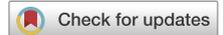


# Trends in maternal mortality in Suriname: 3 confidential enquiries in 3 decades



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**BACKGROUND:** The Sustainable Development Goal target 3.1 aims to reduce the global maternal mortality ratio to less than 70 per 100,000 live births. Great disparities reported in maternal mortality ratio between and within countries make this target unachievable. To gain more insight into such disparities and to monitor and describe trends, confidential enquiries into maternal deaths are crucial.

**OBJECTIVE:** We aimed to study the trend in maternal mortality ratio, causes, delay in access and quality of care, and “lessons learned” in Suriname, over almost 3 decades with 3 confidential enquiries into maternal deaths and provide recommendations to prevent maternal deaths.

**STUDY DESIGN:** The third national confidential enquiry into maternal deaths was conducted between 2015 and 2019 in Suriname by prospective, population-based surveillance and multidisciplinary systematic maternal death review. Subsequently, a comparative analysis with previous confidential enquiry into maternal deaths was performed: confidential enquiry into maternal deaths I (a prospective study, 1991–1993) and confidential enquiry into maternal deaths II (a retrospective study, 2010–2014).

**RESULTS:** We identified 62 maternal deaths and recorded 48,881 live births (maternal mortality ratio, 127/100,000 live births) between 2015–2019. Of the women who died, 14 of 62 (23%) were in poor condition when entering a health facility, whereas 11 of 62 (18%) died at home or during transportation. The maternal mortality ratio decreased over the years, (226 [n=64]; 130 [n=65]; and 127 [n=62]), with underreporting rates of 62%, 26%, and 24%, respectively in confidential enquiry into maternal deaths I, II and III. Of the women deceased, 36 (56%), 37 (57%), and 40 (63%) were of African descent; 46 (72%), 45 (69%), and 47 (76%) died after birth; and 47 (73%), 55 (84%), and 48 (77%) died in the hospital, respectively, in confidential enquiries into maternal deaths I, II, and III. Significantly more women were uninsured in confidential enquiry into maternal deaths III (15 of 59 [25%]) than in confidential enquiry into maternal deaths II (0%) and I (6 of 64 [9%]). Obstetrical hemorrhage was less often the underlying cause of death over the years (19 of 64 [30%], vs 13 of 65 [20%], vs 7 of 62 [11%]), whereas all other obstetrical causes occurred more often in confidential enquiry into maternal deaths III (eg, suicide [0; 1 of 65 (2%); 5 of 62 (8%)]) and unspecified deaths (1 of 64 [2%]; 3 of 65 [5%]; and 11 of 62 [18%] in confidential enquiry into maternal deaths I, II and III respectively). Maternal deaths were preventable in nearly half of the cases in confidential enquiry into maternal deaths II (28 of 65) and III (29 of 62). Delay in quality of care occurred in at least two-thirds of cases (41 of 62 [65%], 47 of 59 [80%], and 47 of 61 [77%]) over the years.

**CONCLUSION:** Suriname’s maternal mortality rate has decreased throughout the past 3 decades, yet the trend is too slow to achieve the Sustainable Development Goal 3.1. Preventable maternal deaths can be reduced by ensuring high-quality facility-based obstetrical and postpartum care, universal access to care especially for vulnerable women (of African descent and low socioeconomic class), and by addressing specific underlying causes of maternal deaths.

**Key words:** confidential enquiries into maternal deaths, ethnic disparity, maternal suicide, phases of delay, quality of care, Suriname, trends, unspecified deaths

## Introduction

Ending preventable maternal death remains at the top of the global health agenda.<sup>1,2</sup> The Sustainable Development

Goals (SDG) target 3.1 aims to achieve a global reduction of the maternal mortality ratio (MMR) of less than 70 by 2030.<sup>3</sup> The MMR varies between and

within countries and relates to the progression of the country’s socioeconomic development and improvement in healthcare resulting in health inequity

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## AJOG Global reports at a Glance

**Why was this study conducted?**

The maternal mortality ratio (MMR) in Suriname is one of the highest in the Latin American Caribbean region. This study aimed to analyze the trend in MMR, causes, and quality of care and provided recommendations to prevent maternal deaths.

**Key findings**

MMR in Suriname decreased by 44% in 28 years. Between 2015 and 2019, women who died were more frequently uninsured, and almost half of the women were already in a deplorable state when reaching a facility. Most late maternal deaths were because of cardiomyopathy, with the onset originating earlier in pregnancy or puerperium. Maternal deaths from outcomes of abortion, “other obstetrical causes” (suicide), unspecified deaths, and late maternal deaths increased. Almost half of the maternal deaths were preventable.

**What does this add to what is known?**

In Suriname, preventable maternal deaths can be reduced by ensuring universal access to higher-quality obstetrical care. Focusing on specific underlying causes of death is essential.

(differences in access to and availability of care) and inequality (differences in quality of care).<sup>3–5</sup> Confidential enquiries into maternal deaths (CEMD) could provide insight into such disparities and comprise the multidisciplinary and systematic investigation of the causes and circumstances surrounding the death and identification of the “lessons learned.”<sup>6,7</sup>

Suriname belongs to the countries with the 5 highest MMR in the Latin American or Caribbean (LAC) region and therefore designated by the Pan American Health Organization in 2010 as 1 of the 10 priority countries to reduce preventable maternal deaths.<sup>8,9</sup> Systematic prospective national multidisciplinary CEMD were implemented in Suriname since 2015 in a nationwide effort to reduce MMR.<sup>10</sup> Furthermore, 2 individual CEMD were conducted previously: 1 prospectively from 1991 to 1993 (CEMD-I) and 1 retrospectively from 2010 to 2014 (CEMD-II) ([Supplemental Files 1 and 2](#)).<sup>11,12</sup> Since 2015, quality-of-care improvements were driven by recommendations from the CEMD-II and included the establishment of the Committee Maternal Mortality Suriname (MaMS) to perform systematically and multidisciplinary maternal death reviews and the development of national guidelines combined

with obstetrical emergency training.<sup>10,13</sup> We aimed to study the trend in incidence, causes, delay in accessibility, and quality of care and “lessons learned” of maternal mortality in Suriname over almost 3 decades with 3 CEMD and provide recommendations to decrease preventable maternal deaths.

**Methods****Study design**

Firstly, we conducted a population-based prospective confidential enquiry (CEMD-III) from January 2015 to December 2019. Pregnancy-related deaths were reviewed by the Committee MaMS. Subsequently, a comparative analysis with 2 previous CEMD (1991–1993 [prospective] and 2010–2014 [retrospective]) was performed.

**Study setting**

Suriname is a middle-income country in South America.<sup>14</sup> Each year, 10,000 births take place: 86% in hospitals, 6% at primary care clinics (3% in the rural interior and 3% rural coastal), 4% at homes, and 4% not registered.<sup>11,15</sup> Women with complicated pregnancies and deliveries in primary care clinics are referred to hospitals.

The health system in Suriname is a public-private mix, with different financing modalities and service-

providing facilities.<sup>16,17</sup> Until 2014, the insurance system in Suriname was either private (13%) or public (21% insured at the State Health Foundation, primarily intended for civil servants and 6% at “Medical Mission,” for those living in the rural interior). In addition, people who are poor and disadvantaged would receive social insurance coverage (44%) from the Ministry of Social Affairs.<sup>11,16</sup> The remaining population (16%) had an unknown insurance status.<sup>16</sup> In 2014, steps toward universal health coverage and equity in healthcare were made by enforcing the Basic Health Law for everyone.<sup>18</sup>

**Data collection**

In CEMD-I, the data collection was performed prospectively from 1991 to 1993, and the methods used were: (1) a hospital-based Reproductive Age Mortality Survey (RAMoS), which included the screening of all women of reproductive age for pregnancy (recent) who died; and (2) a RAMoS of the national Register of Causes of Death, located at the Bureau of Public Health (BOG, its Dutch acronym).<sup>12</sup> A maternal mortality expert committee (7 obstetricians and 1 midwife) confidentially reviewed all case summaries.

In 2015, maternal deaths from 2010 to 2014 were retrospectively collected (CEMD-II) by: (1) conducting a RAMoS in the hospitals and primary care; (2) cross-linking of data with the Central Bureau for Civil Affairs (CBB) and vital registration (BOG); and (3) performing a mortuary inventory.<sup>11</sup> Maternal deaths were reviewed by an expert committee in which obstetricians, midwives, internal medicine specialists, or anesthesiologists participated, and cases were classified using the World Health organization (WHO) International Classification of Diseases-Maternal Mortality (ICD-MM).<sup>11,19</sup>

In CEMD-III, maternal deaths were notified by involved healthcare providers and by vital registration. Various sources were used to identify possible maternal deaths that were not reported: (1) CBB provided a list of all deceased women of reproductive age (15–49 years), including those who died within

1 year after giving birth; and (2) a hospital-based RAMoS was performed where medical files could be retrieved. The Committee MaMS, installed in 2015, reviews any possible maternal death systematically and consists of 4 gynecologists or obstetricians, 1 midwife, 1 internal medicine specialist, 1 BOG representative, 2 medical students, and several external consultants.<sup>10,20</sup> Similar to the previous enquiries, classification of maternal deaths were conforming to the WHO ICD-MM.<sup>19</sup>

### Definitions

A pregnancy-related death was the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the cause of death.<sup>19</sup> Maternal death was a pregnancy-related death from any cause related to or aggravated by the pregnancy or its management but not from accidental or incidental causes.<sup>19</sup> The MMR was the ratio of maternal deaths to live births (calculated per 100,000 live births).<sup>19</sup> A direct maternal death was caused by direct obstetrical causes. An indirect death resulted from a previous existing disease or a disease that developed during pregnancy and that was not because of direct obstetrical causes but aggravated by the physiological effects of pregnancy.<sup>19,21</sup> Maternal deaths were classified as “unspecified” when the underlying cause was unknown or not determined.<sup>19</sup> Late maternal deaths occurred after 42 days but within 1 year following delivery from causes directly related to pregnancy or indirectly precipitated by the effects of pregnancy on underlying diseases; coincidental deaths were not included.<sup>19,22</sup> Advanced maternal age was defined as 35 years or older.<sup>23</sup> Substandard care was defined as a deviation from standard practice according to local clinicians and international guidelines.

### Data analysis

Data on demographics, general and obstetrical history, and committee consensus classification were manually entered in the International Business Machines Corporation (IBM) Statistical Package for the Social Sciences (version 24.0; IBM, Armonk, NY). Descriptive

analysis was used to calculate frequencies and proportions. The significance of the differences between the categorical variables (characteristics) was calculated using the chi-square test, with a significance level below 0.05. Substandard care analysis was according to the 3 delay models: (1) phase I delay, delay in the decision to seek care; (2) phase II delay, delay in reaching a healthcare facility; and (3) phase III delay, delay in receiving adequate and appropriate care at the facility.<sup>24</sup> In all 3 CEMD, preventability was judged by consensus between the members of the review committee based on their knowledge and experience. Cases were only considered preventable if all members of the committee reviewing the case unanimously agreed that the case was preventable.

This study was approved by the ethical review board of the Surinamese Committee on Research Involving Human Subjects on April 23, 2020 (DVG 146). The data are anonymous and in aggregated form, and individual informed consent of the family was waived.

### Results

There were 107 pregnancy-related deaths between 2015 and 2019, of which

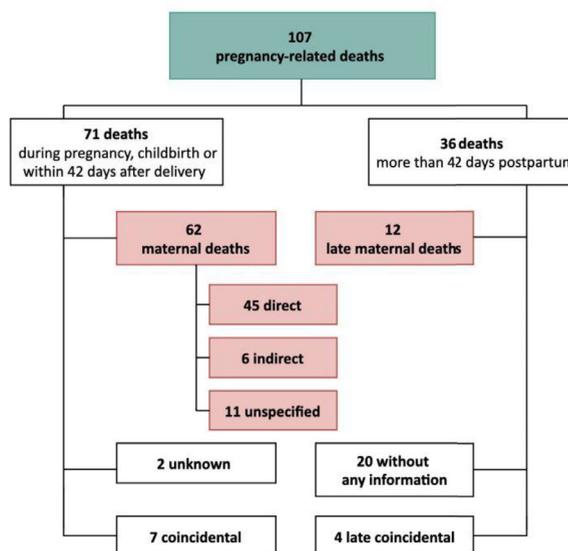
62 were maternal deaths. Of 36 late pregnancy-related deaths, no information was available in 20 cases (Figure 1). In the same time frame, 48,881 live births were recorded, yielding an MMR of 127. The underreporting rate was 24% as the vital registration reported 47 maternal deaths. Figure 2 gives an overview of the MMR reported by vital registration and CEMD from 1990 to 2019. Underreporting decreased significantly ( $P<.001$ ) from 62% in CEMD-I to 26% in CEMD-II and 24% in CEMD-III.

In all 3 CEMD, women who died were more often of African descent (56%, 57%, 63%), died after delivery (72%, 69%, 76%), and died in the hospitals (73%, 84%, 77%) (Table 1).

In CEMD-III, 11 of 62 women (18%) died at home or during transportation, and 14 of 62 women (23%) were already in poor medical condition (in a coma or need for resuscitation) on arrival at a health facility (11 of 62 [18%] at a hospital and 3 of 62 [5%] at a primary care center). In addition, in CEMD-III, significantly more women were uninsured (25% [15 of 59] vs 0 CEMD-II vs 9% [6 of 64] CEMD-I;  $P<.001$ ) than in the previous CEMD.

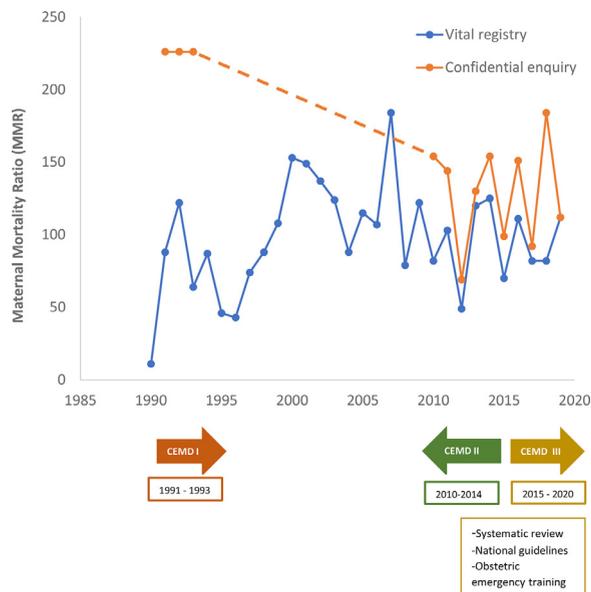
Although deaths were predominantly from direct causes over the years, the

**FIGURE 1**  
**Flowchart of the pregnancy-related deaths in Suriname between 2015–2019**



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**FIGURE 2**  
Maternal mortality ratio of CEMD vs vital registration in Suriname



CEMD, confidential enquiry into maternal deaths.

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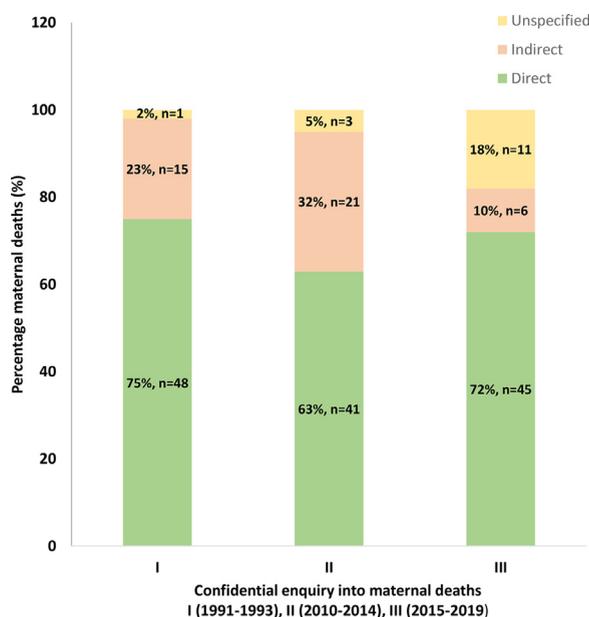
incidence of unspecified deaths increased significantly (CEMD-I, 1 of 64 [2%]; CEMD-II, 3 of 65 [5%]; CEMD-III, 11 of 62 [18%];  $P=0.002$ ) (Figure 3). The unspecified deaths of CEMD-III (n=11) occurred at home, at primary care clinics, or shortly after hospital admittance in 9 cases. In 2 cases, multiple comorbidities (diabetes, sepsis, HIV, severe anemia) were diagnosed. In Table 2, the maternal deaths of CEMD-III are categorized following the WHO ICD-MM groups of underlying causes.<sup>19</sup> The incidence and underlying cause of the abortion-related maternal deaths changed: the 2 cases (2 of 64 [3%]) in CEMD-I were from ectopic pregnancies; in CEMD-II, death was due to hemorrhage from an ectopic pregnancy and sepsis following an induced abortion (2 of 65 [3%]), and in CEMD-III, death was from hemorrhage due to an ectopic pregnancy and 3 induced abortions (4 of 62 [6%]). There was a significant decrease in obstetrical hemorrhage as the underlying cause of death over time [CEMD-I, 30% (19 of 64), vs CEMD-II, 20% (13 of 65), vs CEMD-III, 11% (7 of 62);  $P=0.04$ ]. The group “all other obstetrical causes” included the most frequent underlying

causes in CEMD-III (18 of 62 [29%]), much higher than in the 2 previous CEMD (CEMD-I, 14% [9 of 64], and CEMD-II, 17% [11 of 65],  $P=0.08$ )

(Figure 4). Although there was no case of maternal suicide reported in CEMD-I, there was 1 case (1 of 65 [2%]) in CEMD-II and 5 cases in CEMD-III (5 of 62 [8%]) (Figure 4). CEMD-III reported more late maternal related deaths (n=12) than CEMD-I (n=3) and CEMD-II (n=8). In 8 of 12 late maternal deaths (67%) of CEMD-III, complications started already during pregnancy or within 42 days after delivery. Of these maternal deaths, 6 of 8 (75%) were due to complications of postpartum cardiomyopathy (Supplemental File 3).

In Table 3, an overview of the substandard care analysis is provided by the review committee conforming to the 3 delays model. Maternal deaths were preventable in 47% in both CEMD-II (28 of 65) and CEMD-III (29 of 62). Patient delay did not differ significantly (36 of 62 [38%], 17 of 59 [29%], 23 of 61[38%]) in CEMD-I, CEMD-II, CEMD-III, respectively. However, phase III delay predominated in all 3 CEMD (CEMD-I, 65% [41 of 62], vs CEMD-II, 80% [47 of 59], vs CEMD-III, 77% [47 of 61]).

**FIGURE 3**  
Classification of maternal deaths in the 3 CEMD in type (direct, indirect, and unspecified)



CEMD, Confidential enquiry into maternal deaths.

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**TABLE 1**  
**Characteristics of the maternal deaths of the 3 CEMD**

Characteristics	1991–1993 <sup>a</sup> CEMD-I (n=64 [100%])	2010–2015 <sup>b</sup> CEMD-II (n=65 [100%])	2015–2019 <sup>c</sup> CEMD-III (n=62 [100%])	P value
Age, y				<.01 <sup>d</sup>
<20	11 (17)	11 (17)	6 (10)	
20–35	30 (47)	42 (64)	43 (69)	
>35	23 (36)	12 (18)	13 (21)	
Ethnicity			n=61	.46
Maroon	22 (34)	24 (37)	26 (41)	
Creole	14 (22)	13 (20)	14 (22)	
Hindustani	18 (28)	12 (18)	7 (11)	
Javanese	5 (8)	8 (12)	3 (5)	
Mixed	n/a	5 (8)	4 (6)	
Indigenous	5 (8)	3 (5)	5 (8)	
Other	n/a	n/a	2 (3)	
Insurance		n=63	n=59	
Social	46 (72)	45 (71)	—	—
State	12 (19)	10 (16)	28 (47)	
Private	—	8 (13)	16 (27)	
None	6 (9)	0	15 (25)	
Residency			n=56	.19
Area 1 (urban, Par'bo-Wanica)	35 (55)	40 (62)	34 (61)	
Area 2 (urban, Nickerie)	9 (14)	4 (6)	2 (4)	
Area 3 (rural coastal, Coronie, Saracmacca, Para, Commewijne, Marowijne)	6 (9)	10 (15)	12 (21)	
Area 4 (rural interior, Brokopondo, Sipaliwini)	14 (22)	11 (17)	8 (14)	
Parity at time of death	n=63		n=57	.06
Nullipara	16 (25)	5 (8)	11 (19)	
1–2	19 (30)	31 (50)	20 (35)	
≥3	28 (45)	26 (42)	26 (46)	
Mode of delivery	n=46	n=41	n=47	.44
Vaginal delivery	31 (67)	25 (61)	23 (49)	
Ventouse delivery	2 (4)	3 (7)	3 (6)	
Cesarean delivery	13 (28)	13 (32)	21 (45)	
Time of death				.23
Abortion (<20 wk)	2 (3)	5 (8)	7 (11)	
Antepartum	16 (25)	15 (23)	8 (13)	
Postpartum	46 (72)	45 (69)	47 (76)	
Location of death				.26
Hospital	47 (73)	55 (84)	48 (77)	
Primary care clinic	8 (13)	5 (8)	3 (5)	

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(continued)

**TABLE 1**  
**Characteristics of the maternal deaths of the 3 CEMD** (continued)

Characteristics	1991–1993 <sup>a</sup> CEMD-I (n=64 [100%])	2010–2015 <sup>b</sup> CEMD-II (n=65 [100%])	2015–2019 <sup>c</sup> CEMD-III (n=62 [100%])	P value
At home or during transport	9 (14)	5 (8)	11 (18)	
Geographic location of death			n=56	<.01 <sup>d</sup>
Area 1 (urban, Par'bo-Wanica)	35 (55)	56 (86)	46 (82)	
Area 2 (urban, Nickerie)	9 (14)	2 (3)	2 (4)	
Area 3 (rural coastal, Coronie, Saramacca, Para, Commewijne, Marowijne)	6 (9)	3 (5)	4 (7)	
Area 4 (rural interior, Brokopondo, Sipaliwini)	14 (22)	4 (6)	4 (7)	
Perinatal death		n=57	n=55	<.01 <sup>d</sup>
	42 (66)	36 (64)	18 (33)	
Postmortem autopsy	n/a	2 (3)	3 (5)	

Data are presented as number (percentage).

Adapted from Verschueren et al.<sup>15</sup>

CEMD, confidential enquiry into maternal deaths; n/a, not available.

<sup>a</sup> CEMD-I, 1991–1993, adapted from Mungra et al<sup>12</sup>; <sup>b</sup> CEMD-II, 2010–2014, adapted from Kodan et al<sup>11</sup>; <sup>c</sup> CEMD-III, 2015–2019; <sup>d</sup> Level of significance  $P < .05$ .

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## Comment

### Principal findings

Here, 3 CEMD in Suriname showed an overall declining trend in the MMR, with a reduction of 44% in 28 years. In all 3 CEMD, women who died were more often of African descent, died after delivery, and died in hospitals. Almost half of the maternal deaths in CEMD-III occurred at home, at the primary health clinic, or soon after reaching a health facility. The percentage of uninsured women was the highest in CEMD-III. The incidence of maternal deaths in pregnancies with abortive outcomes, from “other obstetrical causes” (especially maternal suicide), unspecified deaths, and late maternal deaths increased over time. In two-thirds of the late maternal deaths in CEMD-III, the onset of the complications resulting in death started earlier in pregnancy and puerperium and were due to cardiomyopathy. Substandard care analysis showed similar trends over the years, with predominantly phase III delay and no significant change in phase I delay. Almost half of the maternal deaths were preventable.

### Results in context

The 44% decrease in MMR was in line with the global trend but insufficient to reach the Millennium Development Goal (MDG) of 75% reduction in 2015.<sup>9</sup> The average MMR (130) was almost the same in the recent 10 years in Suriname. This trend questions if the SDG target (MMR, 70) will be reached in 2030. The strong focus on the coronavirus disease 2019 (COVID-19) pandemic has led to reduced attention for maternal health-care and a subsequent decrease in the access and quality of care worldwide.<sup>25</sup> The influence of COVID-19 on maternal mortality in Suriname has yet to be determined.

More women died from self-induced abortions in Suriname over the years. In LAC and sub-Saharan Africa regions, maternal deaths from pregnancies with abortive outcomes were the highest globally (10%), higher than the incidence in Suriname in CEMD-III (6%).<sup>26</sup> Induced abortions are illegal in Suriname but are tolerated and often performed by skilled healthcare providers.<sup>11</sup> In addition, this issue is shrouded in strict social taboo because of its illegal character, making it difficult

to tackle and possibly leading to under-reporting of abortion-related deaths.

The incidence of maternal suicide in CEMD-III was 8%, much higher than in Africa (1%) and in the American and Mediterranean region (3%).<sup>27,28</sup> The WHO ICD-MM, published in 2012, classified antepartum and postpartum suicide as a direct maternal death under the group “all other obstetrical causes,” which resulted in increased reporting.<sup>19,29</sup> However, the increase in pregnancy-related suicide was not only from increased reporting. Perinatal (antepartum and postnatal) depression is a major risk factor for suicide and highly prevalent in low- and middle-income countries.<sup>28</sup> The WHO developed a mental health action plan in 2012 to highlight the importance of mental health in achieving health for all people and placed the focus on prevention strategies.<sup>30</sup> In Suriname, 25% of all women suffer from depression and anxiety disorders, and the number of suicide cases has increased steadily over the years.<sup>18,31</sup> Pregnant or postpartum women with mental health problems might not seek help because of fear of stigmatization and discrimination.

**TABLE 2****Groups of underlying causes of maternal deaths in Suriname 2015-2019 conform to WHO ICD-MM**

Type	Group number or name (n) <sup>a</sup>	Case description (n) <sup>a</sup>
Maternal death: direct	1. Abortive outcomes (4)	Abortion with hemorrhagic shock (3) Ectopic pregnancy (1)
Maternal death: direct	2. Hypertensive disorders (12)	Eclampsia (6) Intracerebral hemorrhage (4) HELLP (3)
Maternal death: direct	3. Obstetrical hemorrhage (7)	Postpartum (6) Placental abruption (1) Died during transportation to a hospital (2) Hysterectomy performed (3)
Maternal death: direct	4. Pregnancy-related infections (3)	Postcesarean delivery (2)
Maternal death: direct	5. Other obstetrical complications (18)	Suicide (5) Amniotic fluid embolism (6) Postpartum cardiomyopathy (2) Thrombo-embolism (5)
Maternal death: direct	6. Unanticipated complications of pregnancy (1)	Anesthesia complication
Maternal death: indirect	7. Nonobstetrical complications (6)	Sickle cell anemia (4) (sepsis [2], postpartum hemorrhage; died of ischemic paralytic ileus [1], encephalopathy [1]) HIV or AIDS cardiomyopathy (1) Heart failure or ventricular septum defect (1)
Maternal death: direct	8. Unspecified (11)	Died at home or shortly after hospital admittance (9) Complex cases, cause of death undetermined (2)
Pregnancy related	9. Coincidental causes (7)	Malignant tumors (3) (lymphomas and HIV or AIDS [2], ovarian carcinoma [1]) AIDS-related cryptococcus meningitis in early pregnancy (1) Car accident (1) Drowning (2)

HELLP, hemolysis, elevated liver enzymes, and low platelet levels; ICD-MM, International Classification of Diseases-Maternal Mortality; WHO, World Health Organization.

<sup>a</sup> Number of cases.

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The percentage of unspecified maternal deaths increased over the years in Suriname. Underlying cause attribution is difficult, either because of the complexity of the case or the deplorable medical conditions, which left no time for additional diagnostic investigations. In complex cases, involving several comorbidities or the co-occurrence of direct and indirect conditions, determination of the initiating event leading eventually to death is challenging.<sup>32</sup> In both situations, postmortem autopsy is the gold standard to clarify most of the uncertain causes.<sup>33,34</sup> However, it is seldom performed in Suriname because of financial and cultural reasons.

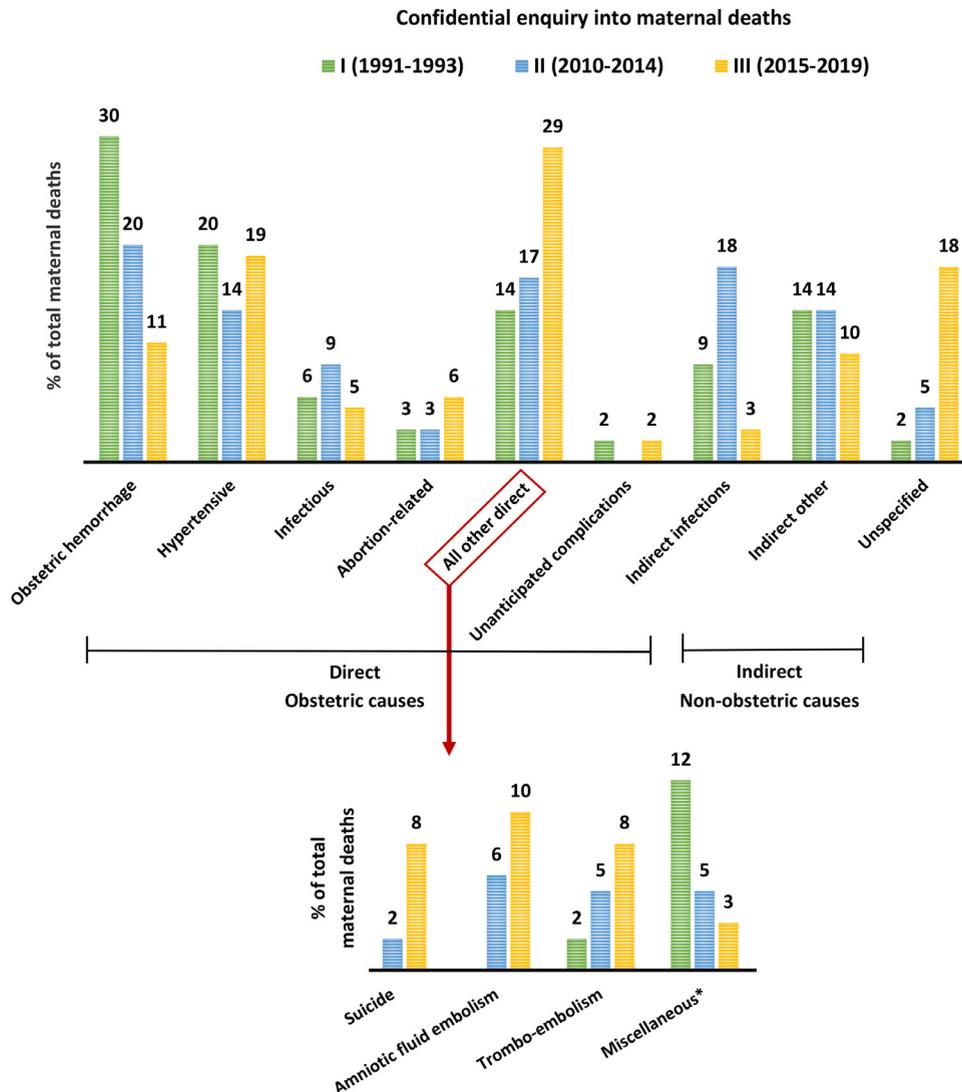
The incidence of late maternal deaths was the highest in CEMD-III. In two-thirds of these cases, the initiating event developed during pregnancy

or puerperium, but ultimately, the death occurred later than 42 days after delivery. Improved and more specialized health systems in Suriname prolonged the survival of women experiencing complications in the puerperium.<sup>9,18,22,35</sup> Most of these deaths were caused by postpartum cardiomyopathy. The contribution of cardiac diseases becomes more relevant as MMR lowers and as countries undergo “obstetrical transition” toward more indirect causes and noncommunicable diseases.<sup>36</sup> Because of the classification of late maternal death, most of these cases were often neither counted in the MMR nor reviewed, missing opportunities to evaluate the “lesson learned.” We agree with the proposition by the ICD-MM workgroup to incorporate these late deaths under a new group

“comprehensive maternal death” in the ICD-11.<sup>9</sup>

Substandard care analysis of the maternal deaths in all 3 studies showed that delay in care occurred predominantly in the hospitals and that almost half of the deaths were preventable, according to the evaluation of the review committees. Although the healthcare infrastructure in Suriname improved nationwide and the National Basic Health Insurance Law was passed in 2014, patient delay was not significantly different over the years.<sup>18,37</sup> However, several gaps in the new insurance system and concomitant deteriorating financial position of the country since 2015 left people uninsured, delaying their decision to seek healthcare and their access to care.<sup>18,38</sup> This delay could probably explain the increase in

**FIGURE 4**  
The underlying causes of maternal deaths in Suriname conform to WHO ICD-MM



CEMD-I (obstructed labor, medication overdose, instrumental delivery complication, postcesarean delivery), CEMD-II (obstructed labor, postcesarean delivery, acute fatty liver of pregnancy), and CEMD-III (cardiomyopathy). Adapted from the World Health Organization.<sup>19</sup>

CEMD, confidential enquiry into maternal deaths; ICD-MM, International Classification of Diseases-Maternal Mortality; WHO, World Health Organization.

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unspecified death and death on arrival at a facility in CEMD-III.

### Research implications

*Recommendations to reduce preventable maternal deaths in Suriname.*

1. Improvement of the continuum of care (quality of clinical care, outpatient antenatal or postnatal care and family or community care).<sup>39,40</sup> To address the quality of care, the national guidelines should be revised and implemented, and actions should

follow on the recommendations from the MDR.<sup>10</sup> For improvement of outpatient antenatal and postnatal care, referral pathways should be revised, and practical national guidelines developed. Development of tailor-made (prevention) programs (eg, contraception, anemia prevention, antenatal care coverage) should focus on the vulnerable groups. Family or community care needs to address the persisting inequity among different social classes and ethnicities by improving educational

opportunities, employment, housing and nutrition.

2. Ensure universal access to healthcare without financial hardships.<sup>41,42</sup> We request policymakers to assess the gaps and practicability of the basic National Basic Health Insurance Law.
3. Postmortem autopsy in deaths of unknown cause in (recent) pregnant women for reliable underlying cause attribution.
4. Raise awareness and offer psychosocial support for mental health disorders during pregnancy and after delivery.<sup>28,43</sup>

**TABLE 3**  
**Substandard care analysis of the maternal deaths in Suriname in the 3 confidential enquiries of Suriname**

Variable	1991–1993 CEMD-I <sup>a</sup> n=62	2010–2014 CEMD-II <sup>b</sup> n=59	2015–2019 CEMD-III <sup>c</sup> n=61
First delay	36 (38)	17 (29)	23 (38)
Second delay	—	9 (15)	5 (8)
Third delay	41 (65)	47 (80)	47 (77)
Preventable maternal death (according to the MDR <sup>d</sup> committee)	n/a	28 (47)	29 (47)
Problems with organization of care (logistics, availability of medication, blood, or ICU bed)	24 (39)	n/a	18 (29)
Existence of any form of substandard care	59 (95)	56 (95)	54 (87)

Data are presented as number (percentage).

CEMD, confidential enquiry into maternal deaths; ICU, intensive care unit; MDR, maternal death review; n/a, not available.

<sup>a</sup> CEMD-I, adapted from Mungra et al<sup>12</sup>; <sup>b</sup> CEMD-II, adapted from Kodan et al<sup>11</sup>; <sup>c</sup> CEMD-III, 2015–2019; <sup>d</sup> Maternal death review.

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- Discuss the legalization of abortion and postabortion care. To prevent unplanned and unwanted pregnancies, contraception should be promoted, accessible, and affordable.
- Review and report late maternal deaths as valuable lessons can be learned.<sup>22,35</sup> Create awareness and prevent and accurately diagnose cardiac diseases in pregnancy and puerperium and establish close collaboration among cardiologists and obstetricians.
- Continue quality-of-care improvements and systematic review of maternal deaths despite COVID-19.

### Strengths and limitations

This study compared 3 CEMD, and the timing of the first 2 CEMD coincides with the MDG start point and endpoint. Various extensive methods were used to identify pregnancy-related deaths and gaps, and issues could be addressed in-depth. As systematic maternal death reviews are not yet implemented in many countries globally, it is praiseworthy that it was possible in Suriname and supported by several stakeholders.<sup>44</sup> Policymakers can use this study for advocacy to prioritize maternal healthcare on the agenda of decision-makers.

Our study has several limitations. The study design of the 3 studies compared differed; CEMD-I and CEMD-III were prospective studies, whereas CEMD-II was retrospective. Because of the small

population in Suriname, the absolute number of maternal deaths was low. In addition, in 2 hospitals, there was no comprehensive digital database for persons who died; therefore, the RAMoS could not be completed. The BOG did not provide information from the death certificates, resulting in unavailability of the cause of death information, and data cross-check was not possible. However, despite these limitations, a vast amount of data were captured to substantially contribute to important recommendations to reduce preventable maternal deaths in Suriname.

### Conclusions

Review of all maternal deaths was prospectively implemented in Suriname in 2015. Based on the data collected in 3 CEMD, MMR almost halved in 28 years. However, this progress is insufficient to achieve the SDG target in 2030. Socio-economic determinants influence maternal death reduction in Suriname. Quality-of-care improvement, better accessible and equitable healthcare for specific groups, enhanced mental and abortion-related care, and early detection or therapy of cardiac diseases are key elements to eliminate preventable maternal deaths. ■

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### Supplementary materials

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