

Original Research Article

Maternal mortality trend in Goa: a record-based study

Uma Sadekar, Switzel V. Braganza*, Sunita Salgaonkar, Sunita Arlekar

State Family Welfare Bureau, Directorate of Health Services, Panaji, Goa, India

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*Correspondence:

Dr. Switzel V. Braganza,

E-mail: switzel03091997@gmail.com

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ABSTRACT

Background: Maternal mortality reflects unequal access to quality health services across the world. Despite a consistent decline in deaths, disparities between states could hinder our progress towards Sustainable Developmental Goals. Maternal Death Reviews were introduced nationwide to address causative aspects of maternal deaths and take corrective actions. This study was devised to assess the maternal mortality trend over a 10-year period and to determine cause-specific distribution of mortality across Goa.

Methods: A retrospective study was conducted using Facility reviews and Verbal Audit forms of reported maternal deaths from 2016 to 2025. All 125 reports were analysed for sociodemographic data, antenatal factors and cause of death using SPSS v.14. Results were presented as frequency, percentages, figures and graphs.

Results: Out of 125 deaths, 103 (82.4%) were indigenous. Among these, 24 (23.3%) were graduates, 44 (42.7%) were above poverty line, 12 (11.6%) conceived with in-vitro fertilization and 82 (79.6%) were from rural Goa. Ten (7.7%) mothers died without antenatal care and 61 (59.2%) died postnatally. Haemorrhage (22.3%), hypertension (21.4%), other infective causes (17.5%) and cardiovascular causes (15.5%) caused the most indigenous deaths; these were primarily concentrated among <35 years old (67%), South Goa (56.3%), Goa Medical College (74.8%) and in 2018 (16.5%).

Conclusions: Though Goa provides commendable obstetric care, equipping all healthcare levels equally to handle any obstetric case before it becomes a tragedy needs prioritizing. Continuing MDSR with responsibility rather than blame, robust counselling of expectant mothers especially at IVF centres and a prompt referral system could help.

Keywords: Maternal health, Maternal mortality, Review, Trend

INTRODUCTION

In 2023, a mother died every 2 minutes from predominantly preventable causes. Since 2000, global maternal mortality ratio (MMR) saw a 40% drop at an average annual drop rate of 2.2%.^{1,2} However, this drop was influenced by poverty and unequal access to healthcare, resulting in a higher lifetime risk of maternal death in low- and middle-income countries. Southern Asia achieved a whopping 71% reduction within this period, yet it still accounted for 17% of global maternal deaths in 2023. Haemorrhage, indirect obstetric causes and hypertensive disorders of pregnancy were the leading causes of maternal death. India itself contributed to 7.2%

of these with MMR of 80.² The COVID-19 pandemic saw a boom in overall deaths among women of reproductive age group due to fear and redirection of resources leading to hindrance in obtaining adequate care. Studies have suggested that COVID-19 predisposes to abortions, life threatening diseases and death, with a case fatality rate of 0.8% in antenatal and postnatal period.^{3,4} Bhore Committee report (1946) was one of the earliest documents to mention MMR to be as high as 2,000 in India. Subsequently, multiple sources estimated a steady drop of MMR using statistically unsound and unreliable methods, until SRS started pooling 3-yearly data into their special bulletins.⁵ With multiple Mother and Child health (MCH) initiatives, this burden has eased due to

quality ante- and postnatal care, higher institutional and supervised deliveries and expanded focus towards nutritional, environmental and social determinants.⁶ Authors have inched closer to achieving sustainable developmental goal (SDG) 3.1 with the latest MMR being 87.⁷ Nevertheless, poor service utilisation and geographical constraints are evident in some states that are at the forefront of these efforts and termed the empowered action group (EAG). A review of mortality trends revealed that EAG states bore higher burden of abortion-related while South India contributed to more hypertensive mortality.⁵

While MMR remains the tool that reflects success of MCH initiatives, corrective actions stem from what led to these deaths. To address these aspects, MDR was introduced under National Health Mission in 2009 after a pilot phase and later evolved into maternal death surveillance and response (MDSR), shifting the focus from simply reviewing the causes to taking corrective action.

Standardised formats aid in a comprehensive review, whether at the facility or community level. This practice has invited better participation from authorities, clinicians and community in our fight towards maternal health, albeit with hesitation due to the fear of culpability.⁸

Goa has been implementing MDSR for a decade with limited data on mortality trend. This study was devised to assess the maternal mortality trend over a 10-year period and to determine cause-specific distribution of mortality across Goa.

METHODS

Study design and setting

A retrospective, record-based study was conducted at the State Family Welfare Bureau, Directorate of Health Services, Goa, India.

Sample size and sampling

Universal sampling of 125 reported cases was done since the study was the first to be covering all maternal deaths reported across the state.

Data collection tool and study period

Data was obtained from the facility based MDSR and verbal audit forms of reported maternal deaths from January 2016 to December 2025.

Maternal death

World Health Organisation (WHO) defines maternal deaths as the annual number of female deaths from any cause related to or aggravated by pregnancy or its management (excluding accidental or incidental causes)

during pregnancy and childbirth or within 42 days of termination of pregnancy, irrespective of the duration and site of the pregnancy.²

Indigenous death

Maternal death wherein the mother was a resident of Goa and/or received most of her antemortem care from centres within Goa.

Imported death

Maternal death wherein the mother was referred solely for her antemortem care from outside Goa.

Study participants

All reported maternal deaths with available MDSR forms over 10 years were analysed for this study.

Inclusion criteria

Indigenous as well as imported death cases reported in Goa.

Exclusion criteria

Cases with incomplete audit forms wherein data cannot be obtained by any further means such as case papers.

Study variables

Age, educational status, financial status, residence of deceased mothers, use of in-vitro fertilization, pregnancy outcome, antenatal care and delivery details, place and primary cause of death (COD) were obtained from the forms. Cause-specific distribution across other variables was analysed.

Ethics and confidentiality

Institutional ethics committee approval was obtained prior to start of the study and all personal data was kept strictly confidential.

Data analysis

Data was entered into MS Excel 2019 and analysed using SPSS ver14.

Categorical data was presented as frequency and percentages. Graphs and figures were used to depict other descriptive data.

RESULTS

Since the state can only positively act on factors affecting indigenous maternal deaths, analysis is primarily focused on those.

General analysis

Of the 125 reported maternal deaths, 103 (82.4%) were indigenous while the rest were imported. Overall, the mean age of the deceased mothers was 31.9 ± 6.5 years but for indigenous cases it was 32.3 ± 6.7 years with 69 (67%) of them aged <35 years. Among indigenous deaths, 24 (23.3%) were graduate or above and 44 (42.7%) were above poverty line. 12 (11.6%) mothers had conceived after in-vitro fertilization (IVF), of which two were aged <35 years.

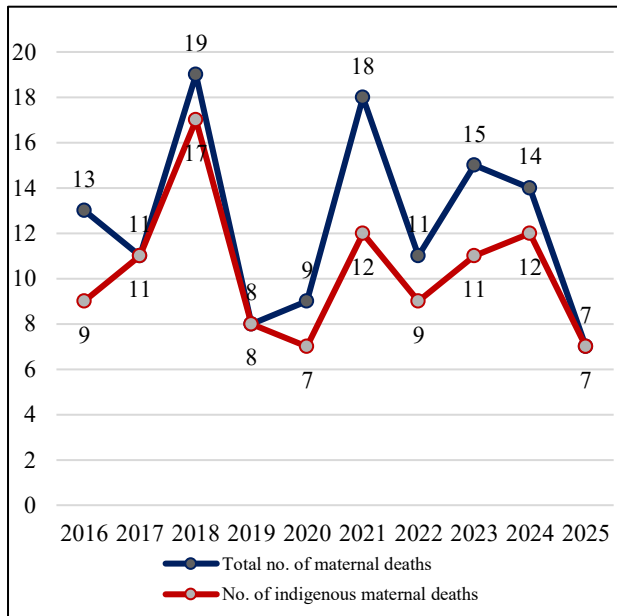


Figure 1: Annual maternal mortality trend for indigenous (n=103) compared to overall maternal deaths (n=125).

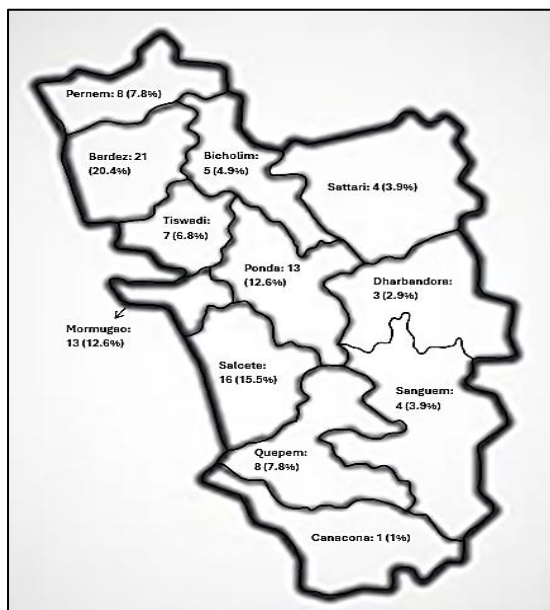


Figure 2: Geographical distribution of indigenous maternal deaths.

Figure 1 depicts the annual maternal mortality trend from 2016 to 2025. Majority of the indigenous deaths hailed from Bardez taluka (n=20 (20.4%)), however, South Goa collectively constituted for 58 (56.3%) deaths; 82 (79.6%) of these were concentrated in the rural areas (Figure 2).

Figure 3 shows that 79 (76.7%) indigenous cases received the required antenatal care (ANC), while 10 (7.7%) did not were abortions, two were ruptured ectopic pregnancies, two had livebirth yet did not seek ANC for unknown reasons and two had family issues that hampered their ANC. Sixty-one (59.2%) mothers died postnatally OR; 46 (44.7%) had livebirths, 14 (13.6%) had stillbirths, outcome of one was untraceable between while 23 (22.3%) women died before delivery. Majority of the deliveries (n=31 (30.1%)) were conducted at Goa Medical College (GMC) and by skilled birth attendants (n=55 (53.4%)).

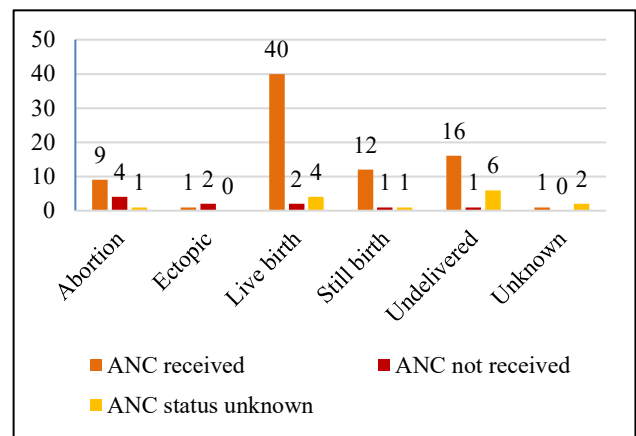


Figure 3: Outcome of pregnancy among deceased mothers with respect to reception of ANC (n=103).

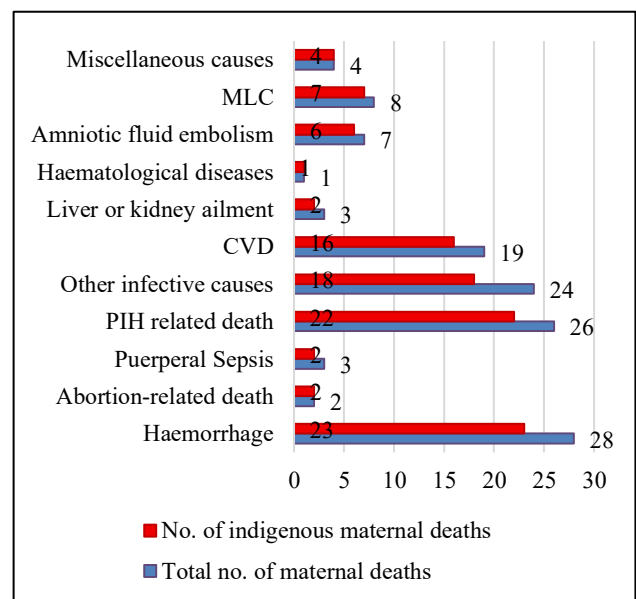


Figure 4: Primary cause of death among indigenous (n=103) compared to overall deaths (n=125).

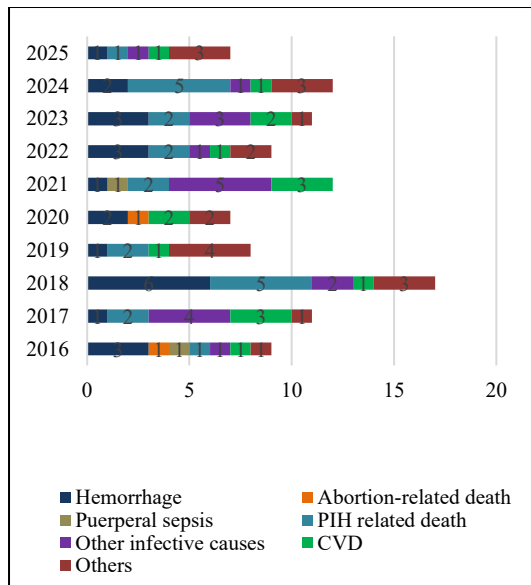


Figure 5: Primary cause of death over the years.

As the only public tertiary institute in the state, GMC bore 77 (74.8%) of all indigenous deaths, followed by private hospitals which witnessed 13 (12.6%) deaths but accounted for maximum referrals to other centres (n=33 (32%)). As is evident from Figure 4, haemorrhage (n=23

(22.3%)), PIH related deaths (n=22 (21.4%)), other infective causes (n=18 (17.5%)) and cardiovascular causes (n=16 (15.5%)) were responsible for most indigenous deaths. PPH, RHD, COVID-19 and TB were the leading COD in their respective categories (Table 1).

Haemorrhage, CVD and other infective causes claimed a higher proportion of younger mothers (n=43 (41.7%)), however PIH-related deaths were predominant in older age group (n=12 (11.6%)) (Table 2). Of the 12 that did IVF, 4 (3.9%) each died of haemorrhage and PIH, 2 (1.9%) of CVD and 1 (1%) from sudden cardiac death; COD for one was undisclosed.

Bardez reported the maximum haemorrhagic (n=5 (4.9%)) and PIH-related deaths (n=5 (4.9%)). Bardez and Ponda each reported 4 (3.9%) cardiovascular deaths, while other infective causes were reported maximally from Salcete (n=4 (3.9%)) (Table 3).

Haemorrhagic deaths were highest in 2018 (n=6 (5.8%)), CVD in 2017 and 2021 (n=6 (5.8%)) and PIH in 2018 and 2024 (n=10 (9.7%)). All 5 deaths from other infections in 2021 were due to COVID-19 (Figure 5). GMC reported 18 (17.4%) PIH-related, 17 (16.5%) haemorrhagic, 14 (13.6%) other infective and 13 (12.6%) cardiovascular causes.

Table 1: Detailed breakdown of haemorrhagic causes of death.

Haemorrhagic cause of death	No. of indigenous maternal deaths (%)
Postpartum haemorrhage (PPH)	17 (74)
Ruptured ectopic	3 (13)
Rupture uterus	3 (13)
Total	23 (100)

Table 2: Detailed breakdown of cardiovascular causes of death.

Cardiovascular cause of death	No. of indigenous maternal deaths (%)
Rheumatic heart disease (RHD)	8 (50)
Myocarditis	3 (18.75)
Peripartum cardiomyopathy (PPCM)	2 (12.5)
Embolus/ischemia	1 (6.25)
Pulmonary artery hypertension (PAH)	1 (6.25)
Left ventricular failure/congestive cardiac failure/ cardiogenic shock	1 (6.25)
Total	16 (100)

Table 3: Detailed breakdown of infective causes of death besides puerperal sepsis.

Other infective causes of death	No. of indigenous maternal deaths (%)
COVID-19	5 (27.77)
Tuberculosis (TB)	5 (27.77)
Community acquired pneumonia (CAP)	3 (16.7)
Dengue	2 (11.1)
Chorioamnionitis	1 (5.5)
Viral hepatitis	1 (5.5)
Undiagnosed febrile illness	1 (5.5)
Total	18 (100)

Table 4: Primary causes of death as per maternal age at death.

Primary cause of death	No. of mothers aged <35 years (%)	No. of mothers aged ≥35 years (%)	Total
Haemorrhage	16 (15.5)	7 (6.8)	23 (22.3)
Abortion-related death	1 (1)	1 (1)	2 (1.9)
Puerperal sepsis	1 (1)	1 (1)	2 (1.9)
PIH related death	10 (9.7)	12 (11.6)	22 (21.4)
Other infective causes	14 (13.6)	4 (3.9)	18 (17.5)
Cardiovascular disorder (CVD)	13 (12.6)	3 (2.9)	16 (15.5)
Liver or kidney ailment	2 (1.9)	0	2 (1.9)
Haematological diseases	1 (1)	0	1 (1)
Amniotic fluid embolism	5 (4.9)	1 (0.9)	6 (5.8)
Medicolegal case (MLC)	4 (3.9)	3 (2.9)	7 (6.8)
Miscellaneous causes	2 (1.9)	2 (1.9)	4 (3.9)
Total	69 (67)	34 (33)	103 (100)

Table 3: Primary causes of death as per residence of mother.

Primary cause of death		Haemorrhage	Abortion -related death	Puerperal sepsis	Other infective causes	PIH related death	CVD	Others	Total
North Goa	Pernem	1 (1%)	0	0	3 (2.9%)	1 (1%)	1 (1%)	2 (1.9%)	45 (43.7%)
	Bardez	5 (4.9%)	0	0	2 (1.9%)	5 (4.9%)	4 (3.9%)	5 (4.9%)	
	Bicholim	2 (1.9%)	0	0	2 (1.9%)	1 (1%)	0	0	
	Sattari	1 (1%)	0	0	1 (1%)	0	1 (1%)	1 (1%)	
	Tiswadi	4 (3.9%)	0	0	0	1 (1%)	1 (1%)	1 (1%)	
South Goa	Ponda	3 (2.9%)	1 (1%)	1 (1%)	1 (1%)	2 (1.9%)	4 (3.9%)	1 (1%)	58 (56.3%)
	Sanguem	0	0	1 (1%)	0	1 (1%)	1 (1%)	1 (1%)	
	Quepem	1 (1%)	0	0	2 (1.9%)	4 (3.9%)	0	1 (1%)	
	Salcete	2 (1.9%)	1 (1%)	0	4 (3.9%)	4 (3.9%)	1 (1%)	4 (3.9%)	
	Mormugao	3 (2.9%)	0	0	3 (2.9%)	1 (1%)	2 (1.9%)	4 (3.9%)	
	Canacona	0	0	0	0	0	1 (1%)	0	
	Dharbandora	1 (1%)	0	0	0	2 (1.9%)	0	0	
Total		23 (22.3%)	2 (1.9%)	2 (1.9%)	18 (17.5%)	22 (21.4%)	16 (15.5%)	20 (19.4%)	103 (100%)

DISCUSSION

A mother is the cornerstone of a family that crumbles to the ground in her death. Goa reported 125 such deaths over the past 10 years, including 22 (17.6%) from the border regions of neighboring states since Goa acts as a hub for obstetric referrals possibly due to their proximity.

Most indigenous deaths were among <35 years olds (69 (67%)), graduates (24 (23.3%)) and APL (44 (42.7%)). Wakode et al reported 98.4% deaths in women aged <35 years while Meh et al pointed out that maternal deaths in

national surveys showed a peak at 20-24 years.^{9,10} Joe et al and Bahadur et al both reiterated the impact of female education and economic growth on reducing MMR.^{5,6} Indigenous deaths were mainly from rural areas (n=82 (79.6%)) similar to findings by Wakode et al.⁹

Although only 12 (11.6%) women employed IVF for conception, a study by Sabr et al has warned about the severe morbidity and mortality associated with it, especially secondary to eclampsia, haemorrhage, cardiorespiratory compromise and sepsis.¹¹ NFHS-6 indicated that 99.2% mothers in Goa got at least one ANC visit and 88% completed the ideal minimum 4 visits.¹²

The present study witnessed only 79 (76.7%) deceased mothers having received required ANC. Inadequate ANC is known to escalate MMR as ANC provides health promotion, screening and disease mitigation.¹³

Postnatal deaths were more frequent in this study and more so in GMC as it is the only public tertiary care institute, as pointed out by Menezes et al.¹⁴ Nevertheless, the quality of care in Goa warrants kudos as these numbers are lesser than studies by Wakode et al and Karuna et al.^{9,15} Private hospitals bear 39.3% of institutional births in Goa but also had the maximum referrals to GMC a wake-up call for all health facilities to be equally well-equipped for obstetric emergencies.¹²

Haemorrhage, PIH, CVD and other infections collectively took 76.7% lives. The COD profile aligned with the ones seen in multiple studies.^{9,15-17} A review by Saccone et al opined that women over 40 years have higher likelihood of preeclampsia while Gupta et al noted young women to suffer from PPH.^{18,19} RHD and TB have been prevalent in India for ages with inadequate community awareness and COVID-19 proved to be an exigency beyond control. The present study reflects these same outcomes.

Limitations

Since Goa is a small state with comparatively smaller vital event indices, MMR was not calculated as it may wrongly be larger than expected. Data was obtained from existing records which generated lacunae in data that couldn't be gathered without further qualitative methods; this created a reporting bias especially in the early phases when MDSR was new.

The present study being purely descriptive, cannot assess association and causality. It also needs a qualitative study for factors (such as temporal and geographic distribution of deaths or the reasons for excessive referrals from lower levels) that need corrective actions.

CONCLUSION

To conclude, with economic improvements, trained workforce, public health initiatives, community participation and intersectoral coordination, we strive to reach SDG within the next four years. But India has a long way to go when it comes to equipping all healthcare levels enough to handle any obstetric case before it becomes a tragedy. Continuing MDSR with responsibility rather than blame, robust counselling of expectant mothers especially at IVF centres and a prompt referral system could help.

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Conflict of interest: None declared

Ethical approval: The study was approved by the Institutional Ethics Committee

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