The Research Journal of Medical Sciences
[E-ISSN: 3078-2481| P-ISSN: 3078-2473]
Available on: https://rjmsonline.com/
Volume: 03 | Issue: 01, 2021
DOI: 10.5281/zenodo.23481914



Research Article *Open Access*

Maternal Near-Miss Events and Maternal Deaths at a Tertiary Referral Hospital: A Secondary Analysis of Published Data and Maternal Outcome Indicators

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Source of support: Nil.
Conflict of interest: None

Received: 06-04-2021
Accepted: 08-05-2021
Available online: 20-05-2021

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Published by TRJMS

Abstract

Background: Maternal near-miss events provide important information about severe complications during pregnancy, childbirth and the postpartum period. Reviewing these cases alongside maternal deaths can help identify clinical priorities and weaknesses in referral pathways and emergency obstetric care.

Objective: To examine the distribution of maternal near-miss events, associated clinical conditions, organ dysfunction, reported interventions and maternal deaths using published aggregate data from a tertiary referral hospital. A further objective was to recalculate key maternal health indicators and assess the internal consistency of the reported figures.

Methods: This descriptive secondary analysis used aggregate data published by Kasliwal and colleagues in their 2021 study of maternal near-miss events at Santokba Durlabhji Memorial Hospital, Jaipur. The original report described 98 maternal near-miss cases, five maternal deaths and 2,770 live births among 2,805 deliveries. Published frequencies were reviewed descriptively. Maternal near-miss ratio, severe maternal outcome ratio, maternal near-miss-to-mortality ratio, maternal mortality ratio and mortality index were recalculated from the reported counts. No individual-level records were available for independent statistical reanalysis.

Results: Sepsis was the most frequent clinical complication reported among the 98 near-miss cases, affecting 36 women (36.73%). Haemorrhage and hypertensive complications were each reported in 22 cases (22.45%). Non-obstetric primary diagnoses accounted for 53 cases (54.08%), while obstetric diagnoses accounted for 45 (45.92%). Organ dysfunction was reported in 57 women (58.16%); 15 cases were classified as multiple-organ dysfunction. Ventilatory support was reported in 22 cases, obstetric hysterectomy in 10 and dialysis in eight. Five maternal deaths were reported. Recalculation using the published counts yielded a maternal near-miss ratio of 35.38 per 1,000 live births, a severe maternal outcome ratio of 37.18 per 1,000 live births, a maternal near-miss-to-mortality ratio of 19.6:1 and a maternal mortality ratio of 180.5 per 100,000 live births. The mortality index calculated from the same counts was 4.85%, which differs substantially from the 48–48.5% reported in the original article.

Conclusion: The published data identify sepsis, haemorrhage and hypertensive complications as important contributors to severe maternal morbidity in this tertiary referral setting. Recalculation also reveals a substantial discrepancy in the reported mortality index, alongside inconsistencies in study dates and intensive care reporting. These findings support careful verification of maternal near-miss indicators and transparent reporting of referral, organ dysfunction and intervention data. Because the analysis uses published aggregate data, it should not be interpreted as a new patient-level clinical study.

Keywords: *Maternal near miss; maternal mortality; severe maternal outcome; sepsis; obstetric haemorrhage; organ dysfunction; referral hospital; maternal health indicators.*

INTRODUCTION

Severe maternal morbidity remains an important measure of the performance of maternal health services. A maternal death represents the most serious outcome of pregnancy-related complications, but women who survive life-threatening events can also provide valuable information about the timeliness and effectiveness of care. These survivors are commonly classified as maternal near-miss cases when they experience life-threatening complications during pregnancy, childbirth or within 42 days after pregnancy termination and survive [1,2].

The World Health Organization (WHO) developed standardized near-miss identification criteria to improve consistency in clinical audits and comparisons between health facilities. These criteria include indicators of clinical deterioration, laboratory abnormalities and life-saving interventions associated with severe organ dysfunction [2,3]. Their application can support structured reviews of severe maternal outcomes and help healthcare facilities identify problems in emergency response and referral arrangements.

Severe maternal complications may arise from haemorrhage, hypertensive disorders, sepsis and medical conditions aggravated by pregnancy. The outcomes of these complications can depend on early recognition, stabilization, access to blood products, critical care capacity, availability of skilled personnel and transport between healthcare facilities. A review of near-miss cases may therefore reveal service gaps that are not apparent from maternal death statistics alone [2,3].

Kasliwal and colleagues reported 98 maternal near-miss cases and five maternal deaths in a retrospective study at a tertiary referral hospital in Jaipur, India [1]. Their publication included information about the clinical causes of near-miss events, primary diagnoses at admission, organ dysfunction, interventions and causes of maternal death.

The present analysis uses the published aggregate results to examine the distribution of these outcomes and independently recalculate key indicators from the reported counts. Particular attention is given to consistency between the tabulated data and the summary indicators, since these measures may influence how the burden of severe maternal outcomes is understood.

AIM AND OBJECTIVES

Aim

To examine published data on maternal near-miss events and maternal deaths at a tertiary referral hospital and assess the consistency of the reported maternal health indicators.

Objectives

1. To describe the reported clinical causes and primary diagnoses associated with maternal near-miss events.
2. To summarize the reported distribution of organ dysfunction and life-saving interventions.
3. To describe the reported causes of maternal death.
4. To recalculate maternal near-miss and severe maternal outcome indicators from the published counts.
5. To identify discrepancies that may affect interpretation of the published findings.

MATERIALS AND METHODS

Study design

This manuscript presents a descriptive secondary analysis of previously published aggregate data. The primary source was the retrospective study by Kasliwal et al.,

The present work did not recruit participants, access individual medical records or generate new clinical observations. Its purpose was to summarize published findings and verify arithmetic relationships between the reported counts and maternal health indicators.

Source study setting and period

The original study was conducted at Santokba Durlabhji Memorial Hospital, a tertiary referral hospital in Jaipur, Rajasthan, India. The abstract and results section identify September 2017 to August 2018 as the study period. The methods section contains a different date range, August 2017 to September 2018; this inconsistency is retained as a limitation requiring clarification from the original study records [1].

Source population and case identification

The source study included women with severe maternal outcomes identified through hospital medical records and discharge summaries. The original authors reported using WHO near-miss criteria published in 2009, incorporating clinical, laboratory and management-based indicators. Women with uncomplicated childbirth were excluded from the source study population [1,2].

The published report recorded 2,805 deliveries, 2,770 live births, 98 maternal near-miss cases and five maternal deaths. The present analysis uses these aggregate values as reported.

Variables extracted

The following information was extracted from the published tables and narrative:

- Maternal age and reported hospital stay.
- Distribution of clinical complications.
- Primary diagnosis at admission.
- Organ dysfunction categories.
- Procedures and interventions used during management.
- Causes of maternal death.
- Published maternal near-miss and mortality indicators.

No individual-level demographic, clinical or laboratory records were available for independent verification.

Recalculation of maternal health indicators

The following calculations were performed using the counts published in the source article.

Maternal near-miss ratio:

[\text{MNMR}=\frac{\text{Maternal near-miss cases}}{\text{Live births}}\times1000]

Severe maternal outcome ratio:

[\text{SMOR}=\frac{\text{Near-miss cases}+\text{Maternal deaths}}{\text{Live births}}\times1000]

Maternal near-miss-to-mortality ratio:

[\text{MNM}=\frac{\text{Maternal near-miss cases}}{\text{Maternal deaths}}]

Maternal mortality ratio:

[\text{MMR}=\frac{\text{Maternal deaths}}{\text{Live births}}\times100000]

Mortality index:

[\text{MI}=\frac{\text{Maternal deaths}}{\text{Near-miss cases}+\text{Maternal deaths}}\times100]

The calculations are based on the published aggregate counts and are not an independent analysis of the underlying patient records.

Statistical approach

Descriptive frequencies and percentages were used to summarize categorical findings. Where appropriate, percentages were checked against the reported denominator of 98 maternal near-miss cases. Maternal health indicators were recalculated arithmetically using the number of live births and severe maternal outcomes stated in the source article.

No hypothesis testing, regression modelling or causal analysis was undertaken because the published aggregate data did not provide the information required for those analyses.

Results

Overall maternal outcomes

The original study reported 2,805 deliveries and 2,770 live births during the study period. Among the reported severe maternal outcomes, 98 women were classified as maternal near-miss cases and five maternal deaths were recorded [1].

The source described the median age of the near-miss population as 26 years. The published summary statistics reported a mean age of 26.35 ± 4.69 years, a median of 26 years and a range of 18–37 years.

Table 1. Reported demographic and hospital stay characteristics of maternal near-miss cases

Variable	Number of cases	Mean ± SD	Median	Minimum–maximum
Age (years)	98	26.35 ± 4.69	26	18–37
Hospital stay (days, as implied by the source context)	98	5.98 ± 3.24	5	0–15
Variable labelled “ICU admission”	98	2.35 ± 2.52	2	0–10

Source: Kasliwal et al. [1]. The original table does not specify the unit or precise definition of the variable labelled “ICU admission”; its summary statistics should not be interpreted as an ICU admission rate without clarification.

The source described most women as primigravida and reported that postnatal presentations were more common than antenatal presentations. Exact parity frequencies were not available in the supplied aggregate results.

Clinical complications associated with maternal near miss

Sepsis was the most frequently reported clinical complication, accounting for 36 of 98 cases (36.73%). Haemorrhage and hypertension accounted for 22 cases each (22.45% each). Medical conditions accounted for 15 cases (15.31%), and postpartum cerebral venous thrombosis (CVT) accounted for three cases (3.06%).

Table 2. Distribution of reported clinical complications among maternal near-miss cases

Clinical complication	Number	Percentage
Sepsis	36	36.73

Haemorrhage	22	22.45
Hypertensive complications	22	22.45
Medical conditions	15	15.31
Postpartum cerebral venous thrombosis	3	3.06
Total	**98**	**100.00**

Source: Aggregate findings reported by Kasliwal et al. [1]. Percentages are based on 98 near-miss cases.

These findings indicate that sepsis, haemorrhage and hypertensive complications represented the largest clinical categories in the source report.

Primary diagnosis at admission

The published table classified 45 cases as having obstetric primary diagnoses and 53 as having non-obstetric diagnoses. Eclampsia was the most frequent listed obstetric diagnosis, with 10 cases (10.20% of all near-miss cases). Antepartum haemorrhage and severe pre-eclampsia accounted for nine cases each.

Among the non-obstetric diagnoses, sepsis was reported in 35 cases (35.71%), followed by hepatitis in 12 cases (12.24%). Respiratory infection attributed to H1N1 and postpartum CVT were each reported in three cases.

Table 3. Primary diagnosis at admission among reported maternal near-miss cases

Primary diagnosis	Number	Percentage of all near-miss cases
Obstetric diagnoses		
Antepartum haemorrhage	9	9.18
Eclampsia	10	10.20
Ectopic pregnancy	4	4.08
HELLP syndrome	3	3.06
Uterine rupture	1	1.02
Septic abortion	1	1.02
Severe pre-eclampsia	9	9.18
Postpartum haemorrhage	8	8.16
Total obstetric diagnoses	**45**	**45.92**
Non-obstetric diagnoses		
Respiratory infection (H1N1)	3	3.06
Sepsis	35	35.71
Hepatitis	12	12.24
Postpartum cerebral venous thrombosis	3	3.06
Total non-obstetric diagnoses	**53**	**54.08**
Overall total	**98**	**100.00**

Source: Counts from Kasliwal et al. [1]. Percentages have been recalculated from the denominator of 98 and rounded to two decimal places. Minor differences from the published rounded percentages are expected.

Organ dysfunction

The original report stated that 57 of the 98 near-miss cases had documented organ dysfunction. Of these, 42 women were described as having dysfunction of one organ system, while 15 had multiple-organ dysfunction. Forty-one cases were listed under “no specific organ dysfunction.”

The liver was the most frequently listed individual organ system, with 13 cases (13.27%). Renal dysfunction and coagulation dysfunction were each reported in eight cases. Brain, respiratory and uterine dysfunction were reported less frequently.

Table 4. Reported organ dysfunction among maternal near-miss cases

Organ dysfunction category	Number	Percentage
Brain/neurological	5	5.10
Coagulation	8	8.16
Liver/hepatic	13	13.27
Multiple-organ dysfunction syndrome	15	15.31
Renal	8	8.16
Respiratory	4	4.08
Uterine	4	4.08
No specific organ dysfunction recorded	41	41.84
Total	**98**	**100.00**

Source: Kasliwal et al. [1]. The categories and counts are reproduced as published and are not assumed to represent mutually exclusive physiological mechanisms. The percentage for multiple-organ dysfunction is based on all 98 near-miss cases.

The count of 57 cases with any reported organ dysfunction is consistent with the 98 total cases minus the 41 listed as having no specific organ dysfunction. This equals 58.16% of the near-miss group.

Interventions reported during management

The source publication listed several procedures and treatment interventions. Ventilation was the most frequent listed intervention, with 22 cases (22.45%), followed by medical management in 15 (15.31%) and examination under anaesthesia in 12 (12.24%). Obstetric hysterectomy was reported in 10 cases (10.20%), and dialysis in eight (8.16%).

Table 5. Interventions listed in the source publication

Intervention	Number reported	Percentage of 98 cases
Ventilation	22	22.45
Medical management	15	15.31
Examination under anaesthesia	12	12.24
Anticonvulsant treatment	11	11.22
Obstetric hysterectomy	10	10.20
Dialysis	8	8.16
Exploratory laparotomy	7	7.14
Diagnostic laparoscopy	5	5.10
Conservative management	4	4.08
Blood transfusion	2	2.04
Uterine artery embolization	1	1.02
Vasoactive drugs	1	1.02

Source: Counts reported by Kasliwal et al. [1]. Percentages are presented against the 98 near-miss cases, as in the supplied source table. Because the original text states that some women received more than one intervention, these rows should not be interpreted as mutually exclusive categories.

The source narrative states that the 98 near-miss cases underwent 83 critical interventions, whereas the numerical entries in the intervention table sum to 98. This discrepancy requires clarification before the number of total procedures or interventions can be reported as definitive.

Maternal deaths

Five maternal deaths were reported during the source study period. The source table listed one death each attributed to postpartum haemorrhage, hepatic failure, infective hepatitis, septic abortion and postpartum sepsis.

Table 6. Causes of maternal death reported in the source study

Recorded cause	Number
Postpartum haemorrhage	1
Hepatic failure	1
Infective hepatitis	1
Septic abortion	1
Postpartum sepsis	1
Total	**5**

Source: Kasliwal et al. [1]. The source narrative separately stated that four of the five deaths were directly related to pregnancy and described sepsis as the leading contributor. The classification of the listed causes should be checked against the original clinical records if a cause-specific analysis is undertaken.

Recalculated maternal health indicators

The published counts allow several maternal health indicators to be recalculated. The calculations below use 98 near-miss cases, five maternal deaths and 2,770 live births.

Table 7. Maternal outcome indicators recalculated from published counts

Indicator	Calculation	Recalculated result
Maternal near-miss ratio	98 ÷ 2,770 × 1,000	35.38 per 1,000 live births
Severe maternal outcome ratio	(98 + 5) ÷ 2,770 × 1,000	37.18 per 1,000 live births
Maternal near-miss-to-mortality ratio	98 ÷ 5	19.6:1
Maternal mortality ratio	5 ÷ 2,770 × 100,000	180.51 per 100,000 live births
Mortality index	5 ÷ (98 + 5) × 100	4.85%

Calculated from the aggregate counts reported in Kasliwal et al. [1]. These are arithmetic recalculations; they are not independently validated against individual medical records.

The recalculated maternal near-miss ratio is consistent with the source's reported value of approximately 35.3 per 1,000

live births. The maternal mortality ratio is also consistent with the source's approximate value of 180 per 100,000 live births.

However, the recalculated mortality index is 4.85%, not the 48–48.5% stated in the published discussion. Using the formula specified in the original methods, five deaths divided by 103 severe maternal outcomes gives a mortality index of approximately 4.85%. The difference is substantial and should be resolved by checking the original calculation.

DISCUSSION

This secondary analysis of published aggregate data identified sepsis as the largest reported clinical category among maternal near-miss cases, followed by haemorrhage and hypertensive complications. The source also reported a substantial proportion of women with organ dysfunction and described the use of intensive interventions, including ventilation, dialysis and obstetric hysterectomy.

The findings can help organize the published results around service priorities and maternal outcome indicators. Nevertheless, because the analysis is based on published summaries rather than patient-level records, it cannot independently verify the clinical classification of individual cases or establish associations between risk factors and outcomes.

Clinical distribution of severe maternal morbidity

Sepsis accounted for 36 of the 98 near-miss cases in the source report. Haemorrhage and hypertensive complications were each reported in 22 cases. These categories represent clinically important causes of severe maternal morbidity and align with the WHO emphasis on early identification, management and audit of potentially life-threatening obstetric complications [2,3].

The primary diagnosis table placed 53 cases in the non-obstetric category and 45 in the obstetric category. This classification describes how the source authors organized the diagnoses at admission. It should not be interpreted as establishing that all non-obstetric conditions were unrelated to pregnancy, since medical conditions can be aggravated by pregnancy or its management.

A detailed evaluation of the timing of symptom onset, referral, stabilization and definitive treatment would be required to determine where delays occurred. Those variables cannot be reconstructed from the aggregate tables.

Organ dysfunction and critical care

The published counts indicate that 57 women had reported organ dysfunction, including 15 with multiple-organ dysfunction. Hepatic dysfunction was the most frequently listed individual organ category. Ventilation, dialysis and hysterectomy were among the interventions documented in the source.

These findings underline the seriousness of the complications managed in the tertiary facility. However, organ dysfunction patterns and interventions should be interpreted alongside admission severity, the clinical indication for each intervention and the timing of treatment. The data supplied do not establish whether an intervention was delayed, whether it was available at the first point of care, or whether its use changed an individual patient's outcome.

There is also uncertainty in the source's reporting of intensive care use. Its abstract states that 60% of patients required direct intensive care admission, while the discussion reports that 80% required intensive care intervention. The table labelled “ICU admission” gives a mean of 2.35, standard deviation of 2.52, median of 2 and range of 0–10 but does not clearly specify the measured variable or unit. These figures cannot be reconciled confidently without the source records.

Referral pathways and maternal health services

The source article describes the hospital as a tertiary referral centre receiving women with severe complications. It also highlights concerns about late referral, transport and access to emergency services at peripheral facilities [1].

These observations are relevant to service planning, but aggregate data cannot establish the individual contribution of each delay to maternal outcomes. A more informative facility audit would document the time from symptom onset to first presentation, referral decision, transport, arrival at the receiving facility and initiation of definitive management.

District-level access to emergency obstetric care, blood products, skilled staff and appropriate stabilization facilities are reasonable areas for evaluation. Recommendations arising from this study should be framed as service priorities to investigate rather than as proven causal explanations for all five deaths or all near-miss cases.

Interpretation of the recalculated indicators

The arithmetic review confirms the maternal near-miss ratio of approximately 35.38 per 1,000 live births and the maternal mortality ratio of approximately 180.51 per 100,000 live births, using the counts stated in the publication.

The severe maternal outcome ratio was 37.18 per 1,000 live births, reflecting 103 women with a severe maternal outcome divided by 2,770 live births. The maternal near-miss-to-mortality ratio was 19.6:1.

The mortality index requires particular attention. Under the formula provided in the source methods, the numerator is the number of maternal deaths and the denominator is the sum of near-miss cases and maternal deaths. Substituting the published counts gives $5/103 \times 100 = 4.85\%$. The original publication reports a mortality index of approximately 48–48.5%, which does not follow from those counts and that formula.

This discrepancy affects the interpretation of the reported quality-of-care indicator. It should not be corrected silently in a manuscript that discusses the source. Instead, the recalculation and the published discrepancy should both be documented until the original authors or source records confirm the intended values.

Internal consistency of the published report

Several issues warrant review:

1. **Study period:** The abstract and results state September 2017 to August 2018, whereas the methods section states August 2017 to September 2018.
2. **Intensive care:** The abstract reports direct ICU admission in 60% of cases, while the discussion reports ICU intervention in 80%.
3. **Intervention total:** The narrative describes 83 critical interventions, but the individual counts in the table sum to 98.
4. **Mortality index:** The published value of approximately 48–48.5% is inconsistent with the reported counts and the stated formula; recalculation gives approximately 4.85%.
5. **ICU variable definition:** The table's "ICU admission" entry includes numerical summary statistics without a clear unit or operational definition.

These differences should be verified before the source data are used for further comparisons or policy-level conclusions. They also illustrate why the calculation methods and denominators for maternal health indicators should be shown explicitly in published reports.

Implications for maternal near-miss audits

The analysis supports the use of structured maternal near-miss audits as a means of organizing information on clinical complications, organ dysfunction, interventions and maternal deaths. The WHO approach emphasizes the assessment of severe outcomes and the review of care processes to identify opportunities for improvement [2,3].

A complete audit should examine not only the final diagnosis but also whether warning signs were recognized, stabilization was timely, appropriate treatment was available, referral was completed efficiently and communication between facilities was effective. The current aggregate data indicate potential areas for investigation but do not allow a definitive assessment of the quality of individual clinical decisions.

Strengths and Limitations

Strengths

The source provides counts for major clinical complication categories, admission diagnoses, organ dysfunction, interventions and maternal deaths. The available denominators also permit recalculation of important maternal health indicators. This makes it possible to identify discrepancies between the published table values and the narrative summary.

Limitations

First, this analysis relies on aggregate information from a single published study. Individual medical records were unavailable, so the accuracy of individual case classification could not be independently confirmed.

Second, the analysis did not adjust for patient characteristics, referral severity, gestational age, comorbidities or treatment delays. It therefore cannot identify independent predictors of maternal near miss or mortality.

Third, there are inconsistencies in the source report concerning the study period, intensive care reporting, the total number of interventions and the mortality index. The underlying data are required to resolve these discrepancies conclusively.

Fourth, the categories in the source intervention table may overlap because one woman could receive multiple interventions. The available aggregate table does not support independent reconstruction of the total number of distinct procedures.

Finally, this is a descriptive secondary analysis rather than a systematic review or new clinical investigation. Its results should not be represented as findings from a newly recruited sample.

CONCLUSION

The published aggregate data describe a substantial burden of maternal near-miss events at a tertiary referral hospital, with sepsis, haemorrhage and hypertensive complications representing the most frequent clinical categories. Organ dysfunction was reported in 57 of 98 near-miss cases, and the source listed several intensive interventions used in management.

Recalculation of the maternal outcome indicators confirms a near-miss ratio of approximately 35.38 per 1,000 live births, a severe maternal outcome ratio of approximately 37.18 per 1,000 live births and a maternal mortality ratio of approximately 180.51 per 100,000 live births. The mortality index calculated from the reported counts is approximately 4.85%, which differs from the published value of 48–48.5%.

The analysis therefore has two principal findings: sepsis and other severe obstetric complications merit continued

attention in maternal health audits, and numerical consistency in the reporting of maternal indicators is essential for valid interpretation. Clarification from the original study records is required before the identified discrepancies can be resolved.

Recommendations

1. Maternal near-miss audits should document clinical presentation, referral history, stabilization, definitive intervention and outcome using clearly defined variables.
2. Reports should specify the denominator for every maternal health indicator and provide the formula used for each calculation.
3. Tables should clearly distinguish the number of women receiving an intervention from the total number of interventions performed.
4. Intensive care reporting should specify whether it refers to admission, direct admission, need for intervention or duration of stay.
5. The study period, maternal outcome totals and mortality index in the original report should be reconciled before the data are reused in comparative analyses.
6. Future studies should use complete patient-level datasets, prespecified definitions and appropriate analytical methods to examine factors associated with severe maternal outcomes.

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