

## Research Article

# Applicability of Three Delay's Model on the assessment of causes for Maternal mortality

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**Abstract:** **Introduction:** Maternal health is a very sensitive issue which has not only affected on the social and economic development of a country but also on the rights of the highest attainable standard of health of an individual. **Methods:** The present prospective study was carried out in the department of Obstetrics and Gynecology, Kurnool Medical College, Kurnool. All cases of maternal mortality between February 2025 to January 2026 were included in the study. Socio-demographic profile and obstetric details of the study participants were collected using a predesigned proforma. **Results:** **Conclusion:** The current study demonstrates Type 1 delay was the major contributor with Lack of awareness of danger signs, illiteracy, ignorance, and neglect of warning symptoms were the leading determinants, occurring predominantly among unbooked women from low socioeconomic and rural backgrounds.

**Keywords:** Maternal care, three delays model, mortality

## INTRODUCTION

Maternal mortality is defined as the death of a woman while pregnant or within 42 days of termination of pregnancy, irrespective of the duration and site of pregnancy, from any cause related to or aggravated by the pregnancy or its management, but not from accidental or incidental causes [1]. Maternal mortality is a definitive indicator of the quality of obstetric care delivered in a community, thereby directly reflecting the utilization of available healthcare services [2]. The Three Delays Model, proposed by Thaddeus and Maine, is a useful and widely accepted framework for understanding delays in the management of obstetric emergencies and their contribution to maternal mortality. This framework facilitates the assessment of patient-related, provider-related, and socio-cultural factors that contribute to maternal mortality and serves as a key component of maternal mortality surveillance and audit systems [3]. The maternal mortality delays were classified into Type-I: Delay in decision to seek care; Type-II: Delay in reaching Health care Facility; Type-III: Delay in receiving adequate care at health facility [4,5].

## MATERIALS AND METHODS

The present prospective study was carried out in the department of Obstetrics and Gynecology, Kurnool Medical College, Kurnool. All cases of maternal mortality between February 2025 to January 2026 were

included in the study. The study commenced after the approval of Institutional Ethics Committee. Data collection was done by means of personal interviews of the family members of the deceased women by the researcher in the hospital. Socio-demographic profile and obstetric details of the study participants were collected using a predesigned proforma. We reviewed the individual case sheet of the women, referral letters, medical records and previous antenatal care records to retrieve the data related to sociodemographic profile and clinical profile of the deceased.

### Inclusion Criteria

- All antenatal women irrespective of the site of pregnancy and gestational age, women in labor and postpartum women within 42 days of delivery with deaths resulting from direct or indirect obstetric causes.

### Exclusion Criteria

- Deaths resulting from accidental causes.
- Deaths resulting from incidental causes unrelated to pregnancy.

Data were entered into Microsoft Excel and analyzed using appropriate statistical software. Categorical variables were expressed as frequencies and percentages. Results were presented using tables, charts, and graphs and p-value of <0.05 was considered statistically significant.

## RESULTS

In the present study, majority of the maternal deaths occurred among women aged <24 years (45%) was noted. Out of 20 cases; 13(65%) cases were referred from rural areas and (35%) 7 cases were referred from urban areas. Majority of maternal deaths were among primi gravida constituting 9(45%). A total of 5 (25%) cases were referred during  $\geq 37$  weeks of Gestational age. The maternal deaths 18 (90%) were found to be unbooked [Table 1]. Lower segment caesarean section was the commonest mode of delivery (65.0%) in the present study. A total of 16(80%) cases showing favorable outcome of the delivery. Postpartum deaths accounted for 95% of all maternal deaths. The Lack of awareness of danger signs in type I delay was the most common cause of delay 6(30%) noted. The preventable death was noted 13(100%) out of 13 under type I delay in association between type of delay and preventability of maternal death noted [Table 2]. We also noted higher incidence of 13(65%) in type I delay in association between residence and type of delay in the present study. Type I delay was the dominant contributor in the present study, implicated in 13(65.0%) of cases and involved overall in 16(80%) when combined delays were considered [Table 3].

**Table 1: Distribution of cases according to different parameters**

| Age Group                 |            | Frequency (n) | Percentage (%) |
|---------------------------|------------|---------------|----------------|
| <24 years                 |            | 9             | 45.0           |
| 25–29 years               |            | 3             | 15.0           |
| $\geq 30$ years           |            | 8             | 40.0           |
| Total                     |            | 20            | 100.0          |
| Sociodemographic Variable |            |               |                |
| Literacy status           | Illiterate | 20            | 100.0          |
| Occupation                | Housewife  | 20            | 100.0          |
| Socioeconomic status      | Low        | 20            | 100.0          |
| Residence                 | Rural      | 13            | 65.0           |
|                           | Urban      | 7             | 35.0           |
| Gravida Status            |            |               |                |
| Primigravida              |            | 9             | 45.0           |
| Gravida 2                 |            | 5             | 25.0           |
| Gravida 3                 |            | 3             | 15.0           |
| Gravida $\geq 4$          |            | 3             | 15.0           |
| Referral Timing           |            |               |                |
| Antenatal                 |            | 12            | 60.0           |
| Postnatal                 |            | 8             | 40.0           |
| Gestational Age Group     |            |               |                |
| <28 weeks                 |            | 3             | 15.0           |
| 28–36+6 weeks             |            | 4             | 20.0           |
| $\geq 37$ weeks           |            | 5             | 25.0           |
| Variable                  |            |               |                |
| Booking status            | Booked     | 2             | 10.0           |
|                           | Unbooked   | 18            | 90.0           |

**Table 2: Distribution of cases according to different parameters along with type of delay**

| Mode of Delivery        | Frequency (n) | Percentage (%) |
|-------------------------|---------------|----------------|
| Normal vaginal delivery | 4             | 20.0           |
| LSCS                    | 13            | 65.0           |
| Instrumental delivery   | 1             | 5.0            |
| Undelivered             | 1             | 5.0            |
| Miscarriage             | 1             | 5.0            |
| Total                   | 20            | 100.0          |

|                        |    |      |
|------------------------|----|------|
| Delivery Outcome       |    |      |
| Live baby              | 16 | 80.0 |
| Stillbirth / Dead baby | 2  | 10.0 |
| Not delivered          | 1  | 5.0  |
| Miscarriage            | 1  | 5.0  |
| Timing of Death        |    |      |
| Antepartum             | 1  | 5.0  |
| Postpartum             | 19 | 95.0 |
| Type of Delay          |    |      |
| Type I delay           | 13 | 65.0 |
| Type II delay          | 2  | 10.0 |
| Type III delay         | 2  | 10.0 |
| Type I + Type II delay | 3  | 15.0 |

**Table 3: Distribution of cases According to Causes of Delay**

| Type of delay | Cause of Delay                                   | Frequency(n) | Percentage (%) |
|---------------|--------------------------------------------------|--------------|----------------|
| Type I        | Illiteracy and ignorance                         | 5            | 25.0           |
|               | Lack of awareness of danger signs                | 6            | 30.0           |
|               | Neglect of danger signs                          | 5            | 25.0           |
|               | Delay in decision-making                         | 1            | 5.0            |
|               | Non-compliance / not following healthcare advice | 2            | 10.0           |
| Type II       | Not reaching appropriate facility in time        | 3            | 15.0           |
|               | Transport-related delay                          | 1            | 5.0            |
| Type III      | Delay in diagnosis                               | 2            | 10.0           |

**Table 4 : Association Between Type of Delay and Preventability of Maternal Death**

| Type of Delay          | Preventable Death n (%) | Non-preventable Death n (%) | Total (N) | Fisher's Exact Test Value | P-value |
|------------------------|-------------------------|-----------------------------|-----------|---------------------------|---------|
| Type I delay           | 13 (100.0)              | 0 (0.0)                     | 13        | 16.844                    | 0.019   |
| Type II delay          | 2 (100.0)               | 0 (0.0)                     | 2         |                           |         |
| Type III delay         | 0 (0.0)                 | 2 (100.0)                   | 2         |                           |         |
| Type I + Type II delay | 3 (100.0)               | 0 (0.0)                     | 3         |                           |         |
| Total                  | 18 (90.0)               | 2 (10.0)                    | 20        |                           |         |

**Table 5: Association Between Residence and Type of Delay**

| Type of Delay          | Rural     | Urban    | Total (N) | Chi-Square Test value | P-value |
|------------------------|-----------|----------|-----------|-----------------------|---------|
| Type I delay           | 9 (69.2)  | 4 (57.1) | 13 (65.0) | 22.00                 | 0.015   |
| Type II delay          | 1 (7.7)   | 1 (14.3) | 2 (10.0)  |                       |         |
| Type III delay         | 1 (7.7)   | 1 (14.3) | 2 (10.0)  |                       |         |
| Type I + Type II delay | 2 (15.4)  | 1 (14.3) | 3 (15.0)  |                       |         |
| Total                  | 13 (65.0) | 7 (35.0) | 20        |                       |         |

## DISCUSSION

### Comparison of Study Profile and Total Cases

The present study included 20 maternal death cases over one year but comparable to previously reported 16 cases in another study [6]. These differences may be due to variation in study duration, hospital workload, and referral pattern. However, the present study still gives

useful information about delay factors contributing to maternal deaths in this setting. In the present study, most deaths occurred among women below 24 years (45.0%), followed by women aged  $\geq 30$  years (40.0%). The maximum deaths in the 21–25 year group (42.6%), noted in the previous literature[7]. The higher proportion of younger women in the present study may be related to early marriage, early pregnancy, and unbooked status. In

the present study, 60.0% of cases were antenatal referrals and 40.0% were postnatal referrals, with a high proportion of unbooked cases. It was reported that 56.8% of deaths occurred among hospital-delivered women and also reported 75.0% were not referred and reached the hospital as the first contact [6,7]. These findings show that delays in timely referral and proper management continue to play an important role in maternal deaths. We noted 25% of deaths occurred at term and primigravida formed the largest group (45.0%). The more deaths in the third trimester (62.5%) and among primigravida (50.0%). The deaths across different trimesters but did not mention gravida status. The similar primigravida pattern suggests the need for closer antenatal monitoring during first pregnancy[7]. The Lower segment caesarean section was the commonest mode of delivery (65.0%), and 80.0% of babies were live births. It was reported 56.8% hospital deliveries with higher adverse fetal outcomes, including 25.0% stillbirths and 9.6% abortion-related events. The higher caesarean rate in the present study may be due to emergency referral of critically ill patients. The better fetal outcome may reflect earlier intervention in some cases [6]. Majority of maternal deaths occurred in the postnatal period (95.0%), showing the high-risk nature of the postpartum phase. Most of the deaths occurred after 48 hours postpartum, mainly due to indirect causes such as severe COVID-19 pneumonia and ARDS. These findings highlight the need for strict postpartum monitoring and timely management after delivery [7]. Maternal death differs from place to place, country to country and institute to institute reflecting the type of care provided and health status of the region [8]. Maternal death has serious implications to the family, the society and the nation. It deprives the surviving infant of a mother's care[9,10]. One of the most important goals of the MDGs is to reduce the maternal mortality [11,12]. The Type I delay was the major contributor, seen in 65.0% of cases and involved in 80.0% when combined delays were included. Similar findings were reported where Delay 1 was also the commonest delay [13]. The delay in seeking care (Type 1 delay) was the most significant contributor to maternal deaths was 48.6% [14]. The Type 1 delay was most common (85.89%) comparatively to Type 2 and 3 delay[15]. Type II and Type III delays were less common in the present study, each accounting for 10.0%. This shows that delay in deciding to seek care remains an important preventable factor in maternal deaths [16]. The main Type I delay factors were lack of awareness of danger signs (30.0%), illiteracy and ignorance (25.0%), and neglect of danger signs (25.0%). These are similar to the awareness and education-related barriers reported. Type II delay was mainly due to failure to reach the proper facility in time, while Type III delay was due to delay in diagnosis. Overall, 90.0% of deaths were preventable, with a significant association between type of delay and preventability, highlighting the need for early recognition, timely referral, and prompt treatment [6,7,11,13].

### Limitations

The study was based on a small sample size of 20 cases from a single tertiary care institution over a one-year period, which limits the statistical power and the generalizability of the findings to the wider population.

## CONCLUSION

The present study demonstrates Type 1 delay was the major contributor with Lack of awareness of danger signs, illiteracy, ignorance, and neglect of warning symptoms were the leading determinants, occurring predominantly among unbooked women from low socioeconomic and rural backgrounds. A substantial proportion of these deaths were judged preventable, indicating considerable scope for intervention. Strengthening community health awareness, promoting birth preparedness, improving antenatal registration, and ensuring timely referral are essential to reduce avoidable deaths. Addressing these modifiable delays through coordinated efforts at the household, community, and health-system levels is key to improving maternal survival

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