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Effectiveness of ANMOL in tracking high-risk pregnancies and non-institutional deliveries in Satna District, Madhya Pradesh

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Abstract

Background: Early identification and appropriate management of high-risk pregnancies, along with timely institutional delivery, are essential for improving maternal and neonatal outcomes. ANMOL (Auxiliary Nurse Midwife Online) is a digital Reproductive and Child Health platform designed to facilitate pregnancy registration, tracking of antenatal care, identification of high-risk pregnancies, and follow-up of beneficiaries. **Objective:** To assess the effectiveness of the ANMOL portal in tracking high-risk pregnancies, monitoring their management, and identifying non-institutional deliveries in Satna district, Madhya Pradesh. **Methods:** A prospective observational study was conducted from April to October 2026 across six blocks of Satna district: Nagod, Rampur Baghelan, Unchahara, Chitrakoot (Majhgawa), Kothi, and Satna City. Data were collected through monthly visits to Community Health Centres and review of ANMOL records. Haemoglobin levels, blood pressure, and urine protein were assessed to identify maternal risk conditions. An independent reassessment of these parameters was performed in a randomly selected 20% of pregnant women in each block to verify record accuracy. Women were followed until delivery and up to 42 days postpartum. **Results:** Of 15,715 targeted pregnant women, 14,440 (92%) were registered on ANMOL, of whom 12,268 (85%) were registered during the first trimester. Among 15,320 expected deliveries, 360 women (2.3%) were identified with severe anaemia, of whom 309 (86%) received management. Pregnancy-induced hypertension was identified in 723 women (4.7%), with 634 (88%) receiving management. Considerable inter-block variation was observed in identification and management rates. A total of 302 non-institutional deliveries were reported, comprising 248 home deliveries and 54 in-transit deliveries. Twelve maternal deaths were recorded in the available block-wise data in the six-month period. **Conclusion:** ANMOL facilitated pregnancy registration, identification and tracking of high-risk conditions, and documentation of non-institutional deliveries in Satna district. However, variations in first-trimester registration and management of identified complications indicate scope for improvement in timely registration, clinical follow-up, referral, and birth preparedness. Strengthening data quality, supportive supervision, and follow-up mechanisms may enhance the utility of ANMOL in maternal healthcare delivery.

Keywords: *ANMOL, High-risk pregnancy, Maternal health, Severe anaemia, Pregnancy-induced hypertension, Non-institutional delivery, Digital health, Madhya Pradesh*

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1. Introduction

Maternal and neonatal outcomes depend substantially on early identification of complications, adequate antenatal care, and delivery at an equipped health facility. High-risk pregnancies, such as those complicated by anaemia, hypertension or pre-eclampsia, gestational diabetes, previous caesarean section, multiple pregnancy, bleeding, or advanced maternal age, require closer follow-up and timely referral. Non-institutional deliveries, meanwhile, remain a critical gap because they may delay recognition and management of obstetric emergencies, increasing the risk of maternal and newborn deaths (World Health Organization, 2016, 2022; Ministry of Health and Family Welfare, 2018).

ANMOL (Auxiliary Nurse Midwife Online) is a tablet-based Reproductive and Child Health application used by Auxiliary Nurse Midwives (ANMs) to register and track pregnant women, record antenatal and postnatal services, and identify beneficiaries requiring follow-up. In Madhya Pradesh, the application includes a High-Risk Pregnant Woman (HRPW) module intended to support early identification and timely management of high-risk pregnancies; it also generates due lists, dashboards, and service-tracking information for frontline workers (Ministry of Health and Family Welfare, 2017; National Health Mission, Madhya Pradesh, n.d.-a, n.d.-b).

Madhya Pradesh introduced ANMOL in 2019 as part of its digital Reproductive and Child Health platform. Pregnant women are expected to be registered soon after pregnancy is confirmed, enabling tracking of antenatal check-ups, estimation of expected date of delivery, and identification of potential complications (Sharma *et al.*, 2024). The state has more recently launched ANMOL 2.0, with an emphasis on complete registration of pregnant women, regular antenatal care, early identification of high-risk pregnancies, and timely service delivery (Business Standard, 2025).

Satna district provides an appropriate setting to examine whether this digital tracking system translates into effective field-level action. Although ANMOL is designed to improve real-time recording and follow-up, its public-health value depends on whether ANMs accurately identify and classify high-risk pregnancies, update records, act on alerts and due lists, counsel women for institutional delivery, and ensure referral or delivery planning before the expected date of delivery. The application itself can support these processes, but it cannot by itself guarantee complete registration, data quality, or appropriate clinical follow-up (Ministry of Health and Family Welfare, 2017; National Health Mission, Madhya Pradesh, n.d.-b; Population Research Centre, 2021).

There is therefore a need to assess ANMOL not merely as a data-entry tool, but as an intervention for maternal-risk management. Evidence on its effectiveness in Satna can help identify implementation strengths, such as timely registration, correct risk classification, and use of due lists, as well as barriers such as incomplete records, delayed data entry, inadequate risk assessment, poor connectivity, workload constraints, or insufficient follow-up of women planning home deliveries. Such evidence can inform corrective supervision, training, and district-level maternal-health planning (National Health Mission, Madhya Pradesh, n.d.-a; Sharma *et al.*, 2024; Population Research Centre, 2021).

2. Materials and methods

A prospective observational study was conducted in Satna district, Madhya Pradesh, between April 2026 and October 2026 to assess the effectiveness of the ANMOL (ANM Online) portal in tracking high-risk pregnancies and identifying home and in-transit deliveries. The study covered six blocks of Satna district, namely Nagod, Rampur Baghelan, Unchahara, Chitrakoot (Majhgawa), Kothi, and Satna City. Ethical approval for the study was obtained from the Institutional Ethics Committee, Government Medical College (GMC), Satna, Madhya Pradesh, prior to the commencement of data collection.

Detailed socio-demographic data regarding pregnant women registered on the ANMOL portal under the Community Health Centres (CHCs) of the six blocks of Satna district were collected through monthly visits to the respective CHCs. During each visit, information available on the ANMOL portal was reviewed,

and the registered pregnant women were interviewed to ensure that data added to the ANMOL portal were accurate, as well as to assess them for a detailed risk profile.

The research team randomly selected 20% of pregnant women in each block and repeated the following investigations independently to verify the precision of records maintained by healthcare workers in the ANMOL portal:

1. **Haemoglobin (Hb) levels:** To identify anaemia among pregnant women.
2. **Blood pressure (BP):** To identify women with hypertension and potential hypertensive disorders of pregnancy.
3. **Urine protein:** To screen for pre-eclampsia.

All registered pregnant women included in the study were followed prospectively throughout pregnancy until delivery and for 42 days following delivery (postpartum period). The follow-up was intended to assess maternal outcomes and evaluate the continuity of tracking.

3. Results

When pregnant women (PW) registered in ANMOL during 2025–26 were compared with the proportional target, and with whether registration occurred in the first trimester (Table 1), 14,440 of the 15,715 targeted women were registered, or 92% overall, while 12,268 of those registered were recorded in the first trimester, or 85%. Registration performance was broadly strong across blocks: Nagod, Rampur Baghelan, Unchahara, Chitrakoot (Majhgawa), and Kothi each registered about 90–92% of their targets, with first-trimester registration between 85% and 88%. Satna City had the highest registration share at 96%, but the lowest first-trimester share at 75%, suggesting that although many women are eventually entered into ANMOL, registration often occurs later in pregnancy there.

Table 1: Pregnancy registrations, targets and first-trimester registrations in Satna District, April–October 2026

S. No.	Block	Total PW registered in ANMOL 2025–26	Proportional target for registration	PW registered in ANMOL	% of proportional target	Registration in 1st trimester	%
1	Nagod	4530	2581	2365	92	2083	88
2	Rampur Baghelan	5110	2912	2673	92	2305	86
3	Unchahara	4066	2317	2078	90	1822	88
4	Majhgawa	5545	3160	2885	91	2450	85
5	Kothi	4328	2466	2260	92	1965	87
6	Satna City	4000	2279	2179	96	1643	75
Total		**27579**	**15715**	**14440**	**92**	**12268**	**85**

PW, pregnant women.

District-wide, 360 severe anaemia cases were identified among 15,320 expected deliveries (Table 2), equal to 2.3%, and 309 cases, or 86%, received management. Block-level identification was close to the expected 2% in most areas, but Satna City stood out with 81 cases, or 3.7%; Kothi had the lowest management rate at 73%, while Nagod performed best at 94%.

Table 2: Severe anaemia prevalence among pregnant women and proportion of cases successfully managed, Satna District, April–October 2026

S. No.	Block	Total PW expected for delivery	Severe anaemia	%	Severe anaemia managed*	% managed
1	Nagod	2473	51	2.1	48	94
2	Rampur Baghelan	2763	51	1.8	47	92
3	Unchahara	2331	59	2.5	52	88
4	Majhgawa	3178	69	2.2	55	80
5	Kothi	2394	49	2.0	36	73
6	Satna City	2181	81	3.7	71	88
Total		**15320**	**360**	**2.3**	**309**	**86**

**Management by blood transfusion (BT), injectable iron sucrose (IS) or ferric carboxymaltose (FCM). PW, pregnant women.*

Overall, 723 pregnancy-induced hypertension (PIH) cases were identified among 15,320 expected deliveries (Table 3), or 4.7%, and 634 cases, or 88%, were managed. Satna City again had the highest reported burden at 7.4%, while Unchahara and Kothi had comparatively lower management rates of 77% and 79%; Nagod and Chitrakoot (Majhgawa) achieved 98% management.

Table 3: Pregnancy-induced hypertension (PIH) prevalence among pregnant women and proportion of cases successfully managed, Satna District, April–October 2026

S. No.	Block	Total PW expected for delivery	PIH	%	Total PIH cases managed	% managed
1	Nagod	2473	97	3.9	95	98
2	Rampur Baghelan	2763	99	3.6	90	91
3	Unchahara	2331	114	4.9	88	77
4	Majhgawa	3178	132	4.2	129	98
5	Kothi	2394	119	5.0	94	79
6	Satna City	2181	162	7.4	138	85
Total		**15320**	**723**	**4.7**	**634**	**88**

PW, pregnant women.

Maternal mortality was highest in Unchahara block of Satna District, at 200 maternal deaths per lakh live births (Table 4), which is 1.48 times higher than the state maternal mortality ratio of 135 maternal deaths per lakh live births. Other blocks reported much lower MMR than Unchahara, with Nagod reporting an MMR of 91, Rampur Baghelan 41, Majhgawa 72, and Satna City 76. Satna City had the highest number of live births at 3959, while Unchahara block reported the lowest at 2002.

Table 4: Live births and maternal mortality in Satna District, April–October 2026				
S. No.	**Block**	**Total live births**	**No. of maternal deaths**	**MMR**
1	Nagod	2207	2	91
2	Rampur Baghelan	2415	1	41
3	Unchahara	2002	4	200
4	Majhgawa	2796	2	72
5	Satna City	3959	3	76
Total		**13379**	**12**	**90**

MMR, maternal mortality ratio per 100,000 (one lakh) live births. Kothi block was not reported.

There were 302 non-institutional deliveries district-wide (Table 5): 248 at home and 54 in transit. Chitrakoot (Majhgawa) accounted for the largest share with 111 cases, including 10 in-transit deliveries, while Kothi had an unusually high share of in-transit deliveries (43 of its 81 cases), whereas Satna City reported only one such delivery.

Table 5: Home deliveries and in-transit deliveries in Satna District, April–October 2026				
S. No.	**Block**	**Home delivery**	**In-transit delivery**	**Total**
1	Nagod	30	1	31
2	Rampur Baghelan	53	0	53
3	Unchahara	25	0	25
4	Majhgawa	101	10	111
5	Kothi	38	43	81
6	Satna City	1	0	1
Total		**248**	**54**	**302**

4. Discussion

Early registration is an essential component of antenatal care, as it provides an opportunity for timely identification of risk factors, appropriate investigations, counselling and intervention. The World Health Organization recommends that the first antenatal care contact should occur within the first 12 weeks of pregnancy (World Health Organization, 2016).

An important comparison can be made with the report published by the Observer Research Foundation (ORF) in 2024, which covered 15 districts of Madhya Pradesh and examined the implementation of the RCH portal and ANMOL (Sharma *et al.*, 2024). The report demonstrated a positive and statistically significant association between RCH portal coverage and early initiation of antenatal care ($\beta = 0.601$, $p < 0.05$). However, it also identified substantial discrepancies between ANM registers and ANMOL records. Only 9.5% of the 84 records assessed showed consistency between the two data sources.

In comparison, the present study found 92% pregnancy registration coverage and 85% first-trimester registration, suggesting encouraging performance in the selected blocks of Satna district. Nevertheless, the independent verification of records remains important because high registration coverage does not necessarily indicate complete or accurate data entry.

Block-wise analysis revealed that Satna City had the highest registration coverage (96%) but the lowest proportion of first-trimester registration (75%). This finding suggests that although pregnancy registration is relatively comprehensive in Satna City, early identification remains a challenge. Delayed registration may reduce opportunities for timely screening and management of complications.

A systematic review by Singh and Walters (2024), focusing on mHealth interventions in the BIMARU states of India, also reported favourable effects of mobile health interventions on pregnancy registration, antenatal care utilization and birth preparedness. One of the included studies reported higher pregnancy registration in the intervention group than in the comparison group (80.4% versus 75.3%, $p < 0.001$). The review concluded that mobile health interventions have considerable potential to strengthen maternal and child healthcare services in resource-limited settings, although implementation barriers remain.

These findings support the role of ANMOL in improving pregnancy registration and facilitating early antenatal follow-up. However, emphasis should be placed on timely registration rather than merely achieving numerical registration targets.

The severe anaemia prevalence of 2.3% observed in Satna is substantially lower than the overall anaemia prevalence reported by Kuppusamy *et al.* (2023). However, these figures are not directly comparable because the national study included anaemia of all severities, whereas the present study specifically reports severe anaemia. A more recent study by Shinde *et al.* (2026), conducted among 292 recently delivered women in an urban slum area of Mumbai, reported a high-risk pregnancy prevalence of 56.5%. Severe anaemia was one of the most frequently identified risk factors, accounting for 24.2% of the high-risk pregnancy group. The study also demonstrated that high-risk pregnancies were associated with higher rates of preterm delivery and neonatal morbidity. Although the study population and risk classification criteria differed from those in Satna, these findings reinforce the importance of systematic identification and management of severe anaemia during pregnancy.

5. Conclusion

The present study demonstrates that ANMOL is a useful digital platform for tracking pregnancies and identifying high-risk cases in Satna district, Madhya Pradesh. Overall pregnancy registration coverage was 92%, with 85% of registered women enrolled during the first trimester. The study identified 360 cases of severe anaemia and 723 cases of pregnancy-induced hypertension, of which 86% and 88%, respectively, received management. These findings highlight the potential of ANMOL in facilitating early identification, monitoring and follow-up of high-risk pregnancies. However, considerable block-wise variations in the management of maternal complications indicate the need for strengthening clinical follow-up and referral services.

The identification of 302 non-institutional deliveries, comprising 248 home deliveries and 54 in-transit deliveries, highlights persistent gaps in institutional delivery services, birth preparedness and accessibility of healthcare facilities. The overall reported maternal mortality ratio was 90 per 100,000 live births, with considerable variation across blocks. The study emphasizes that the effectiveness of ANMOL depends not merely on pregnancy registration but also on accurate data entry, regular updating of clinical parameters, timely referral and continuity of care throughout pregnancy and the postpartum period. Strengthening frontline supervision, emergency transportation and counselling for institutional delivery may further enhance its effectiveness in improving maternal healthcare outcomes.

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