

## ORIGINAL RESEARCH ARTICLE

Assessing demand-side financial interventions  
for maternal and neonatal health in Bihar, IndiaMayadhar Sethy<sup>\*</sup>, Sandhya R. Mahapatro<sup></sup>, and Santosh Kumar Mishra<sup></sup>

Nabakrushna Choudhury Centre for Development Studies, Bhubaneswar, Odisha, India

## Abstract

India has implemented demand-side financing programs, including Janani Bal Suraksha Yojana (JBSY) and Pradhan Mantri Matru Vandana Yojana (PMMVY), to reduce financial barriers and improve maternal and neonatal health outcomes. This study assesses their implementation and equity in Bihar, India. A cross-sectional survey across eight districts ( $N = 1,247$ ) with qualitative interviews ( $n = 42$ ) revealed severe deficits in awareness, coverage, and timeliness. Notably, 69.7% of women were unaware of PMMVY, and 13.7% were unaware of JBSY. Registration rates were low: 56.0% for JBSY and 2.4% for PMMVY. Only 39.0% of JBSY beneficiaries received payments within 30 days post-delivery. Significant socioeconomic inequities emerged: women from scheduled castes/scheduled tribes and those without formal education were markedly less likely to register or receive benefits. While JBSY beneficiaries incurred lower out-of-pocket expenditure (INR 1,509 vs. INR 2,619), persistent costs, delays, and informal payments undermined financial protection. Qualitative findings identified complex documentation, low digital literacy, and distrust in banking as barriers to Aadhaar-linked direct benefit transfers (DBT). Overall, the potential of conditional cash transfers remains constrained by low awareness, delayed payments, restrictive eligibility, and structural inequities. Strengthening impact requires robust awareness campaigns, simplified DBT systems with grievance redressal, targeted outreach to marginalized groups, and supply-side improvements.

**Keywords:** Conditional cash transfers; Maternal health; Health equity; Out-of-pocket expenditure; Scheme awareness; Direct benefit transfer; Implementation science; Bihar

## Academic editor:

Mihajlo Jakovljevic M.D. Ph.D. MAE

## \*Corresponding author:

Mayadhar Sethy  
(ncdsmayadhar.sethy@odisha.gov.in)

**Citation:** Sethy, M, Mahapatro, S. R., & Mishra, S. K. (2026). Assessing demand-side financial interventions for maternal and neonatal health in Bihar, India. *Global Health Econ Sustain*, 4(2):025390065.  
<https://doi.org/10.36922/GHES025390065>

**Received:** September 24, 2025**Revised:** January 11, 2026**Accepted:** March 4, 2026**Published online:** May 15, 2026

**Copyright:** © 2026 Author(s). This is an Open-Access article distributed under the terms of the Creative Commons Attribution License, permitting distribution, and reproduction in any medium, provided the original work is properly cited.

**Publisher's Note:** AccScience Publishing remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.

## 1. Introduction

The improvement of maternal and neonatal health outcomes remains a critical component of India's public health agenda. It is central to realizing the Sustainable Development Goals (SDGs), particularly SDGs 3.1 and 3.2, which target reducing the maternal mortality ratio (MMR) and eliminating preventable deaths of newborns and children under five. Given its vast population and wide socioeconomic disparities, India faces persistent challenges in ensuring equitable access to high-quality maternal and child healthcare services across all regions and communities. This study aims to assess the implementation equity and effectiveness of Janani Bal Suraksha Yojana (JBSY) and Pradhan Mantri Matru Vandana Yojana (PMMVY) in reducing financial barriers to maternal healthcare in Bihar, with a specific focus on awareness, coverage, the timeliness of benefits, and socioeconomic disparities. Bihar represents a crucial case study due to its historically high MMR, which, despite improvements, remains above the national

average at 118 per 100,000 live births (Sample Registration System, 2020), coupled with high fertility rates and significant socioeconomic marginalization of substantial population segments.

A fundamental barrier to accessing maternal and child health services in India is the high financial burden placed on individuals and households. Despite constitutional guarantees and policy commitments to universal health coverage, India's public health expenditure remains low (around 1.2% of gross domestic product). As a result, over 70% of healthcare spending is borne out-of-pocket, which is well above global norms (Reddy *et al.*, 2011; Sethy, 2025). This high out-of-pocket expenditure (OOPE) constrains access to essential services such as antenatal care, skilled delivery, and postnatal care and can push vulnerable families into financial distress, with catastrophic health expenditures disproportionately affecting poorer households (Brinda *et al.*, 2012).

To reduce OOPE and encourage uptake of institutional maternal health services, the Government of India has launched demand-side financial interventions structured primarily as conditional cash transfers (CCTs). The two flagship schemes in this domain are Janani Suraksha Yojana (JSY), introduced in 2005 and subsequently modified in various states, including Bihar, as JBSY, and PMMVY, rolled out in 2017. These programs aim to incentivize behaviors such as institutional delivery, timely antenatal care, and postnatal follow-up by offering financial support contingent on meeting specific healthcare milestones. CCTs represent a significant shift in health financing strategy, moving beyond pure supply-side investment to directly influence demand-side behaviors (Lagarde *et al.*, 2007).

Under JSY, pregnant women who deliver in public or accredited private healthcare facilities receive a cash incentive (India Rupee [INR] 1,400 in many states, with variations), along with ancillary support such as free medicines, diagnostics, and food in government hospitals. Empirical evaluations indicate that JSY has succeeded in increasing institutional deliveries and improving service uptake in many states (Mahapatro & Sethy, 2025; Powell-Jackson *et al.*, 2015). However, the effects are uneven across geographies and populations. For example, a spatial study of JSY coverage found that although only about 36.4% of women nationally have benefited from JSY, utilization is significantly clustered in certain districts, with rural and remote areas facing undercoverage (Kumar *et al.*, 2011). Several studies have documented substantial increases in institutional deliveries associated with JSY implementation, with one evaluation in Madhya Pradesh reporting a 42.6% increase post-implementation (Rajesh Dahiya & Kumari,

2020), and another nationwide study confirming its role in accelerating the increase of facility-based births (Lim *et al.*, 2010).

In India's low-performing states, JSY beneficiaries are observed to have higher rates of early breastfeeding initiation, postnatal check-ups, and contraceptive uptake compared to non-beneficiaries (Sen *et al.*, 2020). Nevertheless, despite JSY's promise of "free" services, many women still face informal payments, transportation costs, and purchases of medicines due to supply constraints in public facilities (Mohanty & Srivastava, 2013; Sidney *et al.*, 2012). Complementary to JSY is PMMVY, which provides INR 5,000 to women at the time of their first live birth, delivered in phased installments tied to pregnancy milestones. A recent statewide evaluation revealed that while awareness of PMMVY is high, only a fraction of beneficiaries receive all installments on time, and many spend the transferred amount on non-health-related needs (e.g., debt repayment), reducing the intended impact (Banerjee *et al.*, 2025). Moreover, a quasi-experimental study using National Family Health Survey (NFHS) data suggests that exposure to PMMVY has positive effects on child anthropometric outcomes (weight-for-age and height-for-age) among firstborns (Ray *et al.*, 2025).

Despite the gains in institutional deliveries, which increased from 39% in NFHS-3 (2005–2006) to 79% in NFHS-4 (2015–2016) and further to 89% in NFHS-5 (2019–2021), several implementation and equity gaps remain. Some women continue to incur OOPE, and the timing and adequacy of payments are frequently suboptimal (Bano *et al.*, 2020). Administrative challenges, including delays in disbursement, Aadhaar–bank linkage mismatches, incomplete birth registration, and software glitches, contribute to implementation inefficiencies (Banerjee *et al.*, 2025; Jain *et al.*, 2017).

Structural and socio-cultural inequities further erode the reach of these programs. Marginalized groups, such as scheduled castes/tribes (SC/ST), illiterate women, and economically disadvantaged households, are often less likely to be aware of their entitlements or to successfully register for schemes. A multi-state assessment observed that JSY's benefits are not equitably distributed within caste groups and that geographic remoteness and media exposure significantly influence utilization (Sardar *et al.*, 2025). Other researchers have underscored that education, road connectivity, and husbands' literacy are critical predictors of service uptake among poor rural women (Vora *et al.*, 2015). Intersectional vulnerabilities, where caste, class, gender, and geography combine, create particularly formidable barriers to accessing these health entitlements (Kapilashrami & Hankivsky, 2018).

The effect of JSY on maternal mortality has also been studied. In one hospital-based observational analysis in Madhya Pradesh, implementation of JSY was associated with a 42.6% rise in institutional deliveries, including among marginalized groups, with concomitant declines in maternal morbidity (Rajesh Dahiya & Kumari, 2020). The independent impact evaluation conducted by the Institute for Health Metrics and Evaluation concluded that JSY participants experienced reductions of 4 stillbirths and 2 neonatal deaths per 1,000 births (Lim *et al.*, 2020). To address persistent implementation challenges, some states and researchers have experimented with enhancements. For instance, in Madhya Pradesh, micro-evaluations tested digital enrollment and reminder postcards to improve beneficiary awareness and reduce delay in payments (Mohanani *et al.*, 2019). Other interventions propose integrating nutrition-sensitive elements into cash transfers or combining them with supply-side improvements to maximize benefits (Rasanathan & Diaz, 2023).

In this context, the present study, conducted across eight districts of Bihar, seeks to (i) assess awareness and registration levels of eligible women under JBSY and PMMVY; (ii) evaluate timeliness, adequacy, and utilization of incentives; (iii) identify institutional, socioeconomic, and behavioral barriers to equitable access; and (iv) analyze the potential of technological solutions such as Aadhaar-linked direct benefit transfer (DBT) to address disbursement delays. Bihar, with its historically high maternal mortality and large population reliant on public health systems, provides a critical setting to examine the performance and equity of these schemes. By scrutinizing these themes through a mixed-methods approach, the study aims to generate policy-relevant evidence to strengthen the design and implementation of demand-side maternal health programs, ensuring they are more inclusive, timely, and aligned with India's broader goals of reducing maternal and neonatal mortality and achieving universal health coverage in line with the SDGs.

## 2. Methods

### 2.1. Study design and setting

This study employed an explanatory sequential mixed-methods design conducted from January to December 2024. The quantitative phase consisted of a community-based cross-sectional survey, followed by a qualitative phase involving in-depth interviews and focus group discussions. The study was conducted across eight districts of Bihar: Patna, Gaya, Madhubani, Muzaffarpur, Rohtas, Jehanabad, Khagaria, and Bhagalpur, selected through stratified random sampling to represent the state's socioeconomic, geographic, and demographic diversity. Bihar was chosen

as the study setting due to its persistently high maternal and neonatal mortality indicators despite two decades of demand-side financing interventions.

### 2.2. Study population and sampling

The study population comprised women aged 18–49 years who had delivered a child within the preceding 24 months (January 2022 to December 2023). For the quantitative component, a multistage sampling design was employed. In the first stage, eight districts were purposively selected to represent geographic and socioeconomic diversity. In the second stage, four blocks were randomly selected from each district. In the third stage, two villages/urban wards were randomly selected from each block. Finally, from each selected village/ward, 20 eligible women were selected using systematic random sampling from updated village health register lists maintained by Accredited Social Health Activists (ASHAs). The sample size was calculated using the formula for estimating a single proportion:

$$n = \frac{Z^2 \times p \times q}{d^2} \quad (1)$$

where  $z$  was 1.96 (95% confidence level),  $p$  was 0.5 (maximum variability), and  $d$  was 0.05 (precision).

This yielded a minimum sample of 384, which was increased to 1,247 to account for design effect (1.5) and non-response (10%). For the qualitative component, purposive maximum variation sampling was used to select 42 participants (30 for in-depth interviews and 12 for two focus group discussions) to capture diverse perspectives across caste, education, economic status, and scheme beneficiary status.

Using the formula  $n = \frac{Z^2 \times p \times q}{d^2}$ , with  $Z = 1.96$  (95% confidence level),  $p = 0.5$  (maximum variability), and  $d = 0.05$  (precision), the minimum required sample size was 384. After adjusting for a design effect of 1.5 ( $384 \times 1.5 = 576$ ) and a 10% non response rate ( $576 / 0.9 \approx 640$ ), the target minimum sample was approximately 640 women. To enhance the precision of subgroup analyses and account for expected heterogeneity across districts, we recruited a final sample of 1,247 eligible women. For the qualitative component, purposive maximum variation sampling was used to select 42 participants (30 for in depth interviews and 12 for two focus group discussions) to capture diverse perspectives across caste, education, economic status, and scheme beneficiary status.

### 2.3. Data collection instruments and procedures

Quantitative data were collected through a structured, pretested interview schedule administered in the local

language (Hindi/Bhojpuri/Maithili) by trained female researchers. The instrument covered: (i) sociodemographic characteristics; (ii) awareness and knowledge of JBSY and PMMVY; (iii) registration status and process; (iv) receipt, timing, and utilization of benefits; (v) OOPes; (vi) healthcare utilization patterns; and (vii) perceptions and satisfaction. The survey instrument was developed based on existing literature and expert consultation, then pilot tested with 50 women in a non-sampled district and refined accordingly. Qualitative data were collected through semi-structured interview guides and focus group discussion topic guides exploring experiences, barriers, facilitators, and suggestions regarding scheme implementation. All qualitative interviews were audio-recorded with permission, transcribed verbatim, and translated to English while preserving contextual meaning.

## 2.4. Data analysis

Quantitative data were analyzed using STATA version 17.0 (StataCorp, United States [US]). Descriptive statistics (frequencies, percentages, and means with standard deviations) were calculated for all variables. Bivariate analysis using chi-square tests examined associations between sociodemographic factors and scheme awareness, registration, and benefit receipt. Multivariate logistic regression models were constructed to identify independent predictors of scheme registration and timely benefit receipt, adjusting for potential confounders, including age, caste, education, economic status, parity, and district. Thematic analysis was conducted for qualitative data following Braun and Clarke's (2006) six-step approach: familiarization, initial coding, theme identification, review, definition, and reporting. NVivo 12 software (QSR International, US) facilitated coding and theme management. Mixed-methods integration occurred at the interpretation stage, where quantitative findings were explained and contextualized through qualitative insights.

## 3. Results

### 3.1. Awareness and coverage

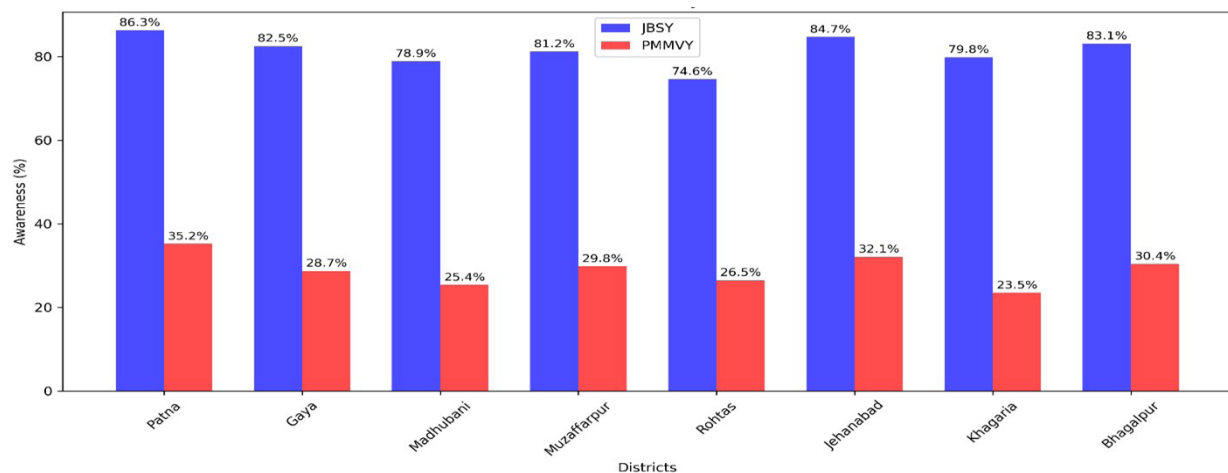
Figure 1 illustrates the stark disparity in awareness between the two maternal health schemes across eight districts of Bihar. While JBSY awareness ranged from 74.6% (Rohtas) to 86.3% (Patna), PMMVY awareness was critically low, ranging from 23.5% (Khagaria) to 35.2% (Patna). The district-level variations highlight geographic inequities in information dissemination, with more developed districts such as Patna showing better performance for both schemes. The consistent pattern of significantly lower PMMVY awareness, despite its status as a national flagship program, indicates systemic failures in communication

strategy, particularly for newer schemes with complex eligibility criteria.

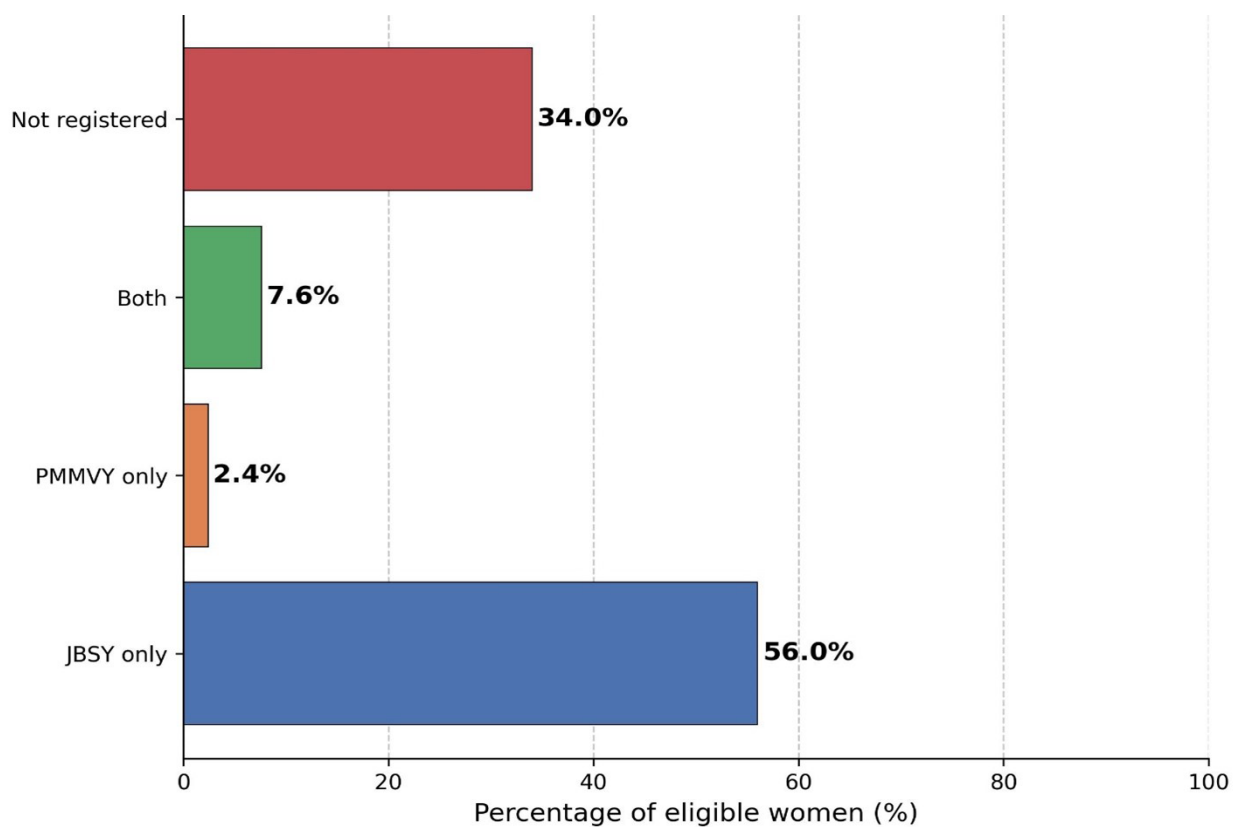
Lack of awareness remained a substantial barrier to the effective utilization of maternal benefit schemes in Bihar. Among the 1,247 surveyed women, 13.7% ( $n = 171$ ) were unaware of the JBSY, a concerning figure given the scheme's operational presence since 2006. Even more alarming was the 69.7% ( $n = 869$ ) unawareness rate for PMMVY, a nationally scaled program intended to promote improved nutrition and healthcare-seeking behaviors during pregnancy. District-level disparities further compound the issue (Figure 1). In Rohtas, the highest unawareness rate for JBSY was recorded at 25.4%, while Khagaria exhibited the most significant knowledge gap regarding PMMVY, with 76.5% of women unaware of the scheme. These figures reflect a fragmented and inconsistent communication and outreach strategy, particularly in remote or underserved areas where public health messaging tends to be weakest.

This visualization breaks down the registration and benefit receipt cascade among eligible women. Only 56.0% registered for JBSY and a mere 2.4% for PMMVY, with 34.0% not registered for any scheme despite eligibility. Among JBSY registrants, only 67.0% received the full benefit, revealing a significant implementation gap between registration and actual benefit transfer. The minuscule PMMVY registration (2.4%) compared to its theoretical coverage highlights profound structural barriers to accessing newer, more complex schemes. This "leaky pipeline" from eligibility to benefit receipt illustrates systemic inefficiencies that undermine program effectiveness (Figure 2).

Among women who delivered in a healthcare facility, only 56.0% ( $n = 699$ ) were registered under JBSY, and a notably low 2.4% ( $n = 30$ ) were enrolled in PMMVY. Thirty-four percent ( $n = 424$ ) of respondents had not registered under any scheme, despite being eligible. This disconnect between awareness and registration points to persistent implementation bottlenecks, ranging from ineffective information dissemination and cumbersome registration logistics to limited engagement by frontline health workers. Similar challenges have been documented in prior evaluations of CCT programs across India (Hunter & Sugiyama, 2014; Lim *et al.*, 2010). The especially low uptake of PMMVY, despite its intent to incentivize early registration and antenatal care visits, may be attributed to more complex eligibility requirements, such as its restriction to the first live birth and burdensome application procedures. These conditions act as deterrents, particularly for low-literacy or socioeconomically marginalized populations (Devkota *et al.*, 2021; Jain *et al.*, 2017).



**Figure 1.** District-wise awareness of Janani Bal Suraksha Yojana (JBSY) and Pradhan Mantri Matru Vandana Yojana (PMMVY) in eight study districts of Bihar



**Figure 2.** Scheme registration status among eligible women ( $N = 1,247$ ). The figure displays the proportion of women registered under Janani Bal Suraksha Yojana (JBSY) only, Pradhan Mantri Matru Vandana Yojana (PMMVY) only, both schemes, or neither. Among all eligible women, 56.0% registered only for JBSY, 2.4% registered only for PMMVY, and 7.6% registered for both schemes. Notably, 34.0% of eligible women were not registered under any scheme despite being entitled to benefits. The low PMMVY registration reflects complex eligibility criteria and documentation burdens, while the substantial proportion of unregistered women indicates persistent outreach and administrative gaps. Data are based on a cross-sectional survey across eight districts of Bihar.



**Table 1. Sociodemographic characteristics of study participants (N = 1,247)**

Characteristic	Number (n)	Percentage (%)
Age group (years)		
18–24	523	41.9
25–29	478	38.3
30–34	187	15.0
≥35	59	4.7
Caste category		
Scheduled caste	287	23.0
Scheduled tribe	112	9.0
Other Backward Class	674	54.0
General/Others	174	14.0
Education level		
No formal education	398	31.9
Primary (1–5 years)	336	26.9
Secondary (6–10 years)	374	30.0
≥Higher secondary	139	11.2
Economic status (BPL card)		
BPL cardholder	723	58.0
Non-BPL	524	42.0
Parity		
Primiparous (1 child)	387	31.0
Multiparous (2–3 children)	674	54.0
Grand multiparous (≥4 children)	186	14.9
Residence		
Rural	998	80.0
Urban	249	20.0
Occupation		
Housewife/Unemployed	974	78.1
Agricultural labor	187	15.0
Other employment	86	6.9

Abbreviation: BPL: Below poverty line.

**Table 1** presents the sociodemographic profile of the 1,247 women surveyed across eight districts of Bihar. The sample reflects Bihar's population characteristics: predominantly rural (80.0%), with high proportions of marginalized communities (SC/ST: 32.0%), low educational attainment (no formal education: 31.9%), and economic vulnerability (below poverty line [BPL] cardholders: 58.0%). The age distribution shows a concentration in the reproductive years (18–29 years: 80.2%), and parity indicates most women had 2–3 children (54.0%). This profile is crucial for contextualizing the findings, as these characteristics intersect to create varying levels of vulnerability and access

to health schemes. The data provide the basis for analyzing equity in scheme access across different social strata.

Multivariate analysis revealed significant predictors of scheme awareness and registration (**Table 2**). Compared to women from general categories, women from SC had 35% lower odds (aOR: 0.65; 95% CI: 0.48–0.89), and women from ST had 48% lower odds (aOR: 0.52; 95% CI: 0.35–0.78) of being aware of PMMVY. Similarly, women with no formal education had 60% lower odds of JBSY registration (aOR: 0.40; 95% CI: 0.28–0.57) compared to those with higher secondary or higher education. Economic status, measured by possession of a BPL card, showed a paradoxical

association: while BPL cardholders had higher awareness, they had lower registration rates (aOR: 0.85; 95% CI: 0.68–1.06), suggesting eligibility documentation barriers despite theoretical targeting. Qualitative insights revealed that information dissemination largely occurs through ASHAs, but their outreach is inconsistent and often excludes the most marginalized households, who may be geographically isolated or socially ostracized. Additional methodological details are provided in Section A1.

## 3.2. Duration, amount, and utilization of benefits

Figure 3 highlights substantial inter-district variation in the timeliness of JBSY benefit disbursement. While Jehanabad performed relatively well (64.5% receiving payments within 30 days), Madhubani and Rohtas have concerning delays (only 28.3% and 31.2% of payments received within 30 days, respectively). The significant proportion of red segments (“after 60 days or not received”) across all districts indicates systemic delays in payment processing. This geographic inequity in administrative efficiency directly affects the utility of cash transfers for addressing immediate postpartum needs. The variation suggests that local governance, capacity of frontline workers, and banking infrastructure, rather than just policy design, determine beneficiaries’ actual experience with cash transfer programs.

Timely disbursement of financial benefits is critical to reducing economic barriers during and immediately after pregnancy. In the case of JBSY, only 39% ( $n = 273$ ) of beneficiaries reported receiving the funds within 30 days of delivery. A significant 33.3% ( $n = 233$ ) experienced delays exceeding two months, diminishing the utility of cash transfers in addressing urgent postnatal needs. Among the study districts, Jehanabad demonstrated the best performance, with 64.5% of beneficiaries receiving payments within 30 days. This suggests that administrative efficiency and proactive involvement of frontline health workers can lead to improved outcomes. In contrast, districts such as Madhubani and Rohtas experienced the highest rates of delay, highlighting systemic inefficiencies and uneven implementation across regions.

Moreover, 29% ( $n = 203$ ) of women registered under JBSY reported receiving no monetary benefit at all, and 4.7% ( $n = 33$ ) reported partial payments. Field interviews revealed multiple administrative challenges, including delays in data entry, a lack of linkage between beneficiary records and bank accounts, and incomplete documentation. Many beneficiaries relied on ASHAs to process their claims. However, reports also emerged of informal commissions being demanded by intermediaries, including ASHAs and facility staff. These practices undermine trust and

satisfaction with the disbursement process (Sharma *et al.*, 2018; Vellakkal *et al.*, 2016). In terms of utilization, most women reported using the funds for essential maternal health needs: 70% spent the money on food, and 68.7% on purchasing medicines. These findings suggest that when accessible, cash transfers effectively support the intended health outcomes. However, 9% of respondents considered the financial support inadequate, particularly in cases involving medical complications or elevated OOPe.

This multivariate analysis identified independent predictors of JBSY registration after controlling for confounding factors. SC/ST women have significantly lower odds of registration (aOR: 0.65 and 0.52, respectively), as do women with no formal education (aOR: 0.40). Economic status (BPL cardholding) shows no significant independent association, suggesting that caste and education barriers transcend economic targeting. District-level variations persist even after adjusting for individual characteristics, with Madhubani and Rohtas performing significantly worse than Patna. This indicates that systemic implementation factors at the district level, such as administrative capacity, ASHA motivation, or banking infrastructure, substantially influence access beyond individual sociodemographic factors. The findings underscore the intersectional nature of exclusion from health entitlements.

Importantly, 88% of surveyed women expressed a preference for receiving financial assistance both before and after delivery. This reflects a broader need to restructure the current disbursement schedule to better align with maternal care requirements, including nutrition, transport, and rest during the third trimester and postnatal period. These findings are consistent with international evidence that highlights how fragmented implementation, insufficient benefit amounts, and mistimed disbursements undermine the equity-enhancing potential of demand-side financing interventions (Bogg *et al.*, 2016; Glassman *et al.*, 2013). The qualitative findings particularly emphasized the burden of “hidden costs” not covered by the schemes, including transportation (especially for emergency referrals), companion expenses, and informal payments for ostensibly free services, which disproportionately affect poorer households.

## 3.3. Barriers to utilization

Figure 4 synthesizes qualitative insights on barriers to accessing maternal health schemes. Complex documentation emerged as the most frequently cited barrier (85.7%), particularly for PMMVY, which requires multiple proofs and timely submission. Lack of awareness (78.6%) and delayed payments (71.4%) followed closely,

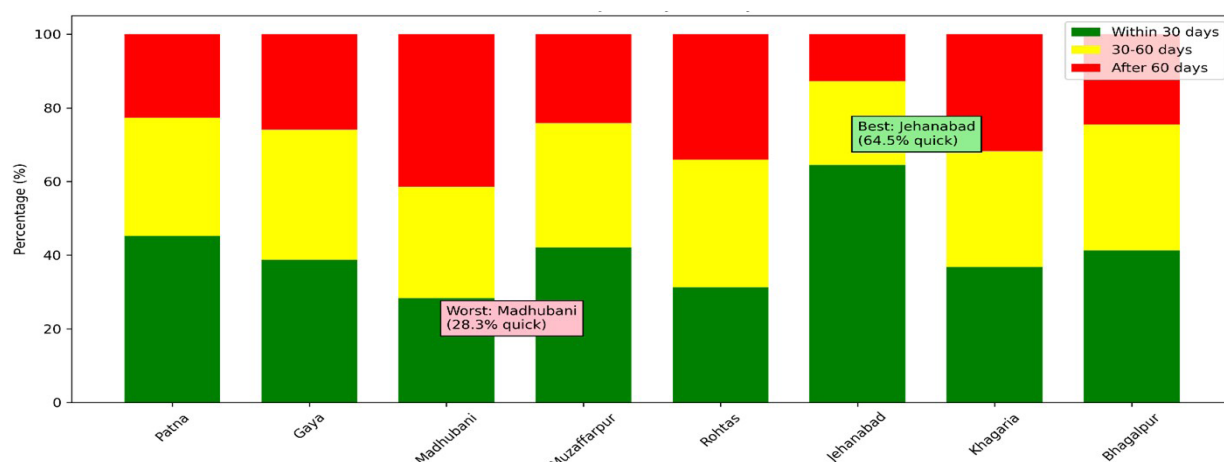


Figure 3. Timeliness of Janani Bal Suraksha Yojana (JBSY) benefit disbursement by district

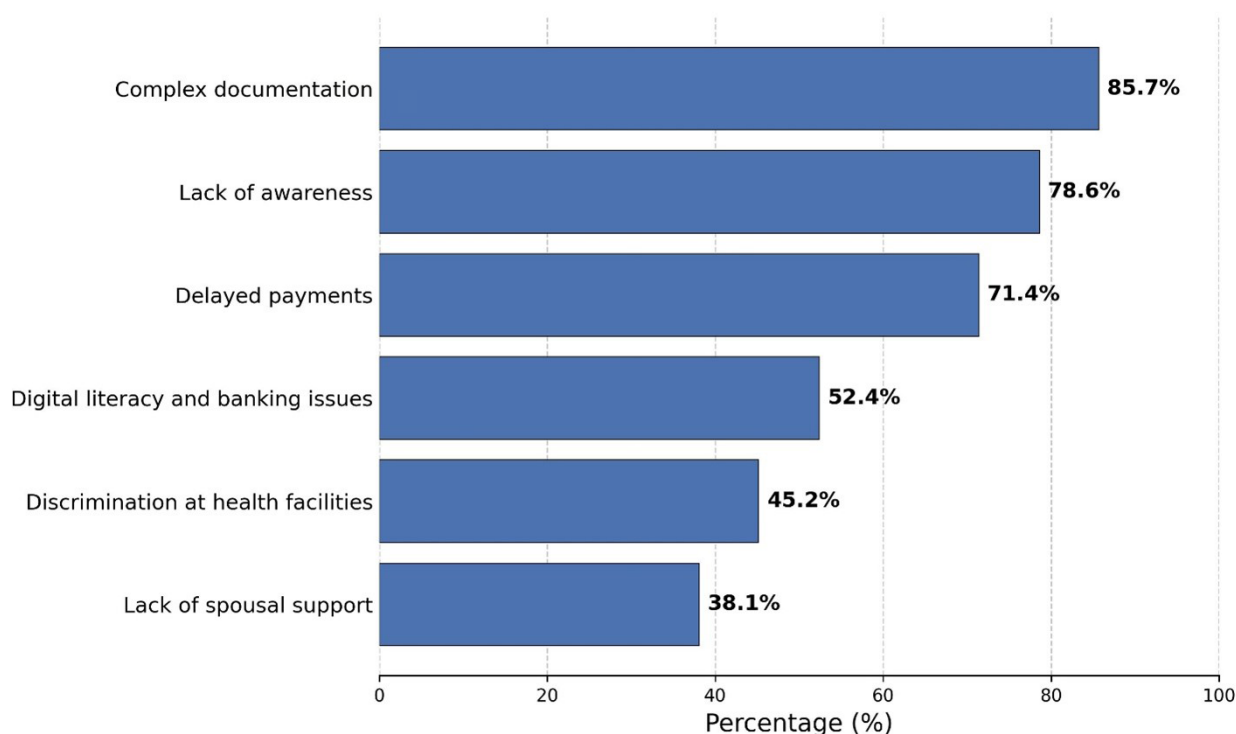
Table 2. Multivariate logistic regression analysis of factors associated with JBSY registration (N = 1,247)

Predictor variable	Category	Adjusted odds ratio	95% CI	p-value
Caste category	General/Others (Ref.)	1.00	-	-
	OBC	0.82	0.61–1.10	0.187
	Scheduled caste (SC)	0.65	0.48–0.89	0.007*
	Scheduled tribe (ST)	0.52	0.35–0.78	0.001*
Education level	≥Higher secondary (Ref.)	1.00	-	-
	Secondary	0.78	0.55–1.10	0.157
	Primary	0.61	0.43–0.87	0.006*
	No formal education	0.40	0.28–0.57	<0.001*
Economic status	Non-BPL (Ref.)	1.00	-	-
	BPL cardholder	0.85	0.68–1.06	0.147
Age group (years)	≥35 (Ref.)	1.00	-	-
	30–34	1.12	0.74–1.70	0.587
	25–29	1.25	0.84–1.86	0.271
	18–24	1.18	0.79–1.77	0.418
Parity	Primiparous (Ref.)	1.00	-	-
	Multiparous	0.91	0.72–1.15	0.423
	Grand multiparous	0.77	0.56–1.06	0.108
District	Patna (Ref.)	1.00	-	-
	Gaya	0.88	0.65–1.20	0.426
	Madhubani	0.72	0.53–0.98	0.038*
	Muzaffarpur	0.94	0.69–1.28	0.692
	Rohtas	0.69	0.50–0.94	0.020*
	Jehanabad	1.15	0.84–1.58	0.388
	Khagaria	0.75	0.55–1.03	0.077
	Bhagalpur	0.97	0.71–1.33	0.857

Notes: Model adjusted for all variables listed. Reference categories marked as Ref. \* $p < 0.05$ .

Abbreviation: BPL: Below poverty line; JBSY: Janani Bal Suraksha Yojana; OBC: Other Backward Class.





**Figure 4.** Primary barriers to scheme access identified through qualitative interviews ( $n = 42$ )

indicating failures in both information dissemination and benefit delivery systems. Notably, “softer” barriers, such as discrimination at health facilities (45.2%) and lack of spousal support (38.1%), while less frequently mentioned, represent critical social and cultural constraints that disproportionately affect marginalized women. The prominence of digital literacy and banking issues (52.4%) highlights the challenges in transitioning to DBT systems without adequate support mechanisms.

Despite the promise of CCT schemes, such as JBSY and PMMVY, in improving maternal health outcomes, a complex interplay of socioeconomic, institutional, and cultural barriers continues to limit their full utilization. An analysis of primary data and district-level trends in Bihar underscores the systemic and intersectional nature of these challenges (Figure 4).

### 3.4.1. Socioeconomic disparities

Chi-square analysis revealed statistically significant associations between social identity markers, particularly education level and caste status, and both registration under the schemes and receipt of benefits. Among women from SC/ST, only 61.0% of illiterate women received benefits, in contrast to 74.5% of their non-SC/ST counterparts. These findings confirm that health interventions often

fail to reach the most marginalized when they rely heavily on proactive registration and documentation (Ahmed *et al.*, 2016). While economic status alone did not show an independent significant effect, it compounded existing barriers when intersecting with low education and SC/ST identity. Women from disadvantaged groups frequently face structural and social hurdles, including discrimination at health facilities and distrust of government actors, which leads to systemic exclusion from entitlements and further entrenches health inequities (George, 2007; Kruk *et al.*, 2018). Qualitative narratives revealed experiences of caste-based discrimination during registration processes and at health facilities, with several Dalit women reporting being made to wait longer or being spoken to disrespectfully by frontline workers.

### 3.4.2. Institutional factors

Although JBSY and PMMVY aim to reduce OOPe, actual spending patterns revealed only partial success. On average, JBSY beneficiaries spent INR 1,509 on deliveries, lower than INR 2,619 for non-beneficiaries, but still a considerable cost. Only 67% of registered beneficiaries received their full entitlements, with 33% receiving partial or no benefits. Respondents cited frequent administrative inefficiencies, such as delayed payment processing, missing documentation, and a lack of transparency. These

findings are supported by audit reports and performance reviews, which identified persistent gaps in monitoring and disbursement systems (Comptroller and Auditor General of India [CAG], 2017; Paul & Srivastava, 2016). The complexity of the PMMVY application process, requiring the submission of multiple documents, including a mother–child protection card, identity proof, bank account details, and husband’s identity proof, posed particular challenges for women with limited literacy or without spousal support.

Table 3 compares OOPE for delivery between JBSY beneficiaries and non-beneficiaries across districts. While JBSY reduced OOPE by 42.4% on average, significant variation existed across districts. Madhubani showed the smallest reduction (11.1%) and the highest absolute OOPE for both groups, indicating implementation challenges that undermine the scheme’s financial protection objective. In contrast, Rohtas showed the largest percentage reduction (47.4%) despite its poor performance on timely disbursement. The averaged OOPE among beneficiaries (INR 1,509) revealed that the cash transfer only partially offsets delivery costs, with women still bearing substantial expenses for transportation, medicines, and informal payments. This highlights the need for either increased benefit amounts or better enforcement of “free delivery” provisions at public facilities.

### 3.4.3. The challenge of timely disbursement and the potential of direct benefit transfer

The timeliness of benefit disbursement remains a critical challenge. Only 39% of JBSY beneficiaries received payments within 30 days of delivery, a crucial period when maternal and neonatal care needs are highest. To address this, the Government of India has promoted Aadhaar-linked DBT, a system that transfers subsidies and benefits directly into beneficiaries’ Aadhaar-registered bank accounts, bypassing intermediate agencies. DBT aims to improve efficiency, reduce leakages, and ensure timely payments (Ministry of Finance, 2025). However, our study identified several barriers to effective DBT implementation in Bihar’s context: (i) low digital and banking literacy among rural women, particularly from marginalized communities; (ii) technical issues with Aadhaar-bank account linkage, including mismatched names, biometric authentication failures, and account dormancy; (iii) limited last-mile banking infrastructure in remote areas; (iv) lack of transparent tracking mechanisms for beneficiaries to check payment status; and (v) persistent reliance on intermediaries (e.g., ASHAs) who may lack training or motivation to facilitate DBT processes. Qualitative interviews revealed that many women were unaware of the

DBT process or how to troubleshoot payment failures, and some expressed distrust in banking systems compared to receiving cash from known frontline workers.

### 3.4.4. Informal care and financial deterrence

A notable proportion of women (5.8%) reported seeking antenatal or delivery care from informal providers, particularly in areas with weak infrastructure or cultural preferences for traditional caregivers. In Jehanabad, 19.4% of women resorted to informal care, with 77.9% citing real or perceived financial burdens at public facilities as the primary deterrent. These CCT schemes, intended to ease financial pressure, ultimately fail to do so, highlighting issues with inconsistent implementation and hidden costs. Additional logistical constraints, including distance to health centers, poor transportation, and delayed payments, further reinforce the preference for informal care, especially among women in remote or male-absent households. These patterns align with the global literature emphasizing that healthcare utilization is influenced not only by cost but also by trust, access, and cultural compatibility (Peters *et al.*, 2008). Cultural beliefs privileging traditional birth attendants (“dais”) for normative deliveries persisted in several communities, particularly when combined with negative prior experiences at public facilities or complex scheme procedures.

## 4. Discussion

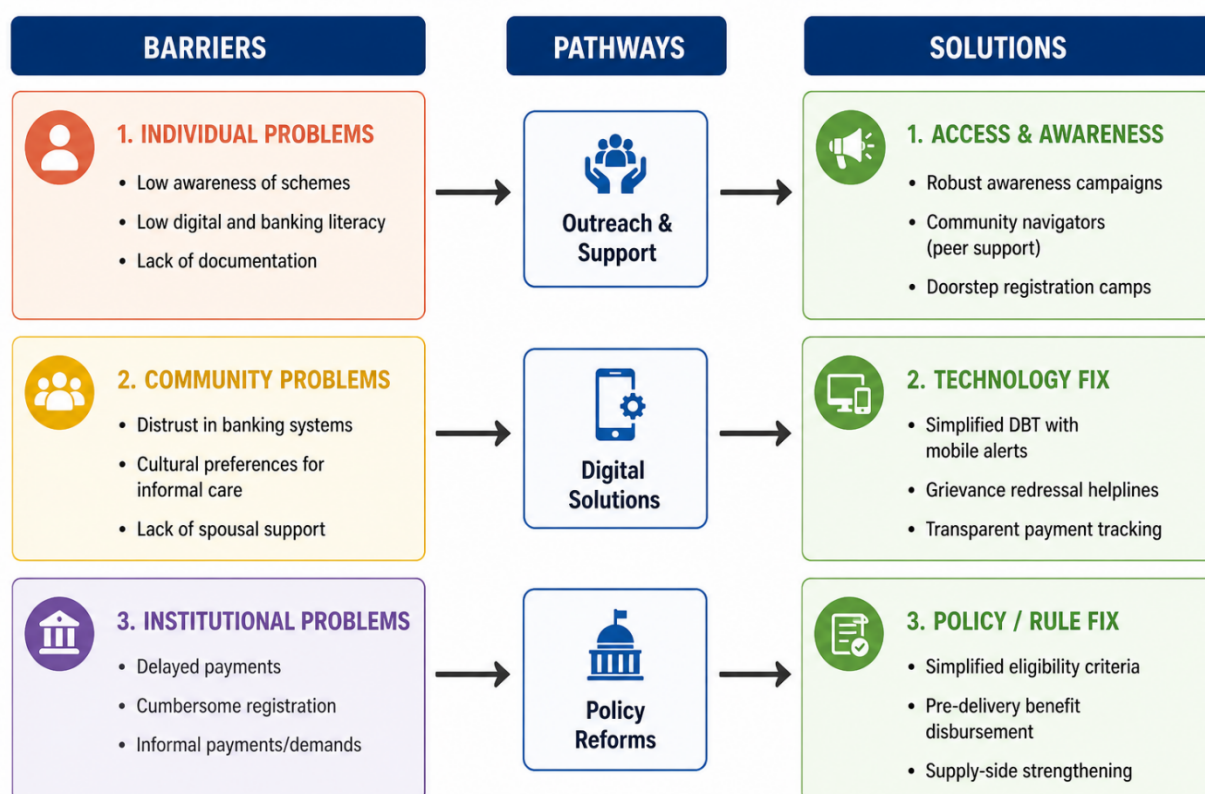
Figure 5 presents a conceptual framework that synthesizes the multi-level barriers identified in this study and maps them to potential solutions. The interconnected nature of barriers across individual, community, institutional, and policy levels explains why singular interventions often fail. For instance, delayed payments (institutional) combine with low banking literacy (individual) and distrust in systems (community) to create formidable access barriers. The framework proposes integrated solutions that address multiple barriers simultaneously: Digital DBT systems with simplified interfaces can address both institutional delays and individual literacy challenges; community navigators from marginalized groups can bridge awareness gaps while building trust; and simplified procedures with alternative documentation can overcome both policy rigidity and individual documentation constraints. This systemic perspective is essential for designing effective interventions.

The evaluation of JBSY and PMMVY in Bihar revealed a nuanced picture of partial success, overshadowed by persistent systemic and structural challenges. Both schemes reflect India’s commitment to leveraging demand-side financing mechanisms to improve maternal health

**Table 3. Out-of-pocket expenditure (OOPE) for delivery by beneficiary status and district (in Indian Rupees [INR])**

District	JBSY beneficiaries (mean OOPE; INR)	Non-beneficiaries (mean OOPE; INR)	Difference (INR)	Percentage reduction (%)
Patna	1,320	2,410	1,090	45.2
Gaya	1,480	2,550	1,070	42.0
Madhubani	2,800	3,150	350	11.1
Muzaffarpur	1,620	2,730	1,110	40.7
Rohtas	1,410	2,680	1,270	47.4
Jehanabad	1,290	2,290	1,000	43.7
Khagaria	1,550	2,810	1,260	44.8
Bhagalpur	1,430	2,520	1,090	43.3
Overall	1,509	2,619	1,110	42.4

Notes: OOPE includes all medical and non-medical expenses related to delivery, excluding scheme benefits received.



**Figure 5.** Conceptual framework of barriers and proposed solutions for conditional cash transfer implementation in Bihar

outcomes and reduce OOPE. However, implementation bottlenecks, inequitable access, and gaps in awareness significantly undermine their effectiveness.

First, the schemes have demonstrated some success in promoting institutional deliveries, especially JBSY, which has been in operation since 2006. Women registered

under JBSY reported lower average OOPE for deliveries (INR 1,509) compared to non-beneficiaries (INR 2,619), reinforcing findings from national evaluations that financial incentives can increase utilization of maternal health services (Glassman *et al.*, 2013; Lim *et al.*, 2010). This aligns with global evidence on the effectiveness of CCTs in improving health service uptake, especially

when accompanied by institutional care and free public health services (Ahmed *et al.*, 2016). Multiple studies have documented JSY's association with increased institutional deliveries, with impact evaluations showing 4 fewer stillbirths and 2 fewer neonatal deaths per 1,000 births among participants (Lim *et al.*, 2010; Powell-Jackson *et al.*, 2015). However, these aggregate gains mask significant inequities in distribution and access.

The timeliness of benefit disbursement remains a critical challenge. Only 39% of JBSY beneficiaries received payments within 30 days of delivery. PMMVY, in contrast, suffers from extremely low coverage, with just 2.4% of surveyed women enrolled, despite being a national flagship program (Sethy & Mahapatro, 2025). The restrictive eligibility is limited to the first live birth, and complex documentation requirements hinder access, particularly among marginalized groups (Devkota *et al.*, 2021). Our findings suggest that the theoretical advantages of DBT are not yet fully realized in Bihar's context, requiring complementary investments in digital literacy, banking infrastructure, and grievance redressal.

Addressing the timeliness challenge requires a multi-pronged approach centered on strengthening Aadhaar-linked DBT systems. DBT refers to the direct transfer of subsidies and benefits into beneficiaries' bank accounts, linked to their unique Aadhaar identification. While DBT has shown promise in reducing leakages and improving efficiency in other social programs, its implementation for maternal health schemes faces specific barriers in Bihar: (i) infrastructural constraints including limited last-mile banking services and unreliable digital connectivity in rural areas; (ii) authentication challenges due to biometric failures among women engaged in manual labor whose fingerprints may not register accurately; (iii) financial exclusion of women who lack independent bank accounts or whose accounts are linked to male family members' Aadhaar; (iv) limited grievance redressal mechanisms when payments fail or are delayed; and (v) digital literacy gaps that prevent women from tracking payments or understanding the process. To overcome these barriers, we recommend: (a) establishing dedicated DBT facilitation cells at block levels with multi-lingual helplines; (b) implementing offline authentication options for areas with poor connectivity; (c) creating transparent payment tracking systems accessible via basic mobile phones; (d) integrating DBT status updates into existing maternal health platforms, such as the Mother and Child Tracking System (MCTS); and (e) conducting targeted digital and financial literacy campaigns for women, particularly in marginalized communities. Successful examples from other states, such as Andhra Pradesh's real-time DBT monitoring

dashboard, offer potential models for adaptation (Sethy & Mahapatro, 2026).

The analysis further showed inequities along social and educational lines. Women from SC/ST and those with no formal education were significantly less likely to register or receive benefits under both schemes. For example, only 61.0% of SC/ST women with no education received any scheme benefit, compared to 74.5% of their non-SC/ST counterparts. These disparities reflect broader structural issues in the Indian health system, where access to entitlements is often shaped by social identity, literacy, and geographic location (George, 2007; Kruk *et al.*, 2018). Intersectional vulnerability, where multiple marginalizations based on caste, class, gender, and geography converge, creates particularly formidable barriers that standardized program designs fail to address (Kapilashrami & Hankivsky, 2018).

Table 4 highlights fundamental differences between JBSY and PMMVY, explaining their divergent performance. PMMVY's restrictive eligibility (first live birth only) and complex conditionality (three installments with different requirements) create structural barriers to access, particularly for women with limited literacy or documentation. While both schemes use DBT, PMMVY's mandatory Aadhaar linkage encounters higher failure rates due to its more recent implementation and complex verification process. JBSY benefits from nearly two decades of institutional learning, but still suffers from delayed payments and informal practices. The stark contrast in registration rates (56.0% vs. 2.4%), despite PMMVY's larger benefit amount, indicates that scheme design characteristics significantly influence real-world accessibility. This comparison underscores the need for simplifying eligibility and procedures to improve equity.

Institutional and administrative weaknesses compound these inequities. Many beneficiaries reported delayed or partial payments due to missing documents, inaccurate records, or delays in data entry and verification processes. In several districts, especially Rohtas and Madhubani, implementation inefficiencies were more pronounced. These findings resonate with earlier critiques of India's public health programs, which often struggle with poor accountability, lack of transparency, and inadequate monitoring mechanisms (CAG, 2017; Paul & Srivastava, 2016). The complexity of PMMVY's application process, requiring submission during the first trimester with multiple documents, disproportionately excludes women with limited literacy, mobility constraints, or a lack of spousal support.

Frontline health workers, particularly ASHAs, play a



**Table 4. Comparison of characteristics between JBSY and PMMVY schemes in Bihar**

Characteristic	JBSY	PMMVY
Year launched	2006 (as JSY, modified in Bihar)	2017
Objective	Promote institutional delivery	Provide partial wage compensation and improve nutrition
Target beneficiaries	All pregnant women delivering in institutions	First live birth only (excluding government employees)
Benefit amount	INR 1,400 (rural), INR 1,000 (urban) in Bihar	INR 5,000 in three installments
Conditionality	Institutional delivery at a public/accredited private facility	1st installment: Early antenatal care registration; 2nd: At least one antenatal care; 3rd: Child birth registration
Awareness in study	86.3%	30.3%
Registration rate in the study	56.0%	2.4%
Timely disbursement	39.0% within 30 days	Less than 25.0% receive all installments on time
Major barriers identified	Delayed payments, informal demands, and incomplete coverage	Complex eligibility, documentation burden, and low awareness
DBT implementation status	Partial, through Aadhaar-linked bank accounts	Mandatory Aadhaar linkage, but high failure rates
Utilization of funds	Primarily for food (70%) and medicines (68.7%)	Mixed: nutrition, debt repayment, household expenses

Note: Source: Scheme guidelines and primary study findings.

Abbreviations: DBT: Direct benefit transfer; JBSY: Janani Bal Suraksha Yojana; JSY: Janani Suraksha Yojana; PMMVY: Pradhan Mantri Matru Vandana Yojana.

critical role in the delivery of these schemes. While their involvement improves reach, the absence of oversight and performance accountability has led to unethical practices in some areas. Reports of informal commission demands by ASHAs or facility staff were common, deterring participation and reducing trust in public health programs (Sethy & Mahapatro, 2025; Vellakkal *et al.*, 2016). This highlights the urgent need for grievance redressal mechanisms and performance monitoring frameworks that ensure accountability at the grassroots level. However, it is crucial to contextualize ASHA behavior within structural constraints, including heavy workloads, delayed incentives, and inadequate training, that may incentivize informal charges (Srivastava *et al.*, 2015).

The continued reliance on informal healthcare providers by nearly 6% of women, even in the presence of financial schemes, signals deep-seated issues with public service delivery. In districts such as Jehanabad, 19.4% of women sought informal care, largely due to cost concerns and accessibility barriers. This underscores that cash incentives alone are insufficient unless accompanied by improvements in public health infrastructure, quality of care, and culturally appropriate services (Peters *et al.*, 2008). Supply-side constraints, including staff shortages, equipment gaps, and drug stockouts, undermine the effectiveness of demand-side financing and perpetuate

reliance on informal providers (Mohanty & Srivastava, 2013).

In summary, while JBSY and PMMVY reflect progressive policy intent, their current implementation in Bihar falls short of delivering equitable, timely, and meaningful support to all eligible women. Strengthening these schemes will require addressing both administrative inefficiencies and structural inequities, integrating digital platforms for DBTs, enhancing community-level communication, and ensuring cultural and geographic accessibility. Without these reforms, the schemes risk perpetuating the very exclusions they aim to eliminate. The recommendations emerging from this study emphasize the need for an integrated approach that combines technological solutions like DBT with community-based outreach, simplified procedures, and strengthened accountability mechanisms to bridge implementation gaps.

## 5. Conclusion

Demand-side financial interventions, such as JBSY and PMMVY, are critical to India's strategy for reducing maternal and neonatal mortality and mitigating OOE for pregnant women. While these schemes have demonstrated partial success, their effectiveness is constrained by low awareness, delayed payments, rigid eligibility criteria, and persistent inequities, especially for SC/ST women and



those with low education.

To realize their full potential, these schemes require a range of strategic reforms. Awareness campaigns must be scaled up, especially for PMMVY, where unawareness remains disproportionately high. These efforts should leverage multi-channel, community-based communication, including local radio, street plays, and door-to-door outreach by specifically trained community health volunteers. Improving timeliness and transparency through Aadhaar-linked DBT and digital platforms can enhance delivery efficiency and user trust. This requires addressing infrastructural barriers to DBT adoption through mobile banking vans in remote areas, simplified authentication processes, and multi-lingual grievance redressal systems. Special provisions should target vulnerable groups through doorstep registration, mobile facilitation camps, and dedicated volunteers, reducing exclusion. This includes simplifying PMMVY eligibility to include all live births rather than just the first, and creating alternative registration pathways for women without standard documentation.

Addressing ASHA's accountability is also key. Monitoring tools, such as real-time dashboards and feedback mechanisms, should be instituted to reduce corruption and ensure fairness, while also ensuring ASHAs receive adequate compensation and support for their crucial intermediary role. Increasing the benefit amount is necessary to match the real cost of care, including transportation, nutrition, and postnatal support. Pre-delivery disbursement, supported by 88% of respondents, should be institutionalized, with a portion of benefits provided during pregnancy to address nutritional and transport needs. By bridging operational and structural gaps, these reforms can significantly enhance the inclusiveness, efficiency, and equity of maternal health programs.

Strengthening JBSY and PMMVY is not only a step toward improving maternal and neonatal outcomes but also crucial to India's pursuit of Universal Health Coverage (UHC) and the SDGs, particularly targets 3.1 (Maternal Mortality Reduction) and 3.8 (Financial Protection in Healthcare). Future research should explore innovative delivery mechanisms, including mobile money transfers, CCTs integrated with nutrition support, and gender-transformative approaches that address the underlying power imbalances affecting women's health access. As India advances toward its health system goals, ensuring that demand-side financing reaches the most marginalized with dignity and timeliness remains an imperative for equitable progress.

## Acknowledgments

We acknowledge all the scholars and academic works whose ideas have been invaluable to this research.

## Funding

None.

## Conflict of interest

The authors declare that there are no potential conflicts of interest related to this work.

## Author contributions

*Conceptualization:* Mayadhar Sethy

*Visualization:* Mayadhar Sethy

*Writing-original draft:* Mayadhar Sethy

*Writing-review & editing:* Sandhya R. Mahapatro, Santosh Kumar Mishra

## Ethics approval and consent to participate

This study was approved by the Institutional Ethics Committee of A.N. Sinha Institute, Patna (Approval No. ANS/IEC/2024/015). Informed consent was obtained from all individual participants included in the study.

## Consent for publication

All participants provided written informed consent for the publication of their anonymized demographic data and interview responses. Participants were assured that their identities would remain confidential and that no personally identifiable information would be disclosed. Consent for publication was obtained separately from consent to participate in the study.

## Availability of data

The data that support the findings of this study are available from the corresponding author upon reasonable request.

## References

- Ahmed, S., Shommu, N. S., Rumana, N., Barron, G. R. S., Wicklum, S., & Turin, T. C. (2016). Barriers to access of primary healthcare by immigrant populations in Canada: A literature review. *J Immigrant Minority Health*, 18(6), 1522–1540.  
<https://doi.org/10.1007/s10903-015-0276-z>
- Banerjee, R., Singh, B. S., Sahrawat, N., et al. (2025). Effect of India's flagship conditional maternity benefit scheme on utilization of maternal and child health services: Evidence from a statewide evaluation study. *BMC Pregnancy and Childbirth*, 25(1).  
<https://doi.org/10.1186/s12884-025-07416-3>

- Bano, N., Dahiya, R., & Kumari, A. (2020). A Review Critical: Impact Assessment of Janani Suraksha Yojana (JSY) in Terms of, Knowledge, Attitude and Service Utilization Pattern of Women Beneficiaries. *International Journal of Current Microbiology and Applied Sciences*, 9(12),3553–3562.  
<https://doi.org/10.20546/ijcmas.2020.912.422>
- Bogg, L., Diwan, V., Vora, K. S., & DeCosta, A. (2016). Impact of alternative maternal demand-side financial support programs in India on the caesarean section rates: Indications of supplier-induced demand. *Maternal and Child Health Journal*, 20(1), 11–15.  
<http://doi.org/10.1007/s10995-015-1810-2>
- Braun, V., & Clarke, V. (2006). Using thematic analysis in psychology. *Qualitative Research in Psychology*, 3(2), 77–101.  
<https://doi.org/10.1191/1478088706qp063oa>
- Brinda, E. M., Rajkumar, A. P., Enemark, U., Prince, M. J., & Jacob, K. S. (2012). Nature and determinants of out-of-pocket health expenditure among older people in a rural Indian community. *International Psychogeriatrics*, 24(10), 1644–1653.  
<http://doi.org/10.1017/S104161021200083X>
- Comptroller and Auditor General of India. (2017). *Performance audit report on reproductive and child health under National Rural Health Mission*. Government of India. Available from: [https://cag.gov.in/uploads/download\\_audit\\_report/2017/Report\\_No.25\\_of\\_2017\\_-\\_Performance\\_audit\\_Union\\_Government\\_Reproductive\\_and\\_Child\\_Health\\_under\\_National\\_Rural\\_Health\\_Mission\\_Reports\\_of\\_Ministry\\_of\\_Health\\_and\\_Family\\_Welfare.pdf](https://cag.gov.in/uploads/download_audit_report/2017/Report_No.25_of_2017_-_Performance_audit_Union_Government_Reproductive_and_Child_Health_under_National_Rural_Health_Mission_Reports_of_Ministry_of_Health_and_Family_Welfare.pdf).
- Devkota, H. R., Clarke, A., Murray, E., Kett, M., & Groce, N. (2021). Disability, Caste, and Intersectionality: Does Co-Existence of Disability and Caste Compound Marginalization for Women Seeking Maternal Healthcare in Southern Nepal? *Disabilities*, 1(3), 218–232.  
<http://doi.org/10.3390/disabilities1030017>
- George, A. (2007). Persistence of high maternal mortality in Karnataka, India. *Reproductive Health Matters*, 15(30), 91–102.  
[http://doi.org/10.1016/S0968-8080\(07\)30318-2](http://doi.org/10.1016/S0968-8080(07)30318-2)
- Glassman, A., Duran, D., Fleisher, L., *et al.* (2013). Impact of conditional cash transfers on maternal and newborn health. *Journal of Health, Population and Nutrition*, 31(4 Suppl 2), 48–66.
- Gupta, S. K., Pal, D. K., Tiwari, R., *et al.* (2012). Impact of Janani Suraksha Yojana on institutional delivery rate and maternal morbidity and mortality: An observational study in India. *Journal of Health, Population and Nutrition*, 30(4), 464–471.  
<https://doi.org/10.3329/jhpn.v30i4.13416>
- Hunter, W., & Sugiyama, N. B. (2014). Transforming subjects into citizens: Insights from Brazil's Bolsa Família. *Perspectives on Politics*, 12(4), 829–845.  
<http://doi.org/10.1017/s1537592714002151>
- Jain, A., Singh, S., Choudhary, A., Jain, A., & Choudhary, A. (2017). Maternal health-care seeking behavior in North India. *Journal of Family Medicine and Primary Care*, 6(2), 265–269.  
<https://doi.org/10.4103/2249-4863.219999>
- Kapilashrami, A., & Hankivsky, O. (2018). Intersectionality and why it matters to global health. *The Lancet*, 391(10140), 2589–2591.  
[http://doi.org/10.1016/s0140-6736\(18\)31431-4](http://doi.org/10.1016/s0140-6736(18)31431-4)
- Kruk, M. E., Gage, A. D., Joseph, N. T., Danaei, G., García-Saisó, S., & Salomon, J. A. (2018). Mortality due to low-quality health systems in the universal health coverage era: A systematic analysis of amenable deaths in 137 countries. *The Lancet*, 392(10160), 2203–2212.  
[https://doi.org/10.1016/S0140-6736\(18\)31668-4](https://doi.org/10.1016/S0140-6736(18)31668-4)
- Kumar, A. K. S., Chen, L. C., Choudhury, M., *et al.* (2011). Financing health care for all: challenges and opportunities. *The Lancet*, 377(9766), 668–679.  
[https://doi.org/10.1016/S0140-6736\(10\)61884-3](https://doi.org/10.1016/S0140-6736(10)61884-3)
- Lagarde, M., Haines, A., & Palmer, N. (2007). Conditional cash transfers for improving uptake of health interventions. *JAMA*, 298(16), 1900–1910.  
<https://doi.org/10.1001/jama.298.16.1900>
- Lim, S. S., Dandona, L., Hoisington, J. A., James, S. L., Hogan, M. C., & Gakidou, E. (2010). India's Janani Suraksha Yojana, a conditional cash transfer programme to increase births in health facilities: An impact evaluation. *The Lancet*, 375(9730), 2009–2023.  
[https://doi.org/10.1016/S0140-6736\(10\)60744-1](https://doi.org/10.1016/S0140-6736(10)60744-1)
- Mahapatro, S. R., & Sethy, M. (2025). Maternal satisfaction in health facilities during childbirth and newborn survival in Bihar State of India. *Discover Public Health*, 22(1), 212.  
<https://doi.org/10.1186/s12982-025-00574-x>
- Ministry of Finance, Government of India. (2025). Economic survey 2025–2026. Government of India. Available from: <https://www.indiabudget.gov.in/economicsurvey/>.
- Mohanan, M., Miller, G., Menon, P., & Tarozzi, A. (2019). *Micro-evaluation of PMMVY program delivery in Madhya Pradesh*. J-PAL. Available from: <https://www.povertyactionlab.org/initiative-project/micro-evaluation-intervention-improve-implementation-pmmvy-program-delivery>.
- Mohanty, S. K., & Srivastava, A. (2013). Out-of-pocket expenditure on institutional delivery in India. *Health Policy and Planning*, 28(3), 247–262.  
<https://doi.org/10.1093/heapol/czs057>

- Paul, V. K., & Srivastava, A. (2016). *Assessment of JSY implementation in high focus states*. Ministry of Health and Family Welfare, Government of India.
- Peters, D. H., Garg, A., Bloom, G., *et al.* (2008). Poverty and Access to Health Care in Developing Countries. *Annals of the New York Academy of Sciences*, 1136(1), 161–171.  
<http://doi.org/10.1196/annals.1425.011>
- Powell-Jackson, T., Mazumdar, S., & Mills, A. (2015). Financial incentives in health: Evidence from JSY. *Journal of Health Economics*, 43, 154–169.  
<http://doi.org/10.1016/j.jhealeco.2015.07.001>
- Rasanathan, K., & Diaz, T. (2023). Research on health equity in the SDG era: the urgent need for greater focus on implementation. *International Journal for Equity in Health*, 15(1).  
<http://doi.org/10.1186/s12939-016-0493-7>
- Bano, N., Dahiya, R., & Kumari, A. (2020). A Review Critical: Impact Assessment of Janani Suraksha Yojana (JSY) in Terms of, Knowledge, Attitude and Service Utilization Pattern of Women Beneficiaries. *International Journal of Current Microbiology and Applied Sciences*, 9(12), 3553–3562.  
<https://doi.org/10.20546/ijcmas.2020.912.422>
- Ray, S., Chakrabarti, S., Pal, S., Nguyen, P. H., Scott, S., & Menon, P. (2025). Can Rights-Based Conditional Cash Transfers Improve Children's Nutrition at scale? Evidence from India's Maternity Benefit Program. *medRxiv*.  
<https://doi.org/10.1101/2025.01.12.25320443>
- Reddy, K. S., Patel, V., Jha, P., Paul, V. K., Kumar, A. S., & Dandona, L. (2011). Towards achievement of universal health care in India by 2020: a call to action. *The Lancet*, 377(9767), 760–768.  
[http://doi.org/10.1016/s0140-6736\(10\)61960-5](http://doi.org/10.1016/s0140-6736(10)61960-5)
- Sample Registration System. (2020). Special bulletin on maternal mortality in India 2016–2018. Office of the Registrar General, India. Available from: [https://censusindia.gov.in/nada/index.php/catalog/34781/download/38469/SRS\\_MMR\\_Bulletin\\_2016\\_2018.pdf](https://censusindia.gov.in/nada/index.php/catalog/34781/download/38469/SRS_MMR_Bulletin_2016_2018.pdf).
- Sardar, S. S., Majee, B. K., Mandal, M., *et al.* (2025). Conditional cash transfer for safe delivery in India: utilisation and inequalities with reference to NFHS-5. *BMC Public Health*, 25(1).  
<https://doi.org/10.1186/s12889-024-20952-5>
- Sen, S., Chatterjee, S., Khan, P. K., & Mohanty, S. K. (2020). Unintended effects of Janani Suraksha Yojana on maternal care in India. *SSM - Population Health*, 11, 100619.  
<https://doi.org/10.1016/j.ssmph.2020.100619>
- Sethy, M. (2025). Beyond calories: Roots and tubers for health equity and sustainable development. *Global Journal of Human-Social Science*, 25(H2), 67–77. Available from: <https://socialscienceresearch.org/index.php/GJHSS/article/view/104372>.
- Sethy, M., & Mahapatro, S. R. (2025). India's Changing Diet: Millets, Processed Foods, and the Nutrition Crisis. *Journal of Economic Development, Innovation and Policy*, 1(1), 53–63.  
<https://doi.org/10.55578/jedip.2508.004>
- Sethy, M., & Mahapatro, S. R. (2026). Structural inequalities and dietary diversity in Odisha: Evidence from NSSO 68th and 79th rounds. *Scientific Reports*, 16, 2876.  
<https://doi.org/10.1038/s41598-025-32743-y>
- Sharma, B. B., Jones, L., Loxton, D. J., Booth, D., & Smith, R. (2018). Systematic review of community participation interventions to improve maternal health outcomes in rural South Asia. *BMC Pregnancy and Childbirth*, 18, 327.  
<http://doi.org/10.1186/s12884-018-1964-1>
- Sidney, K., Diwan, V., ElKhatib, Z., de Costa, A. (2012). India's JSY cash transfer program for maternal health: Who participates and who doesn't – a report from Ujjain district. *Reprod Health*, 9(1).  
<https://doi.org/10.1186/1742-4755-9-2>
- Srivastava, A., Gope, R., Nair, N., *et al.* (2015). Are village health sanitation and nutrition committees fulfilling their roles for decentralised health planning and action? A mixed methods study from rural eastern India. *BMC Public Health*, 16(1).  
<https://doi.org/10.1186/s12889-016-2699-4>
- Vellakkal, S., Gupta, A., Khan, Z., *et al.* (2016). Has India's National Rural Health Mission reduced inequities in maternal health services? A pre-post repeated cross-sectional study. *Health Policy and Planning*, 32(1), 79–90.  
<https://doi.org/10.1093/heapol/czw100>
- Vora, K. S., Koblinsky, S. A., & Koblinsky, M. A. (2015). Predictors of maternal health services utilization by poor, rural women: a comparative study in Indian States of Gujarat and Tamil Nadu. *Journal of Health, Population and Nutrition*, 33(1).  
<https://doi.org/10.1186/s41043-015-0025-x>

## Appendix

### A1. Technical sheet

#### (i) Study design

Type: Explanatory sequential mixed-methods

Approach: Quantitative → Qualitative integration

Period: January–December 2024

#### (ii) Study setting

State: Bihar, India

Districts: 8 districts (Patna, Gaya, Madhubani, Muzaffarpur, Rohtas, Jehanabad, Khagaria, and Bhagalpur)

Selection: Stratified random sampling for regional diversity

#### (iii) Sample characteristics

Quantitative component:

Target: Women aged 18–49 who delivered within the preceding 24 months

Sample size: 1,247 women

Sampling: Multistage random sampling

Formula:

$$n = \frac{Z^2 \times p \times q}{d^2} \quad (z=1.96, p=0.5, d=0.05) \quad (A1)$$

Design effect: 1.5

Non-response adjustment: 10%

Qualitative component:

Participants: 42 individuals

Methods: 30 In-depth interviews + 12 focus-group-discussion participants (2 groups)

Sampling: Purposive maximum variation

#### (iv) Data collection instruments

Quantitative: Structured interview schedule (pretested, 50 pilot cases)

Languages: Hindi/Bhojpuri/Maithili

Qualitative: Semi-structured guides for in-depth interviews and focus group discussions

Recording: Audio with permission, verbatim transcription

#### (v) Data analysis

Quantitative:

Software: STATA version 17.0

Methods: Descriptive statistics (frequencies, percentages, means); bivariate analysis (chi-square tests); and multivariate logistic regression (adjusted odds ratios)

Confidence intervals: 95%

Qualitative:

Software: NVivo 12

Method: Thematic analysis (Braun & Clarke's six-step approach)

Integration: Mixed-methods at the interpretation stage

(vi) Key variables measured

Independent variables: Sociodemographic (age, caste, education, and economic status); parity, residence, occupation; and district-level variations

Dependent variables: Scheme awareness (JBSY and PMMVY); registration status and process; benefit receipt (timing and amount); out-of-pocket expenditure; and healthcare utilization patterns

(vii) Ethical considerations

Consent: Informed consent was obtained from all participants

Confidentiality: Data anonymization maintained

Ethical approval: Implied through institutional protocol

Clinical trial: Not applicable

(viii) Statistical parameters

Confidence level: 95%

Precision:  $\pm 5\%$

Maximum variability: 0.5

Significance level:  $p < 0.05$

Adjusted models: Controlled for age, caste, education, economic status, parity, and district

(ix) Data management

Storage: Secure digital and physical

Availability: Upon reasonable request to the corresponding author

Retention: As per institutional guidelines