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Original Research Article

Impact of Education on Health Literacy among Antenatal Women in Rural and Urban Field Practice Areas of a Tertiary Care Hospital: A Comparative Study

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Abstract

Background: Health literacy, which is the ability to access, understand, and apply health information, is essential during pregnancy. Limited maternal health knowledge results in delayed care-seeking and poor adherence to medical advice leading to adverse maternal and fetal outcomes.

Objectives: The aim of this study was to compare the health literacy levels among antenatal women in urban and rural areas and to assess the role of health education in shaping these levels.

Methods: A comparative cross-sectional study was conducted among 120 antenatal women (60 rural, 60 urban) attending outpatient departments of rural and urban health centers affiliated with a tertiary hospital in Bengaluru, India. A pre-tested questionnaire captured socio-demographic data and four health literacy domains. Data were analyzed using chi-square, Mann–Whitney U, and Kruskal–Wallis tests.

Results: Urban women were older and more likely to be employed. They scored significantly higher in health knowledge ($p = 0.013$), health behaviors ($p = 0.020$), and attitudes ($p < 0.001$), but not in access/utilization of information ($p = 0.574$). Education significantly improved health literacy in rural women ($\chi^2 = 23.77$, $p < 0.001$), especially beyond middle school, but had no significant effect in urban women ($\chi^2 = 3.23$, $p = 0.520$).

Conclusion: A significant gap in health literacy exists between the rural and urban antenatal women. Education plays a strong role in improving literacy in rural areas, whereas multiple facilitators contribute in urban settings. Tailored interventions should be targeted especially for the rural populations to reduce these inequalities.

Keywords: Health Literacy, Antenatal Women, Maternal Health, Education, Urban-Rural Differences.

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Introduction

Lack of proper health literacy remains a major public health concern globally, with more than 50% of adults demonstrating limited or inadequate ability to obtain, understand, and use health information appropriately to make informed health decisions. Inadequate health literacy is linked to poor health outcomes, reduced health-seeking behaviour, increased healthcare costs, and also increased maternal and infant morbidity and mortality. Health literacy is defined as "the degree to which individuals can access, comprehend, appraise, and apply health information to make appropriate health decisions." It is commonly categorized into three types.

1. Functional health literacy – this encompasses basic reading, writing, and numeracy skills which are essential to understand and comprehend health information.
2. Communicative or interactive health literacy – includes advanced cognitive and social skills that help individuals to take active part in healthcare decisions.
3. Critical health literacy – the ability to critically analyze information and apply it over health-related situations at individual as well as community levels.

Globally, although the general literacy rate among individual's ≥15 years is approximately 86.3%, disparities in health literacy persist. In several low-

income countries, adult literacy ranges from 29% to 60%, reflecting inequities in education, healthcare access, and socioeconomic conditions that directly affect maternal health outcomes. In India, the ≥15-year literacy rate is about 77.7%, with urban populations performing better than rural groups. In Karnataka, the overall literacy rate is 75.36%, with female literacy at ~68%. Although maternal health literacy has shown improvement, significant gaps remain, particularly in rural regions. Karnataka's maternal mortality ratio has declined to 69 per 100,000 live births, yet maternal health literacy continues to play a crucial role in antenatal care utilization, compliance with recommended practices, and pregnancy outcomes.

The present study aims to compare maternal health literacy among antenatal women in rural and urban Karnataka and assess the influence of educational status on maternal and fetal health outcomes within the broader context of global health literacy challenges.

Methods

A comparative cross-sectional study was conducted over three months among antenatal women attending outpatient departments of rural and urban primary health centers linked to a tertiary teaching hospital in Bengaluru, Karnataka.

A total of 120 pregnant women were recruited using convenience sampling (60 rural, 60 urban). Inclusion criteria included all antenatal women attending OPD who provided informed consent; those with severe illness or communication barriers were excluded. Data were collected using a pre-tested, semi-structured questionnaire comprising socio-demographic variables and four domains of health literacy: knowledge and understanding, access and utilization, behaviors and practices, and attitudes. Data analysis was performed using SPSS v26.

Chi-square tests assessed categorical variable differences, Mann–Whitney U test compared rural-urban health literacy scores, and Kruskal–Wallis test with Dunn's post-hoc analysis evaluated the effect of education. A p-value < 0.05 was considered statistically significant.

Institutional ethics approval was obtained (Approval no. SIMS & RC / EC--02/PG- 05/ 2025-26), and informed written consent was secured from all participants.

Results

In this study, data obtained from 120 women was used in the analysis.

Table 1: Socio-Demographic Profile of Pregnant Women in Rural and Urban Areas

Characteristics	Rural (n=60) Frequency	Rural Percentage	Urban (n=60) Frequency	Urban Percentage
Age at pregnancy				
≤ 20 years	16	26.7%	3	5.0%
21–34 years	44	73.3%	42	70.0%
≥ 35 years	0	0.0%	15	25.0%
Mean ± SD (years)		23 ± 4.10		28 ± 6.11
Education				
Graduate	12	20.0%	22	36.7%
Intermediate/Diploma	19	31.7%	16	26.7%
High school	17	28.3%	17	28.3%
Middle school	7	11.7%	3	5.0%
Primary school	1	1.7%	2	3.3%
Illiterate	4	6.7%	0	0.0%
Occupation				
Working women	3	5.0%	19	31.7%
Homemaker	57	95.0%	41	68.3%
Number of previous pregnancies				
0	31	51.7%	33	55.0%
1	17	28.3%	20	33.3%
>1	12	20.0%	7	11.7%
Chronic health condition				
Yes	1	1.7%	5	8.0%
No	59	98.3%	55	92.0%
Distance to Health Facility				
< 3 km	24	40.0%	32	53.0%
> 3 km	36	60.0%	28	47.0%

Table 1 shows the comparison of socio-demographic characteristics of ANC cases of rural and urban pregnant women. It revealed significant differences in age at pregnancy ($\chi^2(2) = 23.941$, $p < 0.001$) and occupation ($\chi^2(1) = 14.249$, $p < 0.001$). Urban women were generally older (Mean ± SD: 28 ± 6.11 years) compared to rural women (23 ± 4.10 years), with a higher proportion aged ≥35 years (25% vs. 0%). Additionally, a significantly larger proportion of urban women were employed (31.7%) compared to rural women (5%), indicating a notable difference in workforce participation. While education levels did not show a statistically significant difference between rural and urban women ($\chi^2(5) = 9.132$, $p = 0.104$), urban women had a higher proportion of graduates (36.7% vs. 20%), suggesting better educational attainment. No significant differences were found in the number of previous pregnancies ($\chi^2(3) = 1.639$, $p = 0.651$), presence of chronic health conditions ($\chi^2(1) = 0.000$, $p = 1.000$), or distance to health facilities ($\chi^2(1) = 2.134$, $p = 0.143$), indicating similar healthcare accessibility and maternal health profiles across both groups.

Table 2: Comparison of Health Literacy between Rural and Urban Antenatal Women

Domain	Region	Mean (SD)	Median (IQR)	Test Statistic (p-value)
Health knowledge and understanding	Rural	2.81 (0.31)	2.83 (0.25)	Z = 2.48, p = 0.013*
	Urban	2.92 (0.58)	2.83 (0.42)	Z = 2.48, p = 0.013*
Access and utilization of information	Rural	3.26 (0.83)	3.55 (0.96)	Z = 0.56, p = 0.574
	Urban	3.29 (0.64)	3.22 (0.65)	Z = 0.56, p = 0.574
Health behaviors and practices	Rural	0.56 (0.22)	0.67 (0.33)	Z = 2.32, p = 0.020*
	Urban	1.75 (8.57)	0.69 (0.44)	Z = 2.32, p = 0.020*
General attitude towards health literacy	Rural	1.04 (0.34)	1.00 (0.17)	Z = 5.27, p < 0.001*
	Urban	1.38 (0.19)	1.49 (0.19)	Z = 5.27, p < 0.001*

Table 2 presents the results of Mann-Whitney U tests with descriptive statistics (Mean (SD) and Median (IQR)).

Health Knowledge and Understanding: Urban participants had a slightly higher mean score (Mean=2.92, SD = 0.58) compared to rural participants (Mean=2.81, SD = 0.31). The difference was statistically significant, Z = 2.48, p = .013, indicating a higher level of health knowledge and understanding among urban residents. Access and Utilization of Information: The mean scores were similar between rural (Mean=3.26, SD = 0.83) and urban (Mean=3.29, SD = 0.64) regions, and the difference was not statistically significant, Z = 0.56, p = .574. Health Behaviours and Practices: Urban participants showed a significantly higher mean score (Mean=1.75, SD = 8.57) compared to rural participants (Mean=0.56, SD = 0.22). The difference was statistically significant, Z = 2.32, p = .020.

General Attitude towards Health Literacy: Urban participants had a higher mean score (Mean=1.38, SD = 0.19) compared to rural participants (Mean=1.04, SD = 0.34). This difference was highly significant, Z = 5.27, p < .001, suggesting a more positive attitude toward health literacy among urban residents.

Table 3: Impact of Education Level on Health Literacy Scores

Education Level	Overall Literacy Scores Median (IQR) - Rural	Overall Literacy Scores Median (IQR) - Urban
Illiterate	2.31 (1.59)	---
Primary	4.89 (0.46)	8.38 (0.67)
Middle	5.99 (0.90)	8.08 (2.06)
Higher	7.93 (1.06)	7.93 (0.70)
Intermediate	8.41 (1.14)	8.40 (1.05)
Graduation	8.23 (1.33)	8.71 (2.07)
Test statistics	**$\chi^2(5) = 23.77$, $p < 0.001$***	**$\chi^2(4) = 3.23$, $p = 0.520$**

A Kruskal-Wallis H test was conducted to assess the impact of education level on health literacy scores in rural and urban populations. The results showed a statistically significant difference in health literacy across education levels in the rural population ($\chi^2(1) = 23.770$, $p < 0.001$), whereas no significant difference was observed in the urban population ($\chi^2(1) = 3.228$, $p = 0.520$).

Post hoc analysis (Rural only)

Dunn's pairwise comparisons revealed the following significant differences:

- Middle school vs. High school ($p = 0.002$)
- Middle school vs. Graduation ($p < 0.001$)
- Middle school vs. Intermediate ($p < 0.001$)
- Illiterate vs. Intermediate ($p = 0.040$)

- Primary school vs. Intermediate (p = 0.032)
- Primary school vs. Graduation (p = 0.052, marginally significant)

In our study it's found that in the rural areas, health literacy significantly improves with higher education levels, particularly beyond middle school. The most notable differences were between middle school and higher education levels. However, in urban areas, no significant variation in health literacy across education levels was observed, suggesting that factors other than formal education—such as better access to health information—may play a role in urban settings.

Discussion

The results of the present study reveal critical inequalities in health literacy levels among antenatal women in rural and urban areas, emphasizing the complex triad of education, socioeconomic factors, and access to healthcare information. As seen in the results of the present study, the urban women showed relatively higher levels of health knowledge leading to healthier behaviors, and more positive attitudes towards health literacy as compared to their rural counterparts. Although there was no significant difference in access and utilization of health information for both. These results strongly suggests that factors beyond mere access—such as quality of information, exposure to varied media, and healthcare infrastructure—substantially influences health literacy in urban populations.

Education was one of the strong determinants of health literacy in rural women, with notable improvements seen particularly beyond the middle school level. This finding elucidates the critical role that formal education plays in better understanding of healthcare concepts by rural antenatal women to understand and act on health-related information. On the contrary, education was not significantly associated with health literacy among urban women, thus implying that in urban settings, multiple facilitators like healthcare access, employment rates, peer networking, and digital media exposure contribute collectively to health literacy.

The findings in this study align with previous literature. Johri et al. demonstrated that maternal health literacy influences child nutrition and vaccination uptake in Indian resource-poor settings, reflecting the broader impact of literacy on maternal-child health outcomes. Globally, studies such as Kim et al. in South Korea and Ningrum et al. in Indonesia show that better health literacy predicts favorable pregnancy outcomes and better adherence to antenatal care, confirming the international relevance of this issue. Similarly, Tavananezhad et al. highlighted literacy's empowerment effect on pregnant women, underscoring the benefits of educational interventions.

Socioeconomic and infrastructural differences appear to influence these patterns greatly. The greater employment rates and improved educational levels, together with better healthcare access and digital literacy, provide a richer informational and support environment for the urban mothers. Conversely, rural women are stuck behind due to limited or denied educational opportunities, combined with poor healthcare access, and less exposure to health information technologies which leads to adverse healthcare outcomes for both the mothers and the fetus. The need of the hour is to reduce this socio-structural with targeted public health strategies.

It is pertinent to have strong measures to remove the discrepancies in the antenatal care received by the rural women, mainly by strengthening community outreach programs coupled with enhancing formal education, and integrating maternal health literacy. Likewise for urban population, leveraging digital platforms, utilizing social media for information broadcast, and community networks to promote health literacy could yield remarkable benefits. One-size-fits-all approach programs should be tailored and customed to the unique context of each setting to increase the effectiveness and reception by expecting mothers.

There some notable limitations of this study. Firstly, the single-center design along with convenience sampling cannot be used to generalize the results for other establishments. There were no qualitative insights into psychosocial barriers and causal nature cannot be established by the cross-sectional design. Future researches should therefore consider multicentric, longitudinal studies using mixed methods to explore and interpret causality and intervention impacts more comprehensively.

In conclusion, the results from the present study underscores the inevitable role of education in improving health literacy among rural antenatal women while highlighting multiple factors influencing the healthcare decision in urban females. Addressing these disparities by implementing customized, local-level actions can boost maternal and newborn health while advancing health equality.

Conclusion

Health literacy among antenatal women differs significantly between the urban and rural areas. Education is an important aspect in shaping literacy in rural populations, while urban women benefit from broader access to health information through multiple channels. Strengthening maternal

education and implementing targeted, context-specific interventions are essential to improve maternal and neonatal outcomes and reduce inequalities.

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