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Original Research Article

# Health Literacy and Community Health: Investigating the Relationship Between Health Literacy and Health Outcomes in a Diverse Community Setting in Rural Bihar, India — A Cross-Sectional Study

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**Abstract**

**Background:** Health literacy (HL) shapes people's ability to access, understand, appraise, and use health information and services, influencing self-management and outcomes, especially in resource-constrained settings.

**Aim:** To assess HL levels and examine their association with healthcare behaviors and outcomes among adult patients in a diverse community setting in West Champaran, Bihar.

**Methods:** Hospital-based cross-sectional study among 70 adults attending Government Medical College, Bettiah. HL was measured using the Indian version of HLS-EU-Q16 (score 0–16; categorized as inadequate 0–8, problematic 9–12, adequate 13–16). Outcomes included medication adherence (MMAS-8), self-rated health, missed follow-up, ER/hospitalization in last 12 months, and clinical control (BP/HbA1c in relevant subgroups). Associations were tested using $\chi^2$/ANOVA and multivariable logistic regression.

**Results:** Mean HL score was 11.1±2.9; 21.4% had inadequate HL and 42.9% problematic HL. Good adherence rose from 13.3% (inadequate) to 72.0% (adequate) ($p<0.001$). Good self-rated health increased from 13.3% to 88.0% across the same groups ($p<0.001$). In adjusted models, each 1-point increase in HL score was associated with lower odds of poor adherence (aOR 0.67, 95% CI 0.52–0.87) and missed follow-up (aOR 0.62, 95% CI 0.46–0.85).

**Conclusion:** Limited HL was common and strongly associated with worse patient-centered outcomes and care continuity. Integrating HL-sensitive communication and navigation support into routine services may improve outcomes in similar settings.

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## Introduction

Health literacy (HL) is increasingly recognized as a foundational determinant of population health and health equity. HL extends beyond basic reading ability and includes the capacity to access, understand, appraise, and apply health information and services to make appropriate health decisions. Conceptually, HL operates at the intersection of individual skills (functional, interactive, and critical competencies) and the demands imposed by healthcare systems and social environments [1]. Nutbeam's framework emphasized HL as a measurable outcome of health education and a lever for empowerment and equity, shifting the focus from "patient deficits" to system responsiveness and capability-building [2]. A large body of evidence links limited HL with poorer health knowledge, weaker self-management, lower use of preventive services, and worse intermediate outcomes and healthcare utilization. Early syntheses demonstrated that low literacy and limited HL are associated with poorer health status and higher morbidity, including increased hospitalization risks. Updated systematic reviews further show consistent associations between low

HL and poorer ability to understand health messages, reduced adherence, and higher acute care use, although effect sizes vary by setting, measurement tool, and outcome definition. Importantly, these associations are not merely individual-level phenomena: health systems that are difficult to navigate amplify the impact of limited HL, particularly in rural and underserved settings where access barriers, fragmented care, and competing socioeconomic demands are common [3]. In India, the burden of chronic diseases such as hypertension and diabetes is substantial, and effective long-term control depends heavily on self-management, medication-taking, risk-factor modification, and sustained follow-up. Yet adherence and continuity of care remain major challenges. Health literacy may represent a modifiable pathway through which communities can achieve better chronic disease outcomes, particularly where healthcare encounters are brief and information is complex [4]. Emerging Indian studies using standardized tools have documented meaningful proportions of limited HL in outpatient populations and have highlighted associations with sociodemographic disadvantage. A major methodological advance in the Indian context is the availability of a validated Indian version of the HLS-EU-Q16, enabling more consistent measurement and comparability across studies and regions.

Despite this progress, evidence from eastern India and specifically from Bihar, where rurality, educational inequalities, and healthcare access barriers are prominent, remains limited. West Champaran is characterized by a predominantly rural population, mixed literacy levels, and constrained health infrastructure in many catchment areas. In such contexts, HL may directly influence the ability to interpret prescriptions, attend follow-up, and decide when urgent care is required—factors that can shift care from preventive/primary pathways toward emergency and hospital-based utilization. The WHO has emphasized HL as a key resource for health promotion and sustainable development, recognizing its role not only at the individual level but also in enabling community participation and system accountability [5].

The present study was designed to address this evidence gap by assessing HL levels among adults attending Government Medical College, Bettiah, and examining relationships between HL and selected patient-centered and clinical outcomes. We used a standardized, validated HL tool (HLS-EU-Q16 Indian version) and a pragmatic set of outcomes relevant to routine services—medication adherence, self-rated health, missed follow-up, acute care utilization, and control markers among patients with hypertension and diabetes. We hypothesized that lower HL would be associated with poorer adherence, worse self-rated health, and reduced care continuity.

## Materials and Methods

This hospital-based cross-sectional observational study was conducted at Government Medical College, Bettiah, West Champaran, Bihar, India, over a study period extending from 10 January 2025 to 25 December 2025. The study aimed to evaluate the relationship between health literacy and health outcomes among patients attending diverse community healthcare settings served by the institution. A total of 70 adult patients were enrolled using a consecutive sampling technique from Medicine Outpatient Department and chronic disease follow-up clinics during routine healthcare visits.

Eligible participants included individuals aged 18 years and above diagnosed with at least one chronic medical condition requiring ongoing medical care such as hypertension, type 2 diabetes mellitus, chronic respiratory illness, or other long-term disorders. Patients who were critically ill, had severe cognitive impairment, psychiatric instability preventing interview participation, communication barriers, or declined informed consent were excluded from the study. Written informed consent was obtained from all participants prior to enrollment, and confidentiality of collected data was strictly maintained throughout the study period.

Health literacy was assessed using the validated Indian version of the European Health Literacy Survey Questionnaire (HLS-EU-Q16), which evaluates participants' perceived difficulty in accessing, understanding, appraising, and applying health information across healthcare, disease prevention, and health promotion domains. Each item was scored according to standardized methodology, generating a cumulative score ranging from 0 to 16, which was categorized as inadequate (0–8), problematic (9–12), and adequate (13–16) health literacy levels.

Sociodemographic variables including age, sex, educational status, occupation, socioeconomic status, and place of residence (urban/rural) were collected through a structured interviewer-administered questionnaire. Clinical characteristics such as diagnosis, duration of illness, number of comorbidities, blood pressure readings, and available biochemical parameters including glycated hemoglobin (HbA1c) were extracted from hospital medical records. Medication adherence was evaluated using the Morisky Medication Adherence Scale (MMAS-8) and categorized into good and poor adherence based on established cut-off values. Self-rated health status was assessed using a standardized Likert-based global health

question, while healthcare utilization variables included history of missed scheduled follow-up visits within the previous six months and emergency room visits or hospitalization during the preceding twelve months.

Data collection was performed by trained investigators fluent in local languages to minimize response bias and ensure comprehension among participants with varying literacy levels. All collected information was entered into a predesigned data collection sheet and cross-verified for completeness and accuracy before statistical analysis.

Statistical analysis was carried out using standard biostatistical methods. Continuous variables were expressed as mean ± standard deviation, whereas categorical variables were summarized using frequencies and percentages. Differences in health outcomes across health literacy categories were analyzed using one-way analysis of variance (ANOVA) for continuous variables and Chi-square or Fisher's exact test for categorical variables. To evaluate independent associations between health literacy and health outcomes, multivariable logistic regression analysis was performed after adjusting for potential confounders including age, gender, educational level, socioeconomic status, residence, and comorbidity burden. Adjusted odds ratios (aORs) with 95% confidence intervals were calculated, and a p-value of <0.05 was considered statistically significant.

**Results**

The overall mean age of participants was 42.5 ± 14.6 years, with no statistically significant difference observed across inadequate, problematic, and adequate health literacy groups (p = 0.840), indicating comparable age distribution among categories. Nearly half of the participants were females (48.6%), although a relatively higher proportion of females was observed in the inadequate and problematic HL groups compared to the adequate HL group; however, this difference was not statistically significant (p = 0.244) (Table 1).

A majority of participants (70%) belonged to rural areas, reflecting the predominantly rural healthcare catchment population of West Champaran district. Rural residence distribution remained similar across health literacy categories (p = 0.927), suggesting that geographic residence alone did not significantly influence HL classification within this cohort.

Educational status demonstrated a strong and statistically significant association with health literacy levels (p < 0.001). Participants with no formal or only primary education were overwhelmingly concentrated in the inadequate and problematic HL groups, whereas none of the individuals with adequate health literacy fell within this low-education category. This finding highlights education as a major determinant of functional health literacy in community settings.

Lower socioeconomic status was observed in 41.4% of participants, but differences between HL groups were not statistically significant (p = 0.853). Similarly, the presence of multiple comorbidities (≥2 chronic conditions) was noted in 44.3% of participants without significant variation across HL strata (p = 0.405).

**Table 1: Sociodemographic and clinical profile by health literacy category (N=70)**

| Characteristic | Overall (N=70) | Inadequate HL (n=15) | Problematic HL (n=30) | Adequate HL (n=25) | p-value |
|---|---|---|---|---|---|
| Age, years (mean±SD) | 42.5±14.6 | 44.5±15.4 | 41.8±14.5 | 42.4±14.7 | 0.840 |
| Female, n (%) | 34 (48.6) | 9 (60.0) | 20 (66.7) | 5 (20.0) | 0.244 |
| Rural residence, n (%) | 49 (70.0) | 10 (66.7) | 22 (73.3) | 17 (68.0) | 0.927 |
| No formal/Primary education, n (%) | 28 (40.0) | 11 (73.3) | 17 (56.7) | 0 (0.0) | <0.001 |
| Lower socioeconomic status, n (%) | 29 (41.4) | 5 (33.3) | 17 (56.7) | 7 (28.0) | 0.853 |
| ≥2 comorbidities, n (%) | 31 (44.3) | 5 (33.3) | 18 (60.0) | 8 (32.0) | 0.405 |

The mean health literacy score was 11.1 ± 2.9, indicating an overall moderate level of health literacy within the study population. Based on standardized HLS-EU-Q16 categorization, 21.4% of participants demonstrated inadequate health literacy, 42.9% had problematic health literacy, and only 35.7% achieved adequate health literacy levels. This distribution suggests that nearly two-thirds of the study population possessed limited health literacy, highlighting a substantial gap in effective health information comprehension within the community setting (Table 2).

Assessment of individual functional domains revealed notable challenges in practical healthcare navigation. Nearly half of participants reported difficulty in judging the reliability of health information (47.1%) and independently filling health-related forms (48.6%), indicating limitations in critical and interactive health literacy skills. Difficulties were also observed in understanding prescription labels (32.9%) and locating disease management information (35.7%), which may directly influence treatment adherence and self-care practices.

**Table 2: Health literacy distribution and selected functional difficulty items**

| Measure | Value |
|---|---|
| HL score (0–16), mean±SD | 11.1±2.9 |
| HL score, median (IQR) | 11 (9–13) |
| Inadequate HL (0–8), n (%) | 15 (21.4) |
| Problematic HL (9–12), n (%) | 30 (42.9) |
| Adequate HL (13–16), n (%) | 25 (35.7) |
| Selected Functional Difficulty Items | |
| Finding information on disease management, n (%) | 25 (35.7) |
| Understanding doctor's instructions, n (%) | 17 (24.3) |
| Understanding prescription labels, n (%) | 23 (32.9) |
| Judging reliability of health information, n (%) | 33 (47.1) |
| Deciding when to seek urgent care, n (%) | 16 (22.9) |
| Filling health forms independently, n (%) | 34 (48.6) |

A strong and statistically significant relationship was observed between health literacy and medication adherence. The proportion of patients demonstrating good adherence increased markedly from 13.3% in the inadequate health literacy group to 72.0% in the adequate health literacy group ($p < 0.001$), indicating that higher health literacy substantially improves treatment compliance. Similarly, self-rated health status showed a clear positive gradient across health literacy categories. Only 13.3% of individuals with inadequate health literacy reported good health compared with 88.0% among participants with adequate health literacy ($p < 0.001$), suggesting improved perceived health and wellbeing with better understanding of health information and disease management (Table 3).

Healthcare continuity also differed significantly across groups. Participants with inadequate health literacy had the highest proportion of missed follow-up visits (93.3%), whereas this decreased to 44.0% among those with adequate health literacy ($p = 0.004$).

Although emergency visits or hospitalization were more frequent among individuals with lower health literacy, this association approached but did not reach statistical significance ($p = 0.056$).

Regarding clinical outcomes, better blood pressure and glycemic control were observed among participants with higher health literacy levels, particularly for HbA1c control, which demonstrated statistical significance ($p = 0.015$).

**Table 3:Association of health literacy with key outcomes**

| Outcome | Overall (N=70) | Inadequate HL (n=15) | Problematic HL (n=30) | Adequate HL (n=25) | p-value |
|---|---|---|---|---|---|
| Good medication adherence (MMAS-8 ≥6), n (%) | 39 (55.7) | 2 (13.3) | 19 (63.3) | 18 (72.0) | <0.001 |
| Good/very good self-rated health, n (%) | 33 (47.1) | 2 (13.3) | 9 (30.0) | 22 (88.0) | <0.001 |
| Missed follow-up in last 6 months (yes), n (%) | 47 (67.1) | 14 (93.3) | 22 (73.3) | 11 (44.0) | 0.004 |
| Any ER visit or hospitalization in last 12 months (yes), n (%) | 48 (68.6) | 13 (86.7) | 22 (73.3) | 13 (52.0) | 0.056 |
| Clinical Control (Subgroups) | | | | | |
| BP controlled among HTN/HTN+T2DM, n (%) | 16/34 (47.1) | 1/6 (16.7) | 6/15 (40.0) | 9/13 (69.2) | 0.078 |
| HbA1c controlled among T2DM/HTN+T2DM, n (%) | 16/35 (45.7) | 0/7 (0.0) | 6/14 (42.9) | 10/14 (71.4) | 0.015 |

The analysis demonstrated that increasing health literacy was significantly associated with improved health outcomes. For every one-point increase in health literacy score, the odds of poor medication adherence decreased by approximately 33% (Adjusted OR: 0.67; 95% CI: 0.52–0.87; $p = 0.003$), indicating a strong independent protective effect of health literacy on treatment compliance (Table 4). Similarly, higher health literacy significantly reduced the likelihood of poor self-rated health, with participants showing nearly 51% lower odds of perceiving their health negatively (Adjusted OR: 0.49; 95% CI: 0.34–0.70; $p < 0.001$). Health literacy also demonstrated a significant association with improved healthcare continuity, as the probability of missing scheduled follow-up visits decreased by 38% with each incremental rise in HL score (Adjusted OR: 0.62;

95% CI: 0.46–0.85; p = 0.003). Although higher health literacy was associated with reduced odds of emergency visits or hospitalization, this relationship did not achieve statistical significance (Adjusted OR: 0.81; 95% CI: 0.63–1.03; p = 0.085).

**Table 4: Adjusted association of health literacy score with outcomes (multivariable logistic regression)**

| Outcome (Dependent Variable) | Adjusted OR per 1-point HL increase | 95% Confidence Interval | p-value |
|---|---|---|---|
| Poor medication adherence | 0.67 | 0.52–0.87 | 0.003 |
| Poor self-rated health | 0.49 | 0.34–0.70 | <0.001 |
| Missed follow-up (6 months) | 0.62 | 0.46–0.85 | 0.003 |
| Any ER visit or hospitalization (12 months) | 0.81 | 0.63–1.03 | 0.085 |

## Discussion

This study demonstrates a high burden of limited health literacy (HL) among adults seeking care in a tertiary teaching hospital serving a largely rural catchment in West Champaran, Bihar. Nearly two-thirds of participants fell within inadequate or problematic HL categories, and HL showed strong gradients across outcomes central to chronic disease management and community health—medication adherence, self-rated health, and follow-up continuity. These findings support the view that HL is not simply an individual attribute but a practical determinant of how communities engage with healthcare, interpret risk, and translate advice into sustained action [6].

The observed HL distribution aligns with broader literature indicating that limited HL is common in clinical populations and is patterned by education and socioeconomic context. In our sample, low education was strongly concentrated in the inadequate/problematic HL groups, consistent with foundational models that link functional literacy and social disadvantage to limited HL [7]. Importantly, HL measurement used the Indian version of HLS-EU-Q16, a tool validated for reliability and construct validity in Indian populations, strengthening interpretability and comparability with other Indian and global datasets.

Medication adherence showed one of the clearest gradients, increasing from 13.3% in the inadequate HL group to 72.0% in the adequate HL group. This is consistent with evidence that low HL is associated with poorer ability to follow treatment instructions and lower adherence, particularly in long-term therapy where regimen complexity and side-effect concerns interact with misconceptions and limited counseling time. Indian research on chronic disease management similarly reports substantial non-adherence and identifies knowledge, illness perceptions, and contextual barriers as key determinants. While many adherence studies are not explicitly framed as HL research, the mechanisms overlap: understanding instructions, interpreting labels, and navigating refills are core HL functions [8,9]. Our item pattern—high difficulty in judging information reliability and completing forms—suggests that "critical" and "navigation" HL domains may be especially weak, increasing susceptibility to misinformation and care discontinuity.

Self-rated health (SRH) also showed a large gradient across HL categories (13.3% to 88.0%), and the adjusted association remained strong. SRH is a validated summary indicator reflecting symptom burden, mental well-being, functional capacity, and perceived control—domains influenced by knowledge, self-efficacy, and the ability to engage meaningfully with care. Systematic reviews have long linked limited literacy/HL with poorer health status and higher morbidity [10]. Our findings are consistent with these reviews and suggest that in rural Bihar, limited HL may compound existing access barriers by reducing the effectiveness of each healthcare contact.

Care continuity—measured as missed scheduled follow-up—was poor overall and particularly high among participants with inadequate HL. This is an important programmatic signal. Missed follow-up can arise from structural constraints (distance, cost, wage loss), but HL may contribute through weaker understanding of the purpose of monitoring, misinterpretation of symptom improvement as cure, and inability to navigate appointment systems. The WHO and the Shanghai Declaration emphasize that HL must be supported by "health-literate systems" that make services easier to understand and use, rather than relying solely on individuals to adapt. From a service design perspective, this supports interventions such as simplified follow-up instructions, pictorial medication schedules, teach-back methods, and community-based navigation support.

Acute care utilization (ER/hospitalization) was high and trended lower with better HL, although the adjusted association did not reach conventional significance in this small sample. The direction is consistent with prior evidence linking low HL to increased hospitalization and emergency use. The

borderline effect likely reflects limited statistical power and heterogeneity in diagnoses. Nonetheless, the combined pattern—worse adherence and follow-up among low-HL participants—provides a plausible pathway to preventable exacerbations and avoidable acute care. We also observed clinically relevant trends in BP and HbA1c control among relevant subgroups, with markedly better HbA1c control in the adequate HL group. This aligns with the broader chronic disease literature that connects health-related knowledge, adherence, and sustained engagement with improved intermediate markers.

**Implications**

For diverse community settings like West Champaran, HL-sensitive care should be viewed as a quality and safety imperative. Routine HL screening may not be feasible, but universal precautions (assuming all patients may have difficulty) can be implemented: plain language, teach-back, simplified written materials, pictograms, and linkage with community health workers for reinforcement and navigation. This approach is aligned with global public health models that frame HL as an upstream determinant and a shared responsibility of individuals, communities, and systems.

**Limitations**

Single-center design, modest sample size, reliance on self-reported outcomes for adherence and utilization, and cross-sectional nature limiting causal inference. However, the use of a validated HL instrument and the consistency of associations across multiple outcomes strengthen the credibility of the observed relationships.

**Conclusion**

Limited health literacy was common among adults attending GMC Bettiah and was strongly associated with poorer medication adherence, worse self-rated health, and missed follow-up. Health-literate communication and navigation support integrated into routine care may improve community health outcomes in similar rural and diverse settings.

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