

Multidimensional Vulnerability and Unmet Health Needs: A Study of The Paudi Bhuiyan Tribe of Western Odisha

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Abstract

Unmet health needs remain a significant challenge among Particularly Vulnerable Tribal Groups (PVTGs) in India, reflecting deep inequalities in access to healthcare services. This study examines the relationship between unmet health needs and the Multidimensional Vulnerability Index (MVI) among the Paudi Bhuiyan tribe of Western Odisha. Using a multidimensional framework, the research incorporates key indicators of health, collected through household surveys, which reveal a high prevalence of untreated illness, inadequate maternal healthcare, malnutrition, and limited access to health facilities. These unmet health needs are further aggravated by geographic isolation, poverty, and low levels of awareness. The findings indicate that unmet health needs significantly contribute to higher multidimensional vulnerability among the Paudi Bhuiyan tribe. Tribal communities encounter significant ongoing health inequalities marked by elevated rates of untreated acute and chronic illnesses, infectious diseases (such as malaria and tuberculosis), malnutrition and substantial unfilled requirements for specialised treatment and family planning. These discrepancies stem from geographic isolation, inadequate infrastructure, entrenched economic struggles and cultural divides in healthcare. Undernourishment presents a serious problem, especially among children and older adults. Similarly, malaria is widespread, with prevalence figures for the Paudi Bhuiyan found to be around 11 per cent in certain studies. Additionally, there is a notable incidence of tuberculosis in older individuals. As an endogamous community, the Paudi Bhuiyan are at risk of sickle cell disease, with a prevalence rate of 3.8 per cent. Geographical isolation, reliance on traditional healers, poor infrastructure, restricted maternal care, and poor sanitation all make it difficult for tribal populations to receive healthcare, which increases the burden of disease and reinforces their multifaceted susceptibility. The study concludes that addressing unmet health needs through improved healthcare infrastructure, awareness programs, and targeted policy interventions is essential for reducing vulnerability and promoting inclusive development among tribal communities.

Keywords: Unmet Health needs, Multidimensional Vulnerability index (MVI), PVTGs, Tribal Health Inequality, Healthcare Accessibility.

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I. Introduction

Health is a basic human right and a crucial factor in personal well-being, family stability, and societal progress. Gaining access to suitable, timely, affordable, and acceptable health services is essential for achieving health equity and universal health coverage (UHC). Nevertheless, the mere presence of health facilities and programs does not guarantee that health needs are sufficiently addressed. People may face illnesses, injuries, pregnancy-related issues, chronic ailments, nutritional deficiencies, or needs for preventive care without receiving the necessary services. These circumstances highlight a significant aspect of unmet health needs and expose the disparity between the health care individuals require and the health care they can actually access. The World Health Organisation (WHO, 2023) has progressively acknowledged the issue of unmet health care needs.

Unmet health needs are not simply a consequence of individual choices or health-seeking behaviour. It is frequently produced by a complex interaction between household characteristics and structural conditions. Geographic distance, lack of transportation, financial constraints, opportunity costs, limited availability of health personnel, shortages of medicines and diagnostic services, inadequate information, language differences, cultural expectations, and perceptions of poor-quality care can all prevent people from obtaining necessary health services.

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Consequently, access to health care should be understood as a multidimensional process rather than merely the physical presence of a health facility.

WHO (2010) emphasises that economic, geographic, epidemiological, and cultural barriers can prevent vulnerable and marginalised populations from obtaining needed care. The problem becomes particularly significant among populations living in poverty and social exclusion. Poor households frequently have fewer resources to cope with illness and are more likely to postpone treatment because of direct and indirect costs. Direct costs may include consultation fees, medicines, diagnostic tests, transportation, and hospital expenses, while indirect costs may involve loss of wages, expenditure on food and accommodation during treatment, and the time required to accompany sick family members. Even where public health services are officially free or subsidised, these indirect costs can create substantial barriers. Financial barriers may therefore result in forgone care or delayed treatment, particularly among households whose livelihoods depend on daily wage labour, subsistence agriculture, or forest-based activities.

The relationship between financial hardship and unmet health care is increasingly recognised in international health-system research. Geographical accessibility represents another major determinant of health-service utilisation. Rural and tribal populations may live far from primary health centres, community health centres, district hospitals, laboratories, pharmacies, or specialist facilities. Physical distance becomes more significant where roads are poor, public transportation is limited, and settlements are dispersed. In hilly and forested areas, travel may be difficult during the monsoon season or during periods of extreme weather. The need to travel long distances can lead individuals to postpone treatment, rely on informal providers, use traditional remedies, or seek care only when illness becomes severe.

The Ministry of Tribal Affairs recognises that tribal populations face distinctive health challenges associated with geographical isolation, socioeconomic disparities, and cultural differences. It also identifies the importance of health-seeking behaviour and traditional knowledge systems in designing inclusive health policies. In this context, the present aims to explore the multidimensional vulnerability and unmet health needs among Paudi Bhuiyan Tribe of Western Odisha. The Paudi Bhuiyan tribe, primarily residing in the hilly and forested regions of Western Odisha, exemplifies these challenges. Their dependence on subsistence livelihoods, low literacy levels, and limited integration into formal institutions contribute to multidimensional vulnerability. Health indicators among the community reflect severe deprivation, including high rates of malnutrition, anemia, and disease burden.

Multidimensional Vulnerability and Unmet Health Needs

The relationship between health and vulnerability is potentially bidirectional. On one hand, multidimensional deprivation can increase exposure to illness and reduce access to treatment. On the other hand, illness can intensify household vulnerability through medical expenditure, loss of income, reduced labour productivity, indebtedness, and deterioration of livelihood assets. A serious illness may require a wage labourer to stop working, thereby reducing household income precisely when treatment expenditure is increasing. For households dependent on agriculture or forest-based activities, illness among economically active members can also affect food security and household production; and as a result, the unmet health needs contribute to a cycle of vulnerability in which deprivation produces poor health and poor health further deepens deprivation.

The World Health Organization (WHO) refer unmet health needs is a situation where individuals require healthcare but do not receive appropriate services due to barriers such as accessibility, affordability, and cultural acceptability (WHO, 2008). In tribal contexts, these barriers are particularly pronounced. Physical accessibility is limited by geographical isolation and poor transportation infrastructure. Many tribal villages are located far from Primary Health Centres (PHCs), requiring long and often difficult journeys to access care. Affordability is another major constraint, as low-income levels and high out-of-pocket expenditures deter healthcare utilization.

Moreover, the cultural acceptability plays a significant role in shaping health-seeking behaviour among tribal communities. Traditional healing practices, including the use of herbal remedies and spiritual interventions, remain prevalent among tribal communities. While these practices are integral to cultural identity, they may delay access to formal medical care, particularly in cases of serious illness. Empirical studies have demonstrated that unmet health needs are strongly associated with adverse health outcomes, including higher morbidity and mortality rates. The study of Mudi and Pradhan (2023) identified various determinants of unmet health care needs among the Juang tribe (PVTG) of Odisha and revealed that there are an extremely low utilisation and high inequity in health care services. It was observed that only 11 percent of the Juang women had sought all antenatal care (ANC), whereas more than half of them (51 percent) had attended postnatal (PNC) check-ups. When adjusting for socio-economic factors, the illiterate women had a lower probability of seeking complete ANC services (AOR: 0.22) and PNC (AOR: 0.04) than their literate peers. In addition to this, economic constraints also have a major impact, and women with low to middle socio-economic status (Standard of Living Index) had fewer odds of getting full ANC and institutional delivery.

Similarly, the study of Sahoo and Sahoo (2023) described that to achieve the objectives of Sustainable Development Goal (SDG) 3.2 on a global level, it is necessary to have an urgent change in policy. This can be

done by making interventions in favour of women from marginalised communities, those who do not have formal education and who are settled in distant, poorly served, or tribal areas. To produce fast results regarding the mortality rate of children below five years, the authors suggest adopting policies to promote birth spacing and breastfeeding.

Multidimensional vulnerability and Tribal community

The concept of multidimensional vulnerability is rooted in the capability approach, which conceptualizes poverty as a deprivation of capabilities rather than income alone (Sen, 1999). This framework emphasizes the importance of access to essential resources and opportunities required for achieving well-being. Scholars have developed various indices to measure multidimensional poverty, including the Multidimensional Poverty Index (MPI), which incorporates indicators across health, education, and living standards (Alkire & Foster, 2011). These approaches highlight the interconnected nature of deprivation and the need for integrated policy responses.

The multidimensional vulnerability of tribal community particularly of Paudi Bhuiyan can be attributed to their socio-economic and biophysical environment. As per Bhoi and Acharya (2024), the group is one that was traditionally comprised of shifting cultivators, with many now in the process of settling down, but encountering both technological and cultural difficulties in the process. In terms of their financial situation, the community lives in an economically disadvantaged state, where, according to data, the average monthly income per capita of PVTGs in Odisha stands at Rs. 2,100, thereby placing most families below the poverty line.

Additionally, health needs are further complicated by cultural beliefs and the manner in which healthcare is sought. According to Ghosal et al. (2024), Cultural problems like the belief in the “evil eye” usually cause huge delays in registering pregnancies among the PVTGs. Moreover, almost 30 percent of mothers give birth at home since health institutions are very far or inaccessible due to a lack of transport. With the knowledge of such holistic gaps, the Government of Odisha (2020) released a resolution for the creation of the Paudi Bhuiyan Development Agency (PBDA) in Banspal, Keonjhar. The purpose of the agency would be to undertake special programs to offer social security and welfare to 130 villages that were previously underserved.

Empirical studies consistently demonstrate that tribal populations in India experience poorer health outcomes compared to non-tribal groups. High levels of malnutrition, anemia, and mortality are reported in national surveys (IIPS, 2021). These disparities are attributed to socio-economic inequalities, inadequate healthcare infrastructure, and cultural barriers. The dual burden of disease—coexistence of communicable and non-communicable diseases—further complicates the health scenario in tribal areas (ICMR, 2017). Limited access to healthcare services and low health awareness exacerbates these challenges.

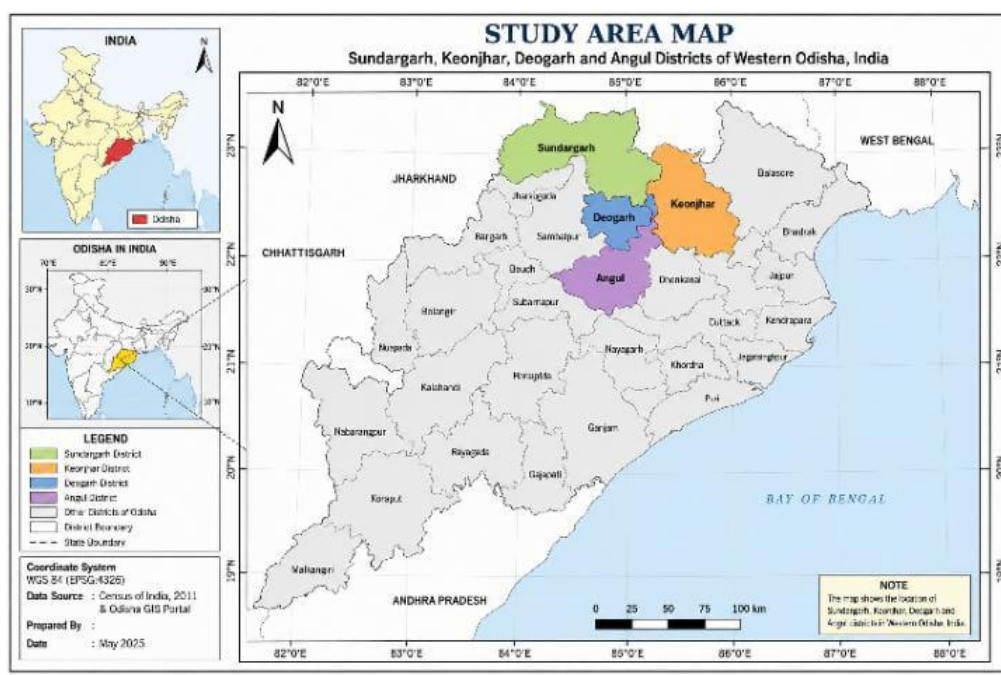
The nutritional health of Paudi Bhuiyan is described as “super critical” because of serious issues with undernutrition and chronic energy deficiency (CED). Goswani (2012) conducted a cross-sectional study in Keonjhar and Angul districts, where nearly 58.7 percent of men and 77.7 percent of women are undernourished. Women experience higher rates of severe Grade-III CED (29.9 percent), which is almost double that of their male counterparts (17.8 percent). These numbers were notably higher than those for other tribal groups in Odisha and across India. Supporting these findings, the ICMR Bulletin (2003) shows that 85 percent of Paudi Bhuiyan in Sundergarh suffer from various grades of anaemia. This is way above the national average, which is linked to poor environmental hygiene, a general lack of awareness and hookworm infestations. The study shows a positive correlation between hookworm infestations and anaemia, spread partly because of open defecation and the habit of walking barefoot. The tribe suffers from micronutrient deficiencies, particularly Vitamin A deficiency, leading to health issues such as Bitot’s spots and night blindness in a significant portion of the population.

Extending this analysis, Kanrar, Goswani, and Roy (2023) further explain that tribal women in Odisha face a “triple burden” of diseases: they are extremely malnourished, lack proper sanitation and face declining food security, leading to tragic incidents like the malnutrition deaths in Nagada village, which shows systemic failure to help remote PVTG communities. These failures stem from food insecurity, weakening of traditional livelihood opportunities and inaccessibility of government healthcare facilities.

II. Research Methodology

Study Area

The study was conducted among the Paudi Bhuiyan, a Particularly Vulnerable Tribal Group (PVTG), residing in western Odisha, particularly in the districts of Sundergarh, Keonjhar, Anugul and Deogarh, where a significant proportion of the community resides. The Paudi Bhuiyan inhabit remote hilly and forested regions characterised by poor road connectivity, limited healthcare infrastructure, and dependence on agriculture and forest-based livelihoods. These geographical and socio-economic conditions make the area appropriate for examining multidimensional vulnerability and unmet health needs.



Research Design

The study adopted a cross-sectional descriptive research design using a mixed-methods approach. Quantitative methods were employed to assess socio-economic characteristics, health status, and healthcare utilisation, while qualitative methods explored perceptions of illness, traditional healthcare practices, barriers to accessing health services, and community experiences. The mixed-methods design provided a comprehensive understanding of both measurable health indicators and the social and cultural dimensions influencing health.

Sampling

A multistage sampling technique was used.

Stage I: Purposive selection of districts with a high concentration of the Paudi Bhuiyan population.

Stage II: Selection of villages using simple random sampling.

Stage III: Selection of households through systematic random sampling. Qualitative respondents were one adult of the household, including community elders, Accredited Social Health Activists (ASHAs), Anganwadi workers, traditional healers, and health officials, were selected through purposive sampling for in-depth interviews.

Sample Size

The quantitative survey included 319 households from selected Paudi Bhuiyan villages. From each household, one adult respondent (18 years or above) was interviewed. Additionally, 25–30 key informants participated in qualitative interviews and focus group discussions. The sample size was considered adequate to capture the socio-economic and health-related characteristics of the study population while remaining feasible within the study's time and resource constraints.

Data Collection

Primary Data

Primary data were collected through Structured household questionnaires. Semi-structured interviews. Focus Group Discussions (FGDs). Key Informant Interviews (KIIs). Field observation of housing conditions, sanitation, drinking water facilities, and healthcare infrastructure.

Secondary Data

Secondary information was obtained from Government reports from the Ministry of Tribal Affairs and the Government of Odisha, National Family Health Survey (NFHS-5), Census of India, National Health Mission (NHM) reports, and Tribal Research Institute publications. Peer-reviewed journal articles, books, and reports related to tribal health and PVTGs.

Study Variables

Health needs not met served as the dependent variable, assessed through indicators such as delayed care because of cost, failure to seek medical attention when ill, distance to health services, use of maternal healthcare, child

immunisation levels, nutritional shortfalls, and availability of necessary medications. Households facing one or more obstacles in accessing necessary healthcare were categorized as having unmet health needs. The Multidimensional Vulnerability Index (MVI) served as the independent variable. The Multidimensional Vulnerability Index (MVI) was developed based on the Alkire Foster framework for multidimensional measurement. The framework encompassed six dimensions: (1) Health and Nutrition, (2) Education, (3) Standard of Living, (4) Livelihood and Assets, (5) Access to Basic Services, and (6) Social and Cultural Vulnerability. Within each dimension, all indicators carried equal weight, with deprived households receiving a score of 1 and non-deprived households a score of 0. Household deprivation scores were determined by summing up individual deprivation indicators with assigned weights, and those households scoring 0.33 or higher were categorized as multidimensionally vulnerable. The overall MVI was computed using the formula $MVI = H \times A$, with H denoting the headcount ratio and A indicating the average intensity of deprivation.

Dependent variables (Unmet Health Needs)	Delayed treatment due to financial constraints, non-utilization of healthcare despite illness, Distance to healthcare facilities, Essential Healthcare utilization, Child immunization status, Nutritional deficiencies, Access to essential Medicines.
Independent Variables (MVI)	Health and Nutrition, Education, Standard of Living, Livelihood and Assets, Access to Basic Services, and Social and Cultural Vulnerability

Tools and Techniques

The study employed both quantitative and qualitative analytical tools. Data Collection Tools: Structured interview schedule. Observation checklist. Focus Group Discussion guide. Key Informant Interview schedule. Data Analysis Techniques: Descriptive statistics (frequency, percentage, mean, and standard deviation). Cross-tabulation to examine relationships between socio-economic variables and health outcomes. Construction of a multidimensional vulnerability framework based on indicators such as education, income, housing, nutrition, healthcare access, and sanitation. Thematic analysis of qualitative data using coding and categorization. Statistical analysis was performed using SPSS, R, or Microsoft Excel, while qualitative data were analysed manually or with qualitative analysis software such as NVivo.

Ethical Considerations

Ethical principles were followed throughout the study. Ethical approval was obtained from the relevant Institutional Ethics Committee before data collection. Permission was obtained from local administrative authorities and community leaders. Informed written or verbal consent was obtained from all participants after explaining the purpose of the study. Participation was voluntary, and respondents were free to withdraw at any stage without penalty. Confidentiality and anonymity of respondents were maintained by removing personal identifiers. Data were used exclusively for academic and research purposes. Cultural values, traditions, and customary practices of the Paudi Bhuiyan community were respected during all stages of fieldwork.

III. Results

Socio-demographic Profile of the Respondents

A total of 319 Paudi Bhuiyan households were surveyed across selected villages in Sundargarh District, Western Odisha. The surveyed households reflected the typical demographic and socioeconomic characteristics of a Particularly Vulnerable Tribal Group (PVTG). The majority of households depended on subsistence agriculture, wage labour, and forest-based livelihood activities. Most respondents had low levels of formal education, and access to basic amenities remained inadequate. Household size averaged between four and six members, with a high dependency ratio, indicating significant economic pressure on working-age adults.

Table 1. Overall Multidimensional Vulnerability among Surveyed Households (n = 319)

Indicator	Value
Total households surveyed	319
Vulnerable households	187
Non-vulnerable households	132
Headcount Ratio (H)	0.586
Average Intensity (A)	0.454
Overall MVI (H × A)	0.266

The findings reveal that 58.6 percent of the surveyed households were identified as multidimensionally vulnerable. The average intensity of deprivation among vulnerable households was 45.4 percent, resulting in an overall Multidimensional Vulnerability Index (MVI) of 0.266. This indicates that vulnerability among the Paudi Bhuiyan extends beyond income poverty and encompasses multiple dimensions of deprivation.

Dimension-wise Contribution to Multidimensional Vulnerability

Health and nutrition contributed the largest share (30.1 percent) to multidimensional vulnerability, followed by Education (26.3 percent) and Standard of Living (22.6 percent). The comparatively lower contribution of Social and Cultural Vulnerability (11.3 percent) suggests that while cultural deprivation is important, deficiencies in health, education, and living conditions remain the primary drivers of vulnerability (see table 2).

Table 2. Contribution of Individual Dimensions to Overall MVI

Dimension	Contribution (%)
Health and Nutrition	30.1
Education	26.3
Standard of Living	22.6
Livelihood and Assets	18.8
Access to Basic Services	13.5
Social and Cultural Vulnerability	11.3

On distribution of households by MVI Category, it is found that more than one-third (34.8 percent) of households experienced high multidimensional vulnerability, while 41.4 percent fell into the moderate category. Only 23.8 percent of households experienced relatively low levels of deprivation (see table 3).

Table 3. Household Distribution According to MVI Category

MVI Category	Households	Percentage
Low Vulnerability (<0.20)	76	23.8
Moderate Vulnerability (0.20–0.33)	132	41.4
High Vulnerability (>0.33)	111	34.8
Total	319	100.0

Unmet Health Needs

The survey indicates that financial barriers and physical accessibility were the leading causes of unmet health needs. More than half of the households delayed seeking medical treatment because of financial hardship or transportation difficulties. High levels of undernutrition and reliance on traditional healers further illustrate the limited availability and utilization of formal healthcare services (see table 4).

Table 4. Major Unmet Health Needs among Households

Indicator	Households	Percentage
Delayed treatment due to financial constraints	182	57.1
Difficulty accessing health facilities	169	53.0
Maternal healthcare inadequacy	96	30.1
Child immunization gaps	84	26.3
Anaemia or chronic undernutrition	141	44.2
Dependence on traditional healers	124	38.9

Moreover, when the association between MVI and unmet health needs calculated, a strong positive correlation ($r = 0.64$, $p < 0.001$) was observed between multidimensional vulnerability and unmet health needs. Households with higher MVI scores consistently reported greater difficulties in obtaining timely and adequate healthcare. The multiple regression model explained 53 percent of the variation in unmet health needs. Health and Nutrition emerged as the strongest predictor, followed by Education and Standard of Living. These findings indicate that improvements in nutrition, educational attainment, and living conditions could substantially reduce unmet healthcare needs among the Paudi Bhuiyan.

Regression analysis conducted among the Paudi Bhuiyan households indicated that the overall regression model was statistically significant ($F = 58.74$, $p < 0.001$). The model yielded an R^2 value of 0.53, suggesting that the predictors together accounted for approximately 53 percent of the variability in multidimensional vulnerability within the surveyed Paudi Bhuiyan households. The adjusted R^2 of 0.52 demonstrates that, after considering the number of predictors in the model, about 52 percent of the variability in vulnerability continued to be explained. The statistically significant F-test indicates that the predictors as a whole have a noteworthy relationship with multidimensional vulnerability. These results imply that socioeconomic, educational, livelihood, health, service-

access, and socio-cultural factors collectively significantly influence vulnerability among the Paudi Bhuiyan community (see table 5).

Table 5. Regression Results

Predictor	β	Std. Error	t	p-value
Health and Nutrition	0.41	0.05	8.21	<0.001
Education	0.27	0.04	6.42	<0.001
Standard of Living	0.18	0.05	3.78	<0.001
Livelihood and Assets	0.14	0.04	3.21	0.002
Access to Basic Services	0.11	0.04	2.76	0.006
Social and Cultural Vulnerability	0.09	0.03	2.41	0.017

Model Summary

Statistic	Value
R ²	0.53
Adjusted R ²	0.52
F-statistic	58.74
p-value	<0.001

The analysis demonstrates that multidimensional vulnerability is widespread among the Paudi Bhuiyan households, with nearly three-fifths classified as vulnerable. Health and nutritional deprivation constitute the largest component of overall vulnerability, while education and poor living conditions further exacerbate disadvantage. Financial constraints, geographical isolation, and inadequate healthcare infrastructure are the principal determinants of unmet health needs. The significant positive association between MVI and unmet health needs confirms that households experiencing multiple deprivations are also those most likely to face barriers to healthcare access.

IV. Discussion

The present study demonstrates that multidimensional vulnerability is a major determinant of unmet health needs among the Paudi Bhuiyan, a Particularly Vulnerable Tribal Group (PVTG) residing in the remote forested regions of Western Odisha. The overall Multidimensional Vulnerability Index (MVI) of 0.266 indicates that deprivation extends beyond income poverty and encompasses deficits in health, education, livelihoods, housing, and access to basic services. More than half of the surveyed households (58.6 percent) were classified as multidimensionally vulnerable, underscoring the persistent structural disadvantages faced by the community.

The findings are consistent with the multidimensional poverty framework proposed by Alkire and Foster (2011), which argues that poverty should be understood as overlapping deprivations rather than solely as a lack of income. Among the Paudi Bhuiyan, poor nutrition, inadequate healthcare access, low educational attainment, insecure livelihoods, and limited infrastructure reinforce one another, creating a cycle of chronic vulnerability. Such cumulative disadvantages reduce household resilience and increase susceptibility to disease, food insecurity, and financial hardship.

Health and nutrition emerged as the largest contributor (30.1 percent) to overall vulnerability. This finding reflects the continuing burden of undernutrition, anaemia, maternal health challenges, and restricted access to quality healthcare in tribal areas. Similar patterns have been reported among other PVTGs in Odisha and elsewhere in India, where remoteness, shortages of health personnel, and poor transport infrastructure limit access to preventive and curative services. Nutritional deprivation among tribal populations is also closely associated with food insecurity, seasonal unemployment, and limited dietary diversity, all of which contribute to poor health outcomes.

Education constituted the second-largest contributor (26.3 percent) to multidimensional vulnerability. Low literacy and limited educational attainment restrict access to information on disease prevention, nutrition, sanitation, and available government health programmes. Educational disadvantage also reduces employment opportunities and household income, thereby indirectly affecting healthcare utilization. Previous research has consistently shown that education is a key social determinant of health because it enhances health literacy, improves decision-making, and increases awareness of public health services.

The contribution of Standard of Living (22.6 percent) highlights the importance of basic infrastructure in shaping health outcomes. Inadequate housing, unsafe drinking water, poor sanitation, and lack of clean cooking fuel increase the risk of communicable diseases, respiratory illnesses, and environmental health hazards. These

conditions remain common in many remote tribal settlements despite improvements in rural development programmes. The findings therefore support the need for integrated interventions that combine healthcare with investments in water, sanitation, housing, and rural infrastructure.

Livelihood and Asset deprivation (18.8 percent) also contributed substantially to household vulnerability. The Paudi Bhuiyan primarily depend on subsistence agriculture, wage labour, and forest-based resources, making household incomes highly vulnerable to seasonal fluctuations and environmental uncertainty. Limited livelihood diversification reduces the ability of households to absorb economic shocks and often compels families to postpone or forgo medical treatment because of financial constraints. This is reflected in the high proportion of households reporting delayed treatment due to healthcare costs.

Although Access to Basic Services (13.5 percent) and Social and Cultural Vulnerability (11.3 percent) contributed comparatively smaller shares to the overall MVI, they remain important dimensions of deprivation. Long distances to health facilities, irregular transport, and shortages of medical personnel continue to hinder healthcare utilization in remote villages. Cultural beliefs, language barriers, and reliance on traditional healing practices may also influence treatment-seeking behaviour. These findings suggest that improving service availability alone may not be sufficient; health programmes should also be culturally responsive and developed in partnership with tribal communities.

The analysis further revealed a significant positive association between multidimensional vulnerability and unmet health needs. Households with higher MVI scores experienced greater difficulty in obtaining timely healthcare, higher levels of untreated illness, and more frequent delays in seeking medical attention. This relationship indicates that unmet health needs are not the result of a single factor but rather arise from the combined effects of economic deprivation, poor education, inadequate infrastructure, and geographic isolation. Similar relationships have been documented in studies of indigenous and marginalized populations, where multiple forms of deprivation jointly influence healthcare access and health outcomes.

From a policy perspective, these findings support the adoption of integrated, multisectoral approaches to tribal development. Health interventions should be linked with improvements in nutrition, education, livelihood security, rural infrastructure, and social protection. Mobile medical units, strengthened primary healthcare facilities, community nutrition programmes, improved road connectivity, and culturally appropriate health communication could substantially reduce barriers to healthcare among the Paudi Bhuiyan. Recruiting and training community health workers from within the tribe may further enhance trust in formal health services and improve service utilization.

Despite its contributions, this study has certain limitations. The analysis is based on a cross-sectional household survey, which limits the ability to establish causal relationships between multidimensional vulnerability and unmet health needs. Self-reported information on healthcare utilization may also be affected by recall bias. Furthermore, the study was conducted among Paudi Bhuiyan households in selected areas of Western Odisha, and therefore the findings should be generalized to other PVTGs with caution. Future research should employ longitudinal designs, incorporate clinical and anthropometric assessments, and compare vulnerability patterns across multiple tribal communities to better understand temporal changes and regional differences.

Overall, the study demonstrates that multidimensional vulnerability provides a comprehensive framework for understanding the health disadvantages experienced by the Paudi Bhuiyan. Reducing unmet health needs requires policies that address not only healthcare delivery but also the broader social, economic, and environmental determinants of health. An integrated approach to tribal development is therefore essential for improving health equity and achieving sustainable development among Odisha's Particularly Vulnerable Tribal Groups.

V. Conclusion

This study examined the relationship between multidimensional vulnerability and unmet health needs among the Paudi Bhuiyan, a Particularly Vulnerable Tribal Group residing in the remote regions of Western Odisha. Using household-level data from 319 households, the study demonstrated that multidimensional deprivation remains widespread within the community. The overall Multidimensional Vulnerability Index (MVI) of 0.266, together with a headcount ratio of 0.586 and an average deprivation intensity of 0.454, indicates that a substantial proportion of household's experience overlapping disadvantages across multiple dimensions of well-being.

Health and Nutrition, Education, and Standard of Living emerged as the principal contributors to multidimensional vulnerability, highlighting the interconnected nature of health, socioeconomic conditions, and access to essential services. The findings further revealed a significant positive relationship between multidimensional vulnerability and unmet health needs, suggesting that households experiencing greater deprivation are also more likely to encounter barriers to timely and appropriate healthcare.

The results emphasize that reducing health inequalities among the Paudi Bhuiyan requires integrated, multisectoral interventions rather than isolated disease-specific programmes. Strengthening primary healthcare,

improving nutrition, expanding educational opportunities, enhancing livelihood security, and investing in rural infrastructure are all critical components of an effective strategy for reducing vulnerability. Policies should also recognize the importance of cultural sensitivity and community participation in the design and implementation of tribal health programmes.

Moreover, the findings of this study have important implications for public health policy and tribal development in Odisha. The high prevalence of multidimensional vulnerability among the Paudi Bhuiyan demonstrates that improving health outcomes requires interventions that address the broader social determinants of health rather than focusing exclusively on healthcare delivery. Since health and nutrition emerged as the largest contributors to overall vulnerability, strengthening primary healthcare, nutrition services, and preventive health programmes should be a priority.

The Government of Odisha and the Ministry of Tribal Affairs should expand mobile medical units and strengthen Health and Wellness Centres in remote Paudi Bhuiyan settlements to improve geographical access to healthcare. Regular outreach services, including antenatal care, immunization, nutrition screening, and management of chronic diseases, can reduce the burden of unmet health needs among households living in inaccessible areas.

Infrastructure development remains a key policy priority. Improved rural roads, transportation networks, safe drinking water, sanitation facilities, electricity, and digital connectivity would facilitate access to healthcare and other essential public services. Investments in these sectors are likely to generate long-term improvements in health and well-being. The study also highlights the importance of culturally responsive healthcare. Recruitment and training of community health workers from the Paudi Bhuiyan community, incorporation of indigenous knowledge into health promotion activities where appropriate, and culturally sensitive communication strategies can improve trust in the public health system and increase healthcare utilization. Community participation in planning and monitoring health programmes should be strengthened to ensure that interventions reflect local needs and priorities.

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