Original Research Article

Navigating eye health problems of urban slums in Asansol, West Bengal: a comprehensive study

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ABSTRACT

Background: Rapid urbanization in India has expanded slum settlements where residents face multidimensional deprivation and limited access to eye care. Asansol, a fast-growing industrial city in West Bengal, has large, underserved slum populations, but little evidence on their eye-health needs. This feasibility study assessed socio-economic vulnerability, eye-care needs, and gaps in service access to inform an urban eye-care model.
Methods: A cross-sectional quantitative study was conducted from March to May 2024 across 20 randomly selected slums of the Asansol Municipal Corporation. Data were collected through a desk review, slum mapping, and household surveys with 378 adults (≥18 years), selected using cluster-based four-segment sampling. A structured questionnaire captured socio-demographics, WASH indicators, ocular symptoms, and care-seeking. A composite Vulnerability Index was developed using four dimensions-industry/employment, housing/sanitation, poverty/unemployment, and healthcare access-integrated with population density and categorized into low, moderate, high, and critical vulnerability.
Results: Nearly half of respondents were illiterate, and 90% were engaged in informal employment. Sanitation gaps were pronounced, with 30% lacking toilet access. A total of 65.9% reported household eye problems, most commonly redness (43.8%), blurred vision (42.6%), and itching (24.5%). Despite proximity to facilities, majority had limited or no access to healthcare, and most relied on government hospitals (80.7%). Vulnerability mapping identified 10 slums as high or critical across all domains, highlighting substantial inequities.
Conclusions: Urban slum communities in Asansol face high socio-economic vulnerability and substantial unmet eye-care needs. Findings support the feasibility and necessity of localized, affordable, community-based eye-care models integrated within broader urban health and slum development programmes, prioritizing high- and critical-vulnerability slums.

Keywords: Urbanisation, Slum mapping, Vulnerability, Eye health

INTRODUCTION

India's rapid urbanization, driven by industrialization, had led to a significant migration to urban areas, resulting in a rise in the urban poor who predominantly resided in slums and makeshift settlements. These communities faced numerous challenges including inadequate housing, limited access to basic services, and poor health outcomes. Asansol, the second largest city in West Bengal. The total population of Asansol had increased approximately seven times in the last sixty years, and the geographical extent expanded over 20 times. The city had undergone economic functional changes-mainly from a mining and transport town to an economically complex city.[1] It was confronted with growth imbalance due to over concentration of economic resources which had resulted in a stratified society with poor people residing in slums.[2]

Asansol slum dwellers lacked quality life and were engulfed with challenges in health care and other basic amenities. It had been widely observed that eye health was important for overall well-being, and eye care services for prevention and treatment of vision disorders. There was increasing blindness rate which highlighted need for early detection along with inclusive wide coverage. It was crucial to note that there were urban-rural disparities in eye care utilization, which should be analysed.[3] Since, implementation of healthcare interventions was determined by multiple factors including the organisational context, implementation strategies and features of the intervention as perceived by multiple stakeholders, it was pertinent to map and assess eye heath care needs and demands of the people in Asansol.[4] Despite the proximity of urban health facilities, urban poor encounter substantial barriers in accessing essential healthcare services. These challenges arose from factors such as overcrowding, increased healthcare costs, and deficiencies within the urban public health system.

The data about the prevalence of ocular comorbidities in underserved areas like urban slums can be used to update and strategize eye health-care delivery models for out-of-school children.[5] Overall, addressing eye health care in urban slums was not only a matter of public health but also a step toward equity, and well-being. Problems of slums in Asansol-Burnpur required a multifaceted approach involving government agencies, NGOs, and community efforts.[6]

A feasibility study for eye health in Asansol was essential for laying the groundwork for effective interventions that addressed the specific challenges faced by communities in accessing and receiving quality eye care services. It could play a vital role in ensuring that efforts are targeted, sustainable, and impactful in improving eye health outcomes for all segments of the population.

The purpose of this study was to gather essential data, analyse market dynamics, and provide recommendations to support informed decision-making for the implementation of urban eye care services in the urban slum areas within the Asansol Municipal Corporation. Broad objective of the study is to assess the feasibility of initiating eye care interventions in slums areas tailored to the characteristics, needs, and vulnerability of slums.

METHODS

A cross-sectional, quantitative study was conducted to assess the feasibility of establishing urban eye-care services among slum populations in the Asansol Municipal Corporation. The study incorporated desk review, slum mapping, and household-level needs assessment surveys. This combination enabled a comprehensive understanding of socio-demographic characteristics, vulnerability profiles, and eye-care needs within selected slum clusters.

Study area

The study was conducted between March and May 2024 across 20 slum settlements under the Asansol Municipal Corporation, an urban-industrial region experiencing rapid demographic growth and housing expansion. Slums included in the mapping represented diverse geographies, including residential belts, industrial fringes, and densely populated semi-permanent settlements.

Study population and respondents

Survey respondents included heads of households or senior adult members residing in the selected slums. Local stakeholders such as medical officers, ASHA workers, optical shop owners, NGO staff, and pharmacists were also consulted to contextualize the findings and validate mapping information.

Inclusion criteria

Households located within the selected slum boundaries, adult respondents (≥18 years) capable of providing reliable information and permanent slum residents (≥6 months) were included.

Exclusion criteria

Temporary migrant workers or transient households and individuals unable or unwilling to provide consent were excluded.

Sample size and sampling procedure

A total sample of 378 respondents was included in the study. Sample size was determined based on operational feasibility and the need to ensure adequate representation across slum clusters. The study population comprised adult members (≥18 years) from households residing in slum settlements within Asansol Municipal Corporation.

A cluster-based sampling approach was adopted. Clusters were selected through simple random sampling using secondary data and municipal lists. A total of 20 slums were selected. Within each slum, a four-segment approach was used to ensure spatial representation: the slum was divided into four natural segments, and alternate households in each segment were selected until the required number (approximately 18-19 households per slum) was reached. In each selected household, the head of the household or the senior-most adult available was interviewed. This approach ensured adequate geographical coverage, reduced selection bias, and enhanced the representativeness of slum-level characteristics.

Ethical considerations

Although formal ethical approval was not required for this feasibility assessment, all procedures adhered to

ethical principles for research involving human participants. Written or verbal informed consent was obtained from every respondent prior to the interview, after explaining the purpose of the study, the voluntary nature of participation, and confidentiality safeguards. No personal identifiers were collected, and all information was handled anonymously to ensure privacy and protect participants' rights.

Data collection tools and procedures

Desk review

A structured desk review of government reports, municipal records, census data, and published research was undertaken to understand the socio-economic and health context of the region.

Slum mapping

Slum profiling consisted of direct observation, stakeholder interviews, and verification of infrastructure indicators such as water supply, sanitation, housing type, access to healthcare and eye-care services, and social vulnerabilities.

Household survey

A structured questionnaire administered through CAPI (Computer-assisted personal interviewing) captured data on: Socio-demographic characteristics, employment and income, housing and sanitation, health and eye-care access and ocular symptoms and care-seeking behaviour.

Vulnerability index construction

A composite vulnerability index was created using nine components under four dimensions: industry and employment, housing and sanitation, poverty and unemployment and healthcare availability and accessibility (Table 1).

These components served as proxies for factors influencing slum development. The overall vulnerability score was calculated by aggregating scores from the four primary dimensions and combining them with population density data.

Methodology for calculating the vulnerability index

The overall vulnerability index was calculated using a combination of survey data and Census information. Data from the survey and Census were exported to excel, where percentile ranks were calculated for each dimension using the formula below:

P=rank-1/N-1

Where, P was the percentile rank, and N was the total number of respondents (218).

A higher percentile rank indicated greater relative vulnerability, with 1.0 denoting the most vulnerable and 0.0 the least vulnerable. The overall vulnerability score was derived by aggregating scores from the four primary dimensions and integrating population density data from the Census 201. The vulnerability index was calculated by referring to methodology developed to construct social vulnerability index (SVI) for each census track in the USA and vulnerability index for the management of and response to the COVID-19 epidemic in India.[7,8]

After calculating the percentile ranks, contributing factors were aggregated to compute a composite vulnerability index. The results were classified into four categories for clearer visualization and interpretation: Low (Green), (0.000-0.250), moderate (Blue), (0.251-0.500), high (Yellow), (0.501-0.750) and critical (Red), (0.751-1.000).

Table 1: Dimensions and components included in the vulnerability index dimensions.

Dimensions	Components
Industry and employment	Slums surrounded by industrial areas. Informal employment being as the primary category of work.
Housing and sanitation	Non-permanent housing structure. Community toilets and no toilets. Accessed sanitation facility at somewhat and no extent.
Poverty and unemployment	Poverty reported as social issue. Unemployment reported as social issue.
Healthcare and quality of facilities	Healthcare facilities or clinics available within settlement. Healthcare accessibility in settlement.

RESULTS

Socio-demographic characteristics

Socio-demographic profile of study participants: As per Table 2, the gender distribution of the respondents was relatively balanced, with males representing 52.9% and females 47.1%. This balance ensured that survey reflected the perspectives and needs of both genders within the urban poor population in Asansol Municipal Corporation. Educational attainment among respondents showed considerable challenges, with 46.0% being illiterate and 14.0% literate but without formal education. Only 28.3% had completed primary education, and just 11.1% had attained secondary education. A very small fraction (0.5%) had reached graduate or higher education levels.

The survey revealed that daily labour was the predominant occupation, with 50.3% of respondents engaged in this type of work. This indicated a high level of reliance on informal, often unstable employment. Homemakers made up 33.3% of the sample, highlighting the significant role of household responsibilities within

the community. Other occupations include sales workers (4.5%), service workers (6.9%), and transport workers (2.1%). Presence of minimal professional roles (0.5%) and very few individuals in private or government jobs (1.3%) reflected the limited formal employment opportunities available to urban poor. The marital status data showed that a significant majority of respondents were married (89.2%), suggesting stable family structure within community. Proportion of unmarried individuals was low (4.8%), and 6.1% were widowed or widowers.

The income distribution revealed that nearly half of the respondents had a monthly income exceeding 10,000 (46.3%), while a substantial portion earned between 5,000 and 10,000 (40.7%). Fewer households earned up to 5,000 (9.3%), and only a small fraction had incomes up to 2,500 (3.7%). This suggested a varied income range, with a significant portion of the population experiencing relatively higher earnings compared to general poverty status. The survey showed that 40.7% of respondents had individual health insurance coverage, indicating a significant portion with some form of health protection. A smaller percentage had family health insurance (16.7%), reflecting limited broader coverage. However, a notable 42.6% of respondents lacked any form of health insurance, highlighting substantial gap in health coverage and potential vulnerability to medical expenses (Table 2).

Table 2: Percentage distribution of the respondents by their background characteristics.

Background characteristics	Percentages (%)
Gender	
Male	52.9
Female	47.1
Education	
Illiterate	46
Primary	28.3
Secondary	11.1
Literate but no formal education	14
Occupation	
Daily labour	50.3
Homemaker	33.3
Other	16.4
Marital status	
Married	89.1
Widow/widower	6.1
Unmarried	4.8
Monthly household income (in INR)	
More than 10000	46.3
Up to 10000	40.7
Up to 5000	9.3
Up to 2500	3.7
Health insurance coverage	
No insurance	42.6
Individual	40.7
Family	16.7

Characteristics of slums

As per Table 3, of total 20 selected slums, most of the slums (80%) were surrounded by the residential area and only 20% were near industries or commercial zones. The data from the slum mapping revealed that 90% of residents were engaged in informal employment, such as street vending and domestic work, while only 10% held formal employment positions, including office jobs and government jobs. The data from the slum mapping, presented in graphical form, revealed several critical insights into the availability and accessibility of sanitation and water facilities. The main source of water supply showed that 85% of residents relied on piped water, whereas 15% depended on communal taps.

Regarding sanitation, 45% of residents had access to individual toilets, while 25% depended on community toilets. Alarmingly, 30% of residents lacked access to any sanitation facilities, underscoring a significant hygiene infrastructure gap. In terms of accessibility, 60% of residents found sanitation facilities easily accessible, 5% found them somewhat accessible, and 35% reported no access at all. These findings highlighted the urgent need for improvements in sanitation and water infrastructure to enhance living conditions within these communities.

The slum mapping revealed that unemployment (85%) and poverty (80%) were the most pressing issues faced by residents, significantly impacted their quality of life. Lack of access to education (70%) exacerbates these problems, while health disparities (45%) further highlighted the need for improved healthcare access. Although crime (15%) and environmental pollution (10%) were less prevalent, they still contributed to the overall challenges. Addressing these interconnected issues through targeted job creation, educational opportunities, poverty alleviation, and improved healthcare could foster substantial improvements in the residents' well-being and living conditions.

The findings on access to healthcare facilities revealed a significant challenge, with 85% of residents lacking access to healthcare services. This highlighted a critical gap in the availability of medical care in the area. Among those who did have access, 80% report that it was limited, indicating that healthcare services available were insufficient to meet their needs adequately. Only 20% experience moderate access, suggested that even those with some access faced substantial barriers. To improve health outcomes, there was a pressing need for increased healthcare infrastructure, expanded services, and better access to medical care within the community. Among the limited initiatives present, 60% involved slum rehabilitation programs and 40% focussed on slum upgradation programs. This suggested that while there were some efforts to address slum conditions, they were insufficient and not widely implemented. Increasing government engagement and expanding comprehensive initiatives crucial for improving living conditions in slum.

Table 3: Characteristics of slums based on the response of the participants.

Characteristics of slums based on the response of the participants	Percentages (%)
Type of area surrounding to the slums	
Residential	80
Commercial	15
Institutional	5
Source of water supply in slums	
Piped water	85
Communal taps	15
Type of toilet facilities	
Individual toilets	45
Community toilets	25
None	30
Accessibility of sanitation facilities	
Accessible	60
Somewhat accessible	5
Not accessible	35
Issues prevalent in slums	
Unemployment	85
Poverty	80
Lack of access to education	70
Health disparity	45
Crime	15
Environmental pollution	10
Healthcare access in slums	
Limited	80
Moderate	20
Access to eye health facilities in slums	
Slum rehabilitation programs	60
Slum upgradation programs	40

Eye care needs and assessment

As per Table 4, most respondents (65.9%) reported that household members had encountered eye-related issues, highlighting a prevalent need for eye care within the community. In contrast, 32.5% had not experienced such issues, and 1.6% was unsure, indicating that while many face eye health challenges, there was some variability in awareness or experience of these problems. Among those who experienced eye issues, common problems included red eyes (43.8%), blurred vision (42.6%), and watery eyes (21.7%). Itching was reported by 24.5% of respondents, while vision loss (8.8%) and cataracts (5.2%) were less common but still notable. The fact that 0.8% reported having normal eyes suggests that eye health issues were widespread and affected a significant portion of the population.

A significant majority (80.7%) of respondents sought eye care at government hospitals or clinics, indicating a reliance on public healthcare facilities. In contrast, 34.5% visited private hospitals or clinics, reflecting some use of private services. Very few utilized eyecare camps or outreach programs (3.2%) or NGO/charitable services (2.4%) and an even smaller percentage consulted local

optometrists or ophthalmologists (0.4%). A small proportion (6.0%) did not seek any treatment, suggesting barriers to accessing care or a lack of perceived need. Most respondents received prescribed medication (62.4%) or spectacles (35.0%) as part of their eye care treatment. A small number were advised to undergo surgery (2.6%), indicating that most issues were managed with less invasive methods. This distribution showed that medication and corrective lenses were the primary treatments utilized for eye problems.

The distances travelled to receive eye care treatment vary, with most respondents traveling between 2.1 to 3 kilometres (32.5%) or 1.1 to 2 kilometres (23.1%). A notable portion travelled between 500 meters and 1 kilometre (16.7%), while fewer travelled within 500 meters (9.0%) or more than 5 kilometres (5.1%). This range of distances indicated diverse accessibility to eye care services, with some facing considerable travel challenges.

Table 4: Eye care needs and demands.

Eye care needs and demands	Percentages (%)
Prevalence of eye -related issues	65.9
Type of eye- related issues	
Red eyes	43.8
Blurred vision	42.6
Itching	24.5
Watery eyes	21.7
Vision loss	8.8
Cataract	5.2
Places visited for eye care	
Govt. hospitals/ clinics	80.7
Private hospitals/clinics	34.5
Types of treatment received	
Prescribed spectacles	35
Suggests surgery	2.6
Prescribed medicine	62.4
Distance to eye care treatment	
Within 500 metres	9
500 m to 1 km	16.7
1.1 km to 2 km	23.1
2.1 km to 3 km	32.5
3.1 km to 5 km	13.7
More than 5 km	5.1

Overall vulnerability mapping

The comprehensive vulnerability index for 20 slums, calculated by integrating individual scores for household density, industry and employment, housing and sanitation, poverty levels, and access to healthcare, was depicted in Figure 1.

The results showed that 5 slums were identified as being in a critical situation across these dimensions, with an additional 5 slums exhibiting high vulnerability.
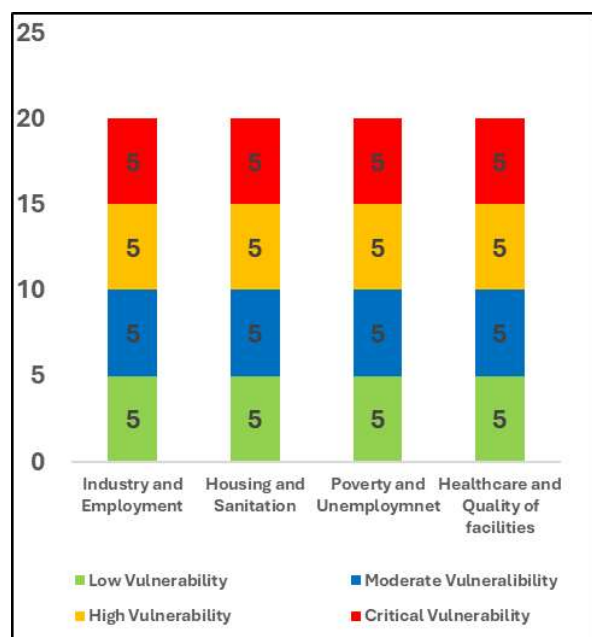
Figure 1: Category-wise vulnerability mapping.

DISCUSSION

This feasibility assessment of slum populations in Asansol Municipal Corporation highlights substantial socioeconomic vulnerability and significant unmet eye-care needs. The findings align with existing literature from India and other low-resource urban settings, reinforcing that the urban poor-despite living geographically close to facilities-continue to experience multiple barriers in accessing essential eye care services.

The study revealed that nearly half of the respondents were illiterate and the majority engaged in low-paying informal work. These findings are consistent with earlier research that identifies low educational attainment and informal employment as defining characteristics of Indian slums.[1,2] Similar patterns have been documented in megacities such as Mumbai and Delhi, where informal employment is linked to unstable income, poor housing, and limited ability to pay for health services.[8]

The identified sanitation gaps, particularly the 30% of residents without access to any toilet facility, reflect broader evidence that inadequate water, sanitation, and hygiene conditions significantly increase vulnerability and disease burden in slum communities, as shown by Flanagan et al and Ghosh et al.[6,7] Studies across Indian urban slums have repeatedly shown that lack of basic amenities correlates strongly with poor health outcomes, including ocular infections and communicable diseases.

The present study revealed that 85% of slum residents had limited or no access to healthcare, reinforcing that the urban poor often experience the "proximity paradox," wherein they are unable to access services due to

financial barriers, travel constraints, long waiting times, and systemic inefficiencies.[3] Similar challenges have been documented in cities such as Chennai, Mumbai, and Hyderabad, where slum communities reported markedly lower utilization of eye-care services despite a high prevalence of preventable ocular conditions. Our data on common eye complaints-including redness (43.8%), blurred vision (42.6%), itching (24.5%), and watery eyes (21.7%)-correspond with existing research indicating that conjunctivitis, refractive errors, and allergic eye diseases are among the most frequently encountered issues in densely populated slum areas.[5,3] Although less common, cataract and vision loss emerged as significant concerns in our findings, underscoring the need for timely diagnosis and referral, in line with national estimates on blindness and visual impairment.

The vulnerability index developed in this study identified ten slums as either high or critical across domains of poverty, sanitation, employment, and healthcare access. This is in line with emerging research advocating for multi-dimensional vulnerability indices to guide urban health planning, including eye health.[8,7] Prior studies in Odisha, Maharashtra, and Karnataka have demonstrated that vulnerability-based targeting improves the effectiveness of health interventions, including cataract screening and refractive error correction.

In line with earlier literature, our findings reinforce the need for community-based, affordable, and accessible eye-care models. This includes mobile eye-care vans, vision centres within slums, community outreach, and integration with urban primary health systems. Evidence from population-based surveys such as the RAVI studies by Marmamula et al demonstrates that community-level screening and outreach services are crucial for identifying undetected visual impairment in underserved populations.[9] Likewise, the integrated primary–secondary eye-care model of the L V Prasad Eye Institute, described by Rao et al, shows that decentralized vision centres staffed by trained personnel, supported by strong referral pathways, substantially improve access and service uptake in resource-constrained communities.[10] Training local health workers (e.g., urban ASHAs) for preliminary eye screening is also supported by this evidence base, with studies showing improved early detection of cataract, refractive errors, and ocular morbidities in underserved areas.[10] These lessons collectively highlight the relevance and feasibility of establishing community-integrated eye-care services in urban slum settings such as asansol.

The study highlighted the need to focus on slums with high economic vulnerability, poor sanitation, and limited access to healthcare. We should pay special attention to areas near industrial zones due to their unique challenges. Improvement in educational access is required to address low educational attainment. Job opportunities should be created and support to informal sector workers to enhance economic stability should be extended. Further,

investment in infrastructure improvements for slums with inadequate sanitation facilities and substandard housing is required. We should support programs aimed at enhancing living conditions. Establishment of new eye care facilities in strategically identified locations to improve accessibility and meet high demand should be strengthened. Implementation of models offering free or subsidized eye check-ups, treatments, and spectacles is suggested. Partnership with NGOs and government schemes should be done to provide support for low-income individuals. Regular eye care camps and mobile clinics should be organised to reach underserved areas and provide basic treatments. Enhanced awareness of eye health and available services through community outreach programs is required. Focus on preventive care and education to promote better eye health practices is necessary.

Additionally, development of strategies to reduce the distance and costs associated with accessing eye care services is crucial. Mobile Van with eye care facilities can cover the areas where there are no healthcare facilities. Training local health workers (Urban ASHAs) would be useful to do primary screening. Ensuring regular linkages to govt hospitals for advanced care and cataract surgeries. For affordability barrier free spectacle dispensing can be done. More awareness campaigns in slums and school-based activities. Improvement in transportation options and reduction in treatment costs to alleviate financial constraints is important as it will ensure accessibility and affordability of eye care to the slum areas. Advocacy with Asansol Municipal Corporation is required to integrate eye health in slum development and urban health programme. Conducting periodic vulnerability mapping to ensure resource allocation aligns with changing community needs. In brief, the study revealed high vulnerability of urban poor in slums with two thirds reporting eye problems, limited access to facilities and strong dependence on overcrowded public services. The way forward is to establish localized, affordable and awareness driven eye health services embedded within broader urban health and slum development programme.

Limitations

While the study offers comprehensive insights into the eye health needs of slum communities in Asansol Municipal Corporation, a few limitations should be noted. The study was geographically limited to 20 slums within Asansol Municipal Corporation and a modest sample size, although sufficient for the study goals, which may not fully capture variations across other urban population in different regions. As the information was self-reported, some recall or response bias may exist (socio-economic and health information). Being cross sectional, the study reflects conditions at one point in time and does not account for seasonal changes. Despite these limitations the study provides valuable insights for targeted eye care interventions in urban slums and for designing an effective urban eye health programme.

CONCLUSION

This feasibility study underscores the significant socio-economic and health-related vulnerabilities faced by slum populations in Asansol Municipal Corporation. With an estimated 280,493 slum residents in 2024, the findings reveal low educational attainment, predominance of informal and unstable employment, inadequate housing, and substantial gaps in sanitation facilities. These conditions collectively contribute to heightened vulnerability, as reflected in the high proportion of slums categorized as high or critical on the vulnerability index. Eye-health needs were pronounced, with nearly two-thirds of respondents reporting at least one ocular problem, ranging from redness and blurred vision to more serious conditions such as cataract and vision loss. Despite the proximity of public health facilities, access remained limited due to financial constraints, distance, overcrowding, and lack of affordable services. Most residents relied on government hospitals and periodic NGO-led camps, indicating an unmet need for accessible, continuous, and community-based eye care.

The findings reinforce the urgent need for localized, affordable, and integrated eye-care models that align with the broader urban health and slum development agenda. Establishing vision centres within or near vulnerable slums, deploying mobile eye-care units, strengthening referral pathways, and training community health workers (Urban ASHAs) can substantially enhance service reach. Addressing the wider determinants-such as poverty, education, housing, and sanitation-remains equally essential for improving long-term health outcomes. Overall, this study highlights that improving eye health in Asansol's slum communities requires a multi-dimensional, equity-driven approach, combining infrastructure development, targeted eye-care services, inter-sectoral collaboration, and sustained community engagement. Such tailored interventions have the potential to reduce preventable visual impairment, improve quality of life, and promote healthier and more resilient urban communities.

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