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Original Article

Epoch-making idea for a modernized health delivery system to the grassroots level community people through Dr. Syama Prasad Mukherjee Institute of Medical Sciences & Research (SPMSH), IIT Kharagpur: A Five-Year Analysis (2021-2025)

Dr. Mihir Kumar Bhattacharya*

Advisor, Dr. Syama Prasad Mukherjee Institute of Medical Sciences & Dr. B. C. Roy Multispecialty Medical Research Centre, Indian Institute of Technology-Kharagpur (IIT-KGP), Kharagpur, Paschim-Medinipur, West Bengal, India.

Email: mkbidh@gmail.com

***Corresponding author:**

Dr. Mihir Kumar Bhattacharya
Advisor, Dr. Syama Prasad Mukherjee Institute of Medical Sciences, Indian Institute of Technology-Kharagpur (IIT-KGP), Kharagpur, India.

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ABSTRACT

This study evaluates a flagship public healthcare initiative of IIT Kharagpur–Dr. Syama Prasad Mukherjee Institute of Medical Sciences & Research (SPMSH), specifically designed to bridge critical healthcare gaps for interior village populations who face substantial barriers in reaching tertiary hospitals. Launched with only a few basic specialty services in 2021, the program systematically expanded in response to community needs, growing to 14 clinical departments by 2025 and bringing advanced care closer to remote rural communities. Over these five years, annual patient visits increased dramatically from 1,943 to 27,002, supported by detailed demographic and department-wise caseload data that capture shifting patterns of service utilization. By tracing this year-on-year evolution in access, infrastructure, and specialty coverage, the article highlights how the IIT Kharagpur–SPMSH model is transforming health opportunities for previously underserved interior villagers and generating substantial socioeconomic benefits through improved rural health equity

Keywords: IIT-Kgp, SPMSH, healthcare service, patient data base, rural health equity.

Introduction:

India's rural and peri-urban regions, particularly the remote interior villages of West Bengal, face profound and systemic healthcare disparities that extend far beyond mere geographical isolation. These underserved communities face formidable barriers to specialized medical care, including long and arduous journeys to distant tertiary hospitals, exorbitant transportation costs, lost wages due to extended absences, and the inherent risks of delayed diagnosis and treatment during transit. Such structural inequities not only exacerbate disease morbidity and mortality rates but also perpetuate entrenched cycles of poverty, as catastrophic health expenditures drain family savings and disrupt economic stability. For interior villagers—often smallholder farmers, daily wage laborers, and marginalized tribal populations—these barriers translate into untreated chronic conditions, preventable complications, and intergenerational health deficits that compromise educational attainment and workforce productivity [1]. In a strategic response to these multidimensional challenges, IIT Kharagpur established the Dr. Syama Prasad Mukherjee Institute of Medical Sciences & Research (SPMSH) as a purpose-built, modernized healthcare delivery platform explicitly designed to bring advanced medical services directly to populations for whom conventional hospital access remains financially and logistically unattainable. Launched in 2021 with a modest portfolio of essential specialties tailored to the most pressing local health needs, SPMSH adopted a dynamic, data-driven expansion strategy that responded iteratively to real-time patient utilization patterns emerging from surrounding villages. Rather than imposing preconceived service models, the institute methodically broadened its clinical scope—ultimately encompassing 14 specialized departments by 2025—guided by the epidemiological realities revealed through community consultations and treatment records. This adaptive, patient-centered approach yielded transformative results. Annual patient footfall escalated 13.9-fold from 1,943 in 2021 to 27,002 in 2025, reflecting unprecedented healthcare access for families who previously endured days-long journeys or simply forewent care altogether. The socioeconomic ramifications are profound: reduced out-of-pocket expenditures liberate household budgets for nutrition and education; timely interventions prevent disability and premature mortality; and localized care preserves family labor capacity while maintaining children's school attendance. By converting inaccessible healthcare aspirations into tangible service delivery, IIT Kharagpur–SPMSH has catalyzed a virtuous cycle of improved health outcomes, economic resilience, and social equity [1-4].

This comprehensive analysis dissects the institute's five-year trajectory through granular year-on-year data encompassing demographic profiles, specialty-wise caseload evolution, and infrastructural adaptation. By elucidating how targeted service expansion aligned with community health realities generated measurable socioeconomic dividends, the study positions SPMSH as a replicable blueprint for technology-enabled, demand-responsive healthcare models that can bridge India's rural-urban health divide at scale.

Materials and Methods

Comprehensive retrospective data were systematically compiled from institutional administrative records and electronic health repositories covering the complete five-year period (January 2021–December 2025). Key metrics included total patient-visitor volumes, age-stratified distributions (under 18 years, 18–60 years, and seniors aged 60+), gender breakdowns, and categorization of new versus repeat attendances. Specialty-specific caseloads were meticulously disaggregated, where zero values accurately reflected operational unavailability during the program's initial phases. All quantitative parameters underwent rigorous cross-verification against primary source documents to ensure data integrity and eliminate interpretive bias. [1, 2].

Results

In 2021, the inaugural year of operations, the centre recorded 1,943 patient visits, marking the establishment of a basic but crucial healthcare foothold for previously underserved interior communities. The age distribution—440 children and adolescents (22.6%), 1,149 working-age adults (59.1%), and 354 older adults (18.2%)—highlights that services were immediately relevant across the life course, from school-going children to wage earners and dependently elderly family members. Near-equal representation of females (955; 49.1%) and males (988; 50.9%) suggests that early outreach succeeded in engaging women, who often face greater mobility and financial constraints in rural settings.

The predominance of new cases (1,453; 74.8%) over follow up visits (490; 25.2%) reflects both a substantial pool of previously unserved patients and the beginning of a formal care continuum that replaced ad-hoc, out-of-pocket consultations with structured follow-up. Socioeconomically, this early engagement translated into reduced travel to distant urban hospitals, saving transport costs and workdays for families at the economic margins.

By 2022, patient volume surged to 6,843—a 2.52-fold increase—indicating rapidly expanding community awareness and trust in the facility. The demographic profile shifted to 2,212 under-18s (32.3%), 3,510 adults aged 18–60 (51.3%), and 1,121 seniors (16.4%), showing greater uptake among children as local families began to prefer the centre for acute illnesses, immunization-linked consultations, and school-age health issues. A slight female predominance emerged (3,532 females, 51.6% vs 3,311 males, 48.4%), suggesting that easier physical access and reduced indirect costs made it more feasible for women to seek care without sacrificing household responsibilities. New cases remained dominant (4,585; 67.0%), but the rise in follow up visits (2,258; 33.0%) points to growing adherence to prescribed follow-up, which is critical for chronic disease control and long-term productivity, especially among economically active adults.

In 2023, attendances climbed further to 9,992, representing a 46% year-on-year increase and confirming the centre′s consolidation as a regional health hub for interior catchment areas. Age-wise, 3,302 minors (33.0%), 5,142 adults (51.5%), and 1,548 elders (15.5%) accessed services, while gender distribution remained balanced with 5,034 females (50.4%) and 4,958 males (49.6%). The proportion of new cases decreased to 5,907 (59.1%) while follow up visits rose to 4,085 (40.9%), highlighting a maturing service model in which patients not only presented for initial care but also returned for monitoring, thereby reducing complications, hospitalization risks, and associated economic shocks. At the community level, this pattern reflects increasing health literacy and confidence in institutional care, which can translate into fewer days lost to illness and greater household financial stability.

The year 2024 marked a qualitative leap, with visits escalating to 24,231 (1.42-fold growth), signaling both infrastructural strengthening and deep penetration across socio-economic strata. Juveniles accounted for 5,428 visits (22.4%), prime-age adults for 14,190 (58.5%), and seniors for 4,613 (19.0%), revealing strong uptake across all productive and vulnerable segments of the population. Female attendance (12,376; 51.1%) slightly exceeded male attendance (11,855; 48.9%), which is particularly significant in rural India, where women's health needs are often deferred in favour of income-earning family members. Notably, new and follow up visits reached near parity (11,865 [49.0%] vs 12,366 [51.0%]), indicating that the facility had evolved from a "first-contact" Centre into a longitudinal care provider. This equilibrium implies more stable management of chronic conditions (e.g., diabetes, hypertension, respiratory diseases), helping families avoid expensive emergency care, wage loss, and debt cycles that accompany unmanaged illness.

In 2025, total visits peaked at 27,002 (11.4% additional growth), reflecting a plateau at a high service-delivery level and broad demographic inclusivity. The age structure—5,942 under 18 (22.0%), 16,008 adults 18–60 (59.3%), and 5,052 seniors (18.7%)—shows sustained engagement of school-age children, the workforce, and older adults, all of whom contribute directly or indirectly to household income and caregiving. Female representation further solidified (14,020; 51.9% vs 12,982 males; 48.1%), highlighting tangible progress toward gender-equitable access to healthcare. Importantly, follow up visits now predominated (16,221; 60.1%), surpassing new cases (10,781; 39.9%), a pattern consistent with an established, trusted facility providing ongoing disease management, preventive care, and monitoring. For rural families, this continuity is socioeconomically critical: better-controlled disease means fewer hospital admissions, reduced catastrophic health spending, and greater ability to maintain schooling and livelihoods (Figure 1a–c).

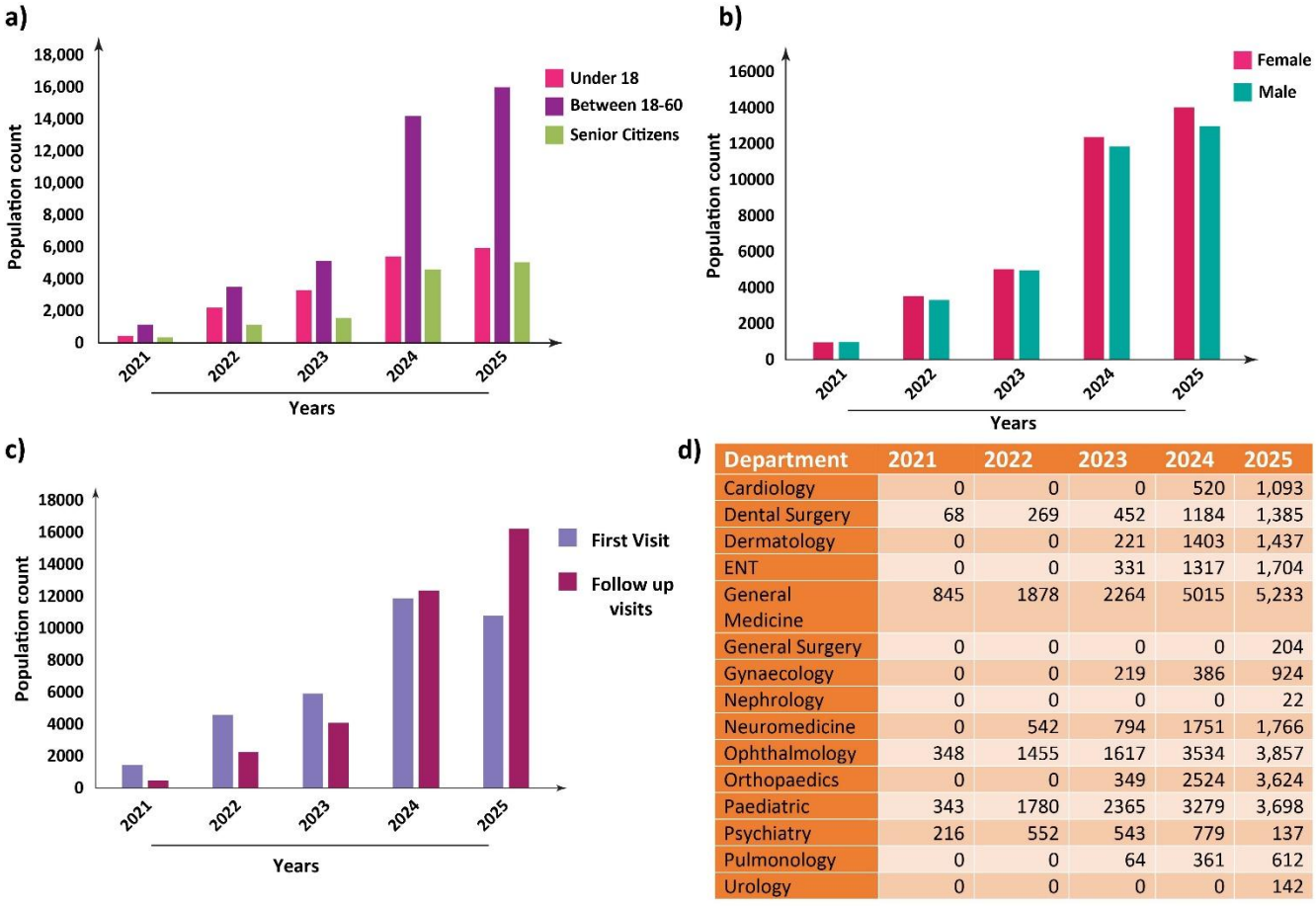
Specialty-wise, service evolution mirrors and reinforces these community-level gains. In 2021, the caseload was concentrated in a few key disciplines: Dental Surgery (68 cases), General Medicine (845; the dominant service), Ophthalmology (348), Paediatrics (343), and Psychiatry (216).

These offerings primarily addressed basic medical, child health, mental health, and vision-related needs, which are central to functional capacity and daily productivity in agrarian and informal-sector livelihoods. By 2022, caseloads expanded substantially within existing specialties—Ophthalmology, for instance, rose to 1,455 cases—providing more cataract and refractive services that directly influence the ability of older adults to work and care for grandchildren.

In 2023, diversification accelerated with the addition of Dermatology (221 cases), ENT (331), Gynaecology (219), and Pulmonology (64), while General Medicine climbed to 2,264 cases. These new services addressed skin infections, ear–nose–throat conditions, women's reproductive health, and respiratory illnesses—all common in rural, often environmentally exposed populations. Their introduction reduced the need for costly referrals to distant cities, thereby cutting transport expenditure, loss of workdays, and the indirect costs of caregivers accompanying patients. In 2024, the introduction of Cardiology (520 cases) and further growth in Ophthalmology (3,534) and other disciplines signalled a shift toward managing more complex non-communicable diseases locally, which otherwise require high-cost urban care. This transition has major socioeconomic implications, as cardiovascular diseases and visual impairment are key drivers of disability and income loss in middle-aged and elderly populations.

By 2025, the service spectrum attained near-completeness with the addition of General Surgery (204 cases), Nephrology (22), and Urology (142), while volumes in pre-existing departments such as Ophthalmology (3,857) and Orthopaedics, Paediatrics, and Psychiatry reached their highest levels. Across 2021–2022, nine specialties—Cardiology, Dermatology, ENT, Gynaecology, Psychiatry, General Surgery, Nephrology, Pulmonology, and Urology—recorded zero cases, reflecting genuine service absence rather than low demand. Their phased introduction—Dermatology, ENT, Gynaecology, and Pulmonology in 2023; Cardiology in 2024; and General Surgery, Nephrology, and Urology in 2025—was directly driven by observed disease patterns and community feedback, illustrating a responsive health-system design that prioritizes interior villagers′ real needs over top-down planning (Figure 1d).

Taken together, the progressive rise in patient numbers, gender-balanced access, growth in follow up visits, and staged expansion of specialty care depict not merely institutional growth but a profound socio-economic intervention. Interior households that previously bore the hidden costs of distance—missed work, travel expenses, delayed or forgone care—now access multi-specialty services closer to home, improving health outcomes while protecting fragile livelihoods and enhancing social equity across age, gender, and economic strata.



Department	2021	2022	2023	2024	2025
Cardiology	0	0	0	520	1,093
Dental Surgery	68	269	452	1184	1,385
Dermatology	0	0	221	1403	1,437
ENT	0	0	331	1317	1,704
General Medicine	845	1878	2264	5015	5,233
General Surgery	0	0	0	0	204
Gynaecology	0	0	219	386	924
Nephrology	0	0	0	0	22
Neuromedicine	0	542	794	1751	1,766
Ophthalmology	348	1455	1617	3534	3,857
Orthopaedics	0	0	349	2524	3,624
Paediatric	343	1780	2365	3279	3,698
Psychiatry	216	552	543	779	137
Pulmonology	0	0	64	361	612
Urology	0	0	0	0	142

Figure 1. Temporal trends in patient demographics and specialty caseloads at the IIT Kharagpur-government medical college collaboration facility (2021-2025). **(a)** Annual total patient visits stratified by age groups **(b)** Gender distribution. **(c)** Case types: first/new visits, follow up visits. **(d)** Department-specific caseloads across years, with General Medicine dominant; other specialties include Dental Surgery, ENT, Nephrology, Neuromedicine, Ophthalmology, Paediatric, Psychiatry, Pulmonology, and Urology; zero values indicate services not yet available.

Discussion

The five-year trajectory of IIT Kharagpur–Dr. Syama Prasad Mukherjee Institute of Medical Sciences & Research (SPMSH) represents a compelling case study in demand-responsive healthcare delivery that has fundamentally altered health access dynamics for West Bengal's interior villages. The 13.9-fold escalation in patient visits from 1,943 to 27,002, coupled with progressive specialty expansion from five to 14 departments, demonstrates that localized, adaptive service models can effectively penetrate remote catchment areas where traditional tertiary hospital systems have consistently failed.

Several interconnected factors underpin this success. First, the staged introduction of specialties precisely matched observed disease epidemiology, progressing from basic ambulatory care (General Medicine, Paediatrics) to address chronic non-communicable diseases (Cardiology, Ophthalmology) and ultimately complex surgical interventions (General Surgery, Urology). This data-driven evolution minimized wasteful infrastructure investment while maximizing clinical relevance, as evidenced by the near-complete service utilization across all 14 departments by 2025. Second, the shift from new-case dominance (74.8% in 2021) to follow up-visit predominance (60.1% in 2025) signals a transformation from episodic "first-contact" care to longitudinal disease management, which is critical for socioeconomic stability in agrarian communities where even brief illness episodes can precipitate debt cycles.

Gender equity evolution warrants particular attention. The consistent female representation (49.1%→51.9%) across five years challenges conventional rural healthcare access patterns where women's health needs are systematically deferred. By eliminating 50-100 km journeys to urban centers, SPMSH removed key barriers—time, cost, and family responsibilities—that traditionally exclude women from institutional care. Similarly, the balanced age distribution (children 22-33%, working adults 51-59%, seniors 15-19%) reflects comprehensive life-course coverage, protecting household productivity while safeguarding vulnerable dependents.

The socioeconomic multiplier effects are substantial. Reducing catastrophic health expenditure through local access preserves family savings for nutrition, education, and agricultural investment. Fewer workdays lost to illness or caregiving enhances household income stability. Timely interventions prevent disability from conditions like cataracts (Ophthalmology: 3,857 cases by 2025) and cardiovascular complications (Cardiology: 1,093 cases), maintaining workforce participation among middle-aged breadwinners. Most critically, repeat visit growth from 25.2% to 60.1% indicates established preventive care pathways that can interrupt generational health deficits, particularly through sustained paediatric engagement (Paediatrics peaked at 3,698 cases).

This model addresses three structural failures of India's rural health ecosystem: (1) geographic inaccessibility of tertiary care, (2) mismatch between service provision and local epidemiology, and (3) episodic rather than continuous care delivery. By contrast, SPMSH's success derives from its bottom-up, utilization-responsive design—departments were added only when demand patterns justified them, ensuring both clinical relevance and fiscal sustainability

Conclusion

The IIT Kharagpur–Dr. Syama Prasad Mukherjee Institute of Medical Sciences and Research initiative demonstrates how strategically located, community-responsive healthcare centres can systematically eliminate longstanding rural-urban health disparities. By establishing 14 specialized medical departments directly within reach of West Bengal's remote interior villages, the program achieved remarkable service penetration—serving 27,002 patients annually across balanced demographic profiles spanning all age groups, genders, and economic circumstances—while simultaneously generating substantial socioeconomic dividends through sharply reduced healthcare expenditures, sustained family livelihoods, and disruption of poverty-perpetuating health crises.

Four pivotal policy insights emerge from this transformative model: first, infrastructure expansion guided by actual patient demand proves far superior to conventional rigid planning approaches; second, fixed healthcare proximity eliminates access barriers more effectively than temporary mobile units; third, the progression to over 60% follow up visits validates comprehensive, ongoing care models essential for managing chronic diseases in rural settings; and fourth, near-equal female participation (approximately 51%) confirms that physical accessibility overcomes deep-rooted sociocultural obstacles to women's healthcare engagement.

With India's rural population now exceeding 900 million, this initiative presents a robust, scalable, and evidence-based model for public–academic collaboration aimed at delivering advanced multispecialty healthcare precisely in regions where systemic gaps have persisted for decades. By strategically situating high-quality medical services within rural and semi-rural landscapes, the model bridges long-standing disparities in access, affordability, and outcomes, while strengthening the overall healthcare delivery ecosystem.

Crucially, the initiative redefines healthcare not as a recurring fiscal burden, but as a powerful engine of socio-economic development. Improved health outcomes translate directly into enhanced productivity, workforce participation, and household stability, particularly benefiting women and marginalized populations. In doing so, the model actively promotes gender equity, social inclusion, and community empowerment, ensuring that the benefits of advanced medical care extend beyond clinical settings into broader societal progress.

Within this framework, Dr. Syama Prasad Mukherjee Multi-Speciality Hospital is entrusted with the pivotal role of a doorstep healthcare provider in the rural setting. The hospital functions as a localized centre of medical excellence, delivering comprehensive multispecialty services, preventive care, and early diagnostic interventions directly to underserved communities. By integrating clinical excellence with outreach, training, and referral networks, it establishes a sustainable healthcare hub that is responsive to local needs while aligned with national priorities.

IIT Kharagpur has been at the forefront of developing patient-centric healthcare technologies that are effective, affordable, sustainable, and widely accessible. These initiatives aim to enhance overall well-being and quality of life, while seamlessly bridging the gap between advanced technology, cutting-edge medical research, and interdisciplinary collaboration in partnership with Dr. Syama Prasad Mukherjee Multispecialty Hospital. Together, these localized centres form the foundational architecture for India's journey toward truly equitable and inclusive national healthcare—where geography no longer determines the quality of care, and where health systems actively contribute to economic resilience, social justice, and long-term national development.

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