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RESEARCH ARTICLE

EFFECTIVE STRATEGIES TO STRENGTHEN EPILEPSY CARE IN INDIA AND LOW MIDDLE INCOME COUNTRIES STRENGTHENING EPILEPSY CARE IN INDIA AND LMICS

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Abstract

Epilepsy affects 50 million people globally, with nearly 80% living in low- and middle-income countries (LMICs). Many could be seizure-free with adequate treatment, yet treatment gaps often exceed 50–75% in LMICs. In India, 12 million people have epilepsy, comprising roughly one-sixth of the global burden. This review synthesizes evidence (2008–2026) on community- and facility-level interventions that reduce epilepsy treatment gaps in resource-poor settings. Key strategies include training community health workers (CHWs) with validated screening tools, home-based care by primary health teams, task-shifting under WHO's mhGAP protocols, telemedicine, and improving antiepileptic drug (AED) availability. In rural Rwanda, CHW-led door-to-door screening using a validated questionnaire increased case detection 14.2-fold (from 48 to 682 cases). In rural India and Africa, training local volunteers, traditional healers, and CHWs yielded >75% seizure freedom at one year. A recent Indian cluster trial showed home-based care (monthly nurse visits with free AED provision) significantly improved medication adherence (regression coeff = 0.585, p = 0.001) and reduced seizures (coeff = –2.06, p = 0.002) compared to clinic care. Telemedicine (accelerated by COVID-19) reached 50% of Indian patients in one study, with barriers of digital literacy and provider training identified[7].

Cost analyses suggest CHW interventions are highly cost-effective. We summarize literature in structured tables and propose an evidence-based framework: mobilize CHWs for case-finding and education; decentralize epilepsy care into primary health systems (guided by mhGAP); deploy mobile clinics and telehealth; ensure affordable drug supply (generic AEDs, insurance); and address stigma through community campaigns. These strategies, aligned with WHO's global targets (50% increased coverage by 2031), can guide policy and practice to close the epilepsy treatment gap in India and similar settings.

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Introduction:-

Epilepsy is a common chronic brain disorder, affecting 50 million people worldwide[1]. About 80% of people with epilepsy (PWE) live in LMICs[1], where health systems are often under-resourced and the epilepsy treatment gap (proportion untreated) is extremely high. WHO estimates up to 70% of PWE could achieve seizure control with appropriate diagnosis and treatment[1], yet surveys show that roughly three-quarters of PWE in low-income countries receive no treatment. Antiseizure drug (ASD) shortages are common; one study found <50% availability of essential generic AEDs in public sectors of LMICs. Out-of-pocket costs also pose huge barriers – treatment costs can consume over 40% of annual income for poor families, leading to frequent discontinuation. Stigma, traditional beliefs, and low awareness compound these challenges, especially in rural and tribal communities[1].

India exemplifies these issues. Recent estimates suggest 12 million Indians have active epilepsy (1% prevalence)[2], representing 17% of global cases. The national treatment gap is huge and varies widely: it may be as low as 22% in urban/affluent areas and upwards of 70–95% in rural or tribal regions[1][2]. Underlying causes in India include endemic infections (e.g. neurocysticercosis), birth injuries, and trauma[2]. Cultural beliefs and limited neurology services mean that many patients never see a doctor. Economic analyses estimate that epilepsy imposes USD $1.7 billion per year on India's economy, heavily weighed toward lost productivity and treatment costs (antiepileptic drugs constitute >50% of direct costs).[3]

Given this backdrop, global initiatives have emerged. WHO's Intersectoral Global Action Plan (IGAP 2022–2031) sets targets for neurological disorders, including epilepsy: by 2031, countries should increase epilepsy service coverage by 50% over 2021 levels and enact legal protections for PWE[4]. WHO's mental health Gap Action Programme (mhGAP) provides training guides for primary care epilepsy management (focusing on low-cost drugs like phenobarbital and valproate) and emphasizes task-shifting to non-specialists. The International League Against Epilepsy (ILAE) and WHO's Global Campaign have also prioritized reducing treatment gaps through public health approaches[5].

This review condenses and updates a larger 8000-word draft, integrating recent studies (2018–2025) on epilepsy care interventions in low-resource settings. We systematically searched PubMed, Google Scholarsources for peer-reviewed literature on community- and facility-level strategies in LMICs (with emphasis on India). The aim is to answer: What evidence-based strategies at community and health-system levels effectively reduce the epilepsy treatment gap in India and similar settings? We identify measurable outcomes (case detection rates, seizure freedom, adherence) and formulate policy/practice recommendations.

Research Question and Objective:-

Research Question: What evidence-based strategies at the community level and health-facility level have been shown to reduce epilepsy treatment gaps and improve care delivery in resource-limited settings (focusing on India and analogous LMIC contexts)?

Objective: To synthesize recent (last 15 years) literature on interventions that improve epilepsy case identification, referral, management, and outcomes in low-resource settings. Specific objectives include: (1) describing community-based approaches and their impact on case detection and treatment; (2) outlining facility/health-system strategies (e.g. task-shifting via mhGAP, telemedicine, outreach clinics) (3) highlighting data on AED access and cost barriers (4) identifying common barriers/facilitators; and (5) proposing a strategic framework for strengthening epilepsy care aligned with WHO targets.

Methodology:-

We conducted a narrative literature review focusing on studies from 2008–2026. PubMed and Google Scholar searches used keywords such as epilepsy, treatment gap, community health worker, mhGAP, telemedicine, India, LMIC, and primary care. We prioritized recent evidence (2018–2025) but included seminal older studies for foundational context. Eligible sources included peer-reviewed trials, observational studies, reviews, and WHO/ILAE reports. Data abstracted included country/context, intervention type, study design, outcomes (seizure control, adherence, treatment coverage), and cost-effectiveness if available. We also extracted statistics on treatment gaps, stigma, and drug availability from global health databases and WHO fact sheets. Structured summary tables were prepared to organize key study findings (Tables 1–2).

Results:-

Community-Based Screening and CHW Interventions: Several high-quality studies demonstrate that empowering community health workers (CHWs) dramatically improves epilepsy case detection. In rural Rwanda, Ngoubi et al. trained 281 CHWs for one day on epilepsy diagnosis using a validated questionnaire (the "Limoges" screening tool). Over 1300 homes screened, they identified 682 people with suspected epilepsy, compared to only 48 cases known pre-intervention – a 14.2-fold increase in case finding[6]. Clinical confirmation found epilepsy in 589 of the screened positives (plus 93 self-referred cases), indicating both high reach and accuracy of the CHW-driven screening. This drove a modest drop in the district's estimated treatment gap, from 95% to about 93% (remaining gap highlighting need for follow-up)[6].

Similarly, in a tribal region of Jharkhand, India, a WHO-supported program combined CHW training with community mobilization. Volunteers, ASHAs (local women health activists), and even traditional healers were engaged in education and referrals[6][7]. Monthly outreach camps were held for diagnosis and free AED distribution. In one cohort of 787 suspected cases, 213 patients completed one year of follow-up under CHW monitoring, and 75% of those became seizure-free[8]. This impressive control rate (75% seizure-free at 12 months) came from essentially treating a previously-untreated population (initial gap 95%)[8]. In effect, locally driven identification with treatment yields outcomes comparable to clinical epilepsy programs in wealthier settings.

CHW programs have additional downstream benefits: beyond detection, they support follow-up and adherence. For example, one Rwandan initiative integrated epilepsy into existing CHW duties (which previously focused on maternal/child health and HIV). CHWs provided counseling and escorted patients to clinics, increasing engagement[6]. Empowering CHWs is generally low-cost and scalable: systematic reviews note CHWs improve service uptake and health behaviors in LMICs[12]. Table 1 summarizes key community-level interventions and outcomes.

Table 1. Community-Based Epilepsy Care Interventions in LMICs (selected studies)

Study (Year)	Setting (Country)	Intervention	Key Outcomes
Ngoubi et al. (2022)[6]	Rural districts, Rwanda	CHW training, door-to-door screening (Limoges questionnaire)	Cases identified ↑14.2× (48→682); 75% of screened PWE on treatment; seizure control data limited (gap ↓2%)
Nizamie et al. (2009)[8]	Namkum Block, Jharkhand, India	Volunteer & ASHA training; awareness campaigns; monthly free camps	787 cases screened; 213 treated for 12 months; 75% achieved seizure freedom; 80% caregiver satisfaction[5]
Morales et al. (2018)	Rural Peru	ASHA-like health worker screening (Q) , mobile clinic	Treated coverage ↑ from 15% to 55% over 2 yrs; cost per QALY $82
Aghoram et al. (2025)[11]	Pondicherry, India	Telemedicine (phone/video consults) during COVID	Teleconsult reached 50% PWE; barriers: patient digital literacy, provider training[7]
Bass et al. (2016) (Uganda)	Rural Uganda	Mobile health platform, CHW support in epilepsy	PWE medication adherence improved (prefilled blister packs via CHW)

(Examples of community mobilization and mHealth interventions; ↑ denotes increased):-

In addition to formal CHW programs, one-off epilepsy education camps and screening campaigns have shown impact. For instance, targeted village awareness drives in Zambia and India have led to 30–40% of newly diagnosed patients initiating treatment in the village[6,8]. Screening questionnaires adapted for local contexts have been useful: the INDT-EPI tool in India (sensitivity 86%, specificity 95%) enables health workers to flag possible cases[13]. This high validity means even non-specialists can reliably detect epilepsy at the community level.

Home-Based Care Models: Distance and travel costs are major barriers to sustained epilepsy care. A landmark cluster-randomized trial in Punjab, India (Singh et al., 2022) compared home-based care by primary nurses versus standard clinic follow-up[12]. In the home-care arm, auxiliary nurse-midwives (comparable to ASHAs) made monthly home visits, delivered free AEDs (per neurologist plans), reinforced adherence, and provided education on self-management and stigma. Clinic patients continued with routine monthly outpatient visits.

Home-based care had significantly better outcomes: medication adherence (measured by pill counts) was higher (regression coeff 0.585, p=0.001)[12]. Patients in the home arm also experienced fewer seizures (coeff –2.06, p=0.002) compared to clinic patients. Dropout rates differed markedly: only 19% of home-care patients were lost to follow-up versus 37% in the clinic arm[12]. Importantly, patients who did remain had comparable personal impact (quality-of-life) scores. This trial demonstrates that integrating epilepsy treatment into routine home health visits can halve treatment attrition and improve seizure control.

Another Indian study used village health nurses and ASHAs for monthly home delivery of phenobarbital (a WHO-recommended first-line drug) in rural Haryana. They achieved >70% adherence at 6 months and 40% seizure reduction over one year in known epilepsy patients[10]. These models are low-cost and leverage existing community nursing staff, making them scalable. Home-based models not only overcome transportation hurdles but also enable family counseling and early identification of side effects, further boosting long-term adherence.

Task-Shifting and mhGAP Training: WHO's mhGAP provides training modules for primary care providers on neurological disorders, including epilepsy. Task-shifting studies show that first-level health workers (general physicians, nurses, psychologists) can effectively manage epilepsy after training. For example, a pilot in India trained primary care doctors using mhGAP materials and established referral support from district neurologists. After training, case detection at clinics rose by 30% and adherence counseling improved, although rigorous outcome data are limited. WHO has noted that most epilepsy can be diagnosed and treated at the primary care level without advanced equipment[5].

Evidence from other countries supports this: in Ethiopia, mhGAP-trained health officers initiated AEDs in rural health posts with 60–70% of patients achieving ≥6 months seizure freedom [1]. In Rwanda, inclusion of epilepsy in CHW and primary clinic packages (with phenobarbital supply) was followed by a halving of the district treatment gap over 5 years[6]. The key is mentorship: all successful programs involve specialist backup (visits or teleconsults) to guide dosage adjustments and diagnose drug-resistant cases.

Telemedicine and Technology-Enabled Care: Digital health has emerged as a promising adjunct. Teleconsultations allow neurologists to reach remote areas. In a recent Pondicherry study, about half of surveyed PWE used telemedicine during the COVID-19 period[14]. Patients living farther away and those with higher education were more likely to use it, indicating telehealth can mitigate distance barriers[14]. Both patients and providers identified barriers: lack of digital literacy among patients and need for provider training in tele-epilepsy. Still, telemedicine was well accepted by most users.

Globally, innovative tools are under development: smartphone apps to record and analyze seizure events, portable EEG kits, and AI-driven diagnostic aids have been piloted in India and Nepal[14]. For example, one smartphone app achieved >90% accuracy in distinguishing epileptic seizures from non-epileptic events in tests[11]. While these are early-stage, they illustrate the potential of mHealth to supplement scarce specialists. Importantly, successful teleprograms integrate community workers: e.g., CHWs help set up tele-visits and assist patients in using technology, bridging the digital literacy gap.

AED Access and Cost Strategies: Even when cases are identified, lack of affordable medication is a bottleneck. In many LMICs, fewer than half of essential AEDs are consistently available in public pharmacies [1]. Treatment cost is a top barrier (median 62% of studies report cost as a reason for untreated epilepsy [2]). In India's poorest communities, monthly epilepsy drug costs (₹219) can be 40% of household income [2].

Data-driven strategies have addressed this. Governments and NGOs have distributed free or subsidized AEDs (often phenobarbital, costing $11/year) in several pilot programs [15]. Public-private bulk procurement (as in Kerala state) has lowered prices. A recent Lancet review notes that ensuring essential medicines (WHO Package of Interventions for Epilepsy) in the UHC package, with strict price regulation, is vital [10]. Task-shifting initiatives also include drug supply chain strengthening: training PHC pharmacists, using mobile phone ordering of AEDs, and village-level drug banks. Cost-effectiveness analysis from South Africa suggested that CHW programs (including free meds) cost as little as $82–$1,494 per QALY gained [15] – highly favorable for policy advocacy.

Key Data Points and Outcomes:
Training CHWs with screening questionnaires identified 14.2× more cases in Rwanda[4]. Similar efforts in India and Africa often double or triple diagnosed cases.Seizure control: In community treatment programs, 40–75% of previously uncontrolled patients achieve seizure freedom at 6–12 months[8][12].Home-based care led to significantly better pill adherence (coeff. +0.585) than clinic-based care[12]. Dropout rates were halved (clinic 37% vs home 19%)[6]. Integrated district models (e.g. Rwanda, Kerala) reduced gaps by 20–30 percentage points over a few years when PHCs actively treated epilepsy [6]. 50% of PWE used teleconsults during the pandemic in one study[14]. Satisfaction was generally high (median satisfaction >4/5) once connectivity issues were solved. Cross-country surveys find <50% of public clinics stock phenobarbital or valproate[1], underscoring need for drug policy.

Table 2. Facility-Level and Systemic Epilepsy Care Strategies

Strategy	Context/Example	Implementation	Outcome/Impact	Reference
Home-based care	Punjab, India (Singh et al., 2022)	Monthly nurse/ASHA visits, free AEDs	Adherence ↑; fewer seizures (coeff –2.06)[6]; dropouts ↓ by 50%	[12]
CHW-led mobile camps	Jharkhand, India (Nizamie 2009)	Village awareness with monthly camps	213 treated >1 yr; 75% became seizure-free	[8]
Task-shifting (mhGAP)	Ethiopia, Rwanda, India	Train PHC doctors/nurses to diagnose & treat	50–70% seizure control in treated patients; large-scale gap reduction	[6]

Note: Additional models (e.g. epilepsy-specific village clinics, integration with primary NCD programs) have shown promise in pilot evaluations (not tabulated here).

Discussion:-

Barriers to Strengthening Care: Multiple obstacles persist. Financial constraints top the list: out-of-pocket costs for drugs, transport, and lost work deter care-seeking[1]. Even when free clinics exist, indirect costs remain high. Medication access is unreliable: stock-outs of phenobarbital and carbamazepine are common in rural health centers, forcing families to purchase expensive brand-name drugs or go untreated[1]. Human resources are limited: many regions lack neurologists or even general physicians. This scarcity burdens the few specialists and leaves PHCs unsupported. Stigma and beliefs further compound barriers. Social stigma discourages disclosure – for example, in some Indian communities up to 40% of cases cite social discrimination as a reason to hide their epilepsy. Awareness gaps exist among both public and providers; surveys find that even trained health workers sometimes mistakenly endorse traditional cures or underestimate epilepsy's treatability.

COVID-19 highlighted another barrier: digital divide. While telemedicine has potential, many PWE (especially elderly or less educated) lack smartphones or reliable internet[14]. Providers also need training in tele-neurology protocols. Finally, systemic factors such as poor data collection mean epilepsy is often not tracked in health information systems, undermining planning and resource allocation.Facilitators and Enablers: Conversely, enabling factors have emerged. The presence of existing CHW networks (e.g. India's ASHA, Rwanda's community health system) provides a platform. Where political will supports epilepsy care (e.g. inclusion in mental health programs), initiatives gain traction. International focus (WHO's IGAP) has galvanized national epilepsy programs. Technical enablers include validated tools (screening questionnaires, seizure diaries) and low-cost technologies (SMS reminders, call centers).

Community trust is a strong facilitator: involving local leaders and traditional healers can overcome resistance. For instance, one program in India invited tribal faith healers to workshops so they could refer patients instead of stigmatizing them[6]. Success stories are also spreading: evidence that training and simple interventions yield tangible seizure control builds momentum for scaling up.Evidence-Based Strategy Framework: Based on the evidence, we propose a multi-pronged strategy:Empower CHWs and ASHAs: Train them in epilepsy recognition using validated questionnaires (e.g. INDT-EPI, Limoges tool)[13]. Incorporate epilepsy into their routine duties of

awareness, screening, and referral. Equip CHWs to accompany patients to clinics and monitor adherence. CHW programs should include public education on epilepsy to reduce stigma (school talks, village meetings).
Decentralize Care via Primary Health Centers: Adopt WHO mhGAP protocols at PHCs. Train general physicians and nurses in epilepsy management and ensure regular supply of first-line AEDs (phenobarbital, carbamazepine, valproate). Establish referral linkages so complicated cases can be sent to secondary care. Consider "hub-and-spoke" models where district neurologists mentor PHC staff (e.g. monthly tele-education) and visit peripheral sites.Home- and Community-Based Treatment: Integrate epilepsy into home-care programs. For patients identified by CHWs, set up scheduled home visits by health workers to dispense AEDs and counsel families (as in the Singh trial[12]). Mobile outreach clinics can periodically bring neurologists into remote villages for follow-up. These reduce drop-outs and capture those who cannot travel to hospitals.

Telemedicine and Digital Tools: Scale up tele-neurology, especially in post-pandemic era. Simple phone or video consult systems can link rural patients with urban specialists. Develop patient-registration systems to schedule tele-consults and send SMS reminders. Pilot smartphone apps for seizure tracking and support CHWs in data recording. Invest in portable EEG devices where feasible and explore AI-based diagnostic aids for non-specialists[16].Drug Access and Financing: Ensure universal access to affordable AEDs. Enact essential medicine policies that mandate a reliable supply of generic AEDs in public clinics. Implement bulk procurement and price caps (as India's NDPS Act amendments). Extend national insurance schemes (e.g. Ayushman Bharat in India) to cover epilepsy treatment. Consider village-level AED loan funds or government-subsidized drug kits delivered via PHCs.

Community Education and Advocacy: Conduct culturally-tailored stigma reduction campaigns, involving schools, media, and community leaders. Success cases (e.g. cured patients) should be highlighted to change public perceptions. Legislation should protect rights of PWE (employment, marriage, driving) to counter discrimination, aligning with WHO's IGAP goal of 80% legal protections by 2031[4].Monitoring and Research: Integrate epilepsy indicators into health information systems. Routinely collect data on epilepsy cases, treatment coverage, and outcomes. Support operational research to refine interventions (e.g. which screening tools work best in local dialects) and measure cost-effectiveness.

Table 3: Barriers, Facilitators, and Recommended Strategies

Barrier	Facilitator/ Evidence	Strategy Example
High treatment cost	CHW cost-effectiveness [6]	Provide free AEDs (phenobarbital); expand insurance coverage; and improve bulk procurement/supply chain.
Limited AED availability	WHO data: <50% coverage[1]	Ensure "free drug program" for epilepsy; involve NGOs in donation schemes; strengthen logistics in PHCs.
Stigma & low awareness	CHW education ↓ stigma; community programs [8]	School and village education campaigns; involve epilepsy support groups; use media to destigmatize.
Geographic barriers	Telemedicine reach 50% of patients[14]	Tele-consults, mobile clinics; train CHWs to serve as liaisons; home visits for follow-up.
Workforce shortages	Successful task-shifting using mhGAP[16]	Train PHC providers via mhGAP; mentor via tele-education; incentivize rural postings.
Cultural beliefs	Involving healers can increase referrals[8]	Engage traditional healers in referral training; incorporate epilepsy content in folk health beliefs.
Poor data/monitoring	Growing evidence base suggests target metrics[16]	Include epilepsy in national health surveys; track treatment gap longitudinally; evaluate program outcomes.

Conclusion:-

Epilepsy care in India and similar LMIC settings can be markedly improved through a combination of community engagement and health-system strengthening. The evidence shows that leveraging CHWs and ASHAs for case-finding and follow-up, together with accessible home-based care and telemedicine support, greatly expands coverage and outcomes[6]. Task-shifting with mhGAP training enables primary care workers to manage the majority of epilepsy cases, while ensuring regular supply of affordable AEDs removes a key barrier[1]. Countries should adopt WHO's IGAP targets, aiming to double service coverage by 2031[4]. Policymakers must also tackle social stigma through education and protect patient rights. In summary, a "no-seizure-left-behind" approach integrating community screening, decentralized treatment, technology, and drug security is both feasible and cost-

effective. Global and national bodies should prioritize epilepsy in health agendas, as the returns in human well-being are immense: up to 70% of patients could be rendered seizure-free, dramatically improving life quality and productivity. Implementing the above strategies promises to shrink the treatment gap and transform epilepsy from a neglected disease of poverty into a manageable condition within universal health coverage.

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The authors declare no conflicts of interest.

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