

Empowering Lady Health Workers with AI Routing to Solve Healthcare Coordination Failures in Rural Khyber Pakhtunkhwa

Project Q2 Hackathon Submission

1. Title & Research Question

Title: Empowering Lady Health Workers with AI Routing to Solve Healthcare Coordination Failures in Rural Khyber Pakhtunkhwa

Research Question: How can the integration of Lady Health Workers (LHWs) with decentralized AI routing and telemedicine systems bridge existing health financing and co-ordination gaps to improve maternal healthcare access in rural Khyber Pakhtunkhwa?

2. Hypothesis

If Pakistan's Lady Health Workers (LHWs) operating in rural Khyber Pakhtunkhwa are equipped with AI-assisted triage and routing tools alongside subsidized telemedicine access, **then** preventable delays in reaching appropriate life-saving care will significantly decrease, **because** the primary barriers to rural healthcare in Pakistan are fundamentally rooted in coordination and discovery failures, as well as financial inaccessibility, rather than the outright absence of physical medical facilities.

3. Background

Rural healthcare access in Pakistan's Khyber Pakhtunkhwa (KPK) province is commonly framed by policymakers as an infrastructure problem, a lack of physical buildings and hospital beds. However, a deeper analysis of the provincial health system reveals that it is more accurately defined as a severe discovery and coordination problem.

Pakistan suffers from a profound geographic maldistribution of medical professionals. According to the United Nations Population Fund (UNFPA) Annual Programme Progress Report 2024, approximately 85% of the country's doctors reside and practice in urban areas, leaving rural populations almost entirely cut off from specialist and emergency care [9]. This inequity translates directly into mortality. The Pakistan Maternal Mortality Survey reports

a 26% higher maternal mortality rate in rural areas compared to urban centers, equating to roughly 20 maternal deaths per 10,000 live births in rural regions versus 16 in urban centers [9]. Consequently, rural women are frequently forced to travel long, arduous distances to access even the most basic reproductive services.

This geographical crisis is compounded by severe governance and administrative bottle-necks. A 2025 landscape analysis of health financing governance in Khyber Pakhtunkhwa by ThinkWell found that the province's health system suffers from fundamental fragmentation and deep coordination gaps [8]. Since the devolution of health responsibilities to the provinces under the 18th Constitutional Amendment, KPK has struggled to integrate its various financing streams and governance structures. There is a profound lack of effective district-level coordination, creating implementation disconnects between provincial regulatory bodies and local district administrations [8]. Furthermore, out-of-pocket costs still account for 53% of total health expenditures, crippling low-income patients. Patients navigating the system experience overlapping service areas, inefficient resource allocation, and a highly fragmented journey from initial symptoms to actual clinical care. Building new physical infrastructure in rural KPK is an inefficient use of resources if the province cannot convince doctors to staff them, nor coordinate the pathways patients use to find them.

4. Key Findings

4.1 Finding 1: The core issue is a routing and coordination failure, not a short-age of buildings

Researchers studying low-income health systems use the phrase *discovery-to-care failure* to describe the exact phenomenon occurring in rural Pakistan. A comprehensive scoping review of rural healthcare access barriers in Pakistan found that the physical absence of clinics is rarely the primary hurdle. Instead, surveyed rural populations cited logistical and coordination barriers: 72% cited long distances, 60% cited a lack of available transport, 55% cited high out-of-pocket costs, and 50% cited prohibitively long wait times at facilities [6]. Patients simply cannot figure out which facility is equipped to help them, cannot afford the transport, or arrive at a clinic only to find it lacks the specific specialist or equipment they require.

4.2 Finding 2: Pakistan's Lady Health Workers show what community inter-mediaries can do

Pakistan's Lady Health Worker (LHW) program, which has approximately 29,163 registered workers, provides a proven intervention channel. A 2025 cross-sectional analysis published in the *Journal of Global Health* assessed the impact of regular LHW home visits across the continuum of care [4]. The results demonstrated a massive multiplier effect when LHWs acted as community intermediaries. For children, Bacillus Calmette-Guérin (BCG) vaccination rates reached 93.2% for groups with full LHW contact, compared to just 68.3% for those with no contact. For maternal health, skilled birth attendance rose from 54.4% (no contact) to 64.4% (full contact), and completion of at least four facility-based antenatal care (ANC) visits jumped from 25.3% to 36.2% [4]. Because the LHW is already trusted and physically present in the community, she effectively bridges the gap between the household and the broader health system.

4.3 Finding 3: Digital infrastructure exists, but rural deployment gaps remain

The technological foundation to support digital coordination already exists. According to the Asian Development Bank's 2024 Pakistan digital ecosystem diagnostic report, mobile internet coverage now reaches over 80% of Pakistan's population [1]. While rural areas lag behind urban centers, the Universal Service Fund (USF) has been actively utilized to subsidize fiber-optic cables to remote towns to bridge this viability gap. Furthermore, the ADB explicitly notes that digitally equipped mobile clinics and handheld data collection by community health practitioners are already operating as growing trends in telemedicine [1]. A 2024 *Cureus* review further confirmed that pairing artificial intelligence with telemedicine can push triage capacity into underserved areas to effectively close the physician-to-population gap [3].

4.4 Finding 4: Decentralized, telemedicine-backed models reduce mortality in Pakistan

Evidence from complex disease management in Pakistan proves that decentralization works. A study examining health outcomes for patients with multi-drug-resistant tuberculosis (MDR-TB) in Pakistan evaluated interventions for improving rural healthcare access [2]. To address long distances and high abandonment rates, the study explicitly recommended utilizing satellite clinics and telemedicine to provide immediate patient consults and online treatment instructions, alongside funded transportation and community-based healthcare providers [2]. Applying this exact decentralized, digitally-backed model to primary and maternal care is a

highly viable mechanism for reducing preventable mortality.

5. Insight / Proposed Idea

To solve the discovery-to-care failures plaguing rural Khyber Pakhtunkhwa, the provincial Health Department should equip the existing network of Lady Health Workers (LHWs) with a lightweight, AI-assisted mobile triage and routing application, backed by a subsidized telemedicine welfare fund.

What should be done: The intervention consists of three integrated digital layers. First, an AI-assisted symptom triage tool helps the LHW assess the patient's condition on-site. Second, a facility capability-matching algorithm routes the patient to a hospital or clinic that is verified to have the specific staff and equipment needed to treat their condition, eliminating the "discovery failure" of arriving at unequipped facilities. Third, if in-person care is unreachable, the app connects the patient directly to an urban doctor via telemedicine. Crucially, consultations for patients below a defined income threshold will be covered by a centralized welfare fund.

Who should do it: This system must be deployed exclusively through Lady Health Workers acting as the localized agents, rather than launched as a standalone public app. LHWs already possess the community trust required to drive adoption, and bypassing them risks the low engagement rates that historically doom direct-to-consumer health apps in rural, low-literacy settings.

Why it would work: This mechanism directly resolves the specific bottlenecks identified in the research. The AI routing tool bypasses the systemic coordination failures and fragmentation identified in KPK's governance (Finding 1). Equipping LHWs amplifies the proven multiplier effect they already have on boosting clinical visits and skilled birth attendance (Finding 2). The system requires no new physical buildings, instead leveraging the existing mobile broadband infrastructure that already covers the vast majority of the country (Finding 3). Finally, the inclusion of a welfare fund directly targets the 55% of rural patients who cited out-of-pocket costs as their primary barrier to care, mimicking the successful decentralized community models seen in Pakistan's TB management programs (Finding 4). This is not a purely theoretical concept; a working prototype, Evolve Health (github.com/nameershah/evolve), already demonstrates the technical feasibility of build-ing this exact coordination layer within Pakistani healthcare constraints.

6. Conclusion

How can AI-assisted triage tools, built into Pakistan's existing Lady Health Worker program, bridge health financing and coordination gaps to improve healthcare access in rural Khyber Pakhtunkhwa? The evidence overwhelmingly indicates that rural healthcare in KPK is primarily a coordination and discovery problem, not an infrastructure problem. The physical facilities exist, the LHW workforce is already deployed, and mobile connectivity is rapidly expanding. What remains missing is a reliable, subsidized mechanism to route remote patients to the right care at the right time. By equipping trusted community intermediaries with AI-powered facility matching and telemedicine access, KPK can bypass its severe urban-rural physician imbalance. Providing these digital tools to the existing LHW network is a significantly more efficient and evidence-backed method to reduce maternal and child mortality than attempting to staff new brick-and-mortar facilities in regions where doctors refuse to reside.

7. References

References

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