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Beyond the Paycheck: A Realist Synthesis of Mechanisms Influencing Retention of Medical Doctors in Rural Sudan

Tarig Ali¹

¹ College of Business Administration-Management Department-Taibah University KSA

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Abstract

Sudan faces a persistent shortage and severe urban–rural maldistribution of medical doctors, undermining progress toward Universal Health Coverage. Despite long-standing reliance on compulsory service and financial incentives, rural areas continue to experience high turnover, and existing studies offer limited explanation of why retention interventions succeed or fail. This realist synthesis develops an explanatory program theory of rural doctor retention in Sudan by examining how outcomes arise from interactions between contextual conditions and underlying mechanisms. Following RAMESES standards, evidence from Sudan and comparable LMICs was purposively identified, appraised for relevance and rigor, and analyzed using retroductive reasoning to construct Context–Mechanism–Outcome (CMO) configurations. Four core mechanisms were found to shape doctors’ decisions to remain in rural posts: professional growth, perceived fairness, professional enablement, and social belonging. These mechanisms are activated—or suppressed—by multi-level contextual factors, including macro-level political and economic instability, organizational conditions such as facility readiness and supervision, and individual or community dynamics such as family ties and cultural integration. Coercive approaches, particularly compulsory service without adequate support, frequently triggered negative mechanisms leading to rapid exit. In contrast, bundled interventions that simultaneously strengthen career development, compensation reliability, workplace

functionality, and community integration produced synergistic effects that enhanced retention.

Keywords: rural retention; medical doctors; realist synthesis; Sudan; health workforce; CMO configurations

1. Introduction

Sudan faces a persistent crisis in its health workforce, marked by both an overall shortage of medical doctors and a severe urban–rural maldistribution (Ali, 2006; Ebrahim et al., 2017). Most doctors remain concentrated in Khartoum and other urban centres, leaving rural and conflict-affected regions critically underserved (Ismail, 2020). This imbalance undermines health equity, weakens system resilience, and threatens progress toward Universal Health Coverage (Babiker, et al. 2022; Nurelhuda et al., 2018).

Policy responses have historically relied on compulsory service and financial incentives, yet these measures have produced limited long-term retention. Rural posts continue to experience high turnover, and compulsory service is widely perceived as a punitive requirement rather than a meaningful career stage (Ali, 2014; Abuagla & Badr, 2016). Existing literature has documented the barriers—poor infrastructure, limited supervision, professional isolation, and challenging living conditions—but largely in descriptive terms that do not explain *how* or *why* interventions succeed or fail.

This study addresses that explanatory gap by applying a realist synthesis to examine the mechanisms through which retention strategies operate in Sudan’s complex socio-political and economic context. Realist methodology seeks to uncover how outcomes arise from interactions between context (C) and mechanism (M) (Pawson & Tilley, 1997). By synthesizing evidence from Sudan and comparable LMIC settings, this review asks: **Which mechanisms influence doctors’ decisions to remain in rural posts, and under what contextual conditions are these mechanisms activated or suppressed?**

The aim is to generate a mechanism-focused explanatory model that can guide more effective, context-sensitive workforce planning in Sudan.

2. Literature Review

The challenge of attracting and retaining health workers in rural and underserved areas is a persistent global health policy concern, particularly in Low- and Middle-Income Countries (LMICs) striving for Universal Health Coverage (UHC) [Esu et al., 2021; Khalil & Alameddine, 2020]. A substantial body of international evidence has catalogued the push and pull factors influencing health worker mobility. Systematic reviews consistently identify a common set of deterrents to rural service, including professional isolation, limited career advancement opportunities, inadequate working and living conditions, and concerns for personal and family well-being [Buykx et al., 2010; Russell et al., 2021; Onnis & Hunter, 2025]. Conversely, effective retention strategies are often multifaceted,

combining financial incentives with non-financial supports such as continuous professional development, improved workplace infrastructure, and community integration initiatives.

Within the Eastern Mediterranean Region and the specific context of Sudan, this maldistribution is acute and well-documented. Studies have long highlighted a significant "brain drain" of Sudanese health professionals and an internal imbalance skewed heavily toward urban centers [Badr, 2005; Ali, 2006]. Recent analyses confirm that profound regional disparities persist, with rural states experiencing a critical shortage of medical doctors relative to the capital, Khartoum [Ismail, 2020]. The Sudanese health system itself, characterized by systemic weaknesses in infrastructure, financing, and drug supply chains, creates a challenging operational environment that exacerbates retention problems [Ebrahim et al., 2017; Babughirana et al., 2025].

The policy response in Sudan has historically centered on compulsory service programs, requiring recent medical graduates to serve in rural areas. However, empirical research indicates that this coercive approach has yielded limited long-term success. Studies frame compulsory service not as a valued career phase but as a punitive "rite of passage" or a barrier to specialization, often leading to minimal engagement and early departure [Ali, 2014; Abuagla & Badr, 2016]. Research on motivation reveals that junior doctors are highly responsive to interventions that offer structured career pathways, such as linkages between rural service and postgraduate training opportunities [Nurelhuda et al., 2018]. Furthermore, the severe economic pressures facing Sudanese doctors, including currency devaluation and the weight of extended family financial obligations, make the reliability and fairness of compensation a paramount concern, beyond the mere amount of salary [Ahmed et al., 2019].

Integrated View of Contextual Influence

Table 1. Integrated View of Contextual Influence on Retention Mechanisms

Mechanism	Primary Context	Secondary Context	Illustrative Studies
Professional Growth	Macro	Organizational	Ali (2014); Nurelhuda et al. (2018); Jinah et al. (2024)
Perceived Fairness	Macro	Organizational	Ahmed et al. (2019); Hammad et al. (n.d.); Russell et al. (2021)
Professional Enablement	Organizational	Macro	Babughirana et al. (2025); Ebrahim et al. (2017); Oparah-Evoeme, M. (2023)
Social Belonging	Individual/Community	Organizational	Elgadi et al. (2025); Ahmed (2016); Buykx et al. (2010)

Despite this growing body of context-specific evidence, a significant gap remains. Much of the literature on Sudan, as in many LMICs, is descriptive, cataloguing *what* factors are associated with attrition or retention, table 1. There is a limited explanatory analysis that examines *how* specific interventions generate their effects, *for whom*, and under *what conditions* (Hammad et al., n.d.). For instance, while financial incentives are widely recommended, their mechanism of action in a fragile economy like Sudan's—where trust in systems is low and instability is high—is poorly understood. Similarly, the emotional and professional mechanism by which community integration fosters retention is underexplored in the Sudanese context (Babiker, et al. 2022; Elgadi et al., 2025).

Integrated theoretical model:

Table 2. Integrated Theoretical Model Linking Mechanisms to Mid-Range Theories

Mechanism	Mid-Range Theory	Contribution to Explanation
Professional Growth	Self-Determination Theory	Competence and autonomy needs drive motivation to stay
Perceived Fairness	Organizational Justice Theory	Transparent, reliable incentives strengthen trust and commitment
Professional Enablement	Job Demands–Resources Model	Adequate resources reduce burnout and support sustained performance
Social Belonging	Professional Identity Formation	Emotional attachment and community integration support retention

This review therefore identifies a need to move beyond factor-listing toward a deeper, theory-informed explanation of retention dynamics. Realist synthesis methodology is specifically designed to address this type of explanatory gap [Pawson & Tilley, 1997; Wong et al., 2013]. By synthesizing the available evidence from Sudan and comparable settings through a Context-Mechanism-Outcome lens, this study aims to develop a mid-range program theory. This theory will explain the underlying causal mechanisms—such as perceptions of fairness, professional growth, or social belonging—that are triggered (or suppressed) by retention interventions within Sudan's unique multi-level context, thereby offering a more robust foundation for effective policy design.

3. Methods

This study employed a realist synthesis methodology, an approach well-suited to examining complex social interventions where outcomes are highly context-dependent. Realist synthesis seeks to develop explanatory program theory by uncovering how outcomes are generated through the interaction of specific contexts (C) and underlying mechanisms (M) [1]. The review was conducted in accordance with the RAMESES (Realist And Meta-narrative Evidence Syntheses: Evolving Standards) publication guidelines to ensure methodological rigor and transparency [2]. The process was iterative and theory-driven, focused on explaining *how* and *why* interventions for retaining medical doctors in rural Sudan succeed or fail.

3.1. Development of Initial Program Theory

An initial program theory was formulated based on foundational realist principles [1], a preliminary scoping of literature on health workforce retention in Sudan and comparable Low- and Middle-Income Countries (LMICs), and a review of relevant policy documents. This theory posited that retention outcomes are contingent upon the interaction between multi-level contextual factors (political, economic, organizational) and mechanisms related to professional motivation, fairness, capability, and social integration.

3.2. Search Strategy and Evidence Selection

A purposive and iterative search strategy was implemented to identify evidence pertinent to theory testing and refinement, rather than to achieve exhaustive coverage. Searches were conducted in PubMed, Scopus, Web of Science, Google Scholar, and African Journals Online (AJOL), supplemented by grey literature from institutional repositories. Search terms included combinations of “Sudan,” “health workforce,” “doctor retention,” “rural,” “compulsory service,” and “realist.” Evidence was included if it addressed the retention or motivation of medical doctors in Sudan or comparable LMIC settings, encompassing empirical studies of any design and relevant policy evaluations. Studies focusing solely on other cadres or from high-income contexts were excluded.

3.3. Evidence Appraisal and Data Extraction

Consistent with realist principles, evidence was appraised for its **relevance** to program theory development and its **rigour** in providing trustworthy insights, rather than using a hierarchical quality assessment. Data extraction focused on identifying and documenting contextual elements, candidate mechanisms (inferred from reported reasoning and responses), and outcomes related to retention or turnover.

3.4. Analysis and Theory Refinement

Analysis followed a retroductive approach (Wong et al., 2013). Fragments of Context-Mechanism-Outcome (CMO) configurations were extracted from individual sources. Through constant comparison across studies, these fragments were synthesized to refine the understanding of key mechanisms. This iterative process continued until theoretical saturation was achieved, culminating in the consolidation of findings into four core CMO configurations.

3.5. Presentation of Findings

The refined program theory, integrating the four principal mechanisms, is presented narratively in the Results in accordance with RAMESES guidelines for reporting realist syntheses (Wong et al., 2013). This model elucidates the contextual conditions that trigger these mechanisms and their resultant outcomes.

3.6. Reflexivity

In line with RAMESES standards (Wong et al., 2013) and the principles of realist inquiry (Pawson & Tilley, 1997), the research team engaged in reflexive consideration of how their professional backgrounds and prior knowledge of Sudan's health system might influence evidence interpretation and theory development. This stance was maintained to enhance the transparency and trustworthiness of the synthesis process.

4. Results

CMO 1: Professional development and career progression

In contexts where rural postings are perceived as professional dead-ends with limited training and mentorship (Ali, 2014), interventions that provide structured continuing education, postgraduate training linkages, and clear pathways for promotion activate a mechanism of perceived professional growth. This reduces career anxiety and increases the attractiveness of a rural post as a viable career stage, not just an obligation (Nurelhuda et al., 2018; Jinah et al., 2024).

CMO 2: Fair and reliable compensation

Within the context of Sudan's economic pressures, currency devaluation, and doctors' significant family and social obligations (Ahmed et al., 2019), compensation is not merely transactional. When financial incentives are bundled (including housing, transport, hardship allowances) and delivered reliably, they activate a mechanism of perceived fairness and institutional respect. This acknowledges the doctor's sacrifice, mitigates financial strain, and reduces dissatisfaction (Hammad et al., n.d.; Russell et al., 2021).

CMO 3: Professional enablement and safety

The context of under-resourced facilities—lacking basic equipment, medications, and supportive staff (Babughirana et al., 2025; Ebrahim et al., 2017)—cripples a doctor's ability to practice effectively, leading to frustration and moral injury. Interventions that ensure adequate medical supplies, functional equipment, and a safe, secure work environment activate a mechanism of professional efficacy and safety. This enables doctors to perform their roles competently and with dignity, strengthening commitment and reducing burnout (Oparah-Evoeme, M. 2023).

CMO 4: Social and community integration

For doctors posted culturally and socially unfamiliar rural settings, isolation is a powerful push factor. Interventions that facilitate community orientation, language support, and accommodation for families activate a mechanism of social belonging and reciprocal respect (Elgadi et al., 2025). When doctors feel welcomed and valued by the community,

their emotional attachment to the place deepens, acting as a potent retention force (Buykx et al., 2010).

5. Discussion

This synthesis demonstrates that retention is not the product of a single "magic bullet" intervention. In Sudan, outcomes are generated through the activation (or suppression) of interconnected mechanisms rooted in professional identity, fairness, capability, and belonging.

The failure of compulsory service schemes to ensure long-term retention can be explained through this lens. When implemented as a standalone, coercive policy within contexts of poor enablement and weak professional growth opportunities, it fails to trigger positive retention mechanisms and often activates resentment, leading to mandatory compliance followed by immediate departure (Babiker, et al. 2022).

The findings underscore the necessity of bundled interventions. For example, a financial incentive (addressing fairness) will have limited effect if a doctor cannot work effectively due to drug stock-outs (negating enablement) or feels isolated from peers and family (negating belonging). This aligns with broader systematic review evidence emphasizing multifaceted, contextually adapted strategies (Russell et al., 2021; Onnis & Hunter, 2025).

5.1. Policy Implications: A Mechanism-Informed Approach to Rural Doctor Retention in Sudan

The findings of this realist synthesis demonstrate that sustainable retention of medical doctors in rural Sudan requires policies that activate multiple mechanisms simultaneously—**professional growth, perceived fairness, professional enablement, and social belonging**—within the constraints of Sudan’s macro-political instability, organizational weaknesses, and community dynamics. Evidence from Sudan and comparable LMICs consistently shows that single-lever interventions, such as financial incentives alone, rarely produce durable retention (Ali, 2014; Babiker, et al. 2022; Buykx et al., 2010; Nurelhuda et al., 2018; Russell et al., 2021). Instead, bundled, mechanism-sensitive strategies are required.

Table 2. Integrated Theoretical Model Linking Mechanisms to Mid-Range Theories

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Mechanism	Mid-Range Theory	Contribution to Explanation
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5.1.1. Strengthening Professional Growth Pathways

Professional growth emerged as the anchor mechanism, particularly for early-career doctors. Rural service is often perceived as a career delay due to limited postgraduate opportunities and opaque specialization processes (Ali, 2014; Nurelhuda et al., 2018). Policies should therefore:

- Integrate rural postings into **accredited training rotations**, which have been shown to improve retention when linked to recognized career progression (Jinah et al., 2024).
- Expand **mentorship and supervision networks**, addressing deficits that undermine competence and autonomy—key motivational needs identified by Self-Determination Theory.
- Establish **transparent, merit-based pathways to specialization**, reducing macro-level uncertainty that suppresses motivation.

These measures directly activate the professional growth mechanism by reframing rural service as a meaningful developmental stage rather than a punitive obligation.

5.1.2. Ensuring Fair and Transparent Compensation Systems

Perceived fairness is a stabilizing mechanism in Sudan’s fragile economic environment. Economic instability, inflation, and currency devaluation heighten doctors’ sensitivity to distributive and procedural justice (Ahmed et al., 2019; Russell et al., 2021). Policy responses should:

- Guarantee **timely and predictable salary payments**, recognizing that reliability often matters more than the absolute amount.
- Standardize **allowances, housing, and hardship benefits** across states to address inequities documented in administrative practices (Hammad et al., n.d.).
- Improve **transparency in deployment and HR processes**, strengthening procedural and interactional justice.

These actions reinforce institutional trust and reduce the resentment associated with perceived injustice.

5.1.3. Investing in Facility Readiness and Professional Enablement

Professional enablement—doctors’ ability to practice safely and competently—is primarily shaped by organizational conditions. Chronic shortages of essential drugs, equipment, and infrastructure undermine clinical performance and morale (Babughirana et al., 2025; Ebrahim et al., 2017). Insecurity and supply chain disruptions further exacerbate these challenges (Oparah-Evoeme, M. 2023). Policy priorities should include:

- Ensuring **consistent availability of essential supplies and functional equipment**, addressing job-resource deficits highlighted by the Job Demands–Resources model.
- Strengthening **facility management and supportive supervision**, which enhance efficacy and reduce burnout.
- Improving **safety and security measures**, particularly in conflict-affected regions where insecurity directly suppresses enablement.

By reducing job demands and increasing job resources, these interventions activate the enablement mechanism and prevent moral injury.

5.1.4. Enhancing Social Belonging and Community Integration

Social belonging is the emotional mechanism most strongly shaped by individual and community contexts. Doctors who feel welcomed, respected, and socially integrated are more likely to remain in rural posts despite material hardships (Babiker, et al. 2022; Elgadi et al., 2025). Policies should:

- Formalize **community orientation and integration programs**, ensuring new doctors are introduced to local leaders, cultural norms, and social networks.
- Support **family-friendly posting policies**, recognizing that separation from family networks is a major driver of attrition.
- Strengthen **collegiality and team cohesion** within facilities, consistent with evidence that supportive workplace relationships predict rural retention (Buykx et al., 2010).

These measures reinforce professional identity formation and foster emotional attachment to rural service.

5.1.5. Designing Bundled, Mechanism-Synergistic Interventions

Retention improves when multiple mechanisms are activated simultaneously. Effective policy bundles may include:

- **Training-linked rural service (growth) + reliable allowances (fairness)** → strengthens commitment.
- **Facility readiness (enablement) + community integration (belonging)** → strengthens attachment.

- **All four mechanisms combined**—structured training, transparent compensation, adequate resources, and community engagement—→ supports long-term retention (Ali, 2014; Nurelhuda et al., 2018; Jinah et al., 2024; Babughirana et al., 2025; Elgadi et al., 2025).

This approach aligns with realist logic and broader evidence that multifaceted, context-adapted strategies outperform isolated interventions (Russell et al., 2021; Onnis & Hunter, 2025).

5.1.6. Avoiding Coercive or Isolated Policy Measures

Coercive policies—such as compulsory service without adequate support—tend to suppress positive mechanisms and activate negative ones, including resentment and professional stagnation. This pattern is well documented in Sudan (Ali, 2014; Nurelhuda et al., 2018). Policies should therefore avoid:

- Compulsory deployment without training
- Financial incentives without facility readiness
- Posting doctors to unfamiliar communities without integration support

Such isolated measures produce short-term compliance but rapid exit.

6. Policy Recommendations with Explicit Mechanism Linkages

Drawing on the refined program theory, this study proposes a set of mechanism-informed policy recommendations to strengthen the retention of medical doctors in rural Sudan. Each recommendation is grounded in the four core mechanisms identified in the synthesis—professional growth, perceived fairness, professional enablement, and social belonging—and is designed to activate these mechanisms within Sudan’s complex macro, organizational, and community contexts.

6.1. Reframe Rural Service as a Contractual Partnership

The first recommendation is to reposition rural service as a mutually beneficial contractual partnership rather than a compulsory obligation. This approach directly activates the **professional growth** mechanism by linking rural postings to guaranteed postgraduate training slots, specialist certification pathways, or accelerated promotion. Such arrangements transform rural service from a perceived career delay into a meaningful developmental stage. At the same time, **perceived fairness** is strengthened because the system signals reciprocity: doctors’ service is exchanged for tangible, career-enhancing benefits. When these two mechanisms are activated together, early-career doctors are more willing to accept and remain in rural posts, motivated by clearer career trajectories and reduced uncertainty.

6.2. Implement Tiered, Bundled Incentive Packages

A second recommendation is the introduction of transparent, tiered incentive packages that combine financial and non-financial supports. This strategy primarily activates the **perceived fairness** mechanism by ensuring predictable, equitable compensation—covering salary, hardship allowances, housing, transport, and education support. In Sudan’s fragile economy, reliability and transparency are more influential than the absolute value of incentives. Bundled packages also support **social belonging** when they include family-oriented components, such as schooling allowances or spousal employment support, which reduce social isolation. Additionally, **professional enablement** is indirectly strengthened when housing and transport reduce daily stressors that undermine clinical performance. Together, these mechanisms reduce dissatisfaction and turnover driven by economic insecurity and perceived inequity.

6.3. Invest in Foundational Professional Enablement

A third recommendation is to prioritize investments in facility readiness and workplace functionality. This directly activates the **professional enablement** mechanism by ensuring that doctors have the equipment, drug supplies, staffing, and security necessary to practice safely and competently. When doctors can perform their duties effectively, the risk of moral injury and burnout is significantly reduced. Improvements in enablement also reinforce **perceived fairness**, as doctors interpret adequate resourcing as a sign of institutional respect and support. Strengthening these mechanisms enhances professional commitment and reduces exits driven by frustration and unsafe working conditions.

6.4. Promote Systemic and Community Integration

The final recommendation is to strengthen both systemic and community-level integration for rural doctors. This activates the **social belonging** mechanism by ensuring that doctors feel welcomed, respected, and socially connected to the communities they serve. Practical measures include structured community orientation, engagement with local leaders, cultural integration support, and family-friendly posting policies. At the same time, **professional growth** is supported through remote mentorship, peer networks, and opportunities for skill development that mitigate professional isolation. When belonging and growth are activated together, doctors develop stronger emotional attachment to rural posts and greater resilience in the face of contextual hardships.

6.5.Overall Implications

Taken together, these recommendations highlight that sustainable rural retention in Sudan cannot be achieved through isolated interventions. Instead, policies must be designed to activate multiple mechanisms simultaneously, aligning career development opportunities, fair and reliable compensation, adequate working conditions, and community integration. By grounding policy design in the mechanisms identified through this realist synthesis, decision-makers can develop more coherent, context-sensitive strategies capable of producing durable improvements in rural doctor retention.

7. Limitations and Conclusion

This synthesis is based on available literature, which varies in depth and methodological rigor. The focus is on medical doctors, and mechanisms for nurses or midwives may differ. Realist explanations are mid-range theories open to refinement with new evidence.

Retaining medical doctors in rural Sudan requires looking beyond the paycheck. Sustainable solutions depend on creating contexts that actively trigger a doctor's sense of professional growth, fairness, capability, and community connection. By understanding and strategically targeting these underlying mechanisms, policymakers can move from ad-hoc interventions to a coherent, effective strategy for building a more equitable and resilient health workforce for all Sudanese.

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