

Causal Pathways Linking Emergency Medicine Service Continuity to Referral Completion in Uganda

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ABSTRACT

Referral completion in low-income health systems is typically modelled as a function of patient characteristics, transport access, or facility capacity, leaving the organisational continuity of emergency care itself undertheorised. The proposed design distinguishes between continuity as an organisational property and the mediating mechanisms of clinical information transfer, trust in receiving facilities, and patient preparation, while accommodating unobserved confounding through a within-between correlated random effects structure. Formal identification conditions are derived for the indirect effects, and the framework is extended to account for referral chains that cross district boundaries. The analysis clarifies why single-level logistic regressions commonly used in African emergency care research conflate compositional and contextual pathways, and it specifies the data architecture required for estimation, including linked facility registries and patient tracking systems. The contribution is a testable causal model that repositions service continuity as a modifiable system-level intervention rather than a background condition, with implications for emergency care strengthening in Uganda and comparable settings.

Keywords: *emergency medicine, referral completion, service continuity, multilevel mediation, Uganda*

Referral failure as an organisational problem

The Pathway From A Rural Health Centre To A District

The pathway from a rural health centre to a district hospital in Uganda is rarely a single transfer. A patient with an obstructed labour or a deteriorating head injury may pass through two or three facilities, each requiring a clinical decision to refer onward, a documented handover, and a means of transport. Completion of that pathway, defined as arrival at the facility capable of providing definitive care, is the outcome on which emergency care systems are ultimately judged.

Yet completion rates in Uganda remain low, and the reasons are usually sought in patient delay, distance, cost, or the scarcity of ambulances. What is missing from this accounting is the possibility that the referring system itself, through the way it organises care across time and between facilities, generates the very failures it is expected to prevent. The present analysis argues that emergency medicine service continuity, understood as the coherence of clinical management across the pre-referral, transfer, and reception phases, constitutes a distinct causal domain that has been collapsed into other explanatory categories. When a health centre lacks protocols for stabilisation, when referral letters omit vital signs, or when the

receiving facility has no system for acknowledging arrival, the patient experiences a discontinuity that is not reducible to distance or poverty.

The Present Analysis Argues That Emergency Medicine Service Continuity Understood

The argument developed here is that these discontinuities exert their effects through identifiable mediating mechanisms, and that modelling them requires a multilevel structure capable of separating facility-level organisational properties from patient-level experiences. The contribution is a formal mediation design, not an empirical estimate, because the data infrastructure needed to test the model does not yet exist in Uganda.

Continuity and referral completion in the Ugandan emergency care literature

Existing Scholarship On Referral Completion In Uganda And East Africa

Existing scholarship on referral completion in Uganda and East Africa has concentrated on three explanatory families. The first concerns patient and household attributes, including education, income, and illness perception, often measured through exit interviews or community surveys. The second addresses geographic and financial barriers, with distance to the nearest referral facility and out-of-pocket transport costs featuring prominently in studies of obstetric and surgical referrals.

The third family examines receiving-facility capacity, such as the availability of surgical staff, blood products, or intensive care beds. Each family has generated useful evidence, but together they share an assumption that the referring facility is a passive origin point rather than an active producer of referral outcomes. The concept of continuity of care has a longer history in chronic disease management than in emergency medicine.

The Concept Of Continuity Of Care Has A Longer History

Haggerty et al. (2003) distinguished informational, management, and relational continuity, a taxonomy developed for primary care but applicable to the handover between an emergency unit and a referral destination. In emergency settings, the relevance of this distinction is acute because the referring clinician and the receiving clinician rarely share a relationship, and the information transfer is compressed into a single document or telephone call.

Studies of referral communication in low-income settings have documented that referral letters frequently omit essential clinical information, and that receiving facilities often have no mechanism to confirm whether the referred patient actually arrived (Glickman et al., 2008). Within Uganda specifically, the Ministry

of Health has established referral guidelines that specify the responsibilities of referring and receiving facilities, but implementation research suggests wide variation in adherence. A national assessment of emergency care services found that fewer than half of health centres had functioning communication equipment for referral coordination, and that ambulance services were concentrated in urban districts (Hsia et al., 2012).

These findings point toward an organisational explanation for referral failure, yet the quantitative literature has not translated them into a causal model. The typical analysis regresses referral completion on a set of covariates measured at the patient level, with facility characteristics included as fixed effects or simply omitted. This design cannot identify whether the organisational properties of the referring facility matter, let alone through which mechanisms they operate.

Conceptualising emergency medicine service continuity

The Framework Proposed Here Defines Emergency Medicine Service Continuity As

The framework proposed here defines emergency medicine service continuity as the degree to which a patient's care across the referral pathway is delivered according to a coherent plan, with complete information transfer, and without avoidable interruption. This definition draws on the informational and management dimensions of continuity identified by Haggerty et al. (2003), but adapts them to the compressed time horizon of emergency care.

Relational continuity, the third dimension in the primary care taxonomy, is less relevant to a single emergency episode and is therefore excluded from the core definition, although it may matter for patients with repeated emergency attendances. Service continuity is conceptualised as a property of the referring facility and the district health system, not of the individual patient. A health centre exhibits high continuity when it has standardised protocols for emergency stabilisation, when its staff are trained in those protocols, when it maintains a registry of referred patients, and when it has a functioning communication link to the next level of care.

Service Continuity Is Conceptualised As A Property Of The Referring

At the district level, continuity emerges from the coordination mechanisms that link facilities, including referral coordination centres, shared patient records, and feedback loops through which receiving facilities report outcomes back to referring clinicians. This multilevel structure is essential because a single facility cannot achieve continuity in isolation; it depends on the responsiveness of the receiving end of the pathway. The distinction between continuity and related constructs requires attention.

Service readiness, as measured by the Service Availability and Readiness Assessment, captures the presence of equipment, medicines, and staff, but says nothing about whether those resources are organised into a coherent care process. Referral completeness, sometimes measured as the proportion of referred patients who arrive at the destination, is an outcome rather than a system property. The framework treats continuity as a latent organisational construct that must be measured through indicators of protocol adherence, information transfer, and coordination activity, rather than inferred directly from referral outcomes.

A multilevel mediation model for referral completion

The Causal Model Proposed Here Positions Service Continuity At The

The causal model proposed here positions service continuity at the facility and district levels as the exposure of interest, referral completion as the outcome, and three patient-level mediating mechanisms as the pathways through which continuity exerts its effects. The first mediator is clinical information transfer, defined as the completeness and accuracy of the clinical information that accompanies the patient. The second is patient preparation, encompassing the explanation given to the patient and family about the reason for referral, the expected course of care, and the logistical arrangements made.

The third is trust in the receiving facility, which reflects the patient's and family's confidence that the referral will lead to appropriate care rather than a dead end. Formally, let Y_{ij} denote referral completion for patient i nested in referring facility j , and let X_j denote the facility-level continuity score. The mediators M_{1ij} , M_{2ij} , and M_{3ij} are measured at the patient level but are hypothesised to be influenced by facility-level continuity.

The mediation model can be written as a system of equations:

$$M_{kij} = \alpha_k + \beta_k X_j + \gamma_k Z_{ij} + u_{kj} + \epsilon_{kij} \quad (1)$$

Formally Let Y_{ij} Denote Referral Completion For Patient i

for each mediator k , where Z_{ij} is a vector of patient covariates, u_{kj} is a facility-level random effect, and ϵ_{kij} is a patient-level error term. The outcome equation is:

$$\text{logit}(P(Y_{ij} = 1)) = \theta + \tau X_j + \sum_k \delta_k M_{kij} + \lambda Z_{ij} + v_j \quad (2)$$

where τ captures the direct effect of continuity on referral completion, δ_k captures the effect of each mediator on the outcome, and v_j is a facility-level random effect. The indirect effect through mediator k is the product $\beta_k \delta_k$, and the total effect is the sum of the direct and indirect effects. This specification raises a well-known identification problem.

The indirect effects are identified only under the assumption of no unobserved confounding of the mediator-outcome relationship, conditional on the covariates and the facility-level random effects. In observational data, this assumption is strong, because patients who receive better information transfer may differ from those who do not in ways that also affect their likelihood of completing the referral. The framework addresses this through a within-between correlated random effects structure, which separates the between-facility association between continuity and the mediators from the within-facility association, and through the inclusion of facility-level fixed effects in sensitivity analyses (Preacher et al., 2010).

Identification conditions and estimation strategy

The Identification Of Causal Mediation Effects In Multilevel Settings Requires

The identification of causal mediation effects in multilevel settings requires conditions that extend the single-level framework of Imai et al. (2010). The first condition is sequential ignorability, which states that, conditional on covariates and facility-level random effects, the exposure is independent of potential mediator values, and the mediators are independent of potential outcomes given the exposure and covariates.

The second condition is that there is no mediator-outcome confounder affected by the exposure, known as the cross-world independence assumption. In the referral context, this assumption would be violated if, for example, facility-level continuity influenced the quality of the receiving facility, which in turn affected both patient trust and the likelihood of completion. The proposed design addresses these threats through three strategies.

First, the multilevel structure allows facility-level confounding to be absorbed by random effects, reducing the risk that unmeasured facility characteristics bias the estimated indirect effects. Second, the measurement model for the mediators should include multiple indicators, allowing latent variable mediation analysis that separates true mediator variation from measurement error (VanderWeele, 2015). Third, the design should exploit natural experiments where they exist, such as the staggered introduction of referral coordination centres across districts, which would permit a difference-in-differences analysis of the effect of a system-level continuity intervention on referral completion.

The Proposed Design Addresses These Threats Through Three Strategies

Estimation would proceed in two stages. In the first stage, a measurement model is fitted to the continuity indicators and the mediator indicators, using confirmatory factor analysis to establish that the latent constructs are empirically

distinguishable. In the second stage, the structural model is estimated using Bayesian methods, which allow uncertainty in the factor scores to propagate into the mediation estimates.

The Bayesian approach also facilitates the incorporation of prior information from the Ugandan context, such as the expected magnitude of facility-level variation based on the national emergency care assessment (Hsia et al., 2012). A key extension of the model concerns referral chains that cross district boundaries. When a patient is referred from a health centre in one district to a hospital in another, the continuity of the pathway depends on coordination between two district health systems.

The model accommodates this by allowing the facility-level random effects to be correlated across districts within the same region, and by including a cross-level interaction between facility continuity and district-level coordination capacity. This extension recognises that referral completion in Uganda is not merely a facility-level outcome but a property of the inter-facility network.

Why single-level models misattribute referral failure

The Methodological Argument Against Single-Level Logistic Regression In This Setting

The methodological argument against single-level logistic regression in this setting deserves explicit statement. When referral completion is regressed on patient characteristics and a set of facility dummy variables, the facility coefficients capture the total association between the facility and the outcome, including both the direct effect of organisational continuity and the indirect effects operating through the mediators. If the analyst then interprets a significant patient-level coefficient, such as distance or transport cost, as the primary driver of referral failure, they risk attributing to the patient what is actually a facility-level organisational deficit.

Consider a patient who fails to complete a referral because the referral letter was incomplete and the receiving facility turned them away. A single-level model that includes distance as a covariate would correctly identify that this patient travelled a long distance, but it would incorrectly attribute the failure to distance rather than to the information deficit. The conflation is not merely a statistical nuisance; it has policy consequences.

Consider A Patient Who Fails To Complete A Referral Because

If the analysis identifies distance as the dominant barrier, the policy response is to invest in transport. If the analysis correctly identifies information discontinuity as the mechanism, the policy response is to invest in referral documentation, staff training, and communication systems. The multilevel mediation framework also

addresses the compositional-contextual distinction that is central to health services research.

A facility with a high proportion of severely ill patients will have a low referral completion rate even if its organisational continuity is excellent, because severely ill patients are more likely to die before arrival. A single-level analysis that does not separate patient composition from facility context will incorrectly rank this facility as poorly performing. The random effects structure separates the facility's contextual effect from the compositional effect of its patient population, providing a fairer basis for performance comparison and for targeting quality improvement interventions (Diez Roux, 2002).

Data architecture for empirical application

The Empirical Application Of This Framework Requires A Data Architecture

The empirical application of this framework requires a data architecture that Uganda does not currently possess but could feasibly develop. The core requirement is a linked patient registry that records every emergency referral from the point of decision to refer through to arrival at the final destination. The registry must capture the referral letter content, the mode of transport, the time of departure and arrival, and the outcome at the receiving facility.

This registry would need to be linked to facility-level data on staffing, protocols, equipment, and communication infrastructure, and to district-level data on coordination mechanisms. The measurement of service continuity requires the development and validation of a facility-level instrument. Drawing on the WHO emergency care assessment framework, the instrument should capture the presence of written referral protocols, the proportion of clinical staff trained in emergency stabilisation, the functioning of communication equipment, and the existence of a referral registry (Razzak et al., 2019).

The Measurement Of Service Continuity Requires The Development And Validation

The mediator measures require a patient or family survey administered shortly after the referral decision, capturing the information received, the clarity of the explanation, and the patient's confidence in the receiving facility. A follow-up survey or facility record check would establish whether the referral was completed. The proposed design also requires attention to the timing of measurement.

Mediators must be measured after the exposure but before the outcome, which in the referral context means that the patient survey must be administered during the referral process, not after arrival or non-arrival at the destination. This timing requirement is practically demanding but methodologically essential, because retrospective accounts of trust and preparation are likely to be coloured by the

eventual outcome. The framework therefore implies a prospective cohort design, with enrolment of patients at the point of referral decision and follow-up through the completion or non-completion of the pathway.

Boundary conditions and alternative explanations

The Causal Claims Of This Framework Are Bounded In Several

The causal claims of this framework are bounded in several respects. First, the model assumes that referral completion is a meaningful outcome for all emergency conditions, but for some conditions, such as a moribund patient with no realistic prospect of survival, non-completion may reflect appropriate clinical judgement rather than system failure. The analysis should therefore be restricted to conditions for which referral is clearly indicated and completion is expected to improve outcomes, or should include a severity adjustment that accounts for the clinical appropriateness of the referral decision.

Second, the framework does not address the quality of care at the receiving facility. A patient may complete a referral and still receive inadequate care, which means that referral completion is a necessary but not sufficient condition for improved health outcomes. The model should be extended in future work to a joint outcome of completion and receipt of appropriate care, although this extension substantially increases the data requirements.

Second The Framework Does Not Address The Quality Of Care

Third, the role of patient agency must be acknowledged. The framework treats patient preparation and trust as mediators influenced by facility-level continuity, but patients and families are not passive recipients of these organisational inputs. A patient with strong social networks may obtain information and transport through family members regardless of the facility's coordination efforts, while a socially isolated patient may fail to complete a referral despite excellent preparation.

The model accommodates this through patient-level covariates, but the possibility of patient-facility interactions, where the effect of continuity differs by patient social position, should be tested explicitly.

Implications for emergency care strengthening

The Framework'S Principal Policy Implication Is That Service Continuity Should

The framework's principal policy implication is that service continuity should be treated as a modifiable system-level intervention rather than a background condition. If the hypothesised mediation pathways are confirmed empirically, they

would imply that investments in referral documentation systems, staff training in stabilisation and communication, and district-level coordination mechanisms could improve referral completion even in the absence of new ambulances or road improvements. This is not an argument against transport investment, but a claim that transport is necessary without being sufficient, and that the organisational pathway through which transport is mobilised is itself a determinant of whether it is used effectively.

The multilevel structure of the model also implies that interventions should be evaluated at the system level rather than the facility level. A randomised trial that introduces a referral coordination centre in some districts and not others would provide the strongest evidence for the causal effect of continuity, and the mediation analysis would then identify which mechanisms, information transfer, patient preparation, or trust, are the active ingredients. This design aligns with the emerging emphasis on health system strengthening as a distinct intervention category, rather than a collection of facility-level projects (Kruk et al., 2018).

The Multilevel Structure Of The Model Also Implies That Interventions

The framework also has implications for monitoring and evaluation. Current indicators of referral performance in Uganda focus on counts of referrals and completion rates, without information on the organisational processes that produce those outcomes. The measurement model proposed here would generate a facility-level continuity score that could be tracked over time and used for benchmarking.

This score would provide an earlier warning of system deterioration than outcome data alone, because organisational discontinuities precede referral failures by weeks or months.

Conclusion

Referral Completion In Uganda Has Been Persistently Framed As A

Referral completion in Uganda has been persistently framed as a problem of patient behaviour, geographic access, and resource scarcity. the present analysis has argued that the organisational continuity of emergency care services constitutes a distinct and potentially modifiable cause that existing analytical designs cannot identify. The multilevel mediation framework developed here specifies how facility-level and district-level continuity might influence referral completion through the mediating mechanisms of clinical information transfer, patient preparation, and trust in receiving facilities. The formal identification conditions make explicit the assumptions under which the indirect effects could be estimated, and the proposed data architecture describes the linked registry and survey system that would be required.

The Contribution Is Deliberately Methodological Rather Than Empirical Because The

The contribution is deliberately methodological rather than empirical, because the data infrastructure for testing the model does not yet exist. This is not a limitation to be concealed but a finding to be reported: the absence of linked referral data in Uganda is itself a form of informational discontinuity that prevents the health system from learning about its own performance. The framework offers a route toward generating the evidence needed to move beyond the attribution of referral failure to patients and distance, and toward a system-level understanding of how emergency care organisations produce or fail to produce completed referral pathways.

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