

REVIEW ARTICLE

Health-System and Access Determinants of Delayed HIV Diagnosis in Underserved, Remote, and Border Areas: A Rapid Review with Neuropsychiatric Relevance

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ARTICLE INFO	ABSTRACT
Received: [dd Month yyyy]	Abstract: Delayed HIV diagnosis and missed opportunities for earlier testing reflect not only patient-level and clinical factors but also the capacity of the health system to recognise an indicator condition, provide accessible testing, and sustain referral pathways, particularly in underserved, remote, and border settings and among patients with neuropsychiatric presentations. This rapid systematic review synthesises evidence on health-system and access-related determinants of delayed or missed HIV diagnosis in underserved, remote, rural, and border settings, and examines their relevance to patients presenting with neuropsychiatric manifestations. A structured search of PubMed/ MEDLINE , supplemented by additional scholarly searching, was conducted for publications from 2021-2026, combining terms for HIV testing with health-system barriers, access barriers, rural or remote settings, and indicator-condition-guided testing, with dedicated terms for Indonesia and the Pacific; this single-reviewer, rapid-review search did not include independent dual screening or formal quality appraisal, and findings were synthesised narratively without meta-analysis. Eleven sources met the review's scope. Geographic distance, rural residence, provider-level testing gaps, indicator-condition-guided testing failures, and stigma were consistently identified as barriers across diverse settings, including Papua New Guinea, while two qualitative studies from a remote Indonesian border district identified transport cost,
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distance, and confidentiality concerns as barriers to HIV testing and sustained care; no evidence specific to Kabupaten Pegunungan Bintang, Papua, was identified. Health-system and access barriers to HIV testing are well documented internationally, but evidence specific to Kabupaten Pegunungan Bintang remains unavailable, providing a hypothesis-generating basis for local empirical investigation of these determinants in relation to clinical presentations, including neuropsychiatric presentations.

INTRODUCTION

Early diagnosis of HIV underpins both individual clinical outcomes and population-level epidemic control: timely linkage to antiretroviral therapy improves survival, while undiagnosed infection is associated with continued transmission and delayed care. Achieving early diagnosis, however, depends on more than an individual's decision to seek testing - it depends on whether the health system encountered at the point of care recognises the need for testing and can deliver it.

Missed opportunities for HIV testing, particularly among patients with neuropsychiatric presentations, reflect not only clinical decision-making at the point of care but also the broader capacity of the health system to recognise and act on an indicator condition. Two related, unpublished analyses conducted as part of the same research program (manuscripts in preparation) examined this problem from a clinical-guideline and care-pathway perspective: the first found that the psychiatry and neurology specialties show below-average adoption of HIV testing recommendations within national indicator-condition guidelines, and the second identified that a provider-initiated, rather than patient-initiated, testing pathway predicts delay in HIV diagnosis. Neither analysis, however, addressed whether the health system itself - its geographic accessibility, workforce, and testing infrastructure - independently contributes to missed opportunities for diagnosis. The present review addresses that gap.

A first domain relevant to this gap is health-system determinants: provider testing practices, clinical recognition of indicator conditions, referral pathways, availability of on-site or rapid testing, workforce capacity, and the organisation of services. Gaps in provider knowledge, referral pathways, and guideline implementation have been documented across specialties and health systems (Jordans et al., 2022; Bogers et al., 2021), and the clinical setting in which a patient is diagnosed - for example opportunistic diagnosis during unrelated medical contact rather than through deliberate testing - independently predicts late presentation (Sun et al., 2021; Mahmoud et al., 2024).

A second, related but conceptually distinct domain is access determinants: geographic distance, transportation, direct and indirect cost, rurality, confidentiality, and stigma, all of which affect whether a patient who is offered testing can actually obtain it. Geographic distance and rural residence have been associated with reduced HIV testing uptake in multiple settings (Clausen et al., 2023; Maviso, 2024), transportation and financial barriers are among the most frequently reported obstacles to rural HIV care (Pellowski, 2013), and stigma operates at the level of the patient, the provider, and the community to reduce both testing uptake and timely diagnosis (Gesese et al., 2017; White et al., 2014).

Underserved, remote, rural, and border settings can compound both domains simultaneously: limited health-workforce and laboratory capacity constrain the health system's ability to act on an indicator condition, while geographic isolation, cost, and small-community stigma constrain the patient's ability to reach testing. This compounding effect is illustrated by the only Indonesian evidence identified in this review, from Belu District, a remote district of East Nusa Tenggara that borders Timor-Leste (Fauk et al., 2018; Fauk et al., 2023).

For patients with neuropsychiatric presentations specifically, these system- and access-level barriers are relevant because HIV can manifest through, or be complicated by, neuropsychiatric symptoms that may not immediately be linked to an HIV diagnosis, particularly when patients enter care through neurology or psychiatry services rather than through HIV-specific pathways (Jordans et al., 2022). This review does not claim that neuropsychiatric presentation itself causes diagnostic delay; rather, it examines whether the health-system and access determinants identified in the broader evidence base are relevant to the pathway by which a neuropsychiatric indicator condition would, or would not, result in HIV testing.

Evidence on these determinants from Indonesia remains limited, and evidence from

Papua in particular is largely absent. The only Indonesian evidence identified in this review originates from Belu District, outside Papua (Fauk et al., 2018; Fauk et al., 2023), leaving the applicability of these determinants to Papuan settings, including highland districts, unconfirmed.

Kabupaten Pegunungan Bintang, a remote, geographically isolated highland district in Papua Province, Indonesia, represents a setting in which these determinants may plausibly operate but for which no published evidence on health-system or access barriers to HIV testing was identified in this review. This absence of evidence is treated here strictly as a research gap rather than as an assumption that the determinants identified elsewhere apply directly to this district.

Taken together, existing evidence describes health-system and access barriers to timely HIV diagnosis across several underserved, remote, and border settings, including one border district of eastern Indonesia. However, evidence specifically examining these determinants in Kabupaten Pegunungan Bintang, Papua, remains unavailable, and the relevance of these system-level barriers to patients presenting with neuropsychiatric manifestations has not been adequately synthesised. This rapid systematic review was conducted to address that gap.

This review addresses the primary research question: what health-system and access determinants are associated with delayed HIV diagnosis or missed opportunities for HIV testing in underserved, remote, rural, and border settings, and what is their relevance to patients presenting with neuropsychiatric manifestations? The corresponding objective is to synthesise evidence on health-system and access-related determinants associated with delayed or missed opportunities for HIV diagnosis in underserved, remote, rural, and border settings, and to examine the relevance of these determinants to patients presenting with neuropsychiatric manifestations.

This objective is pursued through six subquestions: (1) what health-system barriers are associated with delayed HIV diagnosis; (2) what access-related barriers are associated with delayed HIV testing or diagnosis; (3) how these barriers manifest in remote, rural, underserved, and border settings; (4) what evidence is available from Indonesia and the wider Pacific region; (5) what evidence gaps remain relevant to Kabupaten Pegunungan Bintang; and (6) what implications these determinants have for HIV patients presenting with neuropsychiatric manifestations.

Literature Review

Health-system determinants of HIV testing described in the existing literature can be broadly grouped into three domains: geographic and structural barriers, health-workforce and service-delivery barriers, and socio-cultural or stigma-related barriers (Pellowski, 2013). Geographic distance and rural residence have been associated with reduced HIV testing uptake in multiple settings (Clausen et al., 2023; Maviso, 2024), while health-workforce barriers, including gaps in provider knowledge, referral pathways, and guideline implementation, have been documented across specialties and health systems (Jordans et al., 2022; Bogers et al., 2021).

Stigma is consistently identified as a barrier to both testing uptake and timely diagnosis, operating at the level of the patient, the provider, and the community (Gesese et al., 2017; White et al., 2014). In addition, the clinical setting in which a diagnosis occurs - for example opportunistic diagnosis during unrelated medical contact rather than through deliberate testing - has been identified as an independent predictor of late presentation (Sun et al., 2021; Mahmoud et al., 2024).

Although these determinants are well characterised internationally, evidence from Indonesia remains limited, and evidence from Papua in particular is largely absent. The only Indonesian evidence identified in this review originates from a single remote, border district outside Papua (Fauk et al., 2018; Fauk et al., 2023), leaving the applicability of these determinants to Kabupaten Pegunungan Bintang unconfirmed.

RESEARCH METHODOLOGY

This study used a rapid systematic literature review design, structured according to the Population-Concept-Context (PCC) framework recommended for reviews addressing a phenomenon of interest rather than a single intervention effect.

Population: patients or at-risk populations with undiagnosed HIV.

Concept (exposure/determinants): health-system and access-related barriers or facilitators of HIV testing and diagnosis.

Context: rural, remote, resource-limited, underserved, border, or Indonesian health-service settings, supplemented by evidence from indicator-condition-guided testing programs in any setting.

Outcomes: delayed HIV diagnosis, late diagnosis, missed opportunities for HIV testing, delayed HIV testing, barriers to HIV testing, barriers to diagnostic access, and healthcare access barriers.

A structured search of PubMed/MEDLINE was conducted, supplemented by additional scholarly searching, combining terms for HIV testing with terms for health-system barriers (provider knowledge, referral, guideline implementation), access barriers (distance, travel time, transport, laboratory availability, stigma, confidentiality), rural or remote settings, and indicator-condition-guided testing. The search specifically included terms for Indonesia and the Pacific/Melanesia to identify regionally relevant evidence. Publications from 2021-2026 were prioritised, and foundational older studies on rural HIV service barriers were retained where relevant. “Border” setting was not itself a search term; it is used in this review as a factual geographic descriptor of one included study site (Belu District) rather than a pre-specified search facet, and this distinction is maintained transparently throughout. Given the exploratory and regionally focused nature of the search, a full PRISMA-style record count was not generated; the review instead prioritised breadth of relevant regional evidence over an exhaustive database audit.

For each identified source, the setting, population, category of barrier or facilitator, and quantitative estimates (where reported) were extracted. This review reflects a targeted, single-reviewer search rather than an exhaustive systematic search with independent dual screening, and no formal risk-of-bias or quality appraisal was conducted; no meta-analysis was performed given the heterogeneity of settings and outcome measures across included sources. Findings were synthesised narratively. No claim is made that evidence from other countries, or from Indonesian regions outside Papua, is directly generalisable to Kabupaten Pegunungan Bintang. Given its single-reviewer search strategy and the absence of formal quality appraisal, this review is best characterised as a rapid systematic review rather than an exhaustive systematic review with independent dual screening.

RESULTS AND DISCUSSION

Study Characteristics

Eleven sources met the scope of this review, comprising systematic reviews and meta-analyses (n=5), a national cross-sectional survey, a cross-sectional study, and qualitative studies (n=4), spanning the United States, 15 European countries, China, Lebanon, Papua New Guinea, and Indonesia. Table 1 summarises the health-system and access-related determinants identified through the search.

Table 1. Health-system and access-related determinants of missed opportunities for HIV diagnosis identified through the search

No.	Study (Author, Year, Setting)	Determinant / Barrier	Finding
1	Pellowski (2013), USA, systematic review (15 studies)	Rural transport, provider stigma, confidentiality, cost	Transportation, provider discrimination/stigma, confidentiality, and financial barriers were the most frequently reported of 27 rural HIV-care barriers
2	Clausen et al. (2023), rural southern USA	Geographic distance to testing site	Distance, but not travel time, was independently associated with reduced HIV testing
3	Maviso (2024), Papua New Guinea, n=1,274	Rural residence (young men)	AOR 0.54 (95% CI 0.32-0.92) for HIV testing, rural vs. urban
4	Fauk et al. (2023), Belu District, eastern Indonesia (border)	Transport cost, distance, confidentiality concerns	Qualitative evidence of barriers to sustained HIV-care access in a remote, border Indonesian district (ART access, not initial diagnosis)

	district, adjacent to Timor-Leste)		
5	Fauk et al. (2018), Indonesia	Provider- and service-level barriers	Identified barriers to HIV testing among male clients of female sex workers in an Indonesian setting
6	Gesesew et al. (2017), low/middle-income countries, meta-analysis	Perceived HIV-related stigma	Pooled OR 2.4 (95% CI 1.6-3.6) for late presentation, high vs. low perceived stigma
7	White et al. (2014), southeastern USA, qualitative	Provider-level barriers	Physicians cited stigma, conservative community norms, confidentiality, rural geography, and competing clinical priorities
8	Jordans et al. (2022), 15 European countries	Specialty guideline gaps	Neurology/neurosurgery among specialties with below-average testing-recommendation rates (46%)
9	Bogers et al. (2021), Western countries, meta-analysis	Indicator-condition-guided testing implementation	Effective when implemented, but real-world uptake across specialties remains inconsistent
10	Sun et al. (2021), China, meta-analysis	Diagnostic setting (medical institution vs. VCT)	Pooled OR 2.35 (95% CI 2.11-2.62) for late presentation when diagnosed in a medical institution
11	Mahmoud et al. (2024), Lebanon	Health-system contact without testing	76.5% of late presenters had prior contact with the health system for an HIV-indicator condition not followed by testing

AOR = adjusted odds ratio; ART = antiretroviral therapy; CI = confidence interval; OR = odds ratio; VCT = voluntary counselling and testing.

Geographic and Transportation Barriers

A foundational systematic review from the United States identified transportation needs as among the most frequently reported of 27 barriers to rural HIV care (Pellowski, 2013), and a subsequent cross-sectional study confirmed that geographic distance specifically, but not travel time, was independently associated with reduced HIV testing among rural populations in the southern United States (Clausen et al., 2023).

Rurality and Remoteness

A national survey from Papua New Guinea found that young men in rural areas had substantially lower odds of HIV testing than their urban counterparts (adjusted odds ratio [AOR] 0.54, 95% CI 0.32-0.92), representing the geographically closest evidence identified, although Papua New Guinea and Kabupaten Pegunungan Bintang differ in health-system structure (Maviso, 2024).

Health-System and Provider-Level Barriers

Provider-level and health-system barriers were identified across multiple sources. A systematic guideline review of 15 European countries found that neurology and neurosurgery were among the specialties with below-average adoption of HIV testing recommendations within indicator-condition guidelines (46%) (Jordans et al., 2022), and a meta-analysis of indicator-condition-guided testing found that although the approach is effective when implemented, real-world uptake across specialties remains inconsistent (Bogers et al., 2021). A large meta-analysis from China found that diagnosis occurring within a medical institution, rather than through voluntary counselling and testing, independently predicted late presentation (pooled OR 2.35, 95% CI 2.11-2.62) (Sun et al., 2021), and cohort data from Lebanon showed that most late presenters (76.5%) had prior contact with the health system for an HIV-indicator condition that was not followed by testing (Mahmoud et al., 2024). Provider- and service-level barriers to HIV testing were also identified among male clients of female sex workers in an Indonesian setting (Fauk et al., 2018).

Financial and Indirect Costs

Financial barriers, including direct cost and transport cost, were among the most frequently reported barriers to rural HIV care in the United States (Pellowski, 2013). Qualitative evidence from Belu District, a remote, border district of eastern Indonesia, identified transport cost and distance as barriers to sustained HIV-care access during the COVID-19 pandemic, alongside indirect costs associated with travel time and lost income (Fauk et al., 2023).

Stigma, Confidentiality, and Acceptability

A meta-analysis across low- and middle-income countries found that perceived HIV-related stigma was associated with more than twice the odds of late presentation (pooled OR

2.4, 95% CI 1.6-3.6) (Gesesew et al., 2017). Qualitative evidence from primary care physicians in the southeastern United States identified stigma, conservative community norms, confidentiality concerns, and competing clinical priorities as barriers to routine testing (White et al., 2014), and confidentiality concerns were similarly identified as a barrier to sustained HIV care in Belu District (Fauk et al., 2023).

Continuity and Service Accessibility

Evidence on continuity of care was more limited than evidence on initial testing. The qualitative study from Belu District concerned retention in antiretroviral therapy rather than initial diagnosis, and found that transport cost, distance, and confidentiality concerns limited sustained access to care during the COVID-19 pandemic (Fauk et al., 2023). At the health-system level, inconsistent real-world uptake of indicator-condition-guided testing across specialties suggests that continuity between clinical recognition and completed testing is not assured even where testing pathways exist (Bogers et al., 2021).

Evidence from Indonesia and the Pacific

Two qualitative studies provided the only Indonesian evidence identified in this review. One, conducted in Belu District, a remote, border district of East Nusa Tenggara adjacent to Timor-Leste, found that transport cost, distance, and confidentiality concerns limited sustained access to antiretroviral therapy during the COVID-19 pandemic; this evidence concerns retention in care rather than initial diagnosis, and Belu differs substantially from Pegunungan Bintang in geography, health infrastructure, and epidemic context (Fauk et al., 2023). The second identified provider- and service-level barriers to HIV testing among male clients of female sex workers in an Indonesian setting (Fauk et al., 2018). The geographically closest regional evidence, from Papua New Guinea, found substantially lower odds of HIV testing among rural young men (Maviso, 2024). Neither Indonesian study was conducted in Papua, and no evidence specific to Kabupaten Pegunungan Bintang was identified.

Principal Findings

This review identified consistent evidence that health-system determinants (provider testing practice, guideline implementation, referral pathways, and the clinical setting of diagnosis) and access determinants (geographic distance, transport cost, rurality, and stigma) are each independently associated with delayed or missed HIV diagnosis. These two domains were identified across diverse settings, including the geographically proximate context of Papua New Guinea and one border district of eastern Indonesia, but no evidence specific to Kabupaten Pegunungan Bintang was identified.

Health-System Determinants and Missed Diagnostic Opportunities

The health-system barriers identified here - provider-level testing gaps, guideline implementation gaps, and the clinical setting in which diagnosis occurs - point to a shared theme: missed opportunities for HIV diagnosis arise not only because a patient presents with a relevant condition, but because the system encountered at that presentation lacks the accessibility, provider practice, or guideline support to translate that presentation into testing. This pattern is consistent across the evidence base: barriers appear to operate cumulatively rather than singly, so that guideline gaps, referral limitations, and diagnostic setting each independently reduce the likelihood that an indicator condition is translated into a completed HIV test, even where clinical suspicion is appropriately raised.

Access Barriers in Remote, Underserved, and Border Settings

Geographic distance, rurality, transport cost, and confidentiality concerns were identified as access barriers across settings ranging from the rural United States to Papua New Guinea and Belu District, a border district of eastern Indonesia. These barriers are conceptually distinct from health-system determinants - they constrain a patient's ability to reach an available service, rather than the system's ability to recognise or offer testing - but the two domains plausibly interact: a patient who overcomes access barriers to reach care may still not be tested if the health-system determinants above are also present. For health systems similar to that of Kabupaten Pegunungan Bintang, this suggests that improving testing rates for patients with neuropsychiatric indicator conditions is unlikely to depend on guideline dissemination alone, and will also require attention to transport, laboratory and referral

infrastructure, workforce training, and stigma reduction.

Stigma and Confidentiality

Stigma and confidentiality concerns were identified as barriers operating at the level of the patient, the provider, and the community, and were consistently reported across otherwise dissimilar settings (Gesese et al., 2017; White et al., 2014; Fauk et al., 2023). This consistency across settings suggests that stigma-related barriers may be less setting-specific than geographic or infrastructural barriers, though this review cannot confirm whether the same pattern holds in Kabupaten Pegunungan Bintang without local investigation.

Relevance to Neuropsychiatric Presentations

The reviewed evidence primarily concerns system-level and access-related determinants of HIV testing and diagnosis rather than neuropsychiatric populations specifically; only one included source (Jordans et al., 2022) directly addressed neurology and neurosurgery guideline adoption. Therefore, the relevance to neuropsychiatric presentations should be interpreted as a clinical and health-system implication rather than direct evidence of causality. Neuropsychiatric symptoms may enter care through different clinical pathways than other HIV-indicator conditions, and HIV may not immediately be considered when a patient presents primarily through neurology or psychiatry services. Fragmented referral pathways and the diagnostic-setting effects identified above (Sun et al., 2021; Mahmoud et al., 2024) suggest that even where a clinician appropriately suspects HIV, system-level barriers - such as the absence of on-site laboratory capacity or a clear referral pathway - can compound clinical diagnostic uncertainty and contribute to missed opportunities for testing.

Relevance to Indonesia and Eastern Indonesia

Compared with the international evidence base, Indonesian evidence on health-system and access determinants of HIV testing is sparse and geographically limited to Belu District, a border district of East Nusa Tenggara. The barriers identified there - transport cost, distance, and confidentiality - are broadly consistent with international findings, but Belu is a lowland border district with transport infrastructure, health-workforce density, and HIV epidemiology that differ from highland Papua; its findings are therefore a plausible starting point, not a confirmed basis, for hypotheses about Papuan settings.

Implications for Kabupaten Pegunungan Bintang

This review does not provide direct empirical evidence from Kabupaten Pegunungan Bintang. The near-total absence of published research on health-system and access barriers to HIV testing from Papua, Indonesia, is simultaneously the principal limitation of this review and its main finding. The health-system and access determinants identified internationally and regionally can nonetheless serve as a conceptual framework, hypothesis-generating evidence, and rationale for local empirical investigation, and as a basis for developing a local health-system assessment. Kabupaten Pegunungan Bintang is a relevant setting for such research precisely because its remote, highland, resource-limited characteristics resemble those associated with delayed diagnosis elsewhere, while remaining empirically unconfirmed.

Research Gap

There is a lack of empirical evidence examining how health-system and access determinants interact with delayed HIV diagnosis in Kabupaten Pegunungan Bintang, particularly among patients presenting with neuropsychiatric manifestations. This absence of evidence motivates the empirical, Pegunungan Bintang-based research that this review is intended to support, and underlines that the health-system and access determinants identified internationally should be treated as hypotheses to be tested locally rather than as established local findings.

Limitations

This review has several strengths: it applied an explicit PCC framework to structure the search, deliberately sought regionally relevant evidence from Indonesia and the Pacific, distinguished health-system from access determinants throughout, and refrained from extrapolating findings from unrelated settings to the study district.

It also has limitations: the search was conducted by a single reviewer without independent dual screening or formal quality appraisal, no meta-analysis was possible given

heterogeneity in settings and outcome measures, and grey literature and non-English-language sources, including Bahasa Indonesia-language sources on Papua, were not systematically searched, which may have excluded additional regionally relevant evidence. “Border” setting was identified post hoc as a feature of one included study rather than as a pre-specified search facet, and this review's evidence base on border settings specifically should therefore be regarded as limited to that single source.

CONCLUSION AND RECOMMENDATIONS

This rapid systematic review supports the following conclusions. First, health-system determinants - provider testing practice, guideline implementation, referral pathways, and diagnostic setting - are consistently associated with delayed or missed HIV diagnosis. Second, access determinants - geographic distance, transport cost, rurality, and stigma - independently contribute to delayed or missed HIV testing. Third, both domains are particularly relevant in underserved, remote, and border settings, where they may operate cumulatively. Fourth, evidence from Indonesia remains limited to one border district outside Papua. Fifth, evidence specific to Kabupaten Pegunungan Bintang is lacking. Sixth, neuropsychiatric presentations represent an important clinical context in which these system-level barriers may compound diagnostic delay, warranting further investigation rather than assumption. Seventh, local empirical research in Kabupaten Pegunungan Bintang is needed before context-specific interventions or prediction models can be developed.

Local empirical research is recommended to establish which health-system and access determinants actually apply in Kabupaten Pegunungan Bintang, with geographic distance, workforce and laboratory availability, community stigma, and referral pathways treated as candidate determinants requiring local verification rather than assumed findings. This absence of local evidence, discussed above as a limitation of the present review, is itself the rationale for the empirical study that this review is intended to support.

Local health policymakers may also consider strengthening indicator-condition-guided testing in primary care as an interim measure while awaiting more complete local data, alongside investment in referral pathways and on-site or rapid-turnaround testing capacity for patients presenting with HIV-indicator conditions, including neuropsychiatric conditions, in remote and border settings.

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