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Bridging Provider Expectations and Patient Realities: A Mixed-Methods Study of HIV–TB Treatment Adherence Within China's Integrated Care Framework

Ruili Bi
China University of Geosciences
Haijuan Wang
wanghaijuan@cug.edu.cn

China University of Geosciences
Chunnong Jike
Liangshan Prefecture Centre for Disease Control and Prevention
Gang Yu
Liangshan Prefecture Centre for Disease Control and Prevention
Ju Wang
Liangshan Prefecture Centre for Disease Control and Prevention
Rong Pei
Chengdu University of Traditional Chinese Medicine
Jiayi Liao
Chengdu University of Traditional Chinese Medicine
Yulian Zhang
Sichuan Center for Disease Control and Prevention

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Abstract

Background

Treatment adherence is a key determinant of outcomes among patients with HIV–tuberculosis (TB) co-infection. Existing research has often focused on either provider or patient perspectives in isolation, with limited attention to how clinical expectations align with patients' lived experiences. Under China's Integrated Prevention and Control of Four Diseases (IPC4D) policy, which promotes integrated care for multiple infectious diseases, understanding this alignment is particularly important. This study examines differences between healthcare providers' perceptions and patient experiences of treatment adherence in this context.

Methods

An explanatory sequential mixed-methods design was employed. In the quantitative phase, a survey of 492 healthcare workers assessed provider perceptions of adherence among HIV–TB co-infected patients. This was followed by semi-structured interviews with 30 healthcare workers and 22 patients. Qualitative data were analyzed using thematic analysis, and findings were integrated to compare provider expectations with patient experiences.

Results

Healthcare providers generally described adherence as a manageable and protocol-driven process, emphasizing timely treatment initiation, regular follow-up, and regimen compliance. In contrast, patient accounts reflected a more complex and context-dependent process. Entry into treatment was often influenced by psychological responses to diagnosis. During treatment, adherence was shaped by the combined effects of medication side effects and financial constraints. Follow-up and monitoring could raise concerns related to privacy and stigma, while understanding of treatment remained partial despite standardized education. These findings point to persistent gaps between how adherence is defined in clinical practice and how it is experienced in everyday life.

Conclusion

Treatment adherence in HIV–TB co-infection is shaped by interacting individual, social, and structural factors. Improving adherence requires approaches that are better aligned with patients' lived circumstances, particularly in resource-limited settings.

Introduction

The syndemic interaction between tuberculosis (TB) and human immunodeficiency virus (HIV) remains a persistent and complex global health challenge. Their co-occurrence not only accelerates disease progression but also substantially increases the complexity of diagnosis, treatment, and long-term management[1, 2]. According to the World Health Organization's *Global Tuberculosis Report 2024*, an estimated 662,000 incident TB cases occurred among people living with HIV (PLHIV) in 2023, with approximately 161,000 deaths attributable to TB. PLHIV are about 16 times more likely to develop active TB than HIV-negative individuals[3]. Together, these patterns underscore the considerable burden of HIV–TB co-infection and its implications for already strained health systems, particularly in resource-constrained settings.

China remains among the countries with a high TB burden, with pronounced regional disparities[4, 5]. In Liangshan Yi Autonomous Prefecture—a remote, resource-limited region in southwest China—HIV and TB epidemics overlap extensively[6, 7]. Geographic isolation, limited healthcare infrastructure, and low levels of health literacy, combined with distinctive sociocultural structures in predominantly ethnic minority communities, shape both care-seeking behaviors and treatment experiences[8]. These contextual factors complicate the management of HIV–TB co-infection and highlight the need for context-sensitive approaches to care.

Treatment adherence is widely recognized as a critical determinant of outcomes in HIV–TB co-infection[3, 9]. Previous studies have identified multiple barriers, including complex treatment regimens, adverse drug effects, financial hardship, transportation constraints, and limited disease knowledge[10, 11]. In addition, stigma and concerns about confidentiality may undermine trust in healthcare providers and discourage sustained engagement with care[12, 13]. Increasingly, however, adherence is understood not simply as an individual behavior, but as a dynamic process shaped by structural conditions, social context, and health system factors[14–16]. Despite this shift, much of the existing literature continues to frame non-adherence primarily in terms of patient-level deficits, with limited attention to how differing perspectives within the healthcare system may influence adherence behaviors.

In response to the overlapping burden of communicable diseases, China launched the *Integrated Prevention and Control of Four Diseases* (IPC4D) policy in Liangshan in 2021[17]. This initiative integrates the screening, follow-up, and management of HIV/AIDS, TB, hepatitis C, and syphilis within primary care systems through coordinated, multi-sectoral approaches[18]. While the policy aims to improve service integration and patient outcomes, it also reconfigures the roles of frontline healthcare workers, placing greater emphasis on adherence monitoring and management[19]. This initiative can be understood as an integrated care framework that brings together the management of multiple infectious diseases within primary care settings. However, there remains limited empirical evidence on whether such system-level interventions align with patients' lived experiences and needs.

In integrated care settings, adherence is not solely an individual decision but emerges through interactions between healthcare providers and patients. Providers often conceptualize adherence as a controllable, protocol-driven behavior grounded in biomedical and managerial logics. In contrast,

patients' treatment decisions are embedded in everyday life contexts shaped by psychological stress, social relationships, economic pressures, and cultural norms. As a result, a systematic gap may arise between expected adherence from the provider perspective and actual adherence practices from the patient perspective. To date, this expectation–experience misalignment has received limited systematic attention.

Against this backdrop, this study adopts a mixed-methods design within the IPC4D policy context to explore how treatment adherence is understood and experienced in HIV–TB co-infection. It combines a quantitative survey of healthcare workers with in-depth qualitative interviews with both providers and patients, with the aim of examining how adherence is perceived, where challenges arise in practice, and how gaps emerge between provider expectations and patient experiences.

Rather than treating adherence as a fixed individual behavior, this study approaches it as a process shaped by interactions between patients, providers, and broader contextual conditions. By bringing together quantitative and qualitative evidence, it highlights recurring mismatches between how adherence is defined in clinical settings and how it is lived in everyday practice. In doing so, the study seeks to offer a more grounded understanding of adherence in integrated HIV–TB care, with implications for developing more responsive and patient-centered approaches in resource-limited settings.

Methods

Study design

This study employed an explanatory sequential mixed-methods design, integrating a quantitative survey with qualitative interviews to examine the relationship between healthcare providers' perceptions of treatment adherence and patients' lived treatment experiences under China's Integrated Prevention and Control of Four Diseases (IPC4D) policy.

The study was conducted in two phases. In the first phase, a structured survey was administered to healthcare workers to capture their overall assessments of adherence among patients with HIV–TB co-infection. In the second phase, in-depth qualitative interviews were conducted to further interpret the quantitative findings and to provide a more nuanced understanding of patients' real-world treatment experiences.

It should be noted that, although treatment adherence was the central focus of this study, this variable was used primarily for descriptive purposes in the quantitative analysis and was not treated as a primary outcome in inferential statistical modeling.

Study setting

The study was conducted in Liangshan Yi Autonomous Prefecture, a predominantly ethnic minority region in southwest China that has long faced a high burden of overlapping HIV and TB epidemics. Since 2021, the region has implemented the Integrated Prevention and Control of Four Diseases (IPC4D) policy, which integrates the screening, follow-up, and management of HIV/AIDS, tuberculosis, hepatitis C, and syphilis within primary healthcare systems.

By strengthening multi-sectoral collaboration and community-based follow-up, the IPC4D policy has improved service accessibility while also reshaping interactions between healthcare providers and patients. This context provides a relevant and representative setting for examining adherence within an integrated care framework.

Quantitative component

The quantitative component targeted healthcare workers involved in the implementation of the IPC4D policy. The survey was conducted across multiple counties in Liangshan Prefecture and included participants from county-level hospitals, Centers for Disease Control and Prevention (CDC), and primary healthcare facilities. A total of 492 healthcare workers were recruited. Eligible participants were required to be engaged in HIV- or TB-related clinical care or public health management and to have relevant work experience in these areas.

Data were collected through a structured questionnaire, which included items on participants' sociodemographic characteristics, their overall assessment of treatment adherence among HIV–TB co-infected patients, and their perceptions of factors influencing adherence. The questionnaire was developed based on existing literature and preliminary fieldwork and was pilot-tested prior to formal data collection to ensure clarity and comprehensibility.

Following data entry, all responses were checked and cleaned. Descriptive statistical analyses were conducted to summarize healthcare workers' perceptions of adherence and the distribution of key variables.

Qualitative component

The qualitative component consisted of in-depth interviews with patients co-infected with HIV and TB to explore their treatment experiences and adherence behaviors in real-world settings. Participants were purposively sampled to capture variation in demographic characteristics and treatment experiences.

The semi-structured interview guide was developed based on our previous mixed-methods study examining healthcare workers' perceptions of treatment adherence[20], which provided the conceptual foundation for the current research. For this study, the guide was substantially adapted to reflect the patient population and to focus on patients' lived experiences, treatment trajectories, and barriers and

facilitators to adherence. The final English version of the interview guide is provided as a supplementary file. The interview guide with thematic mapping is provided in Supplementary File 1.

All interviews were conducted face-to-face by trained researchers in a private setting. Interviews were audio-recorded with participants' consent and transcribed verbatim.

Data analysis

Qualitative data were analyzed using thematic analysis. Interview transcripts were first read repeatedly to achieve familiarity with the data. Open coding was then conducted, followed by the iterative development of themes through constant comparison.

Particular attention was paid to differences between healthcare providers' expectations and patients' experiences in relation to treatment adherence. Themes were refined continuously through comparison across participant groups to enhance analytical depth and coherence.

For the integration of quantitative and qualitative findings, a connecting and comparing approach was adopted. Quantitative results were systematically compared with qualitative themes, and joint displays were constructed to map correspondences between provider expectations and patient realities, thereby identifying key dimensions of misalignment.

Ethical considerations

Ethical approval

for this study was obtained from the Medical Ethics Committee of the Affiliated Hospital of Chengdu University of Traditional Chinese Medicine (Approval No. 2023KL-099). All procedures involving human participants were conducted in accordance with the ethical standards of the institutional research committee and with the Declaration of Helsinki.

All participants provided written informed consent prior to participation. To ensure confidentiality, all data were anonymized and used solely for research purposes.

Results

4.1 Participant Characteristics

Table 1 presents the socio-demographic and professional characteristics of the 52 participants included in the qualitative interviews, comprising 30 healthcare workers and 22 patients with HIV–TB co-infection.

Healthcare workers had a mean age of 39.2 years (SD 8.5; range 22–60), and 53.3% were male. Participants represented diverse professional roles across CDC/public health institutions, clinical practice, and rural primary care settings. All healthcare workers had completed university-level education. The mean duration of professional experience was 10.2 years (range 2–39), indicating substantial variation in career stage.

All patient participants were of Yi ethnicity. Patients were predominantly male (63.6%) with a mean age of 42.1 years (SD 8.9; range 25–61). Educational attainment was generally low, with 86.4% reporting primary school education or below. Most patients were engaged in farming or manual labor and resided in rural or village settings. The mean duration of current or most recent TB treatment was 16.0 months (range 1–36), based on self-report.

Notable socio-demographic differences were observed between healthcare providers and patients, particularly in terms of educational attainment, occupation, and place of residence. The qualitative participants were recruited purposively to capture diverse treatment experiences, consistent with the sampling strategy described in the Methods section.

Table 1
Socio-demographic and professional characteristics of qualitative interview participants

Characteristic	Healthcare workers (n = 30)	Patients (n = 22)
Gender, n (%)		
Male	16 (53.3)	14 (63.6)
Female	14 (46.7)	8 (36.4)
Age, years		
Mean (SD)	39.2 (8.5)	42.1 (8.9)
Range	22–60	25–61
Ethnicity, n (%)		
Yi	16 (53.3)	22 (100.0)
Han	14 (46.7)	—
Education, n (%)		
Primary school or below	—	19 (86.4)
Secondary school	—	3 (13.6)
University or above	30 (100.0)	—
Professional role (healthcare workers), n (%)		
CDC/public health staff	14 (46.7)	—
Physicians/clinicians	6 (20.0)	—
Rural village physicians	6 (20.0)	—
Nurses/community health workers	4 (13.3)	—
Primary occupation (patients), n (%)		
Farmers/manual laborers	—	13 (59.1)
Other occupations	—	9 (40.9)
Residence, n (%)		
Urban/township	25 (83.3)	4 (18.2)
Rural/village	5 (16.7)	18 (81.8)
Professional experience, years		
Mean (range)	10.2 (2–39)	—

Characteristic	Healthcare workers (n = 30)	Patients (n = 22)
Gender, n (%)		
TB treatment duration, months		
Mean (range)	—	16.0 (1–36)
Data are presented as n (%) unless otherwise indicated.		
SD = standard deviation.		
TB treatment duration was self-reported.		
No missing data were observed.		

4.2 Provider Assessments of Adherence: Quantitative Overview

Our prior quantitative survey of 492 healthcare workers (Phase I) provided an initial landscape of treatment adherence in the region[20]. These findings suggested that adherence among patients with HIV–TB co-infection was generally perceived as moderate to good, with 64.0% of respondents providing a “good” or “very good” rating. However, this overall positive assessment contrasted with reports of specific non-adherent behaviors: 50.4% of respondents reported frequent medication interruptions, 43.7% noted unsupervised discontinuation, and 37.8% identified missed follow-up visits.

When describing barriers, healthcare providers primarily focused on patient-level factors, citing low health literacy (86.8%), regimen complexity (62.8%), medication side effects (61.2%), financial constraints (59.8%), and limited family support (52.2%) as the most significant challenges. This pattern suggests that adherence tends to be interpreted predominantly through the lens of individual capability and immediate socioeconomic constraints.

Further ordinal logistic regression analysis indicated that adherence assessments varied significantly across provider characteristics. Female respondents were less likely to report higher levels of adherence compared with their male counterparts (OR = 0.57, 95% CI: 0.36–0.91). In contrast, clinicians (OR = 2.67, 95% CI: 1.35–5.31) and those working in infectious disease departments (OR = 2.38, 95% CI: 1.23–4.64) tended to provide more favorable assessments. Notably, the use of standardized adherence assessment tools was associated with lower reported adherence (OR = 0.16, 95% CI: 0.09–0.28), whereas institutional efforts to reduce patients’ financial burdens were linked to more positive perceptions (OR = 1.78, 95% CI: 1.02–3.11). These findings indicate that adherence assessments are not only shaped by patient conditions but are also influenced by providers’ professional roles and evaluative frameworks.

Taken together, these quantitative findings point to a subtle but important tension: while providers tend to offer relatively positive overall evaluations, they simultaneously describe frequent deviations from prescribed treatment. This discrepancy suggests that aggregated assessments of adherence may not fully capture the complexity of patients’ day-to-day treatment experiences. It also highlights a gap

between provider-centered evaluations and patient experiences, underscoring the need for further qualitative investigation.

4.3 Dissonance in Treatment Initiation and Readiness: Clinical Expectations vs Patient Psychological Responses

While the survey findings suggested generally high levels of perceived adherence among healthcare providers, qualitative interviews revealed important discrepancies in patients' readiness to initiate treatment. Healthcare workers generally emphasized the importance of timely treatment initiation following diagnosis and viewed early engagement with care as a critical component of adherence. From the provider perspective, once a diagnosis was confirmed, patients were expected to promptly accept their condition and transition into a treatment-oriented role.

In contrast, patient narratives revealed that treatment initiation was often preceded by a period of profound psychological disruption. Many participants described their initial reactions to diagnosis in catastrophic terms, reflecting a profound gap between clinical expectations of prompt treatment initiation and patients' psychological readiness. As one patient explained, "*At first, I thought it was just a common cold, but the cough kept getting worse. I have six children to support, and my parents are both over 90. They were afraid I would die before them, and the whole family was very worried. I couldn't accept it myself*." (P11, male, 40). Such responses frequently resulted in emotional paralysis, delaying patients' readiness to engage with care.

This initial shock was closely intertwined with internalized stigma and fear of infecting others. Several participants reported deliberately distancing themselves from family members, including separating living arrangements or limiting contact. One participant described, "*My family all know about my condition, so we eat separately. I have my meals alone.*" (P14, male, 38). These experiences suggest that concerns about contagion and social judgment were not only externally imposed but also deeply internalized, shaping early treatment behaviors.

At the same time, patients' motivations for treatment were often ambivalent and unstable. While some described a sense of responsibility toward their children or family members as a reason to continue treatment, others expressed feelings of hopelessness that undermined their willingness to persist. As one participant explained, "*My husband died of HIV, and I have two elderly family members and three children to care for. Our family is struggling financially, and without labor, we have no source of income. My condition is quite serious, and I feel that nothing really matters anymore.*" (P20, female, 35). This coexistence of obligation and despair reflects a fragile and fluctuating form of treatment engagement, rather than the consistent adherence assumed in clinical expectations.

Taken together, these findings point to a clear dissonance between provider expectations of rational and timely treatment initiation and patients' lived experiences of psychological shock, stigma, and motivational conflict. Rather than representing a straightforward transition into care, treatment initiation

emerged as a complex and emotionally charged process, which may delay or complicate early adherence behaviors.

4.4 Dissonance in Treatment Burden: Clinical Manageability vs Lived Economic and Physical Constraints

While healthcare providers generally perceived treatment-related side effects and regimen complexity as clinically manageable, patients described substantial economic and physical burdens in their lived experiences. Healthcare workers generally viewed treatment-related side effects and regimen complexity as manageable within existing clinical protocols. From the provider perspective, adverse reactions were expected to be temporary and controllable through medical guidance, dose adjustment, or supportive care, and were therefore not considered major barriers to sustained adherence.

In contrast, patient accounts revealed that the physical burden of treatment was often overwhelming and directly disruptive to daily functioning. Several participants described severe gastrointestinal reactions, dizziness, or visual disturbances that significantly limited their ability to carry out routine activities. As one patient described, "*After taking the medication prescribed by the doctor, I experienced nausea and dizziness, which might have been side effects. I also felt weak all over and could only manage simple household tasks, but not physical labor.*" (P3, female, 48). For patients engaged in physically demanding labor, these side effects were not merely discomforts but constituted a fundamental barrier to sustaining both treatment and livelihood.

The physical impact of treatment was closely intertwined with economic vulnerability. Many participants reported that their inability to work during treatment resulted in an immediate loss of income, placing substantial pressure on already fragile household economies. As one participant explained, *"My husband is no longer around, and my son is not dependable. I am getting older, and after falling ill, I no longer have the strength to work. Although I have medical insurance, I do not receive subsistence support, so the main difficulty is financial."* (P10, female, 61). In this context, decisions about treatment adherence were often shaped not only by medical considerations but also by the urgent need to maintain basic subsistence.

Although all interviewed patients reported having some form of medical insurance and essential medications were provided free of charge under existing policies, patients frequently highlighted a range of indirect or "hidden" costs associated with treatment. These included expenses for transportation, diagnostic tests, and nutritional support, which were not fully covered and accumulated over time. One participant described, "*My husband died of this disease nine years ago, and I was infected by him. I am now raising four sons on my own, one of whom is disabled and another who dropped out of school. Our family survives on just over 1,000 yuan per month in subsistence support. Since falling ill, my physical condition has worsened and I can no longer do heavy labor. Although some medications are free, the costs of transportation, tests, and accommodation add up, making the financial burden on my family even heavier.*" (P7, female, 52). Such financial pressures often forced patients to make difficult trade-offs between continuing treatment and meeting immediate household needs.

Taken together, these findings illustrate a clear mismatch between clinical assumptions of treatment manageability and the lived realities of patients facing simultaneous physical and economic constraints. While healthcare workers emphasized the technical feasibility of managing side effects, patients experienced treatment as a process that could compromise both their bodily capacity and their means of survival, thereby complicating sustained adherence.

4.5 Dissonance in Care Delivery: Adherence Monitoring vs Privacy and Autonomy Concerns

While healthcare providers emphasized adherence monitoring as essential for treatment success, patients often expressed concerns regarding privacy, autonomy, and unintended disclosure. Healthcare workers generally regarded routine follow-up and adherence monitoring as essential components of HIV–TB management under integrated prevention and control policies. Regular patient contact was intended to support treatment continuity, identify problems early, and reinforce adherence behaviors.

However, from the patient perspective, concerns about disclosure and social judgment often shaped how these monitoring practices were perceived and experienced. Most participants reported actively concealing their condition, particularly beyond immediate family members, due to fears of stigma and discrimination. As one patient stated, *"I'm definitely worried, so I choose to keep it hidden."* (P18, male, 33). Another participant similarly noted, *"I try to hide it. I'm afraid of how others might look at me and that I could be discriminated against."* (P13, female, 35). These accounts suggest that concealment was not incidental but a deliberate strategy to manage anticipated social risks.

Such concerns were also reflected in patients' everyday social behaviors. Several participants described limiting disclosure to a small circle or avoiding broader social interactions altogether. One patient explained, *"Apart from my family, only a few people know about my condition. I'm still worried about being discriminated against."* (P8, male, 53). Another added, *"Some neighbors don't understand the disease and feel afraid, so I try to avoid social situations."* (P11, male, 40). These responses indicate that stigma-related concerns extended beyond perception into concrete behavioral adjustments.

In this context, certain forms of adherence monitoring—particularly those that increased visibility within the community—were experienced as potentially exposing. For example, home-based visits by healthcare workers were perceived by some participants as situations that could inadvertently reveal their condition to others. As one patient noted, *"I try to hide it, especially when doctors come to visit my home, because I'm afraid the neighbors might notice."* (P19, male, 46). Under such circumstances, monitoring practices intended to support adherence could instead heighten anxiety about disclosure.

At the same time, a minority of participants reported relatively low concern about stigma, often attributing this to the perceived commonness of the condition within their social context. One participant remarked, *"I'm not worried. Many people of my generation have this condition, so it's not unusual."* (P9, female, 49). This suggests that in certain settings, the normalization of illness may mitigate stigma-related concerns, although such experiences were not widespread.

Taken together, these findings highlight a clear dissonance between the intended role of adherence monitoring as a supportive mechanism and patients' experiences of it as a potential source of exposure and social risk. While integrated care policies emphasize close follow-up to improve adherence, patients' concerns about privacy, stigma, and autonomy may lead them to adopt concealment strategies or limit engagement with monitoring practices, highlighting the importance of context-sensitive approaches to adherence support.

4.6 Dissonance in Knowledge and Communication: Standardized Health Education vs Fragmented Patient Understanding

Although standardized health education was routinely delivered by healthcare providers, patients' understanding of treatment information was often fragmented and incomplete. Healthcare workers generally assumed that health education and disease-related information had been routinely delivered through existing primary healthcare systems, including community-based screening programs, follow-up services, and health promotion activities. These standardized approaches were intended to improve patients' understanding of HIV and tuberculosis (TB), thereby supporting treatment adherence and engagement with care.

However, patients' accounts suggested that their understanding of these conditions was often fragmented, limited, and frequently acquired only after diagnosis. Many participants reported little to no prior exposure to relevant information, or described situations in which health education had been delivered but not meaningfully understood. As one participant noted, *"No, I hadn't heard about it. Even if there was some promotion, I didn't really understand it." Another stated, "I had never heard of it at all."* (P2, male, 34). In several cases, knowledge of the disease emerged only after personal illness, as reflected in the statement: *"I only learned about these diseases after I got sick."* (P14, male, 38). These accounts point to a gap between the provision of information and its effective comprehension.

Even among participants who had encountered some form of health education, understanding remained partial and unsystematic. Several respondents described having heard of certain diseases without grasping their implications, for example, *"I had heard about it before, but not much, and I didn't really understand."* Others reported learning about diseases through incidental experiences, such as medical examinations or observing illness in others, rather than through structured education. When asked about other infectious diseases, participants frequently mentioned conditions such as hepatitis but acknowledged limited knowledge, noting that *"I've heard of it, but I don't really understand it," or that information provided during health promotion activities was "hard to remember."* (P12, male, 37). These responses suggest that patients' knowledge often remained at the level of isolated facts rather than forming a coherent framework to guide health-related decisions.

Engagement with health education activities was similarly inconsistent. While some participants expressed willingness to attend or had participated in occasional sessions, others reported being unaware of such opportunities or had never taken part in them. This variability in exposure and participation further limited the potential impact of standardized education efforts.

Gaps in understanding were also reflected in how patients interpreted and enacted treatment recommendations. Some participants questioned the effectiveness of medication, for instance stating that “it didn’t seem to have much effect,” while others reported difficulties adhering to complex regimens or inconsistencies between reported and actual medication-taking behaviors. These accounts indicate that, although patients may appear to comply with medical advice, their underlying understanding of treatment processes and adherence requirements may remain incomplete.

Taken together, these findings highlight a dissonance between the assumption embedded in standardized health education—that patients possess sufficient and stable knowledge to support adherence—and the reality that patients’ understanding is often fragmented, context-dependent, and inconsistently retained. This gap between information delivery and meaningful comprehension may, in turn, shape how patients interpret medical advice and engage with treatment.

4.7 Integration of Quantitative and Qualitative Findings: Mapping Provider Expectations and Patient Realities

By systematically comparing quantitative assessments with qualitative findings, several key areas of misalignment between provider expectations and patient realities were identified. Quantitative results generally reflected optimistic assessments of adherence and emphasized the manageability of treatment within existing protocols, whereas qualitative findings provided a more nuanced account of the challenges patients faced in real-world contexts.

To systematically examine these divergences, a joint display was developed (Table 2), aligning key domains identified in the quantitative analysis with corresponding themes emerging from patient narratives. This integrative approach highlights not only differences in perception but also the underlying mechanisms through which these discrepancies may influence adherence behaviors.

In the domain of treatment side effects, healthcare workers largely regarded adverse reactions as manageable through standardized clinical protocols. However, patients described these effects as physically debilitating and, in many cases, directly threatening their ability to work and sustain their livelihoods. This contrast reflects a perceptual gap, in which clinically defined “manageability” does not adequately capture the functional and economic consequences experienced by patients.

Similarly, in relation to adherence monitoring and supervision, providers emphasized the necessity of regular follow-up as a means of ensuring treatment safety and continuity. In contrast, patients frequently interpreted these practices through the lens of privacy concerns and stigma, particularly in community-based settings. Rather than being experienced as supportive, monitoring could be perceived as intrusive or as increasing the risk of unwanted disclosure, thereby generating a relational conflict between healthcare systems and patients.

Economic considerations further illustrated a pronounced misalignment. While healthcare workers pointed to the availability of free medications and institutional support as key facilitators of adherence,

patients highlighted the cumulative burden of indirect costs, including transportation, diagnostic tests, and nutritional needs. This discrepancy represents an economic misalignment, where formal policy coverage does not fully translate into perceived affordability at the household level.

Across these domains, the integration of findings suggests that adherence is not solely determined by individual patient behavior, but is shaped by the interaction between policy design, provider assumptions, and patients' lived realities. The observed dissonance underscores the importance of examining not only whether services are delivered, but also how they are experienced and interpreted by patients within specific social and economic contexts.

Table 2
Joint Display of Provider Expectations and Patient Realities

Domain	HCW Expectation (Quantitative)	Patient Reality (Qualitative)	Nature of Dissonance
Side-effects	Managed through clinical protocols	Physically debilitating and livelihood-threatening	Perceptual gap
Supervision	Essential for treatment safety and continuity	Experienced as intrusive and stigma-inducing	Relational conflict
Cost	"Free" treatment coverage ensures affordability	Accumulation of indirect and hidden costs	Economic misalignment

Discussion

By integrating quantitative and qualitative findings, this study identified several key areas of misalignment between healthcare providers' expectations and patients' lived experiences in HIV–TB treatment adherence. This mixed-methods study identified a systematic divergence between healthcare providers' expectations and patients' lived experiences of treatment adherence under China's IPC4D policy. From the provider perspective, adherence is typically framed within a logic of standardized management, emphasizing timely treatment initiation, regular follow-up, and sustained compliance with prescribed regimens. In contrast, patients' accounts suggest that treatment practices are not simply determined by whether medical advice is followed, but are embedded in complex life contexts shaped by psychological, economic, and social constraints.

At the stage of treatment initiation, patients did not necessarily respond to diagnosis in the rational and linear manner anticipated by healthcare providers. Instead, many experienced an initial period of psychological disruption, sometimes characterized by cognitive paralysis. Narratives reflecting catastrophic interpretations of co-infection were common, with some patients perceiving the diagnosis as irreversible or life-ending, leading to hesitation or delay in entering care. This finding is consistent with previous studies on early responses to HIV or TB diagnosis, which have shown that emotional reactions and illness perceptions play a decisive role in shaping treatment engagement[21–23]. In this sense, adherence challenges may not originate during treatment itself, but emerge at the moment of diagnosis.

During the course of treatment, physical burden and economic pressure constituted persistent constraints on patients' ability to sustain adherence. While providers often regarded side effects as manageable within clinical protocols, patients described them as directly undermining their capacity to work and maintain daily functioning. Symptoms such as nausea and dizziness were not merely discomforts, but obstacles to subsistence. Existing research similarly identifies adverse drug reactions and regimen complexity as central barriers to TB treatment adherence [24–26]. At the same time, this study shows that financial strain is cumulative rather than singular, arising from transportation costs, diagnostic expenses, and income loss due to reduced labor capacity. This aligns with evidence suggesting that "free treatment" does not eliminate the broader economic burden faced by patients[27–29], pointing to gaps between policy design and lived affordability.

In terms of care delivery, follow-up and adherence monitoring were generally perceived by providers as essential mechanisms for ensuring treatment continuity. However, patients often experienced these practices differently. In contexts where stigma remains salient, frequent phone calls or home visits may be interpreted as risks of unintended disclosure, prompting avoidance behaviors. Similar dynamics have been observed in HIV-related research, where monitoring-oriented interventions can generate unintended resistance or disengagement in certain social contexts[30, 31]. These findings suggest that the effectiveness of healthcare interventions is not inherent to the intervention itself, but contingent upon how it is perceived and experienced by patients.

Health knowledge and modes of information acquisition also emerged as critical factors shaping adherence. Despite providers' emphasis on standardized health education, patients' understanding of disease mechanisms, treatment processes, and the importance of follow-up remained fragmented. In some cases, patients turned to informal or non-biomedical sources when faced with treatment difficulties. This pattern is consistent with prior studies linking low health literacy to reduced adherence[32–34]. Notably, in ethnic minority settings, linguistic and cultural differences further complicate communication, creating a disconnect between information delivery and actual comprehension [35, 36]. In such contexts, the assumption that "information provided" equates to "information understood" becomes particularly problematic.

Taken together, these findings suggest that treatment adherence among individuals with HIV–TB co-infection is a multi-level and context-dependent process. It is shaped not only by individual cognition and psychological responses, but also by family support, patient–provider interactions, and broader social and structural conditions. This perspective is consistent with the view that health and illness are socially shaped[37, 38], and that effective disease management extends beyond clinical care alone.

These findings also point to several practical considerations. The period immediately following diagnosis appears to be particularly important, as psychological responses at this stage may influence patients' engagement with treatment. During the course of treatment, adherence is closely linked to patients' material conditions, especially economic vulnerability and reduced work capacity. Concerns

related to privacy and stigma may further affect how patients interact with follow-up and monitoring arrangements, suggesting the need for more sensitive approaches in care delivery.

In addition, health education may be more effective when it moves beyond one-way information provision toward communication approaches that are better aligned with local contexts and cultural practices, particularly in settings characterized by linguistic diversity. At the policy level, these findings also highlight the importance of addressing indirect and often hidden costs of treatment, which continue to shape patients' ability to sustain long-term adherence.

Conclusion

This study provides empirical evidence of a systematic gap between provider expectations and patient realities in HIV–TB treatment adherence under China's IPC4D policy. While providers tend to conceptualize adherence as a protocol-driven and manageable behavior, patients' practices are shaped by psychological disruption, economic constraints, stigma, and fragmented health understanding.

By integrating quantitative and qualitative findings, the study shows that adherence is not merely an individual behavior but a context-dependent and socially embedded process. Misalignments across treatment initiation, treatment burden, care interactions, and health communication highlight the limitations of standardized management approaches when detached from patients' lived conditions.

Improving adherence in integrated care settings therefore requires more context-responsive and patient-centered strategies. Aligning clinical expectations with patient realities is essential for enhancing policy effectiveness and achieving sustainable outcomes in resource-constrained settings.

Limitations

This study has several limitations. First, the qualitative component was conducted in a specific regional context, which may limit the generalizability of the findings to other settings. Second, patient experiences were self-reported and may be subject to recall or social desirability bias. Third, while the mixed-methods design enhances interpretive depth, causal relationships cannot be established. Despite these limitations, the study provides valuable insights into the multi-level and context-dependent nature of adherence in integrated HIV–TB care.

Declarations

Ethics approval and consent to participate

This study was approved by the Medical Ethics Committee of the Affiliated Hospital of Chengdu University of Traditional Chinese Medicine (Approval No. 2023KL-099). All procedures involving human participants were conducted in accordance with the ethical standards of the institutional research

committee and with the Declaration of Helsinki. Written informed consent was obtained from all participants.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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Author Contribution

All authors contributed significantly to the study design and data interpretation. Material preparation and data collection were carried out by CJ, JW, GY, and RP. Data analysis was performed by RB and HW. The initial manuscript was drafted by RB, JL, and YZ. All authors reviewed and edited subsequent versions of the manuscript and approved the final version for submission.

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Not applicable.

Data Availability

Due to ethical considerations, the datasets generated and/or analyzed during the currentstudy are not publicly available. However, they are available from the corresponding author on reasonable request.

References

1. Mhango DV, Mzinza DT, Jambo KC, Mwandumba HC. New management approaches to tuberculosis in people living with HIV. Curr Opin Infect Dis. 2021;34(1):25–33.

2. Waters R, Ndengane M, Abrahams MR, Diedrich CR, Wilkinson RJ, Coussens AK. The Mtb-HIV syndemic interaction: why treating M. tuberculosis infection may be crucial for HIV-1 eradication. Future Virol. 2020;15(2):101–25.
3. WHO. 2024. Global tuberculosis report 2024 https://www.who.int/teams/global-programme-on-tuberculosis-and-lung-health/tb-reports/global-tuberculosis-report-2024. Accessed 10 March 2026.
4. Deng LL, Zhao F, Li ZW, Zhang WW, He GX, Ren X. Epidemiological characteristics of tuberculosis incidence and its macro-influence factors in Chinese mainland during 2014–2021. Infect Dis Poverty. 2024;13(1):34.
5. Guo J, Liu C, Liu F, Zhou E, Ma R, Zhang L, Luo B. Tuberculosis disease burden in China: a spatio-temporal clustering and prediction study. Front Public Health. 2024;12:1436515.
6. China YHS. 2024. China Health Statistics Yearbook https://. Accessed March 30, 2025.
7. Liao R, Hu L, Yu J, Chen Y, Chen M, Yan J, Li X, Han X, Jike C, Yu G, et al. Association between TB delay and TB treatment outcomes in HIV-TB co-infected patients: a study based on the multilevel propensity score method. BMC Infect Dis. 2024;24(1):457.
8. Li J, He J, Li T, Li Y, Gao W, Zhong Y, Yang N, Chen C, Xia L, Yang W. 6-month regimen of isoniazid prevention therapy for tuberculosis among people living with human immunodeficiency virus in minority areas of China: a 3-year prospective cohort study. BMJ Open Respir Res 2024, 11(1).
9. Lawal A, Hussein A, Tiberi S, Kunst H. Barriers to and enablers of adherence to the treatment of active drug-sensitive tuberculosis in people living with HIV: a mixed method systematic review. BMC Public Health. 2025;26(1):39.
10. Nezenega ZS, Perimal-Lewis L, Maeder AJ. Factors Influencing Patient Adherence to Tuberculosis Treatment in Ethiopia: A Literature Review. Int J Environ Res Public Health 2020, 17(15).
11. Shah GH, Ewetola R, Etheredge G, Maluantesa L, Waterfield K, Engetele E, Kilundu A. Risk Factors for TB/HIV Coinfection and Consequences for Patient Outcomes: Evidence from 241 Clinics in the Democratic Republic of Congo. Int J Environ Res Public Health 2021, 18(10).
12. Wouters E, van Rensburg AJ, Engelbrecht M, Buffel V, Campbell L, Sommerland N, Rau A, Kigozi G, van Olmen J, Masquillier C. How the 'HIV/TB co-epidemic-HIV stigma-TB stigma' syndemic impacts on the use of occupational health services for TB in South African hospitals: a structural equation modelling analysis of the baseline data from the HaTSaH Study (cluster RCT). BMJ Open. 2022;12(4):e045477.
13. George LS, Rakesh PS, Vijayakumar K, Kunoor A, Kumar A. Social stigma associated with TB and HIV/AIDS among Kudumbashree members: A crosssectional study. J Family Med Prim Care. 2020;9(8):4062–6.
14. Hargreaves JR, Boccia D, Evans CA, Adato M, Petticrew M, Porter JD. The social determinants of tuberculosis: from evidence to action. Am J Public Health. 2011;101(4):654–62.
15. Sylvain H, Delmas P. Readiness in HIV Treatment Adherence: A Matter of Confidence. An Exploratory Study. Open AIDS J. 2011;5:119–24.

16. Lönnroth K, Jaramillo E, Williams BG, Dye C, Raviglione M. Drivers of tuberculosis epidemics: the role of risk factors and social determinants. Soc Sci Med. 2009;68(12):2240–6.
17. Liangshan D. 2021. Policy Interpretation: Implementation Plan for Phase II of the HIV/AIDS Control Strategy in Liangshan Prefecture, China. https://www.lsz.gov.cn/xxgk/zdms/ylws_45685/zccs_45686/202112/t20211201_2092304.html. Accessed February 10, 2026.
18. China CDC. 2022. Guiding HIV Prevention and Advancing Integrated Control of Four Diseases: 2022 Liangshan Workstation Meeting Held in Xichang City, Liangshan Prefecture https://www.chinaaids.cn/fzyw_10256/gzjz_10269/202208/t20220801_260631.htm. Accessed March 15, 2026.
19. Liang Xiaobei GS, Chen Miao W, Guangpeng ZJ. 2021. Sustained Efforts in Liangshan Yi Autonomous Prefecture to Ensure the Effective and Orderly Implementation of the Second Phase of the HIV Prevention Initiative https://www.163.com/dy/article/GQ4TBQP90512BOIV.html. Accessed January 5, 2025.
20. Bi R, Dou L, Pei R, Jike C, Yu G, Wang J, Zheng Y. Correction: A mixed-methods study on healthcare workers' perceptions of treatment adherence among HIV-TB co-infected patients in a multi-disease prevention policy context. Front Public Health. 2025;13:1761803.
21. Kagee A, Remien RH, Berkman A, Hoffman S, Campos L, Swartz L. Structural barriers to ART adherence in Southern Africa: Challenges and potential ways forward. Glob Public Health. 2011;6(1):83–97.
22. Rzeszutek M, Gruszczyńska E. Posttraumatic growth among people living with HIV: A systematic review. J Psychosom Res. 2018;114:81–91.
23. Hagger MS, Orbell S. The common sense model of illness self-regulation: a conceptual review and proposed extended model. Health Psychol Rev. 2022;16(3):347–77.
24. Munro SA, Lewin SA, Smith HJ, Engel ME, Fretheim A, Volmink J. Patient adherence to tuberculosis treatment: a systematic review of qualitative research. PLoS Med. 2007;4(7):e238.
25. Appiah MA, Arthur JA, Gborgblorvor D, Asampong E, Kye-Duodu G, Kamau EM, Dako-Gyeke P. Barriers to tuberculosis treatment adherence in high-burden tuberculosis settings in Ashanti region, Ghana: a qualitative study from patient's perspective. BMC Public Health. 2023;23(1):1317.
26. Grigoryan Z, McPherson R, Harutyunyan T, Truzyan N, Sahakyan S. Factors Influencing Treatment Adherence Among Drug-Sensitive Tuberculosis (DS-TB) Patients in Armenia: A Qualitative Study. Patient Prefer Adherence. 2022;16:2399–408.
27. Tanimura T, Jaramillo E, Weil D, Raviglione M, Lönnroth K. Financial burden for tuberculosis patients in low- and middle-income countries: a systematic review. Eur Respir J. 2014;43(6):1763–75.
28. Wingfield T, Tovar MA, Huff D, Boccia D, Montoya R, Ramos E, Lewis JJ, Gilman RH, Evans CA. The economic effects of supporting tuberculosis-affected households in Peru. Eur Respir J. 2016;48(5):1396–410.

29. Long Q, Smith H, Zhang T, Tang S, Garner P. Patient medical costs for tuberculosis treatment and impact on adherence in China: a systematic review. BMC Public Health. 2011;11:393.
30. Katz IT, Ryu AE, Onuegbu AG, Psaros C, Weiser SD, Bangsberg DR, Tsai AC. Impact of HIV-related stigma on treatment adherence: systematic review and meta-synthesis. J Int AIDS Soc. 2013;16(3 Suppl 2):18640.
31. Mshana GH, Wamoyi J, Busza J, Zaba B, Changalucha J, Kaluvya S, Urassa M. Barriers to accessing antiretroviral therapy in Kisesa, Tanzania: a qualitative study of early rural referrals to the national program. AIDS Patient Care STDS. 2006;20(9):649–57.
32. Berkman ND, Sheridan SL, Donahue KE, Halpern DJ, Crotty K. Low health literacy and health outcomes: an updated systematic review. Ann Intern Med. 2011;155(2):97–107.
33. Bi R, Pei R, Jike C, Yu G, Wang J, Wang Z, Wang Y, Zhang X. Healthcare workers' experiences with integrated HIV and TB prevention in Liangshan, China: a qualitative exploration of barriers and enablers. Front Public Health. 2025;13:1615781.
34. Pujaannicha P, Widiana H. Health literacy on HIV/AIDS and adherence to antiretroviral treatment: the moderating role of social support. Int J Public Health Sci (IJPHS). 2025;14:1658.
35. Hu L, Zhu W, Yu J, Chen Y, Yan J, Liao Q, Zhang T. Family-based improvement for health literacy among the Yi nationality (FAMILY) in Liangshan: protocol of an open cohort stepped wedge cluster randomized controlled trial. BMC Public Health. 2022;22(1):1543.
36. Liu Z, Tang X, Liu Y, Zhang L, Yang Y, Zheng Y, Liu W, Jike C, Mai H, Fan H, et al. HIV Prevention and Health Poverty Alleviation - Liangshan Prefecture, Sichuan Province, China, 2017–2020. China CDC Wkly. 2021;3(48):1031–5.
37. Marmot M, Friel S, Bell R, Houweling TAJ, Taylor S. Closing the gap in a generation: health equity through action on the social determinants of health. Lancet. 2008;372(9650):1661–9.
38. WHO. 2010. A Conceptual Framework for Action on the Social Determinants of Health https://www.who.int/publications/i/item/9789241500852. Accessed 23 March 2026.

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