

# Understanding barriers and enablers of tuberculosis prevention in high-risk boarding school settings

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## ABSTRACT

Tuberculosis prevention remains a significant challenge in high-risk boarding school settings due to overcrowding, prolonged close contact, and limited institutional health governance. At the same time, existing Research has largely emphasised epidemiological and individual-level factors with limited attention to contextual and institutional dynamics, particularly among adolescents in congregate educational environments. This qualitative exploratory study aimed to examine barriers and enablers to tuberculosis prevention from the perspectives of adolescents, caregivers, school administrators, and health professionals, using in-depth interviews and focus group discussions with purposively selected participants involved in boarding school health management and tuberculosis prevention. Thematic analysis revealed that the availability of basic environmental facilities, caregiving support, and strong institutional cohesion served as key enablers of tuberculosis prevention; however, these were constrained by overcrowded living conditions, the absence of formal tuberculosis-specific procedures, tuberculosis-related stigma among adolescents, limited financial and health system support, informal governance practices, and fear of social consequences, which collectively hindered early reporting and preventive behaviors. Overall, tuberculosis prevention in boarding schools is shaped by a complex interplay of environmental, institutional, and sociocultural factors, underscoring the need for context-sensitive, institution-based prevention strategies that address stigma, strengthen governance, and enhance collaboration with health systems to reduce tuberculosis risk among adolescents in boarding schools.

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## INTRODUCTION

Tuberculosis remains a significant global public health concern, particularly in low- and middle-income countries where transmission persists in community and institutional settings. According to the World Health Organisation, tuberculosis continues to be one of the leading causes of death from infectious diseases worldwide, with millions of new cases reported annually despite the availability of effective prevention and treatment strategies (Organization, 2024). Transmission is more likely in congregate living environments where prolonged close contact is common.

Boarding schools represent a high-risk institutional setting for tuberculosis transmission due to their unique structural and social characteristics. Students live in shared dormitories and use communal facilities, creating conditions that may facilitate the spread of disease. While previous studies have highlighted the role of physical and environmental risk factors, these explanations remain insufficient to understand how tuberculosis prevention is implemented within boarding school institutions (Hou et al., 2020)(Hidayati, 2021). Institutional arrangements, including health governance and linkages with formal health systems, may play a critical role in shaping prevention practices (Zhang et al., 2024).

Tuberculosis prevention in boarding schools is also influenced by social and cultural dynamics. Adolescents may delay symptom disclosure due to stigma, fear of social exclusion, or academic consequences, while institutional hierarchy and caregiving relationships can either hinder or enable preventive behaviors (Hadipranoto et al., 2025); (Vo et al., 2020). (Jamil, 2021); (Nguyen et al., 2021).

Existing research on tuberculosis in educational and residential settings relies on quantitative approaches that focus on prevalence, screening outcomes, or individual-level knowledge. Such studies provide limited insight into the institutional and sociocultural processes through which prevention strategies are enacted in daily life (Collein et al., 2024). Qualitative evidence examining informal governance, caregiving practices, and stigma in high-risk boarding school settings remains scarce.

To address this gap, the present study aims to explore barriers and enablers to tuberculosis prevention in high-risk boarding school settings using a qualitative approach. By integrating perspectives from students, caregivers, school administrators, and health professionals, this study seeks to generate context-sensitive and policy-relevant insights to inform institution-based tuberculosis prevention strategies.

## RESEARCH METHOD

This study employed a qualitative exploratory design to examine barriers and enablers of tuberculosis prevention in high-risk boarding school settings. A qualitative approach was chosen to explore contextual, social, and institutional factors influencing prevention practices that cannot be adequately captured through quantitative methods (Creswell & Poth, 2018). Data were analysed using thematic analysis following Braun and Clarke's framework (Braun & Clarke, 2006).

Data were collected through in-depth interviews and focus group discussions (FGD) with purposively selected participants with direct experience in tuberculosis prevention in boarding school settings. Participants included students (n=6), caregivers or supervisors (n=2), school administrators (n=4), and health professionals collaborating with boarding schools (n=6). Purposive sampling ensured the inclusion of participants with relevant institutional roles and experiences.

In-depth interviews lasted approximately 45–60 minutes, while focus group discussions lasted 113 minutes. Interviews were conducted first to explore individual perspectives, followed by FGDs to examine shared norms and institutional practices. Semi-structured guides were developed based on relevant literature and study objectives. All sessions were audio-recorded with participants' consent and transcribed verbatim. Data collection continued until thematic saturation

was achieved, defined as the point at which no new themes or meaningful insights emerged from additional interviews or discussions.

Trustworthiness was ensured through several strategies. Triangulation was achieved by comparing data across participant groups and data collection methods (interviews and FGDs). Reflexivity was maintained through ongoing reflection during data collection and analysis to minimise researcher bias. An audit trail was established by documenting analytic decisions, coding processes, and theme development. Ethical approval was obtained prior to data collection, and all participants provided informed consent.

## RESULTS AND DISCUSSIONS

### Result

#### Structural and Environmental Factors Influencing Tuberculosis Prevention

The findings indicate that structural and environmental conditions function as both enablers and barriers to tuberculosis prevention in boarding school settings. Several participants reported the availability of basic preventive facilities, such as windows for ventilation, fans, handwashing stations, and the separation of personal eating utensils for students who were ill.

Windows and dormitory cleanliness: "As part of our routine, every morning we receive reports of unwell students, and we go to each dormitory room to check on sick students and provide medication. At the same time, we also inspect the cleanliness of the rooms. However, the windows are often not opened in the morning because students are in a hurry, and usually only the sick students remember to open them." (Boarding school administrator, FGD).

Separation of eating utensils: "Students bring and use their own eating utensils. The responsibility for cleaning the utensils lies with each student, under supervision to ensure health and hygiene standards are maintained." (Boarding school administrator, FGD). Recommendation to use masks: "*It is clear that we are required always to wear masks.*" (Student, in-depth interview).

These conditions were perceived as supportive of general hygiene and infection prevention. Similar findings have been reported in previous studies, which emphasize that adequate ventilation and basic sanitation facilities help reduce the risk of tuberculosis transmission in congregate living environments. Despite the presence of these facilities, significant environmental barriers were also identified. Overcrowding emerged as a major challenge, with dormitory rooms housing large numbers of students, resulting in limited personal space and restricted air circulation.

Number of students per room and limited space: "For three years, one dormitory room has accommodated around thirty to forty students. We use floor mattresses, which are rolled up after sleeping. The mattresses are rarely aired out because of the students' daily activities." (Boarding school administrator, FGD). "As a result, most rooms are generally occupied by a large number of students." (Boarding school administrator, FGD).

Limited space and financial constraints for infrastructure improvement: "There are no funds available to add more rooms. Having more representative rooms with only eight to ten students per room is very rare." (Boarding school administrator, FGD).

#### Institutional Care and Informal Governance Practices

Institutional caregiving practices were identified as important enablers of tuberculosis prevention. Participants described the active role of caregivers and supervisors in monitoring students' health, providing emotional support, and facilitating access to basic healthcare services.

Monitoring sick students every morning: "As part of our routine, every morning we receive reports of sick students, and we go to each dormitory room to check on them. We then provide medication and at the same time inspect the cleanliness of the rooms." (Boarding school administrator, FGD)

Routine rounds to check students' health status: "Our boarding school clinic staff also make daily rounds to check on students and to see whether there are any students who are unwell." (Boarding school health officer, FGD)

Monitoring and treatment process for sick students: "If a student is too ill to attend school, we usually visit them in their dormitory. However, for students who are still able to attend classes and are capable of coming, they come directly to the boarding school health post." (Boarding school health officer, FGD)

Provision of medication and health supervision: "For medication, we mainly provide basic medicines." (Boarding school health officer, FGD).

Supervision by dormitory supervisors (musrifah/ustazah): "The ustazah also leads a cleaning team. Every morning, they are responsible for cleaning the students' dormitory rooms." (Boarding school health officer, FGD)

The presence of internal health posts and informal referral mechanisms to nearby health facilities further supported early health-seeking behavior. These findings align with studies highlighting the importance of institutional support systems and caregiving relationships in promoting preventive health behaviors among adolescents in residential settings. However, the absence of formalized tuberculosis-specific policies and standard operating procedures was identified as a critical barrier. "There is no written documentation for case management." (Boarding school health officer, FGD) "There are periodic evaluations for certain cases that are discussed, but we do not have written standard operating procedures." (Boarding school health officer, FGD).

"The boarding school can cover some costs. For example, at the time of admission, students with health insurance, such as BPJS, should be recorded. There needs to be better managerial planning in this regard." (Boarding school health officer, FGD).

### **Sociocultural Dynamics as Enablers and Barriers**

Sociocultural factors within boarding school communities played a significant role in shaping tuberculosis prevention practices. Strong social cohesion, respect for authority, and adherence to institutional rules were identified as enabling factors that could support collective prevention efforts. Compliance with rules and leadership involvement: "After that, the leadership usually provides reminders. This is not only for health-related issues, because here we have a specific division responsible for health matters." (Health administrator, FGD).

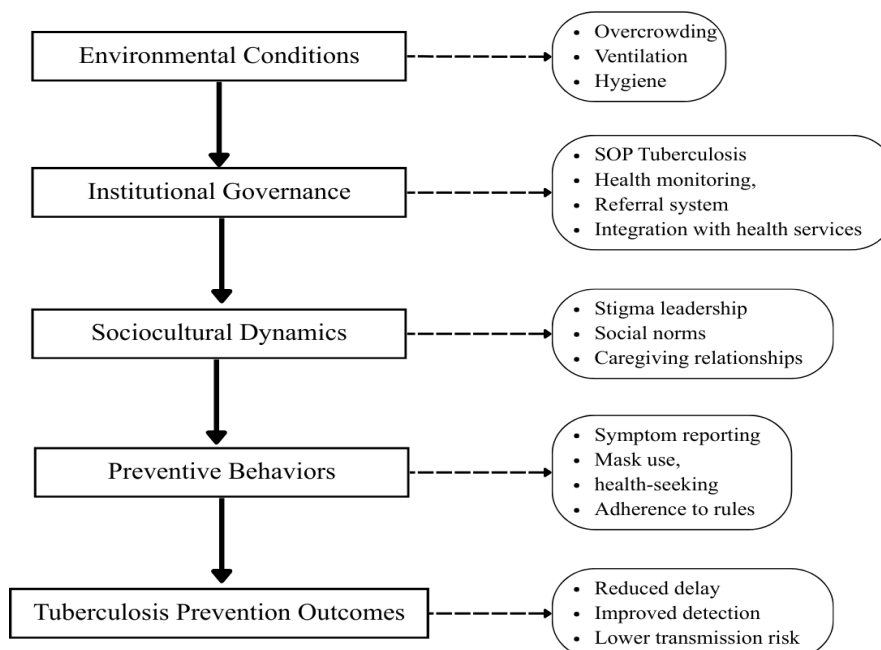
Leadership role in providing guidance: "There should be guidance. It comes from the leadership at the higher level." (Boarding school health officer, FGD). When school leaders or caregivers clearly communicated health-related instructions, students were generally compliant. Conversely, tuberculosis-related stigma emerged as a major psychosocial barrier. "*There is certainly some stigma. When someone is sick, others become more cautious. However, thankfully, there have been no tuberculosis cases here.*" (Student, in-depth interview).

### **Financial and Health System Constraints**

Financial factors also influenced tuberculosis prevention in boarding school settings. While the institution often supported initial medical assessments and basic treatments, long-term tuberculosis-related care was largely dependent on students' families. "In several cases we have experienced, the initial treatment is provided by the boarding school. We provide first care, then inform the parents. The first question we ask concerns the student's health insurance status. However, in urgent situations, we do not need to contact the parents before taking the student to a health facility. If it is an emergency, the student is taken immediately. Once the student is already at the health facility, the responsibility for further treatment and costs is then transferred to the parents." (Boarding school health officer, FGD).

### **Discussion**

This study proposes a conceptual framework illustrating how environmental conditions, institutional governance, and sociocultural dynamics interact to shape tuberculosis preventive behaviours in boarding school settings.



**Figure 1.** Conceptual framework of tuberculosis prevention in boarding school settings

Participants acknowledged that although windows were available, they were not always opened consistently due to daily routines or a lack of supervision. High room occupancy and suboptimal ventilation have been consistently associated with increased tuberculosis risk in residential institutions, reinforcing the notion that physical infrastructure alone is insufficient without supportive behavioural and institutional practices (Escombe et al., 2007); (Lygizos et al., 2019); (Beggs et al., 2020); (Morawska et al., 2021).

The findings of this study reinforce existing evidence that overcrowding and inadequate ventilation remain critical determinants of tuberculosis transmission in congregate living environments. Previous studies have consistently shown that high room occupancy, limited air circulation, and shared sleeping arrangements significantly increase the risk of airborne disease transmission, including tuberculosis, particularly in institutional settings such as boarding schools and dormitories (Beggs et al., 2020); (Lygizos et al., 2019); (Escombe et al., 2007). Although basic facilities such as windows and handwashing stations were available in the studied settings, their inconsistent use highlights that environmental infrastructure alone is insufficient without sustained behavioural reinforcement and institutional monitoring (Menziez, 2021); (Saunders, 2020).

Health-related decisions were largely based on informal rules and situational judgment, leading to inconsistent prevention practices. Tuberculosis prevention efforts were often reactive rather than proactive, initiated only after a suspected case emerged. This finding indicates the absence of formalised tuberculosis governance at the institutional level. The development and implementation of tuberculosis-specific standard operating procedures (SOP) tailored to boarding school settings are therefore essential to standardise prevention, case detection, and follow-up processes.

The presence of routine health monitoring, internal health posts, and informal referral mechanisms reflects a form of institutional caregiving that supports early detection and basic management of illness (Snow, 2021); (Datiko, 2020). However, the absence of written tuberculosis-specific standard operating procedures (SOP) represents a significant governance gap (Zhang et al., 2024); (Verguet, 2021). Formal SOPs should explicitly define the roles and responsibilities of school administrators, caregivers, and health personnel in tuberculosis prevention and response.

Participants expressed concerns that tuberculosis was perceived as a shameful condition, leading to fear of social isolation, discrimination, or being sent home. This stigma discouraged open communication about symptoms and delayed health-seeking behaviour. Consistent with previous qualitative research, tuberculosis-related stigma emerged as a key psychosocial barrier influencing prevention practices in boarding school settings. Fear of social exclusion, labeling, and institutional consequences has been widely documented as a factor delaying symptom disclosure and care-seeking among adolescents (Kilic, 2025); (MacPherson, 2021); (Hadipranoto et al., 2025). At the same time, strong leadership structures and high levels of rule compliance within boarding schools represent an underutilized opportunity for stigma reduction and health promotion when institutional leaders clearly endorse health messages (Snow, 2021); (MacPherson, 2021). Active involvement of boarding school leadership is critical for stigma reduction, as institutional leaders play a central role in shaping norms, legitimizing health messages, and fostering a supportive environment for symptom disclosure and care-seeking.

Limited health insurance coverage and the absence of dedicated funding for tuberculosis prevention further constrained institutional capacity. These findings are consistent with existing literature emphasising that financial barriers and weak integration with formal health systems undermine sustained tuberculosis prevention in high-risk settings (Uplekar, 2015);(Verguet, 2021). Strengthening institutional integration with primary health centers (puskesmas) and the national health insurance system (BPJS) is necessary to ensure continuity of care, financing of diagnostic and treatment services, and long-term sustainability of tuberculosis prevention in boarding schools.

This study has several limitations that should be considered when interpreting the findings. First, the qualitative nature of the study limits the generalizability of results beyond similar boarding school contexts. Second, data were based on self-reported experiences, which may be influenced by social desirability bias. However, using multiple data sources and participant groups enhanced the credibility of the findings through triangulation.

## CONCLUSION

This study provides an in-depth understanding of the barriers and enablers of tuberculosis prevention in high-risk boarding school settings by highlighting the interplay between structural, social, and institutional factors. The findings demonstrate that while basic environmental facilities, caregiving support, and strong institutional cohesion function as important enablers of tuberculosis prevention, overcrowded living conditions constrain their effectiveness, particularly in the absence of formalised tuberculosis-specific policies, persistent stigma, and limited financial and health system support.

This study contributes to the existing literature by providing qualitative evidence that extends beyond individual-level knowledge and behaviour, emphasising the critical role of institutional governance and sociocultural dynamics in shaping tuberculosis prevention practices in congregate educational environments. By synthesising these factors, the study underscores the importance of moving from ad hoc, reactive practices to structured, institution-based tuberculosis prevention approaches.

The implications of this research suggest that effective tuberculosis prevention in boarding schools requires context-sensitive strategies that integrate environmental improvements, formalised institutional procedures, stigma reduction, and strengthened collaboration with health systems. Specifically, boarding schools should develop a tuberculosis SOP tailored to residential educational settings that clearly defines the roles and responsibilities of school leaders, caregivers, and health personnel. Active involvement of institutional leadership is essential to reduce tuberculosis-related stigma, promote open communication, and legitimise preventive health behaviours among students.

Strengthening institutional integration with primary health centers (puskesmas) and the national health insurance system (BPJS) is also critical to ensure continuity of care, access to

diagnostic and treatment services, and sustainable financing for tuberculosis prevention. In addition, institution-based tuberculosis screening, particularly in high-density boarding school environments, should be considered to facilitate early detection and reduce delays in diagnosis and treatment.

Several limitations should be considered when interpreting the findings. First, the qualitative design and the limited number of boarding school settings included in this study may affect the transferability of findings to other institutional or cultural contexts. Second, reliance on self-reported data may introduce social desirability bias, particularly given the sensitive nature of tuberculosis-related stigma. However, triangulation across multiple participant groups enhances the credibility of the findings.

Future research should prioritise multi-site qualitative or mixed-method studies to improve transferability across diverse boarding school contexts, evaluate the effectiveness of institution-based tuberculosis prevention interventions, and employ longitudinal designs to assess changes in governance, stigma, and preventive behaviors over time. Such approaches would provide stronger evidence to inform policy and practice for tuberculosis prevention among adolescents in congregate educational settings.

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