

Exploring Training Needs to Improve Tuberculosis Notification in the Private Healthcare Sector: A Qualitative Study

Suryanti^{1*)}, Hamzah², Saiful Batubara³, Susanti⁴

^{1*)} Faculty of Medicine, Universitas Dian Nuswantoro, Indonesia

² Faculty of Medicine, University of Airlangga, Indonesia

³ Faculty of Medicine, Institut Kesehatan Deli Husada, Indonesia

⁴ Faculty of Health Sciences, University of Batam, Indonesia

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**) corresponding author*

dr. Suryanti, M.Kes, MPd.Ked, Ph.D, FIHFAA

Email: suryanti@dsn.dinus.ac.id;

suryanti_83@yahoo.com

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ABSTRACT

Tuberculosis (TB) under-notification remains a challenge in pluralistic healthcare systems, where cases managed in private healthcare settings may not be captured in national surveillance systems. This study explored the training needs of physicians working in private healthcare settings to improve TB notification practices. A qualitative exploratory study was conducted among 10 physicians working in private clinics and independent practices in Batam, Indonesia. Participants were purposively selected based on experience managing TB cases. Semi-structured interviews were conducted between May and July 2026, audio-recorded, transcribed verbatim, and analyzed using thematic analysis. TB notification practices were shaped by interactions between provider competence, clinical workflow constraints, and the reporting environment. Although participants were aware of notification requirements, competing clinical responsibilities, limited workflow integration, and perceived reporting-system complexity constrained routine notification. Participants identified needs for practical competencies, including step-by-step guidance and hands-on practice, together with flexible educational delivery and continued implementation support. They also emphasized that system- and organizational-level barriers could not be addressed through training alone. Improving TB notification may therefore require practical, context-sensitive training integrated with ongoing support and enabling workflow and reporting conditions.



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INTRODUCTION

Tuberculosis (TB) remains a major global public health problem, particularly in low- and middle-income countries (LMICs). Accurate and timely notification of diagnosed TB cases is essential for estimating disease burden, monitoring the TB care cascade, allocating resources, and planning effective control strategies (World Health Organization, 2025a). According to the WHO, TB case notifications refer to people diagnosed with TB disease and officially reported as cases to national authorities (World Health Organization, 2025a). However, the present study is specifically concerned with gaps that occur when TB cases have already been identified or diagnosed but are not subsequently reported and captured within national surveillance systems, particularly in health systems involving multiple public and private providers. Strengthening notification is therefore an important component of TB surveillance and disease control (Vidyasagan et al., 2025; World Health Organization, 2025b).

This challenge remains highly relevant in Indonesia, where the private healthcare sector plays an important role in

TB service delivery. The 2025 national TB surveillance review reported that under-reporting had declined substantially, from 41% in 2017 to approximately 16% in 2023, but reporting gaps persisted (Kementerian Kesehatan Republik Indonesia, 2024; World Health Organization, 2025b). The WHO also identified gaps in reporting from private healthcare facilities, limited integration of digital infrastructure, and human-resource and governance constraints as continuing challenges for TB surveillance in Indonesia (Kementerian Kesehatan Republik Indonesia, 2024; World Health Organization, 2025b). The national Sistem Informasi Tuberculosis (SITB) is Indonesia's main TB surveillance system and is being integrated into the national health platform, SATUSEHAT, to streamline data collection and improve coordination across health services (World Health Organization, 2025b). In broad terms, the pathway relevant to this study involves a TB case being diagnosed in a private healthcare setting, followed by its reporting and subsequent capture within the national TB surveillance system. Accordingly, for the purposes of this study, TB notification refers to the reporting of a diagnosed TB case and its capture within the national TB surveillance system.

Although closely related, TB detection, notification, under-reporting, and missing TB cases are not identical constructs. TB detection concerns the identification of people with TB, whereas TB notification concerns the subsequent reporting and capture of diagnosed cases within the surveillance system. Under-reporting refers to the incomplete capture of cases that should have been reported, whereas missing TB cases represent a broader concept that may include people who are undiagnosed, untreated, or unreported. Accordingly, the primary focus of the present study is TB notification, particularly the reporting of cases that have already been identified or diagnosed within private healthcare settings.

Within this context, private-sector engagement is an important component of strengthening TB notification and surveillance. Evidence from Indonesia indicates that public-private mix (PPM) approaches can improve the involvement of private healthcare facilities in TB services, but engagement remains uneven across types of facilities and requires institutional support and coordination (Irawaty L Manurung et al., 2023; Paskaria et al., 2022). A recent systematic review similarly found that PPM approaches can strengthen TB detection and service delivery in LMICs, although their effectiveness depends on how partnerships are implemented within local health systems (Vidyasagaran et al., 2025). Although TB detection and service delivery are not the primary focus of the present study, these findings are relevant because effective engagement and coordination of private providers are also necessary to ensure that TB cases diagnosed and managed within private healthcare settings are subsequently reported and captured by the surveillance system. In Indonesia, private practitioners also provide a substantial proportion of TB-related care, highlighting their importance as partners in TB control and surveillance (Lestari et al., 2024b; Yuliandari et al., 2025). These findings indicate that establishing a reporting framework alone may not be sufficient to ensure consistent implementation across diverse healthcare settings.

Recent qualitative evidence further demonstrates that barriers to TB notification extend beyond the availability of reporting systems. In a qualitative study of private healthcare providers in Indonesia, barriers included hesitancy and misconceptions, lack of awareness and training, technological and logistical challenges, stigma and confidentiality concerns, and regulatory and enforcement issues (Chan et al., 2025). The present study is related to, but distinct from, Chan et al. (2025), which focused specifically on barriers associated with the under-reporting of paediatric TB cases among private healthcare providers. Although both studies were conducted within the broader context of TB reporting in private healthcare settings, they addressed different research questions and analytical purposes. The present study focuses on TB notification more broadly and was designed as a qualitative needs assessment to explore training and competency needs, preferred learning approaches, and requirements for supporting the application of learning in practice. It involved a distinct group of participants and a separate dataset collected specifically for the present study, and the interview guide for the present study was designed to explore training needs and learning-related requirements.

Similarly, qualitative research among Indonesian private practitioners has identified multiple determinants affecting adherence to TB guidelines, indicating that provider practices are shaped by factors beyond knowledge alone (Lestari et al., 2024a). Although guideline adherence and TB notification are distinct issues, this evidence is relevant because it demonstrates that healthcare providers' practices may be influenced by interacting individual, organizational, and

contextual factors beyond knowledge alone. These findings suggest that TB notification is influenced by interacting individual, organizational, technological, and health-system factors rather than by knowledge deficits alone. Consequently, interventions designed to improve notification need to address the realities of providers' clinical environments and the systems within which reporting takes place.

The role of training is particularly important in this context. Conventional training may focus primarily on knowledge of TB diagnosis, treatment, and reporting requirements, but knowledge acquisition does not necessarily translate into consistent practice when providers face competing clinical priorities, complex reporting procedures, or limited integration of reporting activities into routine workflows (Lestari et al., 2024a). Importantly, however, not all barriers to notification can necessarily be addressed through training alone. Some barriers may reflect gaps in knowledge, skills, or confidence that can be addressed through educational interventions, whereas difficulties related to workflow integration, reporting procedures, technological infrastructure, or organizational arrangements may require practical or system-level support in addition to training.

Evidence from healthcare education suggests that effective professional training benefits from approaches that combine knowledge acquisition with practical learning opportunities, interaction with peers and instructors, and organizational support. A systematic review of educational interventions for healthcare professionals found that multimethod approaches, including blended learning, practical exercises, simulations, and peer interaction, can support the development of knowledge, skills, confidence, and professional competence (Hill et al., 2024; Kulju et al., 2024). In the TB context, a recent study in Indonesia also found that a short-course intervention accompanied by routine assistance improved the identification of children suspected of having TB among private doctors, demonstrating the potential value of combining training with ongoing support (Yuliandari et al., 2024). Although this intervention focused on TB detection rather than notification, it illustrates the potential value of combining educational activities with ongoing support when translating learning into routine professional practice.

Despite increasing evidence on barriers to TB notification among private healthcare providers and emerging evidence on training interventions, an important gap remains in understanding how these barriers translate into specific training needs. Existing research has primarily focused on identifying factors that hinder notification or evaluating predefined training interventions, while comparatively limited attention has been given to how providers' experiences of notification barriers can be translated into specific competency needs, appropriate learning approaches, and requirements for supporting the implementation of learning in routine practice (Chan et al., 2025; Yuliandari et al., 2024). This distinction is important because identifying barriers does not automatically establish the appropriate educational response. For example, limited knowledge of notification requirements may indicate a need for specific educational content, whereas difficulties in completing reporting procedures may require practical skills development and hands-on training. In contrast, barriers related to workflow integration, reporting-system usability, or organizational arrangements may require support beyond education alone.

The contribution of the present study, therefore, is not merely to identify or rediscover barriers to TB notification,

such as workload, reporting complexity, or limited training. Rather, it seeks to examine how healthcare providers' experiences and perceived barriers can be translated into specific competency and training needs, preferred learning approaches, and the conditions required to facilitate the application of learning in routine TB notification practice.

A needs-based and context-sensitive approach to professional learning may therefore provide a more appropriate basis for designing TB notification training. Adult learning principles emphasize the importance of relevance, experience, and direct applicability to professional practice (Knowles et al., 2014). Similarly, Kern's six-step approach to curriculum development places needs assessment at the foundation of educational programme development, allowing educational interventions to be aligned with the needs of learners and the healthcare environment (Thomas et al., 2015). Together, these perspectives provide a conceptual basis for the present study. A needs assessment can identify gaps between current and desired performance and subsequently inform the development of learning objectives and educational strategies. Adult learning principles can guide the development of approaches that are relevant to learners' experiences and directly applicable to professional practice. At the same time, identifying barriers that extend beyond knowledge and skills can help clarify the organizational or system-level conditions that may be necessary for learning to translate into sustained changes in practice.

Accordingly, the findings of the present needs assessment are intended to provide an empirical foundation for a subsequent process in which identified needs can be translated into learning objectives, educational strategies, and considerations for supporting implementation. This approach recognizes that training may address some barriers to notification, whereas sustained improvements in practice may also depend on supportive organizational and reporting environments.

Accordingly, this study aimed to explore the training needs of private healthcare providers to improve TB notification practices, with particular attention to their experiences, perceived barriers, preferred training approaches, and expectations for ongoing support. Specifically, the study aimed to examine how participants' experiences of TB notification could be translated into competency and training needs, preferred learning approaches, and requirements for supporting the application of learning in routine notification practice. By identifying training needs from the perspectives of providers working within private healthcare settings, this study seeks to inform the development of practical, context-specific, and sustainable training strategies that are aligned with clinical workflows and supported by the broader TB surveillance system.

METHODS

Study Design and Participants

This study employed a qualitative exploratory design to explore the training needs of private healthcare providers for improving tuberculosis (TB) notification in private healthcare settings in Indonesia. An exploratory qualitative approach was considered appropriate because the study aimed to obtain an in-depth understanding of physicians' experiences with TB case management and notification-related practices and to explore how these experiences could be translated into

specific training and support needs. The study was conducted and reported with reference to the Standards for Reporting Qualitative Research (SRQR) to enhance transparency and rigor in reporting qualitative findings (O'Brien et al., 2014). In addition, the Consolidated Criteria for Reporting Qualitative Research (COREQ) 32-item checklist was consulted to support comprehensive reporting of the research team and reflexivity, participant selection, data collection, data analysis, and reporting procedures (Tong et al., 2007).

The study was conducted in Batam City, Kepulauan Riau Province, Indonesia. Participants were recruited from 10 private healthcare settings and consisted of physicians working in private clinics and independent private practices. Of the 10 participants, six worked in private clinics and four practiced independently. These private healthcare settings represented the context in which physicians may encounter and manage patients with TB and may subsequently become involved in TB notification practices.

Ten practicing physicians participated in the study. All participants had actual experience managing TB cases. However, direct experience with TB notification was limited: two participants had previously been involved in TB notification or reporting, and one participant had experience using the national TB information system, Sistem Informasi Tuberkulosis (SITB). Including physicians with direct experience in TB case management was considered important because the study aimed to explore training needs among private healthcare providers who encounter TB in clinical practice, including their preparedness, experiences, and perceived needs related to notification practices.

Eligibility and Sampling

Purposive sampling was used to recruit participants who met the following inclusion criteria: (1) practicing physicians; (2) currently working in a private healthcare setting in Batam City, Kepulauan Riau Province, Indonesia; and (3) having actual experience in TB case management. Participants who did not meet these criteria were not included in the study.

The criterion of actual experience in TB case management was used to ensure that participants could provide accounts grounded in their clinical experience of managing patients with TB. Direct experience with TB notification was not required because one objective of the needs assessment was to explore physicians' preparedness and perceived training needs related to notification, including among physicians who had managed TB cases but had limited previous involvement in reporting procedures.

Participants were recruited through coordination with private healthcare facilities and professional networks. Eligible participants were provided with information about the study before participation, and written informed consent was obtained prior to data collection. A total of 25 potential participants were invited to participate. Of these, 10 agreed to participate, eight declined participation, and seven did not respond to the invitation.

Recruitment continued until data saturation was reached, defined as the point at which additional interviews no longer generated substantially new information relevant to the study objectives. A total of 10 physicians participated in the study.

Researcher Characteristics and Reflexivity

The primary researcher (Suryanti) conducted all interviews and was responsible for data collection. She is a medical doctor with postgraduate qualifications in medical education and public health and a PhD in Health Science with

a research focus on TB notification. She also had previous research experience in TB-related topics, including barriers affecting TB detection and reporting among private healthcare providers. This professional and research background provided familiarity with the context of TB notification and medical education.

The primary researcher had no prior direct relationship with the participants before recruitment. Although she also practiced independently as a physician in Batam City, participants were specifically invited to participate in the study and were not recruited on the basis of a pre-existing personal relationship. Data management, coding, and the initial stages of analysis were conducted collaboratively by Suryanti and Hamzah.

Data Collection

Data were collected between May-July 2026 using semi-structured interviews conducted in Bahasa Indonesia. The interview guide was developed by the primary researcher (Suryanti) based on the study objectives and relevant literature. The guide was developed to explore physicians' experiences with TB case management and notification-related practices and to identify how these experiences could inform specific training needs, preferred learning approaches, and requirements for ongoing support. Before data collection, the interview guide was reviewed through consultation with a TB expert in Batam to assess the relevance and clarity of the questions.

The guide explored participants' experiences with TB notification practices, perceived barriers and challenges in reporting TB cases, gaps between knowledge and practice, experiences with existing training, preferences regarding training content and delivery formats, and expectations for ongoing support.

The primary researcher served as the interviewer and the primary instrument for data collection. Interviews were conducted either face-to-face or through online platforms according to participants' preferences and availability. Seven interviews were conducted face-to-face, and three were conducted online.

Each interview lasted approximately 30-60 minutes and was conducted in a private setting to maintain confidentiality and participant comfort. With participants' consent, all interviews were audio-recorded and transcribed verbatim. Field notes were used to document relevant contextual observations and preliminary reflections during and immediately after the interviews. These notes supported contextual understanding and interpretation of the interview data rather than serving as an independent source of data for the analysis.

Data Analysis

The interview data were analyzed using thematic analysis, following the six-phase approach described by Braun and Clarke (2006). An inductive, semantic approach to thematic analysis was used, with codes and themes developed primarily from participants' accounts rather than from a predefined coding framework (Braun & Clarke, 2006).

Data management, coding, and the initial stages of analysis were conducted collaboratively by Suryanti and Hamzah. The process involved repeated reading of the interview transcripts to achieve familiarity with the data, coding meaningful units of information, comparing and discussing codes, grouping related codes, identifying and developing themes and subthemes, reviewing the coherence

of the emerging themes, and interpreting the findings in relation to the study objectives.

A working coding structure was progressively developed during the analysis to organize related codes and support the development of themes and subthemes. No qualitative data-analysis software was used.

Accounts were compared across participants to identify both convergent and divergent perspectives. This process was used as cross-case comparison rather than data triangulation, as all data were obtained from the same participant group using the same method of data collection.

To enhance the trustworthiness and credibility of the findings, cross-case comparison, peer debriefing, and member checking were conducted. Peer debriefing involved discussion of emerging codes, themes, and interpretations with the other authors to obtain critical feedback and examine the developing interpretation. Feedback from these discussions was used to refine the interpretation of the data and the development of themes where appropriate.

Member checking was conducted by returning relevant interpretations to participants for confirmation and clarification where appropriate.

The analysis was conducted using the original interview data in Bahasa Indonesia. Quotations selected for presentation in the manuscript were translated into English while preserving the intended meaning of the participants' statements.

Ethical Considerations

Ethical approval was obtained from the Universitas Dian Nuswantoro Research Ethics Committee on 13 April 2026 (Approval No. 001938/UNIVERSITAS DIAN NUSWANTORO/2026). All participants provided written informed consent before participation. Confidentiality and anonymity were maintained throughout the research process by removing identifying information from the research data and reports.

RESULTS OF STUDY

A total of 10 practicing physicians from private healthcare settings in Batam City, Kepulauan Riau Province, Indonesia, participated in the study. All participants had at least five years of clinical practice experience. Six participants worked in private clinics, whereas four were engaged in independent private practice. All participants had previous experience managing TB cases. None had previously received formal training specifically focused on TB notification for private practitioners. However, only two participants had previous experience with TB notification or reporting, and one participant had experience using the national TB information system, Sistem Informasi Tuberkulosis (SITB). Participant characteristics relevant to the phenomenon under study are presented in Table 1.

The analysis generated four interrelated themes describing how physicians' experiences and challenges related to TB notification were translated into educational and implementation needs: (1) TB notification as a knowledge-to-practice challenge shaped by interacting clinical and system conditions; (2) translating notification barriers into specific competency needs; (3) designing feasible and context-sensitive learning approaches; and (4) supporting the transition from training to sustained notification practice. Rather than representing independent domains

corresponding to the interview guide, these themes describe an analytical pathway from challenges encountered in practice to the educational and implementation responses perceived as necessary to address them.

The findings suggest that barriers encountered during routine clinical practice informed specific competency needs; these competency needs subsequently shaped preferences regarding training content, instructional strategies, and delivery modalities; and the sustained application of learning required support beyond the training intervention itself. The analytical relationships among the themes and their implications are summarized in Table 2.

Table 1. Characteristics of Study Participants Relevant to TB Notification (N = 10)

Characteristic	n (%)
Years of clinical practice ≥ 5 years	10 (100)
Practice setting	
• Private clinic	6 (60)
• Independent private practice	4 (40)
Previous experience managing TB cases	
• Yes	10 (100)
Previous experience with TB notification/reporting	
• Yes	2 (20)
• No	8 (80)
Previous experience using SITB	
• Yes	1 (10)
• No	9 (90)

Note: Participants had previous exposure to general TB-related educational activities; however, no formal training specifically focused on TB notification for private practitioners had been conducted in Batam at the time of the study.

The findings suggest that barriers encountered during routine clinical practice informed specific competency needs; these competency needs subsequently shaped preferences regarding training content, instructional strategies, and delivery modalities; and the sustained application of learning required support beyond the training intervention itself. The analytical relationships among the themes and their implications are summarized in Table 2.

Theme 1. TB Notification as a Knowledge-to-Practice Challenge Shaped by Interacting Clinical and System Conditions

Participants' accounts indicated that difficulties in TB notification could not be understood simply as a lack of knowledge or awareness. Instead, the gap between knowing that notification was required and consistently performing notification appeared to result from interactions among competing clinical responsibilities, workload, limited integration of reporting activities into routine workflows, and the perceived burden of reporting procedures.

Participants generally demonstrated awareness of TB notification requirements, but this knowledge was not consistently translated into routine notification practices. Notification was often positioned as an activity competing with immediate clinical responsibilities and could therefore be postponed or overlooked within busy clinical practice.

"I know reporting is important, but it is often missed because of workload." (R1)

"We focus more on treating patients; reporting is not always prioritized." (R3)

These accounts suggest that awareness of notification requirements alone was insufficient to ensure consistent practice. The challenge was not only whether physicians understood the importance of reporting but also whether notification could be incorporated into the competing demands of routine clinical work.

System-related factors further contributed to this knowledge-to-practice challenge. Participants described the reporting system as complex, time-consuming, and insufficiently integrated with existing clinical information systems.

"The system is quite complicated and takes time to use." (R9)

"There is no integration with our clinic system, so it feels like extra work." (R5)

The lack of integration was perceived as increasing the administrative burden associated with notification and reinforcing the perception of reporting as an additional task rather than an integrated component of routine patient care. Taken together, these findings indicate that the knowledge-to-practice gap was shaped by interacting individual, workflow, and system-level conditions rather than by knowledge deficits alone.

Table 2. Analytical Themes, Key Findings, and Implications for Training and Implementation

Analytical theme	Key finding	Implication for training and implementation
TB notification as a knowledge-to-practice challenge shaped by interacting clinical and system conditions	Awareness of notification requirements did not consistently translate into routine practice because of interacting workload, competing priorities, limited workflow integration, and reporting-system burden.	Training should address the practical integration of notification into routine clinical workflows; workflow and system barriers also require organizational responses.
Translating notification barriers into specific competency needs	Reporting difficulties pointed to needs for practical competencies, including procedural understanding, confidence, and the ability to apply notification requirements in clinical practice.	Learning objectives should focus on observable, practice-oriented competencies rather than knowledge acquisition alone.
Designing feasible and context-sensitive learning approaches	Participants differentiated the relevance of training content from preferences regarding instructional strategies and delivery modalities. Practical, case-based, hands-on, and flexible approaches were preferred.	Curriculum design should distinguish learning content and objectives from instructional strategies and delivery formats.
Supporting the transition from training to sustained notification practice	Mentoring, feedback, follow-up, monitoring, institutional support, and improvements in reporting systems were considered important for sustaining practice.	Educational interventions should be accompanied by post-training implementation support and organizational or system-level reinforcement.

Theme 2. Translating Notification Barriers into Specific Competency Needs

Participants' accounts suggested that the barriers they encountered could be translated into specific competency needs. Rather than indicating a general need for more information about TB, the reported difficulties pointed to practical competencies required to perform notification activities within routine clinical practice. Participants expressed a preference for training that was practical, skills-based, and aligned with real clinical workflows. They emphasized the need for step-by-step guidance on TB notification procedures and opportunities to practice using reporting systems.

"We need training that shows exactly how to report, step by step." (R3)

"Hands-on practice is more useful than theory." (R5)

The ability to complete notification procedures and use relevant reporting systems can therefore be understood as a practical competency rather than simply as knowledge to be delivered during training. Participants' accounts suggested a need to develop procedural understanding, practical confidence, and the ability to apply notification requirements within real clinical settings. Participants also described limitations in existing TB-related training approaches. Previous educational experiences were perceived as predominantly theoretical and insufficiently connected to the practical realities of private healthcare practice.

"The training was mostly theory and not directly applicable." (R2)

"It did not match our daily practice in private clinics." (R10)

This finding highlights the distinction between identifying a barrier and determining an appropriate educational response. For example, difficulties with reporting procedures may indicate a need for procedural competence, whereas limited applicability of previous educational experiences may indicate a need for learning activities explicitly aligned with private clinical workflows.

Theme 3. Designing Feasible and Context-Sensitive Learning Approaches

Participants' accounts distinguished between what needed to be learned and how learning should be facilitated. The findings therefore suggest three related but conceptually distinct considerations: training content, instructional strategies, and delivery modalities. Regarding training content, participants preferred learning that was directly relevant to TB notification procedures and the practical circumstances of private healthcare settings. Case-based learning and real-life scenarios were perceived as useful approaches for connecting learning content with routine clinical practice.

Regarding instructional strategies, participants emphasized the value of active and hands-on learning. Practical exercises and opportunities to apply notification procedures were perceived as more useful than theoretical instruction alone. Hands-on practice was therefore considered an instructional strategy for developing practical competencies rather than a competency in itself. Participants also expressed preferences regarding the delivery of training. A blended approach combining online and face-to-face components was preferred. Online sessions were valued for their flexibility and accessibility, whereas face-to-face sessions were considered useful for practical skill development.

"Online is flexible, but we still need offline practice." (R6)

"Short sessions are better because of our busy schedule." (R2)

These preferences reflected the practical constraints of private clinical practice. Training therefore needed not only to address relevant competency needs but also to be delivered in ways that were feasible for physicians managing busy clinical schedules. Some participants indicated that incentives, including certification and continuing professional development (CPD) credits, could increase motivation to participate in training. These findings suggest that engagement with training may be influenced by its perceived professional value, relevance, and feasibility.

Theme 4. Supporting the Transition from Training to Sustained Notification Practice

Participants emphasized that training alone might not be sufficient to produce sustained changes in notification practices. They described the need for continued support to facilitate the application of learning after the training intervention had ended. Mentoring, supervision, feedback, and follow-up were identified as important forms of support.

"There should be follow-up after training so we don't forget." (R8)

This finding distinguishes implementation support from the educational intervention itself. Whereas training can address knowledge and practical competency needs, follow-up mechanisms can support the transfer and continued application of learning within routine clinical practice. Participants also highlighted the importance of monitoring, institutional support, and improvements in reporting systems.

"Support from the system and regular monitoring are important." (R7)

These findings indicate that not all barriers identified by participants can be addressed through training alone. Educational interventions may improve knowledge and practical competencies, but sustained notification practices also depend on organizational and system-level conditions that enable physicians to apply these competencies within their routine workflows.

Overall, the four themes describe an interconnected pathway from practice-based challenges to potential educational and implementation responses. Challenges related to workload, workflow integration, and reporting burden contributed to difficulties in translating knowledge into practice. These difficulties informed specific competency needs, which in turn shaped preferences for practical and context-sensitive learning approaches. However, the application and sustainability of learning required continuing implementation support and a supportive organizational and reporting environment.

DISCUSSION

This study explored the training needs of physicians working in private healthcare settings to improve TB notification practices. Three principal interpretations emerge from the findings. First, awareness of notification requirements alone was insufficient to ensure routine notification when reporting competed with clinical priorities and was perceived as difficult to integrate into everyday workflows. Second, the barriers described by participants differed in the extent to which they could be addressed

through education, ranging from trainable competency gaps to broader organizational and system-level constraints. Third, the findings suggest that sustainable improvement in notification practice may require training to be combined with implementation and system support rather than delivered as a standalone educational intervention.

TB Notification as a Knowledge-to-Practice and Workflow Challenge

The findings suggest that the central challenge was not simply a lack of awareness about the importance of TB notification. Rather, participants described a gap between knowing that notification should occur and being able to incorporate notification consistently into routine clinical practice. Reporting competed with immediate clinical responsibilities, time constraints, and other demands within private practice. Thus, the knowledge-to-practice gap can be understood as arising from the interaction between provider awareness, competing priorities, workflow conditions, and the perceived burden of reporting. Similar gaps between awareness and actual notification practice have been reported among private practitioners, even where knowledge of mandatory notification was relatively high (Philip et al., 2015; Yeole et al., 2015).

This interpretation is consistent with evidence from Indonesia showing that private-sector engagement in TB programmes depends not only on awareness but also on programme understanding, institutional support, and healthcare-facility readiness (Sunjaya et al., 2022). Qualitative research among Indonesian private practitioners has similarly identified contextual and organizational determinants of provider practices beyond knowledge alone (Lestari et al., 2024a). Evidence from other private-sector settings also indicates that procedural uncertainty, weak coordination with public programmes, time constraints, and inadequate organizational arrangements can impede TB notification (Satpati et al., 2017; Siddaiah et al., 2019).

Recent national evidence indicates that reporting gaps remain despite substantial improvements in TB surveillance. The 2023–2024 national TB inventory estimated overall TB under-reporting at 15.6%, with higher levels observed in clinics and private facilities than in public health centres (Kementerian Kesehatan Republik Indonesia, 2024). The present findings provide a provider-level perspective on how such reporting challenges may be experienced in daily practice. Importantly, non-notification should not be interpreted solely as a deficit in individual knowledge or motivation; implementation behaviour is also shaped by opportunities, organizational conditions, and the wider practice environment (Damschroder et al., 2022; Michie et al., 2011). This distinction has important implications for intervention design. Improving knowledge may be necessary when providers require greater procedural understanding or confidence, but education alone is unlikely to be sufficient when notification remains difficult to integrate into routine clinical workflows.

Distinguishing Trainable, Partially Trainable, and System-Level Barriers

An important interpretation arising from the findings is that not all barriers to TB notification should be treated as training problems. Behaviour-change frameworks similarly distinguish individual capability from environmental opportunities and other contextual determinants that enable or constrain practice (Michie et al., 2011). Trainable barriers

include gaps in procedural knowledge, practical reporting skills, confidence, and familiarity with the steps required to complete notification. These barriers can potentially be addressed through competency-based educational strategies, including demonstrations, guided practice, case-based learning, and opportunities to perform notification-related tasks in a supported learning environment.

Other barriers are only partially trainable. Training may help providers integrate notification into clinical workflows, prioritize reporting activities, or resolve common operational problems. However, education alone cannot eliminate competing clinical responsibilities or organizational constraints. Implementation research similarly emphasizes that available resources, organizational processes, compatibility with existing work, and implementation context can determine whether new practices are successfully adopted (Damschroder et al., 2022).

Finally, some barriers are predominantly system-level. Participants perceived reporting procedures as complex and time-consuming and described limited integration between reporting activities and existing clinical information systems. Because this study did not objectively evaluate SITB usability or reporting infrastructure, these findings should be interpreted as participants' perceptions rather than direct measurements of system performance. Nevertheless, broader evidence on electronic health-record implementation identifies interoperability, workflow disruption, technical complexity, workload, and time constraints as important implementation barriers that cannot be resolved through training alone (McGinn et al., 2011).

This interpretation is consistent with evidence that digital-health implementation within public-private TB programmes can be affected by information-system limitations, communication challenges, and difficulties integrating reporting into routine service delivery (Paskaria et al., 2022). Studies of TB notification in other private-sector settings similarly indicate that notification improves not only through provider sensitization but also through clearer operational mechanisms, stronger programme coordination, and supportive organizational systems (Satpati et al., 2017; Siddaiah et al., 2019; Yeole et al., 2015). In Indonesia, SITB supports TB recording and reporting, while its integration with SATUSEHAT is intended to strengthen data collection and coordination across healthcare services (World Health Organization, 2025b).

Therefore, training should be designed with an explicit understanding of its boundaries. Educational interventions can strengthen providers' capability to perform notification, but sustained practice also requires organizational opportunity, supportive implementation conditions, and functional reporting infrastructure (Damschroder et al., 2022; Michie et al., 2011).

From Barrier Identification to Specific Competency Needs

The main contribution of this study is not simply the identification of barriers to TB notification, but the translation of provider-reported barriers into specific competency needs, educational strategies, and implementation-support requirements. Previous qualitative research among private healthcare providers in Indonesia has documented barriers including limited awareness and training, technological and logistical difficulties, stigma, confidentiality concerns, and regulatory issues (Chan et al., 2025). However, identifying a barrier does not automatically determine the appropriate educational response.

For example, difficulty navigating notification procedures may indicate a need for procedural competency; uncertainty about reporting tasks may require step-by-step guidance; and difficulty applying knowledge in routine practice may require case-based learning and supported practice. Evidence from health professions education indicates that deliberate and repeated practice with feedback can produce stronger skill acquisition than traditional clinical education alone (McGaghie et al., 2011). This is particularly relevant because awareness of notification requirements does not necessarily imply the practical ability or confidence to complete reporting consistently.

The findings therefore provide a basis for progressing from needs assessment to curriculum development. Consistent with Kern's approach, identified needs can be translated into learning objectives that subsequently guide educational strategies and implementation planning (Thomas et al., 2015). Adult learning principles are also relevant because participants emphasized learning that is immediately applicable to their professional responsibilities and clinical environments (Knowles et al., 2014).

Participants described previous TB-related educational activities as predominantly theoretical and insufficiently connected to the practical realities of notification. The educational need may therefore involve not simply acquiring additional information, but developing the capability to perform specific reporting tasks within real clinical workflows. This interpretation is consistent with broader evidence showing that educational interventions are more likely to influence professional performance when they incorporate active, practice-oriented approaches rather than information transfer alone (Hill et al., 2024; McGaghie et al., 2011). Accordingly, TB notification training should place greater emphasis on observable, practice-oriented competencies supported by realistic cases, guided practice, and feedback.

Designing Feasible and Context-Sensitive Learning Approaches

Participants preferred learning approaches that accommodated the operational realities of private clinical practice. Online learning was valued for flexibility, whereas face-to-face sessions were considered particularly useful for practical activities. Shorter sessions were also preferred because they could be more readily accommodated within busy clinical schedules.

These findings should be interpreted as preferences concerning feasibility and acceptability rather than evidence that blended learning is inherently more effective for TB notification. Evidence from health professions education shows that internet-based education can improve learning compared with no intervention, but differences from conventional instructional approaches are generally smaller and depend substantially on instructional design and context (Cook et al., 2008). Similarly, a systematic review and meta-analysis found that blended learning can improve knowledge outcomes in health professions education, although considerable heterogeneity exists across interventions (Liu et al., 2016). These findings reinforce the importance of matching educational modality to learning objectives rather than assuming that a particular delivery format is universally superior.

A potential TB-notification programme could therefore use different modalities for different purposes. Online components could provide concise foundational content, reporting demonstrations, and preparatory materials, while

synchronous or face-to-face sessions could focus on hands-on practice, case discussion, troubleshooting, and guided application. Practical exercises and simulations may be particularly relevant for procedural competencies because repeated practice with feedback supports skill development (McGaghie et al., 2011). Existing evidence on multimethod and digital health-professions education further supports combining instructional approaches according to the intended competency and context (Kulju et al., 2024; Martinengo et al., 2024).

Thus, feasibility should be treated as a central component of programme design. Even a theoretically sound intervention may have limited uptake if its duration, scheduling, technological requirements, or delivery format are incompatible with the working conditions of private practitioners. Any proposed blended approach should therefore be evaluated empirically for feasibility, acceptability, learning outcomes, and changes in notification practice.

From Training to Training-Plus-System-Support

The findings further suggest that competency development through training represents only one stage in improving notification practice. Participants emphasized the need for continued mentoring, feedback, monitoring, technical assistance, and support when problems arise during routine implementation. This shifts the focus from training delivery toward the conditions required to translate learning into sustained practice.

Implementation science similarly recognizes that education alone is rarely sufficient to achieve sustained practice change. Implementation strategies may include training, ongoing consultation, facilitation, audit and feedback, technical assistance, adaptation of workflows, and changes to organizational infrastructure (Powell et al., 2015). This perspective is consistent with evidence that institutional and system support are important for sustained private-sector engagement in TB programmes (Sunjaya et al., 2022; Manurung et al., 2023; Vidyasagaran et al., 2025).

Taken together, the findings support a proposed training-plus-system-support framework in which practical competencies represent the educational component; feasible and context-sensitive delivery represents the instructional component; mentoring, feedback, and technical assistance represent implementation support; and workflow integration and reporting-system usability represent enabling conditions within the broader healthcare environment. These components are proposed to interact in supporting sustained TB notification practice (Figure 1).

This framework should be interpreted as a conceptual proposition derived from the present qualitative findings rather than as a validated intervention or causal model. Future research should therefore move beyond educational outcomes alone and examine implementation outcomes such as acceptability, appropriateness, feasibility, adoption, fidelity, and sustainability, which provide distinct indicators of whether an intervention can be successfully integrated into routine practice (Proctor et al., 2011). Subsequent studies should test whether interventions informed by this framework are feasible, acceptable, and effective in strengthening sustained TB notification among private healthcare providers.

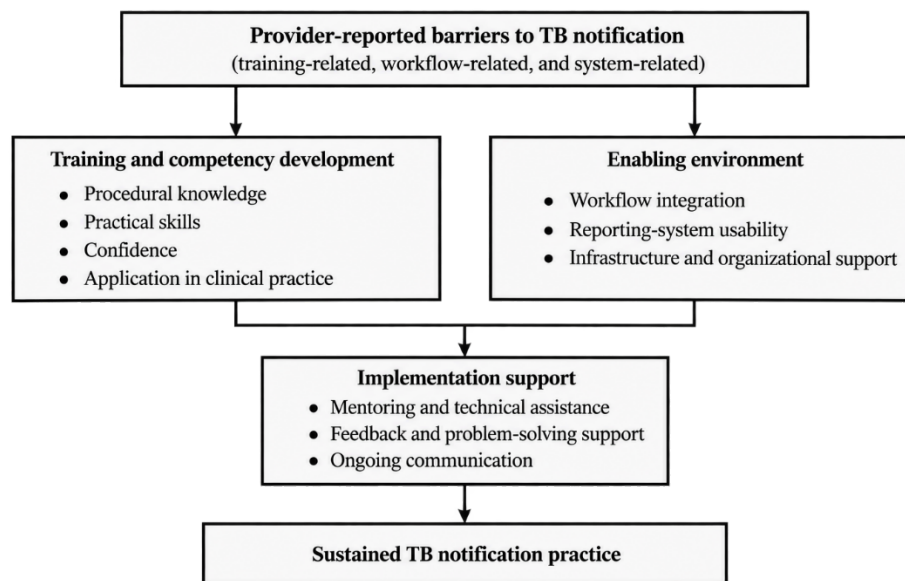


Figure 1. Proposed conceptual framework for training and system support to improve TB notification in private healthcare setting

Implications for Practice and Policy

The findings suggest several implications for the design of future interventions, although these recommendations should be interpreted as implications derived from participant reports and the researchers' interpretation rather than as evidence of intervention effectiveness. First, training could be organized around actual notification competencies rather than predominantly theoretical knowledge. Potential content may include step-by-step notification procedures, practical demonstrations, case-based exercises, troubleshooting, and opportunities to practice relevant reporting tasks.

Second, educational delivery should take account of the operational realities of private healthcare practice. Participants preferred flexible formats and shorter sessions, suggesting that modular and multimodal approaches may be more feasible than lengthy conventional programmes. However, the effectiveness of different delivery formats should be evaluated empirically. Third, training should be accompanied by implementation support. Mentoring, technical assistance, feedback, and monitoring may help providers apply newly acquired competencies when they encounter challenges during routine practice.

Fourth, programme and policy responses should distinguish educational needs from system requirements. Where barriers relate primarily to provider competencies, training may be appropriate. Where barriers arise from workflow constraints, institutional arrangements, or reporting infrastructure, organizational and system-level solutions are also required. At the policy level, the findings support continued strengthening of public-private collaboration. Private-sector physicians should not be viewed solely as recipients of notification requirements but as active partners in the TB surveillance system. Supporting this role may require coordinated educational, organizational, and technological strategies rather than reliance on training alone.

Research Contribution

The primary contribution of this study is not the identification of a specific number of themes. Rather, the study demonstrates that training needs for TB notification

emerge from the interaction among provider competence, clinical workflow constraints, reporting conditions, and continuing implementation support. Previous research has characterized barriers to private-sector TB notification, including knowledge and training gaps, technological limitations, and organizational or regulatory challenges (Chan et al., 2025; Paskaria et al., 2022). Existing evidence has also examined predefined TB-related training interventions among private doctors (Yuliandari et al., 2024). The present study contributes by connecting these two areas: it moves from identifying barriers toward translating provider-reported challenges into competency needs, feasible learning approaches, and requirements for post-training implementation support.

This distinction provides a needs-assessment foundation for curriculum development. The findings suggest a pathway from provider experiences and barriers to learning objectives, educational strategies, and implementation-support requirements, while also recognizing that some notification barriers require organizational or system-level changes rather than educational solutions. The proposed training-plus-system-support perspective therefore represents the main conceptual contribution of this study. It positions TB notification training not as an isolated knowledge-transfer activity, but as one component of a broader implementation environment in which workflow integration, reporting infrastructure, technical assistance, feedback, and organizational support may influence whether learning is translated into sustained practice.

Limitations

This study should be interpreted in light of several limitations related primarily to transferability rather than statistical generalizability. The study involved 10 physicians working in private clinics and independent private practices in Batam City, Kepulauan Riau Province. The findings therefore reflect experiences within a specific geographic and healthcare context and may not be directly transferable to other regions of Indonesia or to settings with different TB reporting systems, organizational structures, or private-sector characteristics.

All participants had experience managing TB cases; however, only a small proportion had previous experience with TB notification, and only one participant had experience using SITB. This participant profile is important when interpreting the findings because the identified needs may particularly reflect the perspectives of physicians who encounter TB care but have limited direct experience with formal notification procedures.

The study included physicians only. The perspectives of nurses, laboratory personnel, clinic managers, administrative staff, and TB programme officers were not directly represented. These stakeholders may encounter different barriers and may have different educational and implementation-support needs.

The findings were based on participant reports and did not include an objective assessment of SITB usability, reporting-system performance, workflow efficiency, or notification accuracy. Consequently, system-related findings should be interpreted as participants' experiences and perceptions rather than as direct evaluations of the reporting infrastructure. Finally, the study explored perceived training needs and did not evaluate whether a specific educational intervention improves notification practices or notification rates. Future research should develop and evaluate interventions derived from these findings, with attention to feasibility, acceptability, implementation, and changes in notification practice.

CONCLUSIONS AND RECOMMENDATION

This study suggests that improving tuberculosis (TB) notification practices among physicians in private healthcare settings requires more than increasing awareness of reporting requirements. The identified training needs arise from the interaction between provider competencies, clinical workflow constraints, and the broader organizational and reporting environment in which notification takes place. The findings indicate that training may address practical competency needs, including procedural knowledge, practical skills, confidence, and the application of notification procedures in routine clinical practice. However, barriers related to workflow integration, reporting-system usability, infrastructure, and organizational support cannot be addressed through education alone. Training should therefore be considered alongside broader implementation and system-support strategies.

The main contribution of this study is the proposed conceptual framework that links provider-reported barriers with competency development, context-sensitive educational approaches, implementation support, and enabling organizational and system conditions. This framework represents a conceptual proposition derived from the findings of the present qualitative study and should not be interpreted as a validated intervention model.

Future research should develop and evaluate interventions informed by the identified training needs and proposed conceptual framework. Such research should assess the feasibility, acceptability, implementation, and effectiveness of interventions in supporting TB notification practices. Future studies should also include other stakeholders involved in the notification process, including nurses, laboratory personnel, clinic managers, and TB programme staff, to develop a more comprehensive understanding of the educational, organizational, and system

requirements needed to support sustainable private-sector TB notification.

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DECLARATION

Ethics approval and consent to participate

Ethical approval was obtained from the Research Ethics Committee of Universitas Dian Nuswantoro (Approval No. 001938/UNIVERSITAS DIAN NUSWANTORO/2026). Written informed consent was obtained from all participants prior to participation in the study.

Consent for publication

Not applicable.

Availability of data and materials

The qualitative interview data are not publicly available because they contain potentially identifiable information and are subject to confidentiality and ethical restrictions. Further information regarding data availability may be obtained from the corresponding author, subject to applicable ethical and confidentiality requirements.

Conflicts of interest Statement

The authors declare that they have no competing interests.

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Artificial Intelligence-Assisted Technology

The authors used QuillBot to assist with grammar checking, paraphrasing, and language refinement during manuscript preparation. The author reviewed and verified the revised text, and all authors reviewed and approved the final manuscript. All authors remain fully responsible for the accuracy and integrity of the manuscript, including its scientific content, interpretations, data, tables, figures, citations, and references.

Authors' contributions

Suryanti: Conceptualization, methodology, investigation, data collection, formal analysis, interpretation of findings, and writing original draft. Hamzah: Methodology, supervision, validation, and writing; review and editing. Saiful Batubara: Conceptualization, writing; review and editing. Susanti: Investigation, data collection, and writing; review and editing. All authors Writing, review and editing, and approval of the final manuscript.

ABOUT THE AUTHORS

Suryanti is a physician, public health researcher, and medical educator at the Faculty of Medicine, Universitas Dian Nuswantoro, Indonesia. Her academic and research interests include public health, tuberculosis control, health systems, health promotion, epidemiology, and medical education. Her research particularly focuses on tuberculosis notification, surveillance gaps, health system strengthening, and improving the quality of healthcare practices through evidence-based approaches. She is actively involved in academic research and medical education, with a commitment to generating research that contributes to improved health services and public health outcomes.

Hamzah is a physician and specialist in anesthesiology and intensive care medicine affiliated with the Faculty of Medicine, University of Batam. He is involved in clinical practice, medical education, supervision, and research. His academic interests include anesthesiology, intensive care medicine, clinical governance, healthcare quality, and health system management. He contributes to medical education and postgraduate supervision and is actively involved in scholarly activities related to clinical practice and healthcare systems.

Saiful Batubara is a physician and academic at the Institut Kesehatan Deli Husada Deli Tua, Indonesia. He has an academic background spanning medicine, medical education, and public health and is involved in medical education, academic leadership, curriculum development, and research. His scholarly interests include competency-based medical education, curriculum development, healthcare quality, and the integration of public health principles into medical education. He is actively engaged in academic and research activities aimed at strengthening the quality of healthcare education and practice.

Susanti is an academic at the Faculty of Health Sciences, University of Batam, Indonesia. Her academic and professional interests include health sciences, biomedical and health research, health education, and healthcare practice. She is involved in teaching, research, and academic activities within the Faculty of Health Sciences and contributes to research through data collection, manuscript development, and scholarly collaboration.

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Correspondence All inquiries and requests for additional materials should be directed to the Corresponding Author.

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