

Original Article

Enhancing the quality of tuberculosis care in a high-prevalence area of West Java, Indonesia: A comparative study between public and private hospitals

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Abstract

Despite the World Health Organization's (WHO) ambitious goal of eradicating tuberculosis (TB) by 2035, the three key indicators of the End TB Strategy remain unmet. Improving the quality of care is essential to achieving better health outcomes in Indonesia, where both public and private hospitals play a pivotal role in strengthening TB services. The aim of this study was to evaluate the quality of TB care in public and private hospitals in Karawang Regency, a district with the fifth highest TB prevalence in West Java, Indonesia. A mixed-methods approach was employed, using an evaluation framework that integrated the High-Quality Health System (HQHS) model and the Quality of Tuberculosis Service Assessment (QTSA) tool. Quantitative data were collected using a modified QTSA questionnaire administered to patients, while qualitative primary data were obtained through in-depth interviews with stakeholders and healthcare providers. Secondary qualitative data were sourced from patient visit records and TB control reports. The findings indicated that low treatment success rates were associated with increased patient loss to follow-up, inadequate evaluation, patient mortality, and dissatisfaction, which were largely driven by deficiencies in foundational elements and suboptimal treatment processes, including budgeting, policy dissemination, and the functioning of internal and external networks. Positive patient experiences and access to follow-up care significantly influenced patient satisfaction. Strengthening the foundational components of the TB health system and adopting a sustainable, integrated treatment approach are critical to improving treatment success rates, clinical outcomes, and patient satisfaction.

Keywords: Tuberculosis, high-quality health system, quality of tuberculosis service assessment, hospital, Indonesia

Introduction

In 2014, the 67th World Health Assembly endorsed the End Tuberculosis (TB) Strategy with the ambitious goal of eradicating the global TB epidemic by 2035 [1]. The strategy includes three high-level targets: a 95% reduction in TB mortality, a 90% decrease in TB incidence rates, and ensuring no TB patients or their households face catastrophic expenses. These targets apply globally, with interim milestones set for 2020, 2025, and 2030 [2]. However, the 2020 targets of the World Health Organization End TB Strategy were not achieved [3].

Indonesia, which ranked second globally for TB incidence in 2022, has experienced a rise in TB cases over the past three years. The COVID-19 pandemic has further exacerbated TB services,



leading to increased incidence and mortality rates [4]. Concurrently, there has been a global decline in TB treatment coverage, dropping from 69% in 2021 to 61% in 2022. Indonesia is among the ten countries with the highest TB burden and the lowest treatment uptake [5].

The Indonesian government has made several efforts to eliminate TB, including expanding case detection and increasing TB treatment initiation to over 90%, as well as setting a treatment success rate target of more than 90%. One of the government's initiatives involves all healthcare facilities in TB treatment. However, according to data from the Indonesian Ministry of Health in 2023, both government and private hospitals have not yet achieved the target treatment success rate, reaching only 80% and 82%, respectively [6]. Besides, the creation of a "TB-Free World" requires more than just expanding diagnosis and treatment; it necessitates a high-quality health system [7]. The quality of health services, which aligns with service standards and the latest scientific advancements, is a key factor in improving patient health outcomes [8]. The Indonesian government engages all health service facilities, including government and private hospitals, to enhance the quality of TB services [9]. Hospitals are indirectly compelled to establish excellent TB programs as accreditation is a prerequisite for collaboration with the National Healthcare and Social Security Agency [10]. However, 19–53% of both government and private hospitals in Indonesia still do not adhere to standardized TB treatment protocols [11].

Despite an increase in the TB treatment success rate in Karawang Regency, West Java Province from 73.8% in 2022 to 82.5% in 2023, the national target of a 90% success rate has not been achieved. Furthermore, there has been an increase in TB prevalence in Karawang Regency from 312 per 100.000 population in 2022 to 511 per 100.000 population in 2023 [12,13]. As a result, Karawang Regency ranks fifth in the highest number of TB cases in West Java [13], with West Java being the province with the most TB cases in Indonesia [6]. There are 26 hospitals in Karawang Regency, and all of these health facilities are involved in treating TB. However, two hospitals stand out: Jatisari Karawang Hospital, a public hospital designated as the TB referral center in Karawang Regency and Izza Hospital, a private hospital in Karawang Regency, which is the most active private hospital participating in the TB program. However, based on TB Control Reports at each hospital, both hospitals have yet to reach the target treatment success rate despite their active participation in TB treatment activities [14,15]. The treatment success rate is a key indicator of the quality of TB services. It is anticipated that enhancing the quality of TB services in healthcare facilities, including hospitals, will contribute to TB elimination.

While previous research has explored the quality of TB services in hospitals, this study distinguishes itself in several ways. Firstly, most earlier studies have utilized or modified the Donabedian paradigm of service quality [7,16,17,18]. In contrast, this study leverages a combination of the High-Quality Health System (HQHS) Framework and Quality of Tuberculosis Service Assessment (QTSA) to scrutinize service quality. The reason for using these two frameworks in combination is that each enhances the other. For example, the QTSA framework focuses more on evaluating the quality of TB services in terms of processes, particularly the interactions between patients and TB service providers, while the HQHS framework places greater emphasis on a detailed quality assessment of the system's foundation [7,19]. Secondly, the research setting also varies. This investigation was conducted in two distinct health facilities within the Karawang Regency. The presence of variations in facilities, regulations, and other factors is expected to facilitate meaningful comparisons and provide valuable insights to enhance TB care quality. The aim of this study was to compare and optimize the quality of TB care in both public and private hospitals in the Karawang Regency, employing the HQHS Framework and QTSA.

Methods

Study design

A concurrent mixed-method approach, combining qualitative and quantitative data collection within a case study framework, was employed in two distinct health facilities: Jatisari Karawang Hospital and Izza Hospital in Karawang, West Java, Indonesia. Quantitative and qualitative data were collected simultaneously and then integrated to provide a comprehensive understanding of the research problem. This study was conducted from November 2023 to January 2024.

Quantitative study

Sample

The study population comprised TB patients receiving treatment at Jatisari Karawang Hospital and Izza Hospital. Purposive sampling was used to select samples from the patient population based on inclusion and exclusion criteria. Inclusion criteria encompassed patients undergoing TB treatment for a minimum of two weeks for drug-sensitive patients and four weeks for drug-resistant patients, patients with both pulmonary and extrapulmonary TB, and patients aged 15 years and above. Patients aged 15–18 years are classified as children. Therefore, informed consent was obtained from the patient's parents or family members who accompanied them during treatment. Exclusion criteria included patients receiving TB treatment for less than two weeks, first-time visitors, patients who were too frail, and patients who declined to participate in the study.

The Slovin formula was used to determine the sample size with a margin of error of 10%. The population was 955 TB patients who received treatment in both hospitals over a one-year period [20]. This resulted in a sample size of 91 respondents.

Study variables

The dependent variables in this study were the service process (patient's level of TB awareness, positive user experience, patient-provider communication and interaction, barriers to TB care, and access to follow-up care). The patient's level of TB awareness was assessed using a questionnaire from MEASURE Evaluation (2020), a project funded by United States Agency for International Development (USAID), consisting of 41 questions based on the Guttman scale, with 0 indicating false and 1 indicating true. A higher score indicated better awareness. Awareness levels were categorized into three groups based on the percentage of the total score: good (76–100%), moderate (60–75%), and low (<60%). The patient's positive experience was measured using a questionnaire from MEASURE Evaluation (2020), consisting of 11 questions on a Likert Scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicated a more positive experience. Experience levels were categorized into five groups based on the percentage of the total score: very poor (20–36%), poor (36–52%), acceptable (52–68%), good (68–84%), and very good (84–100%). Barriers to TB care were assessed using questionnaire from MEASURE Evaluation (2020), consisting of 11 questions on a Likert Scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicated fewer barriers to TB care. The barriers to TB care were categorized into five groups based on the percentage of the total score: very high (20–36%), above average (36–52%), average (52–68%), below average (68–84%), and very low (84–100%) [19].

Patient-provider communication was assessed using a questionnaire by MEASURE Evaluation (2020), consisting of 19 questions based on the Guttman scale, with responses of 0 (No) and 1 (Yes). A higher score indicated better communication between the patient and the healthcare provider (doctor/nurse). Communication was categorized into three groups based on the percentage of the total score: good (76–100%), adequate (60–75%), and poor (<60%). Access to follow-up care was measured using a questionnaire by MEASURE Evaluation (2020), consisting of four questions on a Likert Scale, with responses ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicated easier access for patients to return to the hospital for TB services. The ease of returning to hospital to access TB services was categorized into five groups based on the percentage of the total score: very poor (20–36%), poor (36–52%), acceptable (52–68%), good (68–84%), and very good (84–100%) [19].

The independent variable in this study was the impact on quality, represented by patient satisfaction. Patient satisfaction was measured using a questionnaire by MEASURE Evaluation (2020), consisting of one question on a Likert Scale, ranging from 1 (strongly disagree) to 5 (strongly agree). A higher score indicated greater patient satisfaction [19]. The questionnaire can be found in the **Underlying data**.

Data collection

TB patients who met the inclusion criteria were asked to provide informed consent to participate as respondents. TB patients who visited the hospital (either as inpatients or outpatients) and met

the inclusion criteria were selected as samples. Data were collected using a questionnaire administered directly by the researcher. Before distributing the questionnaire, informed consent was obtained from the TB patients or a parent/guardian for those aged 15–18 years. Those who provided informed consent were interviewed directly by the researcher at the hospital. The questionnaires were not self-administered to ensure clarity of the questions and to accommodate participants with varying literacy levels.

Statistical analysis

Quantitative data were analyzed descriptively by calculating the highest and lowest scores, percentage values, and percentage range values, and then determining percentage categories. The Spearman correlation test is conducted to measure the relationship between two variables. The Guilford criteria are applied to assess the strength of the relationship following the Spearman correlation test. Prior to conducting multiple linear regression analysis, classical assumptions were verified using normality, multicollinearity, and heteroscedasticity tests. The T statistical test (T-test) and the F statistical test (F-test) were used in the multiple linear regression analysis. Following this, the coefficient of determination test (R^2) was utilized to determine the degree to which the significant factors influence the associated variables.

Qualitative study

Informants and data collection

The qualitative study used in-depth interviews, observation, and secondary data as data collection methods. Interviews were conducted on-site, privately at each hospital to ensure confidentiality. Informants selected for in-depth interviews were required to have at least one year of experience in their respective fields to ensure they had sufficient knowledge of TB services. Twenty-four informants, including stakeholders (director, deputy director of medical services, heads of the outpatient, inpatient, emergency, and pharmacy units), employees (human resources staff, IT staff), and TB service providers (members of the Tuberculosis Directly Observed Treatment Short-course (TB DOTS) team, the medical doctor in charge, general practitioners), were purposively selected based on the principles of appropriateness and adequacy. Their insights were gathered to better understand the TB service process at both facilities. Two informants from TB officers in the community health center were selected as triangulation. Each informant was asked a different number of questions depending on the variable being assessed and which was appropriate to the field they mastered. The probing questions are available in the **Appendix**. The selection of these informants was based on their direct involvement and comprehensive understanding of the TB treatment and care process within the healthcare facility. Each of the chosen informants plays a significant role in ensuring the effective diagnosis, treatment, and management of TB patients, thus contributing to the study's focus on TB care and outcomes.

Observations were made to assess the completeness of medical equipment and medicine supplies supporting TB services. Secondary data were compiled from TB patient visits and TB control reports. The things that were observed included completeness of facilities and medicine supplies supporting TB services. Data on TB patient visits and TB control reports results were used to compile secondary data.

Study variables

The HQHS framework was used in the qualitative study. HQHS assessed foundational variables, including the number of patients, financing mechanisms, TB service policies, infrastructure, service networks, and health worker capacity, as well as impact variables, such as the TB treatment success rate and TB treatment outcomes. Meanwhile, the QTSA evaluated process variables, including patients' level of TB awareness, positive user experience, patient-provider communication and interaction, barriers to TB care, and access to follow-up care, along with patient satisfaction. The number of patients was determined by calculating the number of registered TB patients undergoing treatment at both hospitals. The financing mechanisms were assessed through in-depth interviews with the hospital director to identify sources of funding and investment in equipment supporting the TB program, including patient treatment and service delivery supplies. These funds were obtained through budgets, grants, and health insurance. TB

service policies were evaluated through in-depth interviews and document reviews, including decisions and guidelines established by the director that regulate TB services. Infrastructure was assessed through in-depth interviews, direct observation of facilities, medical equipment, diagnostic tools, drugs, and information systems used for TB services. Additionally, the availability of infrastructure was cross-checked by reviewing documents detailing stock or inventory lists. The service network was evaluated by examining how different units within and outside the hospital collaborated in TB patient identification and treatment. Health worker capacity was assessed by calculating the number of healthcare workers involved in TB services and reviewing the training they had attended to provide TB care.

TB treatment success rate was obtained from each hospital's TB control report. It was calculated by dividing the number of TB patients who were cured and those who completed treatment by the total number of TB patients undergoing treatment. A hospital is considered to have successfully treated TB if its treatment success rate exceeds 90% [21]. The TB treatment outcomes were also collected from each hospital's TB control report. These outcomes were classified into six categories: cured, treatment completed, treatment failure, death, loss-to-follow-up, and transferred/not evaluated. Pulmonary TB patients were classified as cured if they had a positive bacteriological confirmation at the start of treatment but achieved a negative sputum Acid-Fast Bacillus (AFB) or negative culture at the end of treatment, with at least one previous examination also showing negative results. Patients were considered to have completed treatment if they had undergone the full course of TB treatment with no signs of treatment failure but did not have a negative sputum AFB or culture results at the end of treatment or in a prior examination, either due to the test not being performed or the results being unavailable. Patients were categorized as having failed treatment if their sputum AFB or culture results remained positive in the fifth month or at the end of treatment. Patients were classified as dead if they passed away for any reason before or during TB treatment. Loss to follow-up was applied to patients who either never started treatment after being diagnosed with TB or discontinued treatment for two or more consecutive months. Patients fell into transferred/not evaluated category if their treatment results were not recorded at the end of the treatment cohort reporting period. This included patients who have been transferred to another healthcare facility, where the treatment outcomes remained unknown to the referring facility at the reporting deadline [22].

Data analysis

The data were analyzed using a thematic approach. A voice recorder, notebook, and mobile phone camera were used to capture data and generate field notes. Qualitative data were collected through in-depth interviews with informants, direct observations by researchers, and secondary data obtained from document searches. All interview recordings were transcribed into a matrix for further analysis. The data were then coded based on the informants and the corresponding questions, with the assigned codes known only to the researcher. After coding, the data were categorized according to the research variables. Relevant information from document searches was extracted and classified based on the study's data requirements. Field observation data, initially recorded in document checklists, were converted into text and integrated to support infrastructure-related variables. Finally, the researcher validated the data using the triangulation method, including source triangulation (comparing and cross-checking multiple informants), method triangulation (contrasting the results of in-depth interviews, relevant document searches, and direct observation), and theory triangulation (comparing the acquired data findings with theory as a guide).

Results

Patient's level of TB awareness

The characteristics of the study participants are presented in **Table 1**. Based on educational attainment, the largest proportion of respondents, which accounted for 42 individuals (46.2%), had completed only elementary school. In terms of occupation, the majority were housewives, accounting for 33 respondents (36.3%). Regarding treatment facilities, most participants (83

respondents; 91.2%) received care at Jatisari Karawang Hospital. The mean treatment duration was 9.03 ± 5.85 months.

A total of 91 respondents completed questionnaires assessing their awareness of TB. The overall score for the patient awareness variable was 68.88%, which falls into the “poor” category, indicating that the indicators for this variable were inadequately met according to the continuum of average values.

Table 1. Characteristics of the respondents (n=91)

Variable	Frequency (%)
Sex	
Male	52 (57.1)
Female	39 (42.9)
Level of education	
Elementary school	42 (46.2)
Junior high school	16 (17.6)
Senior high school	30 (33.0)
Bachelor	3 (3.3)
Employment	
Unemployed	10 (11.0)
Housewife	33 (36.3)
Private sector employee	4 (4.4)
Self-employed	17 (18.7)
Labor	20 (22.0)
Other	7 (7.7)
Location of treatment	
Izza hospital	8 (8.8)
Jatisari karawang hospital	83 (91.2)
Length of treatment (mean \pm SD) months	9.03 ± 5.847

The Guilford criteria were applied to assess the degree of relationship closeness following statistical testing using the Spearman correlation test. There was a significant but weak (not close) correlation between the patient's level of TB awareness (X1) and patient-provider communication, as well as between TB awareness (X1) and access to follow-up care (X5) (**Table 2**). Therefore, individuals with greater awareness of TB tended to communicate more with healthcare providers and had better access to follow-up care.

Table 2. Total score of the QTSA questionnaire assessing the quality of the TB service process and patient satisfaction

Variable	Total score	Ideal score	Total score percentage
Patient's Level of TB awareness (X1)	2,570	3,731	68.88%
Patient's positive experience (X2)	4,101	5,005	81.94%
Barriers to TB Care (X3)	3,434	5,005	68.61%
Patient-Provider Communication (X4)	1,520	1,729	87.91%
Access to Follow Up Care (X5)	310	364	85.16%
Patient satisfaction (Y)	421	455	92.53%

Patient's positive experience

The patient positive experience variable achieved a score of 81.94%, which was classified as strong according to the continuum scale (**Table 2**). This finding indicated that all indicators within this variable were performed effectively. The Spearman correlation analysis revealed a significant but weak correlation between positive patient experience and patient-provider communication ($R=0.306$), as well as a moderate correlation between positive patient experience and both barriers to TB care ($R=0.479$) and patient satisfaction ($R=0.417$). These results suggest that improved patient experiences are associated with enhanced communication with healthcare providers, fewer barriers to TB care, and higher levels of patient satisfaction (**Table 3**).

Barriers to TB care

The barriers to TB care variable had an average score of 68.61% (**Table 2**), which was classified as strong on the continuum scale, indicating that the components of this variable were generally well implemented. Spearman correlation analysis demonstrated a significant but weak

correlation between barriers to TB care and both access to follow-up care ($R=0.323$) and patient satisfaction ($R=0.330$). These findings suggest that reducing barriers to TB care is associated with improved patient satisfaction and greater accessibility of TB services (**Table 3**).

Patient-provider communication

The patient–healthcare provider communication variable achieved an overall score of 87.91%, categorized as “good,” indicating that all indicators within this variable were successfully implemented according to the continuum of average values (**Table 2**). Spearman correlation analysis revealed a significant but weak correlation between patient–provider communication and access to follow-up care ($R=0.301$). These results suggest that stronger communication between patients and healthcare providers is associated with improved access to follow-up care (**Table 3**).

Table 3. Findings from the correlation analysis between variables using the Spearman correlation test

Variable	X1	X2	X3	X4	X5	Y
Patient’s level of TB awareness (X1)		0.157	0.042	0.391*	0.296*	0.047
Patient’s positive experience (X2)			0.479*	0.306*	0.195	0.417*
Barriers to TB care (X3)				0.119	0.323*	0.330*
Patient-provider communication (X4)					0.301*	0.184
Access to follow-up care (X5)						0.340*

*Statistically significant at $p<0.05$

Patient satisfaction

The patient satisfaction variable achieved a score of 92.53%, which was classified as “very strong” indicating that all indicators within this variable were well implemented. Multiple linear regression analysis was conducted to examine the relationship between patient satisfaction and five independent variables: patient awareness of TB, positive patient experience, barriers to TB care, patient–provider communication, and access to follow-up care (**Table 4**). The F-test demonstrated that the model was statistically significant, with a $p<0.001$, indicating that patient satisfaction was significantly influenced by the combined effects of the independent variables.

Subsequently, independent t-tests were performed to evaluate the individual impact of each independent variable—patient awareness of TB, positive patient experience, barriers to TB care, patient–provider communication, and access to follow-up care—on patient satisfaction.

Table 4. Multiple linear regression analysis of patient’s level of tuberculosis (TB) awareness, patient’s positive experience, barriers to TB care, patient-provider communication, and access to follow-up care on patient satisfaction

Model	Unstandardized Coefficients		Standardized Coefficients	t-value	p-value
	β	Std. Error	Beta		
1 (Constant)	3.114	0.430		7.237	0.000
Patient’s level of TB awareness	-0.003	0.007	-0.043	-0.421	0.674
Patient’s positive experience	0.184	0.086	0.227	2.136	0.036
Barriers to TB care	0.092	0.104	0.096	0.881	0.381
Patient-provider communication	-0.006	0.019	-0.036	-0.345	0.731
Access to follow-up care	0.759	0.205	0.377	3.705	0.000

In the multiple linear regression analysis, positive patient experience ($\beta=0.184$, $p=0.036$) and access to follow-up care ($\beta=0.759$, $p<0.001$) were positively associated with patient satisfaction and had a significant impact. Although barriers to TB care showed a positive association with patient satisfaction, the relationship was not statistically significant. In contrast, both patient awareness of TB and patient–provider communication were negatively associated with patient satisfaction and did not demonstrate significant effects (**Table 4**).

Qualitative analysis

Observations and document reviews were performed to assess structural domain variables, including patient visit frequency, payment methods, service guidelines, infrastructure, service

networks, and the competency of medical professionals (**Table 5**). Several structural deficiencies were identified within the TB services at both Jatisari Karawang Hospital and Izza Hospital.

Table 5. Characteristics of the informants

Position	Jatisari Karawang Hospital		Izza Hospital		Community Health Center	
	Age (year)	Sex	Age (year)	Sex	Age (year)	Sex
Hospital director	50	Female	44	Male	-	-
Deputy director of medical services	48	Male	33	Female	-	-
Head of outpatient unit	41	Female	32	Male	-	-
Head of inpatient unit	30	Male	26	Male	-	-
Head of emergency unit	30	Male	26	Male	-	-
Head of pharmacy unit	30	Female	30	Male	-	-
Staff of human resources	29	Male	48	Female	-	-
Staff of IT	26	Male	34	Male	-	-
TB DOTS team member	25	Female	27	Female	-	-
Medical doctor in charge	47	Male	48	Male	-	-
General -practitioner	34	Female	33	Male	-	-
TB officer	-	-	-	-	54	Female
TB officer	-	-	-	-	48	Female

Financing mechanism

Numerous issues related to financing mechanisms in both hospitals were identified. At Jatisari Karawang Hospital, these included the lack of incentives for the TB DOTS team, the absence of special funding allocated for TB services, the low rate of Indonesia Case-Based Groups (INA-CBGs) despite the high volume of cases and prolonged length of stay, and patient refusal to be referred to primary health care. At Izza Hospital, similar challenges were noted, including the lack of incentives for the TB DOTS team, the absence of special funding allocated for TB services, limits on the duration of follow-up visits for TB patients using *Badan Penyelenggara Jaminan Sosial* (BPJS), and services for TB patients that cannot be claimed by BPJS due to regulations.

“Many patients present with severe conditions, but the hospital only makes class C claims. As a result, despite the lengthy and expensive stay, only a small portion of the costs can be reimbursed through INA-CBGs” (IJ 1).

“Many TB patient services have gone unclaimed due to BPJS regulations prohibiting TB patients without comorbidities from receiving treatment in hospitals. Many TB patients without complications are treated in hospitals because of opposition from patients and professionals who find the implementation of the restrictions difficult” (IZ 2).

TB service policies

With respect to service policies, various guidelines, protocols, decrees, and standard operating procedures have been established for TB services in both hospitals. In order to increase the standard of TB services, Izza Hospital's Director implemented a number of measures, such as zoning isolation rooms, actively participating in TB refreshing, defining priority quality indicators, and conducting TB screening in the emergency room and outpatient care.

However, not all units, medical professionals, or health workers had been informed about or socialized with these policies, leading to disparities in the healthcare system and impacting patient treatment outcomes. At Jatisari Karawang Hospital, no formal evaluation of TB policy implementation had been conducted, and no structured dissemination efforts had taken place. While TB health service providers reported that they had never undergone any socialization or evaluation, Izza Hospital administration claimed that dissemination and evaluation of TB policy had been carried out.

“SOPs for TB services have never been socialized or assessed because there isn't enough time.” (IZ 10)

Infrastructure

Jatisari Karawang Hospital and Izza Hospital boast comprehensive infrastructure facilities, although some deficiencies remain. These include the absence of dedicated triage rooms for TB patients, separate waiting rooms for non-TB patients, and distinct examination rooms, the latter due to a shortage of physicians. At Izza Hospital, there is no isolation room within the intensive care unit (ICU) available, and while an isolation room with a ventilation system is available, it lacks a negative pressure mechanism.

Both hospitals are adequately equipped with medical and diagnostic tools; however, each faces specific limitations. At Jatisari Karawang Hospital, hemodialysis machines and other medical equipment for managing comorbidities in TB patients are currently unavailable. While diagnostic methods for pulmonary TB at Jatisari Hospital are relatively comprehensive, advanced diagnostics such as computed tomography (CT) scans and rifampicin-resistant (RR-TB) detection are not yet accessible. In contrast, Izza Hospital lacks portable ventilators and isolation ICU ventilators, as well as a rapid molecular testing platform for TB diagnosis. Nonetheless, it is comparatively better equipped for diagnosing extrapulmonary TB.

The availability of TB medications, especially those intended for children, was limited. This scarcity of pediatric TB medication was due to a vacancy at the center. To mitigate this, the hospital employed alternative methods such as obtaining medications from other healthcare facilities, exchanging medication packets, and dispensing loose medication to patients. Apart from that, Izza Hospital also offered an alternative by providing patients with the option to use patent TB drugs.

While the TB Information System (*Sistem Informasi Tuberkulosis*, SITB) had been fully utilized at Jatisari Karawang Hospital and Izza Hospital, integration with the Hospital Management Information System (*Sistem Informasi Manajemen Rumah Sakit*, SIMRS) remained incomplete. This integration is expected to streamline the follow-up process for TB patients. However, challenges persist in documenting and reporting TB patients to external entities, particularly community health centers. These centers often experience delays in recording treatment outcomes for patients who transition from hospitals due to a lack of TB officers. Consequently, the likelihood of treatment success may decrease as the incidence of non-evaluation increases.

Service network

Despite the use of internal networking between hospital units for diagnosis and treatment planning purposes, several issues persist. Hospitalized TB patients are not consistently reported to the TB DOTS team, particularly if they are already undergoing treatment. Moreover, patients with confirmed TB who initiate treatment during hospitalization are often not reported, resulting in incomplete records within the SITB. Consequently, cases lost to follow-up after discharge may go untracked, negatively impacting reported treatment success rates. Challenges within the external network issues include failure to deliver medications to patients switching treatments, patients being referred via SITB but not having their status tracked in SITB, and delayed or incomplete reporting of final treatment outcomes by the community health center. Furthermore, both hospitals faced difficulties identifying referral hospitals with available isolation rooms—particularly ICUs for hospitalized TB patients.

“In 2023, due to the fact that only one nurse was assigned to assist the polyclinic, the recording and reporting were not completed on time, which resulted in delayed data input during the three-month evaluation for TCM claims.” (IZ 9)

“The community health center occasionally has a tendency to be late or forgets to submit the treatment's final results, Doc. Thus, it also influences the treatment's success rate. I occasionally speak with each TB officer at the community health center individually, but they still don't receive feedback.” (IJ 9)

“Sometimes I forget to directly input the results into SITB because only 1 nurse and it's a lot of work” (IP 13)

Health workers capacity

The number of health professionals, as determined by workload calculations and job analysis, was deemed either excessive or sufficient. However, an informant from the TB DOTS team reported that the team is understaffed with physicians, nurses, and public relations personnel due to the current workload. Not all healthcare professionals had received TB training. Furthermore, at Jatisari Karawang Hospital, the management had never assessed employees' knowledge and proficiency in TB care, and information about previous training was not routinely documented. Therefore, there has never been a systematic mapping of the training needed by health staff.

At Izza Hospital, TB training attended by staff had never involved collaboration with external institutions, although it was certified. The training sessions were refreshment held by the provincial and regency health offices. Izza Hospital has implemented a policy requiring employees who participate in the training to conduct outreach to relevant units. However, in practice, outreach has only been carried out among staff involved in TB services within outpatient and inpatient departments, while personnel in the emergency department have not received any TB-related training or outreach.

Patient-provider communication

There remains insufficient time for meaningful discussions with TB patients, primarily due to the high patient volume within limited timeframes and the numerous responsibilities assigned to healthcare staff.

"Sometimes there is not enough time for discussion, I did it simultaneously while checking patient's vital signs because of the large number of patients" (IZ 9)

"While examining the patient, I invite them to discuss it in the polyclinic. But in inpatient rooms,, it takes quite a bit of time because there are a lot of patients who have to be visited." (IJ 10)

Access to follow-up care

Access to follow-up care variable yielded an average result of 85.16% (**Table 2**). This result falls into "good" category, indicating that all indicators of this sub-variable were successfully implemented, according to the continuum of average values. The Spearman correlation test revealed a statistically significant but weak correlation between access to follow-up care and patient satisfaction. Therefore, patient satisfaction tends to increase with improved access to follow-up care.

In-depth interviews revealed that both Izza Hospital and Jatisari Hospital's drug-susceptible TB (DS-TB) clinics conducted follow-up interviews when patients completed outpatient control or were discharged from the hospital. At Jatisari Hospital's multidrug-resistant (MDR-TB) polyclinic, additional follow-up was conducted by contacting patients who missed or delayed scheduled re-examinations.

"We remind every patient, whether DS-TB or DR-TB, that they have completed the control before going home and before they go home after being hospitalized to schedule the next control. But at the DR-TB clinic, they have their own administrative staff who remind patients the day before the scheduled control or if they are late for another control." (IJ 9)

Tuberculosis treatment outcome

Treatment outcomes are frequently outdated due to limited human resources. At Jatisari Hospital and Izza Hospital, the number of DS-TB patients recorded as having completed treatment exceeded those classified as cured. This predominance of "treatment completed" outcomes is largely attributable to patients' difficulty in producing sputum, which is crucial for establishing the diagnosis and assessing treatment outcomes.

"Sometimes the community health center tends to be late or forget to input the final results of the treatment" (IJ 9)

“Sometimes we forget to directly input the results into SITB because we are alone and have a lot of work to do” (IP 12)

Discussion

TB is a disease that is highly sensitive to the quality of health systems. In 2016, half of TB-related deaths were attributed to substandard care in 137 low and middle-income countries [7]. Evaluating the quality of TB treatment services is crucial as it provides insights into the performance of the health system and informs strategies for enhanced care [18]. Moreover, quality assessment also plays a key role in promoting treatment adherence, encouraging patients to seek follow-up care, and reinforcing to healthcare providers that quality is a fundamental aspect of the program, thereby setting expectations for improved staff performance. It also serves as a tool to gauge the success of interventions and steer future program strategies [23].

The HQHS and QTSA are instruments employed to assess the quality of TB services. Both frameworks are grounded in the Donabedian framework, which encompasses structure, process, and impact. When used in combination, HQHS and QTSA enable a comprehensive evaluation of TB services from the perspectives of both patients and healthcare providers [24][23].

Structural domain issues can ultimately compromise treatment and patient satisfaction by disrupting the TB service delivery process. To ensure that these processes and structural issues are beneficial to the hospital performance and patient well-being, continuous evaluation and improvement are essential [25]. Patient satisfaction is a critical component in assessing the quality of care, particularly in the context of achieving universal health coverage and ending the TB epidemic and other communicable diseases [26]. The average percentage result for the patient satisfaction was determined to be 92.53%, which is considered very good [17]. This finding is consistent with results from other regions. For instance, satisfaction rates in African countries ranged from 53.5% to 97.0%, while in South-East Asia, including India, rates ranged from 67.8% to 97.2%. These variations demonstrate differences based on healthcare systems and regions. QTSA highlights discrepancies between patient-reported experiences and provider-reported services, such as counseling rates. Similar issues were noted globally, where technical competency and interpersonal relationships significantly influenced satisfaction [26].

Patient satisfaction in TB care is influenced by multiple factors, including patient characteristics, healthcare providers, and healthcare settings. Healthcare service-related factors include accessibility, availability, healthcare cost, treatment duration, and implementation of directly observed treatment [26]. In the present study, patient satisfaction was significantly associated with positive patient experience and access to follow-up care. This is in line with the study by Cazabon *et al.* (2020), which showed that enhancing patient satisfaction with healthcare is essential for improving patient retention rates, adherence to treatment, and public confidence in the healthcare system. The Lancet Global Health Commission defines a positive user experience as having a health professional who avoids discriminatory behavior, communicates effectively, gives autonomy and confidentiality, and treats patients with dignity and respect [27]. The director or informants also stated that the hospital's ability to provide timely, affordable, and easily accessible TB services is directly linked to patient satisfaction. Patient experience was found to be influenced by challenges such as inconsistent follow-up care, a shortage of human resources, and inadequate dissemination of TB policies. In ensuring that patients feel heard, respected, and well-informed throughout their treatment, informants emphasized the importance of effective communication between healthcare providers and patients. Apart from that, the present study also found that patient satisfaction was significantly impacted by patients' access to follow-up care. The findings were consistent with the study by Rianti *et al.* (2022), who reported that the availability of consistent TB services influenced patient satisfaction at the Palu City Health Center. Availability was assessed based on the continuity of care for patients in need and the quality of information provided to patients [28]. In this study, health workers consistently informed patients of their scheduled follow-up visits, both after completing outpatient treatment and hospital discharge. Furthermore, the TB RO clinic at Jatisari Hospital has a dedicated administrative officer who reminds patients of their follow-up schedule, either the day before or when they missed a scheduled visit.

The findings indicate that the treatment success rate was not achieved, primarily due to a decline in the number of patients completing treatment and an increase in cases categorized as transferred out or not evaluated. This was primarily due to difficulties in tracking patient outcomes following referral to community health centers, as well as incomplete or delayed reporting. According to the HQHS framework, these issues reflect weaknesses in foundational elements, including infrastructure, human resources, and network coordination, as well as in service delivery processes like follow-up care and internal communication. The QTSA further reinforces these findings by emphasizing the importance of proper documentation, timely referral systems, and consistent patient-provider engagement.

The present study aligns with Abebe *et al.* (2022), who identified several variables contributing to challenges in treating and monitoring TB patients, including socioeconomic barriers, issues with health service providers, a shortage of medication supplies, and unfavorable working conditions for medical professionals. Factors related to health service providers that may hinder treatment adherence include poor staff attitudes, lack of motivation, underestimation of disease severity, frustration over treatment failures, internal and external referral systems, job turnover, and ignorance of duties [29]. Other influencing factors include accountability for treatment, exhaustion from follow-up, staffing shortages, and disregard for proper treatment protocols [29]. Similarly, Koomen *et al.* (2019) found that TB drug stockouts directly reduced treatment success rates [30], and Reviono *et al.* (2019) identified poor internal network coordination as a critical factor impacting TB treatment outcomes [31]. The present study reflects similar constraints, including limited staffing, exhaustion from follow-up, and both internal and external referral networks. In both hospitals, a single TB officer is responsible for a wide range of duties, including supporting specialized physicians, documenting patient information in SIMRS, managing outpatient administration, entering data into SITB for all newly diagnosed and confirmed TB cases, and performing other tasks that wear out officers. Given the increasing number of TB patients each year, it is not feasible for TB officers to individually follow up with each patient. Consequently, follow-up care is often reactive rather than proactive, occurring only when patients initiate contact or express a desire to complete the examination. Furthermore, neither Jatisari Karawang Regional Hospital's DS-TB clinic nor Izza Hospital employs dedicated officer responsible for patient interaction and engagement.

Five key factors—treatment, treatment supervision, internal/external networks, equipment facilities, and commitment and organization—have been identified as influencing TB treatment success rates [31]. However, essential diagnostic tests such as culture testing, drug sensitivity tests, and Second-line Line Probe Assay tests remained unavailable at both Jatisari Karawang Hospital and Izza Hospital, limiting the capacity to confirm and appropriately manage DR-TB. These tests are crucial for diagnosing DR-TB and determining the appropriate medication for the patient. In addition, several diagnostic techniques required for confirming extrapulmonary TB and associated complications, such as CT, magnetic resonance imaging (MRI), urography, laparoscopy, and echocardiography, are still unavailable in Izza Hospital and Jatisari Karawang Hospital. Although CT scan is available at Izza Hospital, rapid molecular testing for TB diagnosis is lacking, necessitating the referral of patient's sputum samples to the community health center. The limited availability of key diagnostic tools significantly hampers the timely and accurate diagnosis of TB, particularly in complex cases. When the TB treatment process, including diagnosis and continued therapy, is impeded, it adversely affects the course of the patient's treatment and the patient outcomes [21].

Another factor influencing the success rate of treatment is the availability of anti-TB medications [31]. The present study identified a shortage of TB drugs in 2023 at both hospitals, especially pediatric TB drugs. Apart from shortages at the center, drug shortages can also be attributed to inaccuracies in the planning process due to suboptimal patient reporting. This is in line with study by Koomen *et al.* (2019), who reported a negative correlation between TB success rates and TB drug stockouts. The regression analysis demonstrated that a 10% rise in TB drug stockouts resulted in a 1.43% decline in the TB treatment success rate [30]. Drug shortages may result from improper drug planning, procurement, and monitoring [28]. Jatisari Karawang Hospital and Izza Hospital utilize the consumption-based planning method in their pharmacy logistics systems. This method estimates the required stock of medicines and medical supplies

based on past consumption data, with input drawn from the SITB system. However, inpatients who receive treatment but are not admitted to outpatient care after being discharged from inpatient care are not recorded in the SITB. As a result, these patients are classified as lost to follow-up before treatment and excluded from the list of treated patients. Consequently, the amount of usage will exceed the planned amount.

This study identified additional information system issues, particularly delays in patient registration with the SITB. These delays were attributed to both internal and external factors within the hospital. Internally, the recording and reporting of TB cases remain suboptimal due to several challenges, including the lack of nursing staff as the spearhead of manual recording. Besides, discrepancies exist between actual practices and the network mechanism outlined in the Tuberculosis Service Network Implementation Guide from the Ministry of Health [32]. According to these guidelines, inpatient officers are required to notify the DOTS unit when a TB patient is hospitalized to ensure timely registration, even if the patient is later discharged without follow-up.

One contributing factor to these challenges is the need for increased availability and socialization of internal networking SOPs among all health workers involved in TB services at both hospitals. Consequently, inpatients who were diagnosed with TB, received treatment, but were not registered in the SITB system and did not receive post-discharge follow-up were ultimately unrecorded. This increases the number of patients who are lost to follow-up before treatment, even though the patient has been treated, and can be included in the calculation of treatment success rates. These findings are in line with Reviono *et al.* (2019), who reported that dysfunctional internal networks in TB care are often the result of limited commitment of hospital management in the implementation of DOTS in hospitals, high workload or overlapping responsibilities within the DOTS team, the absence of dedicated DOTS units for integrated TB services, and poor coordination between hospital units and external networks [31]. Recording and reporting of TB cases is not running optimally due to several factors, namely the lack of nursing staff as the spearhead of manual recording, the absence of funding for the TB DOTS program, including for recording and reporting, no EMR integrated into all service units yet, and internal networks that are not running well [33]. The study's findings support the notion that human resources play a role in some of the challenges Jatisari Karawang Hospital faces. Nuryani *et al.* (2021) suggest that limited human resources and the quality and quantity of performance must be accompanied by structured job training programs to achieve maximum work targets [34].

The problems identified in the external network were the lack of coordination in transferring patient treatment and reporting patients who were referred for continued treatment at the community health center. The Public Private Mix (PPM) strategy, coordinated by the Regency or City Health Service, aims to integrate all TB service facilities into a unified system to support comprehensive TB control. One of the core components of the PPM is the TB recording and reporting network, which is essential to accomplish *temukan obati sampai sembuh* (TOSS TB) and Universal Access targets. The present study found that community health center did not regularly check and coordinate the status of patients who were referred for treatment transfer to their facilities. Furthermore, they often failed to update patient records in the SITB system. According to community health center task guide in the external network, health centers are expected to coordinate and track TB patients who are absent from their work area and are referred to transfer treatment to their health facility, as well as implement the mandatory reporting of TB patients at the SITB. Insufficient coordination with external networks in the follow-up process can result in patients being lost to follow-up or not being evaluated, which will ultimately reduce the success rate of treatment [9].

Despite imbalances in the number of medical professionals and healthcare workers in both hospitals, TB-related responsibilities were often concentrated on a single trained nurse. This individual was tasked with assisting physicians, managing patient follow-up, recording and reporting TB cases, and handling outpatient administration. Consequently, an excessive workload continues to worsen as more tasks or other health service activities are added. These professionals were still expected to deliver a multitude of other health services daily. Frequent staff turnover exacerbated the situation, leading to the replacement of experienced TB staff with new staff without TB experience. The transition created barriers to the continuity and success of

the program. As a result, the quality of daily TB services was negatively affected. A patient's positive experience was influenced by the technical competence of health service professionals, including their ability to diagnose and treat [27]. Patients dissatisfied with the clinical skills of healthcare providers were more likely to discontinue follow-up care. Therefore, ensuring the knowledge, skill, capability, and facility to manage TB cases is crucial in minimizing potential problems in TB care, including minimizing poor treatment outcomes [35].

Several issues related to financing mechanisms were identified in both hospitals. These included the lack of incentives for the DOTS TB Team, the absence of special funding for TB services, the low INA-CBGs reimbursement rate despite the high volume of cases and extended length of stay, and patient refusal to be referred to primary healthcare. Additional issues included limitations on the duration of follow-up visits for TB patients covered by BPJS, and the inability to claim certain TB services under BPJS regulations. However, a quantitative analysis of hospital financing could not be conducted, as both hospitals declined to grant access or disclose their financial data. This study found that no special incentives were given to the DOTS TB Team or those offering TB care. This is consistent with studies conducted by Pradipta *et al.* (2022), which suggests that employees who operate in settings with a high risk of transmission should be paid more [35]. Furthermore, TB service units had not received guidelines or standard operating procedures, potentially compromising treatment outcomes and disrupting the service delivery system. Treatment outcomes may suffer as a result, and the care system may be hindered. The implementation of TB has not been carried out to its full potential due to the lack of commitment from policy makers and service implementers. Therefore, hospital administrators play a critical role in enhancing TB care in hospitals by establishing hospital policies and providing complete support for TB DOTS services in accordance with national standards [32].

By integrating the QTSA in conjunction with the HQHS framework, this study offers important insights into the quality of TB care in both public and private hospitals. The study provides a thorough understanding of the structural, process, and outcome-related elements influencing the success of TB therapy by using a mixed-method approach that includes both quantitative and qualitative data. The results are strengthened by the inclusion of viewpoints from patients, stakeholders, and healthcare professionals. However, several limitations should be noted. The study was conducted in only two hospitals in a single regency, which may limit the generalizability of the results to other regions or health system contexts. Furthermore, while the study highlighted important obstacles in TB service delivery, it did not measure long-term patient adherence or post-treatment outcomes beyond the hospital context. Future research is recommended to address these gaps by employing larger, more diverse samples, and incorporating longitudinal follow-up.

Conclusion

Low success rates in TB treatment are attributed to deficiencies in foundational components and suboptimal treatment processes. These shortcomings contribute to increased loss to follow-up, inadequate patient evaluation, higher mortality, and reduced patient satisfaction. The findings of this study highlight that positive patient experiences and access to follow-up care significantly influence patient satisfaction. Nevertheless, improvements are required in several foundational aspects of TB service delivery, particularly in the dissemination of TB service policies, the strengthening of internal and external networks, and the allocation of funding for TB control programs. On a positive note, the hospitals benefit from skilled medical personnel and the availability of advanced diagnostic and therapeutic tools, which support the effective diagnosis and management of both pulmonary and extrapulmonary TB, as well as associated comorbidities.

Ethics approval

Ethical Approval and consent to participate: Ethical clearance was obtained from the IRB at Research Ethics and Community Health Service Commission, Universitas Indonesia, Indonesia (808/UN2.F10.D11/PPM.00.02/2023), and all questionnaires and interviews were performed following individual written informed consent. Informed consent for participants aged 15 to 17 was obtained from their parents or legal guardians before their participation in the study.

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Competing interests

All the authors declare that there are no conflicts of interest.

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Underlying data

Research instruments and all data generated during this study are available from: <https://figshare.com/s/4aee21ec00729aa20792>.

Declaration of artificial intelligence use

This study used artificial intelligence (AI) tool, ChatGPT, in manuscript writing support including language refinement (improving grammar, sentence structure, and manuscript readability) and technical writing assistance (providing suggestions for structuring complex technical descriptions more effectively). We confirm that all AI-assisted processes were critically reviewed by the authors to ensure the integrity and reliability of the results. The final decisions and interpretations presented in this article were solely made by the authors.

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