

Available online at www.ijournalse.org

Emerging Science Journal

(ISSN: 2610-9182)

Vol. 9, No. 1, February, 2025



Development and Testing of a Patient Outcome Measure for Interprofessional Tuberculosis Care: A Delphi Study

Bau D. Ardyansyah ^{1, 2, 3}*, Reinie Cordier ^{1, 4, 5}, Margo Brewer ¹, Dave Parsons ^{1, 6}

¹ Curtin School of Allied Health, Faculty of Health Sciences, Curtin University, Perth, Australia.

² Department of Medical Education, Faculty of Medicine, Hasanuddin University, Makassar, Indonesia.

³ Hasanuddin University Hospital, Makassar, Indonesia.

⁴ Department of Social Work, Education and Community Wellbeing, Faculty of Health & Life Sciences, Northumbria University, Newcastle upon the Tyne, United Kingdom.

⁵ Department of Health & Rehabilitation Sciences, Faculty of Health Sciences, University of Cape Town, Cape Town, South Africa.

⁶ St John of God Public and Private Hospitals Midland, Perth, Australia.

Abstract

Background: A chronic medical condition such as tuberculosis can be physically and emotionally challenging for both health practitioners and patients and their families. Tuberculosis requires a team-based care model that provides resilience and coordinated work, such as the one offered by an interprofessional collaborative practice team. Despite the increasing interest in interprofessionalbased care globally, there is a notable lack of measures to assess patient impact. We aimed to develop a patient outcome measure to quantify the functional impact of interprofessional care on tuberculosis patients. Methods: The study involved four phases: 1) developing a conceptual framework and creating items, 2) evaluating the construct through Delphi studies to obtain international consensus, 3) back-to-back translation into Indonesian, and 4) re-evaluating the construct with Delphi study to obtain Indonesian consensus. The consensus was reached if the Content Validity Index covers at least 70% agreement from experts, an interquartile range <1, and a median score of 4 or 5 on a 5point Likert-type scale. The COnsensus-based Standards for the Selection of Health Measurement INstruments (COSMIN) guidelines were used to assess item relevance, comprehensibility, and comprehensiveness. Results: A total of 65 international and 61 Indonesian participants in the Delphi studies. The final instrument consists of 44 items organized into five domains. All items were relevant to the construct being measured and deemed understandable, and significant concerns related to TB care were comprehensively addressed in the instrument. Conclusion: The findings indicate that the instrument content validity was good, fulfilling COSMIN requirements for items' relevance, comprehensibility, and comprehensiveness.

Keywords:

Interprofessional Education; Interprofessional Practice; Content Validity; Tuberculosis Care; Patient Outcome Measure.

Article History:

Received:	29	August	2024
Revised:	16	December	2024
Accepted:	21	December	2024
Published:	01	February	2025

1- Introduction

Tuberculosis (TB) is the leading infectious cause of death worldwide. In 2021, the World Health Organization (WHO) reported that approximately 1.6 million people died from TB and TB-related diseases, underscoring the disease's severe public health impact. More than 10 million people contract TB annually, with India, Indonesia, Myanmar, and the Philippines identified as the four countries most heavily affected [1]. Indonesia ranks second globally in terms of new

^{*} CONTACT: bardyansyah@med.unhas.ac.id

DOI: http://dx.doi.org/10.28991/ESJ-2025-09-01-08

^{© 2025} by the authors. Licensee ESJ, Italy. This is an open access article under the terms and conditions of the Creative Commons Attribution (CC-BY) license (https://creativecommons.org/licenses/by/4.0/).

TB cases, primarily due to its dense population and high prevalence rate, contributing significantly to the global TB burden [2-4]. In recent years, the escalating number of newly diagnosed infections and multi-drug-resistant TB cases has raised concerns about the quality of implementation of the current TB management [5]. Despite high diagnostic rates, a significant portion of TB cases may remain undiagnosed, attributed to an inadequate identification system, lack of awareness among healthcare practitioners regarding the TB program, and ineffective referral processes. Additionally, patients often hesitate to seek treatment due to various barriers, highlighting the need for a strategic response to these challenges [1].

To enhance TB management, there is an urgent need to bridge gaps in case prevention, detection, and access to quality treatment [1]. Effective collaboration among healthcare providers is essential for driving system-wide improvements in TB care [1, 6]. Given the physical and emotional challenges associated with treating TB, a complex chronic disease such as TB demands a team-based care model, which not only benefits patients but also supports health practitioners. Fostering resilience and promoting coordinated teamwork is key to ensuring sustainable, high-quality care for both patients and healthcare providers [1, 6]. Furthermore, TB is a multifactorial disease that often requires a comprehensive approach involving various healthcare professionals, including physicians, nurses, social workers, and public health officials. Effective management demands coordination among these providers to address both clinical treatment and social determinants of health [1]. An interprofessional outcome measure is proposed to facilitate this integration, ensuring that all aspects of patient care are addressed. In 2010, the World Health Organization (WHO) launched an initiative to transform the health workforce. This initiative focused on strengthening and improving health systems by promoting team-based care through an interprofessional approach, including in the context of TB care. An interprofessional approach enhances coordination among healthcare providers, each contributing their unique expertise to create a comprehensive treatment plan [6].

Despite the growing attention to interprofessional collaborative practice in various countries, measuring their impact on patient outcomes remains a significant challenge, with limited studies documenting such effects [7-13]. This lack of research is compounded by the lack of valid measures [11, 14, 15]. There is a pressing need for more evidence linking interprofessional collaborative practice with improved patient outcomes [12, 13, 16, 17].

Traditional TB outcome measures often focus narrowly on clinical endpoints based on microbiological indicators (negative smear/culture), successful completion of treatment, reduction in symptoms, weight gain, or increased appetite [18]. Rather than relying solely on these clinical assessments to determine patient outcomes, more holistic quality-of-life scales are being developed that combine various domains related to the patient's physical, social, psychological, economic, and spiritual well-being [15, 19]. Given calls for greater interprofessional collaborative practice for successful TB care, these outcome scales must include a measure of an interprofessional approach to TB patient care [1, 6].

1-1-Instrument Constructs

This study aimed to develop an instrument to measure the impact of an interprofessional approach to TB care on patients from their perspective. The proposed framework combines the following two concepts: *interprofessional collaborative practice* (IPCP) and *TB care*. Concepts related to IPCP draw on literature from four areas: *Interprofessional Education Collaborative (IPEC) Core Competencies for Interprofessional Collaborative Practice* [20], *Canadian Interprofessional Health Collaborative National Interprofessional Competency Framework* [21], *Curtin University Interprofessional Capability Framework* [22], *and WHO Framework for Action on Interprofessional Education and Collaborative Practice* [6]. The second concept regarding TB care was developed based on the growing literature on concepts that define TB care success, particularly the WHO Report on Adherence to Long-term Therapies: Evidence for Action [23]. In addition, relevant literature related to *patient engagement* [24], *patient safety* [25], and guides on *multi-professional care* [26] were also referenced.

The transition from professionalism to inter-professionalism has emphasized the importance of coordination and cooperation between healthcare professionals [27]. Over the past decades, interprofessional collaboration has been increasingly studied, leading to various definitions that depend on context and author perspective. For this study, the WHO's definition is adopted: Collaborative practice is an inter-professional process that integrates separate and shared knowledge and skills from various care providers, working with patients, families, and communities to provide high-quality care, ultimately enhancing patient care [6]. This concept is rooted in social phenomena like communication, decision-making, and collaborative knowledge exchange. While these elements are essential to optimizing patient care, they represent latent variables (i.e., factors that influence outcomes but cannot be directly measured). For practical application, these latent variables are assessed through observable indicators that provide insight into the effectiveness of collaborative practice and the development of the measure.

The core components of collaborative practice, communication, and collaboration are the primary latent variables influencing interprofessional care outcomes [28, 29]. These variables are critical in shaping the success of

interprofessional teams and patient outcomes. The *communication* variable encompasses several sub-domains, including *communication skills* [30], *communication and information exchange* [31], and *communication and teamwork* [32]. Effective communication within a team is not just about transmitting information but about creating a collaborative atmosphere where shared decision-making can thrive. Similarly, *collaboration* is a broad construct involving *team functioning* [28], *team working* [33], *interprofessional collaboration* [34], and *interprofessional interaction* [32]. These subdomains of collaboration directly affect healthcare teams' ability to deliver comprehensive, patient-centered care. Effective teamwork and interprofessional collaboration are vital for ensuring that care providers work cohesively towards common patient outcomes [28, 29].

Beyond communication and collaboration, other variables considered in the literature include the role or scope of practice of professionals, such as *understanding the value and contribution of professionals/other professions* [35], *professional roles* [36], *roles and responsibilities* [28, 29], *general role responsibilities and autonomy* [31], and *role understanding* [30]. Outcome measures highlight the importance of recognizing the value of each profession's contributions and how this understanding shapes team dynamics and decision-making [35, 36]. Role clarity and autonomy are crucial for reducing role conflict and enhancing interprofessional collaboration [31]. Additionally, resolving conflicts and differences in perspectives is often necessary to maintain harmonious team functioning. Measures related to *conflict management, decision-making, team ethics, values, and respect* are often used to assess how well interprofessional teams manage disagreements, which can directly affect team performance and patient care [30-32].

In addition to the variables outlined above, a much smaller number of measures mention variables related to patient care. This variable is typically expressed as *a collaborative approach centered on the patient/client family* [28], *patient involvement* [31], and *patient empowerment* [30]. The ultimate goal of collaborative practice is to improve patient care [6]. While many instruments focus on communication, collaboration, and role understanding, fewer measures address the patient-related outcomes that are central to collaborative practice. However, those who highlight the importance of a patient-centred approach involve the patient and their family in decision-making processes and empower patients to participate actively in their care [13, 30, 37, 38]. Interprofessional collaboration is most effective when it focuses on holistic, patient-centred care. Yet, the limited inclusion of patient-specific variables in many outcome measures poses a challenge in fully capturing the impact of collaborative practice on patient outcomes [10, 13, 17, 38].

One of the significant challenges in evaluating the success of collaborative practice lies in the indirect measurement of latent variables such as communication and collaboration. Since these variables are complex and context-dependent, measuring them through observable variables—such as teamwork skills, role clarity, and conflict resolution—is essential but highly challenging to interpret. Furthermore, while many instruments focus on improving health practitioners' attitudes and collaborative behaviors, i.e., Kirkpatrick's modified model of learning outcome level 2 to 3 [36] or team functioning, fewer are designed to assess patient-related outcomes (level 4b) directly, making it difficult to ascertain the full impact of interprofessional collaboration on patient care [10, 13, 17, 38].

1-2-Objectives

This study aimed to develop and test a patient outcome measure for interprofessional TB care, which can be used to quantify the quality and functional impact of an interprofessional model of TB care on the patient as perceived by that patient. This study was conducted in four key phases to achieve this goal: (a) Development of a conceptual framework for the instrument and the creation of items. This process identifies existing gaps in the literature, informs the item development process, and ensures that the items are aligned with the theoretical foundations of the framework; (b) Testing the instrument through a Delphi study to obtain international participants' consensus regarding the components to be included in the measure; (c) Back-to-back translation into Indonesian; and (d) Testing the instrument with a second Delphi study to obtain consensus from Indonesian participants.

2- Research Methodology

2-1-Study Design

This research used a mixed-methods approach that quantifies closed responses into values that can be ranked and compared and allows for the exploration of narrative responses to describe perceptions beyond the limitations of numbers. The stages of the Delphi series involving international and Indonesian participants, interspersed with massive translational work activities, represent the process's rigor and the desire to produce an instrument with robust psychometric properties.

The Delphi study methodology was chosen as it allowed the experts to provide extensive input anonymously but in a controlled and structured manner [39, 40]. The Delphi study with international participants was conducted between May

and October 2023. Delphi with Indonesian participants was conducted between January and February 2024. The overall study procedures, including instrument development requirements for data collection, analysis, and reporting, followed the **CO**nsensus-based **Standards** for the selection of health **M**easurement **IN**struments (**COSMIN**) taxonomy and standards of content validity checks and translations [40-42]. The study procedure is outlined in Figure 1.



Figure 1. Study procedures

The number of Delphi rounds depends on when experts reach a consensus; however, two or three Delphi rounds are the most common [39]. In this study, the international participants were involved in the first two rounds of the Delphi study (similar set of participants) to capture key information related to TB care globally, while the experts from Indonesia were involved in the final stage to ensure the specific practices aligned with TB care in Indonesia. Findings from the Delphi studies were used to evaluate the instrument's content validity and inform the development of the final measure.

Each participant was provided with a personalised link to an online Qualtrics survey [43]. At the start of the survey, information was provided regarding how to provide their consent, details of the study, links to further readings according to participants' interests, and an explanation of how consensus would be achieved. A feedback report was provided in the next round, including response percentages, arguments, and results for all items from the previous round. Participants were able to withdraw at any time during the survey. All information was anonymous. The first Delphi with international participants and the Delphi with Indonesian participants included questions with closed and open response options; the second round with international participants mainly consisted of closed questions.

The survey questions were organised into three sections [41]. The first section asked participants to rate the *items'* relevance to the outcome measure. The second section asked them to rate the *items'* comprehensibility (i.e., to assess whether each item's meaning was easily understood). Both sections used a 5-point Likert scale (1= strongly disagree, 2=disagree, 3=neither agree nor disagree, 4=agree, 5=strongly agree). The third section asked participants to provide

an opinion on *the comprehensiveness* of the items in each domain by inviting them to suggest any additional item(s) they felt were needed. Experts who answered *disagree* or *strongly disagree* with questions about comprehensibility were invited to provide their reasoning and alternative wording for the respective items. The first author of this study facilitated the Delphi in collaboration with all other authors. Findings from each Delphi were discussed, analysed and reported with the agreement of all authors before being presented for the next Delphi round. Aligned with the COSMIN requirements, all authors were involved in preparing and discussing Delphi questionnaires and made final decisions related to issues identified after the Delphi studies.

2-2-Participants and Recruitment

Expert participants considered actively involved in TB care and management in countries with high TB burden in Asia [1], but not limited to Asia, were identified through official portals of universities, hospitals, and government and non-government institutions. Identification was also extended to researchers who published articles on TB team care in a hospital or community-based service in the previously mentioned countries. Participants who consented and members of the research team were also asked to identify other potential participants from their professional network. Once identified, potential participants were invited to engage in the study via email with an information sheet.

Health professionals with different areas of expertise in the construct and population of interest were targeted [40]. In particular, clinicians with experience in TB care and/or interprofessional approaches to care and professionals, academics, and researchers are actively involved in TB education, management, and control. A minimum of five relevant health professions with >50 sample sizes (for COSMIN, a *very good* size) were targeted [40]. The criteria of international participants to be eligible in the Delphi study were: 1) sufficient English skills to understand the main points, technical terms, and study purposes; 2) at least one year of experience caring for TB patients in a hospital or community-based clinic, as professional role identity is believed to begin developing with at least six months to one year of clinical exposure [44]; 3) a health professional of any clinical background with experience working in a team that consisted of at least two health professions, given that IPCP requires a team to consist of at least two different health professions [6]. Criteria 2 and 3 were also applied to the eligibility of the Indonesian participants.

2-3-Translation

Translation procedures followed COSMIN guidelines [41] and WHO standards [45]. Four translators were used in total. Two forward translators who were native Indonesian speakers translated the instrument from English to Indonesian. One was a medical professional with a postgraduate degree from an English-speaking country and, therefore, was familiar with the terminology and content of the instrument. The other was a nationally certified translator and Fédération Internationale des Traducteurs member without a health professional background. Two backward translators, native English speakers, translated the instrument back into English. Both backward translators were fluent in Indonesian and had doctoral degrees from Indonesian universities, one of which was in English Education. To maintain the original constructs of the instrument, translators were encouraged to emphasize conceptual equivalence rather than a literal word-for-word translation of each item [45].

The translation process began with the forward translators working independently and then jointly to reach a consensus on words or statements where there was disagreement. The agreed Indonesian translation was sent to the backward translators, who worked independently and jointly to resolve any disagreements. Several review meetings were held involving the research team with the forward or backward translators, and meetings involving the four translators were held for final verification.

2-4-Data Analysis

Quantitative and qualitative approaches were used to analyze participants' responses. Quantitative responses were imported and analyzed using the Statistical Package for the Social Sciences (SPSS) v26 [46]. Consensus criteria were defined in the information sheets; consensus was reached with a Content Validity Index (CVI) or agreement score of at least 70% of the experts selected who *agree* or *strongly agree* with an interquartile range [IQR] of ≤ 1 and a median score of 4 or 5 on a 5-point Likert-type scale [47]. Items with less than a 70% agreement score on *relevance* were removed from the instrument.

Qualitative responses from open-ended questions related to *comprehensibility* were analyzed with content analysis [48] before deciding whether to reword or reorganize the item into a different domain. Responses related to the instrument's *comprehensiveness* were analyzed using content analysis [48], where responses were grouped into themes and potential new items were identified based on the participants' feedback. Decisions regarding qualitative responses involved all authors and were used to inform item rewording, domain reorganization, and item addition.

3- Results

Key constructs regarding interprofessional TB care were synthesized and categorized into themes, resulting in several instrument constructs used to generate domains. The five domains were *patient-centered care, team collaboration, team communication, respect and ethics,* and *health awareness.* Items were developed based on relevant literature and the authors' expert opinion to ensure each domain was represented by items appropriate to the construct to be measured. The instrument conceptual framework is provided in Figure 2.



Figure 2. Conceptual Framework

3-1-Delphi Participants

As outlined previously, the Delphi study was organised in two phases. Phase Two involved international participants (two rounds), and Phase Four involved Indonesian participants (one round). Delphi Round 1 involved 65 international experts; however, three participants completed less than 50% of the survey, so their responses were not included (response rate 95.4% [62/65]. A total of 56 of these international experts participated in Round 2 (response rate = 90.3% [56/62]). In Phase 4, 61 Indonesian participants provided their consent for participation, 55 of whom completed the survey (response rate 90.2% [55/61]. Participant demographics are represented in Table 1.

Background information collected on participants included age, gender, country of residence, professional background, area of expertise, educational level, and years of experience in TB care. Across the Delphi series, the two professions most frequently involved were medical doctors (31.8%) and nurses (26.6%). The majority of participants had completed postgraduate studies (57.2%) at a Master's (29.5%) or PhD (27.7%) level. Hospitals were the primary practice setting for most participants (59.5%). Length of experience directly caring for TB patients varied; the largest was 29.5%, who reported having worked for 3-5 years, and 43.4% of participants had more than five years of experience. International participants were mainly from Asia, namely Bangladesh (47.5%) and India (40.7). A small cohort was from Australia (7.6%), with another group (4.2%) from Solomon Island, South Africa and the United States.

Indonesian **International Participants** Participants **Round One Round Two Round One** n=55 Number of participants n=62 n=56 **Demographics** Frequency (%) Frequency (%) Frequency (%) Residentials 54 (87%, 2) 51 (91%, 2); Asia (Participants; Countries) (Bangladesh [n=29]; India [n=24]) (Bangladesh [n=27]; India [n=24]) 8 (13%; 4), (Australia [n=5]; 5 (9%; 4) (Australia, [n=4]; Non-Asia (Participants; Countries) South Africa [n=1]; Solomon Solomon Island [n=1]) Island [n=1]; United States [n=1]) Highest qualification Bachelor 34 (54.8%) 30 (53.6%) 10 (18.2%) Master 20 (32.3%) 18 (32.1%) 13 (23.6%) PhD (with/without clinical specialisation) 8 (12.9%) 32 (58.2%) 8 (14.3%) Profession Medical Doctor 17 (27.4%) 15 (26.8%) 23 (41.8%) Nurse 17 (27.4%) 17 (30.4%) 12 (21.8%) Social workers 9 (14.5%) 8 (14.3%) 0(0%)Public health expert 4 (7.3%) 8 (12.9%) 6 (10.7%) Nutritionist 3 (4.8%) 3 (5.4%) 0 (0%) Occupational therapist 2 (3.2%) 2 (3.5%) 0 (0%) Pharmacist 2 (3.2%) 2 (3.6%) 7 (12.7%) Psychologist 2 (3.6%) 2 (3.2%) 2(3.6%)Other allied healthcare professionals 2 (3.2%) 1 (1.8%) 0(0%)Midwife 3 (5.5%) 0 (0%) 0(0%)Physiotherapist 0 (0%) 0 (0%) 2 (3.6%) Dentist 0 (0%) 0 (0%) 2 (3.6%) Practice setting (Primary) Hospital 39 (62.9%) 28 (50.9%) 36 (64.3%) University/Education sector 9 (14.5%) 9 (16.1%) 16 (29.1%) Private practice 7 (11.3%) 7 (12.5%) 1 (1.8%) Others1 4 (6.5%) 2 (3.6%) 5 (9.1%) Community health centre 3 (4.8%) 2 (3.6%) 5 (9.1%) Years of experience (TB patient care-related experience) 14 (22.6%) 1-2 years 14 (25.0%) 13(22.0%)3-5 years 19 (30.6%) 17 (30.4%) 15 (25.4%) 6-10 years 10 (16.1%) 8 (14.3%) 8 (13.6%) 11-15 years 8 (12.9%) 8 (14.3%) 7 (11.9%) 16-20 years 6 (9.7%) 6 (10.7%) 2 (3.4%) 21-30 years 3 (4.8%) 1 (1.8%) 3 (5.1%) Over 30 years 2 (3.2%) 2 (3.6%) 1 (1.7%) No direct contact with TB patients² 0 (0%) 0(0%)8 (13.6%)

Table 1. Participants demographics

Notes: ¹ non-government organisation, Ministry/Department of Health, TB consultant; ²Actively involved in teaching related to TB prevention, detection, and therapy at universities; providing consultation and education regarding TB for NGOs, involved in regional and national policy-making regarding TB management in their respective country

3-2-Delphi Round 1: International Participants

As outlined earlier, the Delphi involved two rounds with international participants followed by back-to-back translation and the process was completed with one Delphi round with Indonesian participants. The quantitative and qualitative results for the three rounds are described below. A separate thematic analysis of the qualitative comments across all three rounds is provided to assist in contextualizing the findings from the Delphi rounds.

The Delphi's first round with international participants consisted of three sections. Participants were asked to rate the relevance of the item for inclusion, the comprehensibility of the items for clarity of understanding, and the comprehensiveness of items in representing the construct intended to be measured in a domain. Round 1 included 50 items related to the interprofessional approach to TB care. The items were classified into six domains: *patient-centered care* (n=4 items); *patient involvement* (n=8 items); *team collaboration* (n=8 items); *team communication* (n=5 items); *respectful and ethical* (n=10 items); and *health awareness* (n=15 items). A total of 39 items (78%) reached consensus for acceptance without revision. These items meet the criteria for percentage agreement > 70% and IQR ≤ 1 for responses related to item relevance and comprehensibility. Three items were reworded to improve clarity and avoid confusion when responding to the questions and presented again in Round 2.

Five items, 'Important issues asked at each visit/appointment', 'Important issues as highest priority', 'Active participation in care decision', 'Team membership', and 'Alternative treatment methods', although deemed relevant, clear and understandable (>70% agreement score on relevance and comprehensibility), were reviewed by the author panel based on participants' open-ended responses. All five items were determined to be redundant, so they were excluded from the instrument. Two items, 'High-risk people' and 'Material support', were removed as they were not considered relevant for a patient outcome measure of interprofessional TB care by participants (<70% agreement score). Furthermore, based on participants' feedback concerning the comprehensiveness of the instrument, one item was added, 'Treatment plan changes based on family/caregiver feedback'. Based on participants' feedback, the item, 'Coordination of appointments to meet multiple practitioners', was deemed conceptually better connected to *Team Collaboration* rather than '*Team Communication*'; this change was made for Round 2.

Three of the seven items removed were part of the *Patient-Centered Care* domain (previously n=4 items), leaving only one item for this domain. Single-item measures are poor representations of a construct [49]. In addition, the domains of *Patient-Centered care* and *Patient Involvement* essentially stem from the central pillar of the construct (see Fig. 2). As a result, the conceptual structure of the domains was modified with the *Patient-Centered Care* (n=1 item) and *Patient Involvement* (n=8 items) domains combined into one domain, *Patient-Centered Care*. Given the addition of the item 'Treatment plan changes based on family/caregiver feedback' to patient care (as outlined above), this domain included ten items in the revised instrument.

3-3-Delphi Round 2: International Participants

The first section in Round 2 asked participants to rate their agreement with three revised items on relevance and comprehensibility, using the same 5-point Likert scale. The second section asked participants to identify the relevance and comprehensibility of one new item ('*Treatment plan changes based on family/caregiver feedback'*) and whether this new item was redundant given the other items in that domain. Those who rated this new item as redundant were then asked to indicate whether they preferred this new item or a related item previously approved in Round 1 ('*Inclusion of family/caregiver in care planning'*). The third section asked participants to rate their agreement on including the item '*Coordination of appointments to meet multiple practitioners'* under the domain *Team Collaboration* rather than *Team Communication*. No questions related to *comprehensiveness* were asked in this second round.

The three revised items received > 70% agreement and IQR \leq 1 on relevance and comprehensibility. The newly added item, 'Treatment plan changes based on family/caregiver feedback', reached consensus for inclusion (>70% agreement on relevance and comprehensibility); the item was not considered redundant by 75% of participants. The item 'Coordination of appointments to meet multiple practitioners' was identified by 89.3% of participants as being better classified under the domain *Team Collaboration*.

Following the Delphi surveys with the international participants, a total of 44 items were classified into five domains for inclusion in the instrument (*Patient-centered Care* [n=10 items]; *Team Collaboration* [n=8 items]; *Team Communication* [n=4 items]; *Respectful and Ethical* [n=9 items]; and *Health Awareness* [n=13 items]). The items were translated to Bahasa Indonesia (see Table 2 for the overview of agreement ratings and item decisions for Rounds 1 and 2 with international participants).

3-4-Back-to-Back Translation

The 44 items that reached consensus following the Delphi rounds were translated into Indonesian. Of these, a total of 33 items showed absolute similarity in terms of word choice and grammar structure and were, therefore, equivalent in meaning. The remaining 11 items used different word choices and grammatical arrangements, which were considered to have the potential to influence meaning and produce items that were not conceptually equivalent to the original version. These items were returned to the forward-translators for review and the backward-translators for suggestions. A final two-hour consensus meeting was held involving the four translators and the lead author to reach an agreement.

The issues discussed mainly concerned ensuring items were conceptually equivalent rather than a literal word-forword translation [40, 45]. The instrument being developed was a guided measure, with health workers assisting patients in completing it. Therefore, because the target users of this instrument were patients with various levels of health literacy, translators were encouraged to adopt language (words and sentences) that are commonly used.

Table 2. Agreement Ratings and Items Decisions

		International Participants			ticipants		Indonesian Participants			
Domains	Variables	Relevance Compre		Comprehe	prehensibility Decision		Relevance		Comprehensibility	
		% Agreement	Median (IQR)	% Agreement	Median (IQR)	inclusion	% Agreement	Median (IQR)	% Agreement	Median (IQR)
	Main issues with TB identified at each visit/appointment	82.3	5 (1)	88.7	5 (1)	Round 1	94.6	5 (0)	89.1	5 (1)
	Treatment plan can be adapted to current need	85.5	5 (1)	87.1	5 (1)	Round 1	81.8	5 (1)	90.9	5 (1)
	Focus care on most important issues	95.2	5 (1)	93.5	5 (1)	Round 1	98.2	5 (0)	90.9	5 (1)
	Meet with team members*	94.6	5 (0)	94.6	5 (0)	Round 2	96.4	5 (0)	94.6	5 (0)
Patient-centred	Relevant information shared	91.9	5 (1)	88.7	5 (1)	Round 1	98.2	5 (0)	90.9	5 (0)
Care	Inclusion in one's own care planning	88.7	5 (1)	91.9	5 (1)	Round 1	96.4	5 (0)	96.4	5 (0)
	Inclusion of family/caregiver in care planning	95.2	5 (1)	91.9	5 (1)	Round 1	98.2	5 (0)	96.4	5 (1)
	Encouragement to participate when evaluating care	90.3	5 (1)	93.5	5 (1)	Round 1	98.2	5 (1)	94.6	5 (1)
	Treatment plan changes based on patient feedback	85.5	5 (1)	93.5	5 (1)	Round 1	94.6	5 (1)	94.6	5 (1)
	Treatment plan changes based on family/caregiver feedback**	72.1	5 (2)	78.6	5 (1)	Round 2	89.1	5 (1)	92.7	5 (1)
	Coordination of appointments to meet multiple practitioners***	82.3	5 (1)	85.5	5 (1)	Round 2	89.1	5 (0)	89.1	5 (0)
	Providing care as a team	88.7	5 (1)	90.3	5 (1)	Round 1	98.2	5 (0)	96.4	5 (0)
	Team knowledge and skill	90.3	5 (1)	90.3	5 (1)	Round 1	98.2	5 (0)	96.4	5 (0)
Team	Clear roles and responsibilities	93.5	5 (1)	96.8	5 (1)	Round 1	98.2	5 (0)	98.2	5 (0)
Collaboration	Respect of roles and expertise	90.3	5 (1)	90.3	5 (1)	Round 1	98.2	5 (0)	98.2	5 (0)
	Constraint to roles and responsibilities	93.5	5 (1)	91.9	5 (1)	Round 1	94.5	5 (0)	96.4	5 (0)
	Being respectful to each other	96.8	5 (0)	91.9	5 (0)	Round 1	100.0	5 (0)	100.0	5 (0)
	Enjoy working as a team	93.5	5 (1)	95.2	5 (1)	Round 1	96.4	5 (0)	98.2	5 (0)
	Access to information needed	93.5	5 (1)	93.5	5 (1)	Round 1	94.5	5 (0)	90.9	5 (0)
Team	Team checks for understanding	90.3	5 (1)	93.5	5 (1)	Round 1	100	5 (0)	98.2	5 (0)
Communication	Communicating concerns to the team	87.1	5 (1)	88.7	5 (1)	Round 1	83.6	5 (1)	83.6	5 (0)
	Team understanding of care plan and goals	93.5	5 (1)	93.5	5 (1)	Round 1	98.2	5 (0)	90.9	5 (0)
	Request and share information respectfully	88.7	5 (1)	91.9	5 (1)	Round 1	98.2	5 (0)	94.5	5 (0)
	Being respectful to patient	98.4	5 (0)	96.8	5 (0)	Round 1	96.4	5 (0)	94.5	5 (0)
	Team listens to concerns	95.2	5 (0)	96.8	5 (0)	Round 1	98.2	5 (0)	100.0	5 (0)
	Non-judgmental manner	87.1	5 (1)	91.9	5 (1)	Round 1	100.0	5 (0)	96.4	5 (0)
Respectful &	Consent before treatment	96.8	5 (0)	88.7	5 (0)	Round 1	100.0	5 (0)	98.2	5 (0)
Ethical	Options regarding the costs of available medications	88.7	5(1)	83.9	5(1)	Round 1	92.7	5 (0)	96.4	5 (0)
	Options regarding available tests	91.9	5(1)	93.5	5(1)	Round 1	98.2	5 (0)	100.0	5 (0)
	Options to get medications best suits one's situation'*	92.9	4(1)	89.3	5(1)	Round 2	98.2	5 (0)	94.5	5 (0)
	Team communicating adverse event	96.8	5 (0)	90.3	5 (0)	Round 1	100.0	5 (0)	100.0	5 (0)
	Access to health service	93.5	5(1)	91.9	5(1)	Round 1	100.0	5 (0)	96.4	5 (0)
Health Awareness	The need to take medications as prescribed	98.4	5(1)	96.8	5(1)	Round 1	96.4	5(0)	96.4	5 (0)
	Understanding of medications	95.2	5(1)	96.8	5 (1)	Round 1	08.7	5 (0)	94.5	5 (0)
	Miss taking medications	95.2	5(1)	96.8	5(1)	Round 1	98.2	5(0)	100.0	5(0)
	Understanding of side effects of medications	90.3	5(1)	91.9	5(1)	Round 1	100.0	5(0)	98.2	5(0)
	Understanding of action to side effects of medication	87.1	5(1)	90.3	5(1)	Round 1	98.2	5(0)	96.4	5(0)
	Support and monitoring for medication adherence	91.9	5(1)	90.3	5(1)	Round 1	98.2	5(0)	92.7	5(0)
	Monitoring of treatment progress	88.7	5(1)	93.5	5(1)	Round 1	100.0	5(0)	98.2	5(0)
	Preventing others from being infected	90.3	5(1)	93.5	5(1)	Round 1	98.2	5 (0)	94.5	5 (0)
	Vaccination for tuberculosis	88.7	5(1)	88.7	5 (1)	Round 1	94.5	5 (0)	100.0	5 (0)
	The need for nutritious food	95.2	5 (0)	96.8	5(0)	Round 1	100.0	5(0)	100.0	5 (0)
	Counselling support	87.1	5(1)	95.2	5 (1)	Round 1	100.0	5 (0)	90.9	5 (0)
	Health education*	92.9	5 (0)	91.1	5 (0)	Round 2	100.0	5 (0)	90.9	5 (0)

Notes : IQR = Interquartile range.

*Items reworded based on participants' feedback on Round 1 and presented in Round 2 with international participants (n=3 items);

**Item added based on participants' feedback in Round 1 and presented in Round 2 with international participants (n=1 item);

***Item with domain reorganised, presented in Round 2 with international participants (n=1 item);

All Items presented in the table are included in the final measure (*n*=44 items)

3-5-Delphi One Round: Indonesian Participants

Indonesian participants were presented with 44 items written in Bahasa Indonesia, organized into five domains: Patient-centered Care (n=10 items); Team Collaboration (n=8 items); Team Communication (n=4 items); Respectful and Ethical (n=9 items); and Health Awareness (n=13 items). As with Delphi Round 1 with international participants, Indonesian participants were asked to assess the relevance of the items to be included, the comprehensibility of the items, and the comprehensibility of the items, all 44 items received >70% agreement (with IQR \leq 1 and median = 5, see Table 2), indicating that all items were considered relevant and supported the construct proposed by the instrument. These items, given by at most 5.1% of participants for related items. This input was conveyed in a panel meeting involving the translators and lead author. As a result, the words and sentences used were considered to be better represented by the existing words/sentences compared to the alternatives proposed by the participants. No changes have been made regarding the use of words and sentences. We received no feedback regarding the comprehensiveness of the instrument's coverage of all relevant constructs it was intended to measure. Participants' responses were deemed to have achieved a saturated agreement with one round of Delphi. A summary of the Delphi study findings across rounds is provided in Table 3.

Delphi Round	Domain	Initial Items	Final Items	Changes Made
1 International	Patient-Centered Care	4	1	3 items were deemed redundant and removed; 1 item was reviewed for rewording
	Patient Involvement	8	8	No changes; all items were accepted
	Team Collaboration	8	9	No changes; all items were accepted
	Team Communication	5	4	1 item was moved to Team Collaboration
	Respectful and Ethical	10	9	1 item was deemed redundant, and removed
	Health Awareness	15	13	2 items were deemed redundant, and removed
	Total Items	50	39	-
2 International	Patient-Centered Care	1 (revised)	10	1 revised item was accepted; 1 new item was added; and 8 items from the domain Patient Involvement were merged into this domain.
	Patient Involvement	8	0	All items merged to the domain Patient-Centred Care
	Team Collaboration	9	9	No changes; all items were accepted
	Team Communication	4	4	No changes; all items were accepted
	Respectful and Ethical	9	9	No changes; all items were accepted
	Health Awareness	13	13	No changes; all items were accepted
	Total Items	44	44	
Translation Process	Total Items	44	44	33 items reached consensus without revision by the translators; 11 items were reviewed for rewording
3 Indonesian	Patient-Centered Care	10	10	No changes; all items were accepted
	Team Collaboration	9	9	No changes; all items were accepted
	Team Communication	4	4	No changes; all items were accepted
	Respectful and Ethical	9	9	No changes; all items were accepted
	Health Awareness	13	13	No changes; all items were accepted
	Total Items	44	44	-

Table 3. Summary of Delphi Findings

3-6-Qualitative Findings: Potential Roles of Family/Caregivers

Content analysis of participants' narrative responses identified three main themes: 1) potential roles of family/caregivers, 2) ethical considerations in treatment options, and 3) factors impacting quality TB care.

The importance of patient involvement was explicitly addressed in the instrument by including items related to 'Inclusion in one's own care planning,' 'Encouragement to participate when evaluating care,' and 'Treatment plan changes based on patient feedback.'. In addition, recognition of the family/caregiver(s) role in care was confirmed with the item 'Inclusion of family/caregiver in care planning.'. Some participants found the above statement about the family/caregiver(s) role insufficient. The following quote supports this: "*Feedback from the support/caregiver should also be encouraged as they may provide further insight into behavior, adherence, substance use, and what their challenges are in supporting the patient.*".

The researchers used the feedback to create an item representing a relevant construct: 'Treatment plan changes based on family/caregiver feedback'. Given that a related item, 'Inclusion of family/caregiver in care planning,' had reached a consensus for inclusion in Round 1 with international participants, participants in Round 2 were asked to rate whether including both items was redundant. The participants were of the view both items should be included.

3-7-Qualitative Findings: Ethical Consideration in Treatment Options

The domain Respectful and Ethical included items related to 'Options regarding the costs of available medications,' 'Options regarding alternative treatment methods,' 'Options regarding available tests,' and 'Options to get medications that best suit one's situation.'. Some participants disagreed with the ethical aspect of providing options for alternative treatments, medicine, or available tests before deciding on the best approach for TB care. The following quote supports this: "There are sometimes meaningful options for diagnosis or its timing, but these are often limited, and decision-making is often illusory. I think it's important to offer real choices while avoiding decision theater".

Conversely, one participant expressed difficulty getting the medicine the patient needed despite available health services. The following quote supports this: "Sometimes there is a health service available, but the service does not include TB, so the medication will not be available from them."

Another participant raised an ethical dilemma related to offering medications to patients who refused to take them due to cultural beliefs. The following quote supports this: *"How to be ethical with a cultural or ethical dilemma arises, for example, a patient refuses medication due to cultural beliefs."* The researchers used the participants' feedback to remove an item related to 'Options regarding alternative treatment methods.'. The remaining items were included in the final measure.

3-8-Qualitative Findings: Factors Impacting Quality of TB Care

The items presented in the survey were organized to align with the flow in the conceptual framework (see Figure 2). As a result, the domain 'Health Awareness' was presented at the end of the survey. Participants identified several factors that they felt were important in determining the success of TB care. Consequently, most (57%) narrative texts in the health awareness domain questioned the absence of three aspects: 1) the role of monitoring/follow-up, 2) understanding of nutrition/food requirements, and 3) understanding of drug side effects. The following quote supports this: "Questions related to adverse drug reactions should be asked." After presenting the items related to 'Health Awareness,' participants stated that the instrument was comprehensive. The qualitative key findings are provided in Table 4.

Theme	Key Findings	Supporting Quotes
Potential Roles of Family/Caregivers	 Family/caregivers' involvement in care planning is crucial. Patients should be encouraged to provide feedback and participate in care decisions. Participants felt the role of caregivers was not adequately captured. A new item about treatment plan changes based on family/caregiver feedback was added. 	"Feedback from the support/caregiver should also be encouraged as they may provide further insight into behaviour, adherence, substance use and what their challenges are in supporting the patient." "How are you doing overall? How was your journey here? (questions to identify patient overall health and access to care) TB is more than a disease; it involves social and economic concerns and other acute or chronic illnesses that impact adherence, economic stability and social support)."
Ethical Considerations in Treatment	Ethical dilemmas arise when offering treatment options, such as alternative methods or medications.Concerns over cultural beliefs and patient autonomy in decision-making.	"How to be ethical when a cultural or ethical dilemma arises, for example, the patient refuses medication due to cultural beliefs." "Sometimes there is a health service available, but the service does not include TB, so the medication will not be available from them."
Factors Impacting Quality TB Care	 Monitoring/follow-up, nutrition/food requirements, and understanding drug side effects were seen as components needing to be strengthened in TB care assessment. Participants emphasised these as critical aspects for improving TB care quality. 	"Some more information related to follow-up should have been asked, i.e., follow-up investigations like culture reports." "There is a detailed, shared clinical record that has the history of my illness and treatment to date that is shared amongst the professionals."

Table 4. Summary of Qualitative Findings

4- Discussions

This study focuses on developing an instrument to measure the impact of interprofessional collaboration in tuberculosis (TB) care, specifically from the perspective of patients. The research addresses the need for an assessment tool that goes beyond traditional professional silos, capturing how interprofessional collaborative practice affects patient outcomes. This is particularly important in TB care, where a multi-faceted, patient-centered approach is essential for TB treatment adherence and successful long-term therapy outcomes. To facilitate the achievement of this goal, this study

aimed to develop and test a patient outcome measure for interprofessional TB care. The instrument attempts to capture most, if not all, of the complexity of TB treatment. This study represents an important step toward bridging the gap between research and practice involving two essential yet very complex fields of study: interprofessional collaborative practice [50] and TB care [1]; drawing on key interprofessional competency frameworks, such as the *Interprofessional Education Collaborative (IPEC) Core Competencies for Interprofessional Collaborative Practice* [20], *Canadian Interprofessional Health Collaborative National Interprofessional Competency Framework* [21], *Curtin University Interprofessional Capability Framework* [22], and WHO Framework for Action on Interprofessional Education and Collaborative Practice [6]. The authors also refer to literature on TB care success, patient engagement, and safety [23-26].

The instrument is intended to be completed by patients with practitioner(s) guidance, making both practitioners and patients the instrument's end users. Health practitioners' opinions are important in determining the quality of patient outcome measures [39, 47]. Hence, COSMIN's requirements for content validity extend to practitioner involvement in developing and evaluating the measurement properties. Professionals' opinions can ensure that the items included align with the constructs intended to be measured in the instrument and are consistent with the underlying theories, conceptual framework, and disease models [40].

COSMIN's requirements for content validity are fulfilled in this study by meeting four criteria. First, the surveys involved professionals from various relevant health disciplines, with a minimum of eight health disciplines being involved in each Delphi study. The sample population represented a group of qualified and experienced participants, with the majority having completed postgraduate studies (57.2%) and reported having over three years of experience working with TB patients (72.9%). Second, each item was tested on an appropriate number of professionals and thus fulfilled the '*very good*' COSMIN sample size requirement with > 50 participants completing each survey. Third, a widely recognised approach using Delphi surveys with standard consensus thresholds was used to analyse the data. Fourth, at least two researchers were involved in analysing the data. The findings from this study suggested that important concerns related to TB care were comprehensively addressed in the instrument. Furthermore, all items included were considered clear and relevant to the instrument.

4-1-Interprofessional-TB Constructs

This instrument validates previously established constructs identified as key principles of interprofessional care, including trust, collaboration, communication, shared understanding of roles, and knowledge exchange among healthcare professionals, all of which contribute to improved patient outcomes [6, 21, 22, 30, 31]. This instrument also covers a domain, *patient-centered care*, which has never been explicitly included as a domain in instruments measuring interprofessional or TB patient outcomes. The primary aim of a patient-centred care approach is to empower patients to actively participate in decisions regarding their care [14, 22, 51]. The foundation used to develop this instrument is visualized in Figure 2, centering on patient involvement as the core focus. This approach is integral to interprofessional-based care, emphasizing that patient care holds true value only when carried out in the best interests of the patient and their families perceive the care they receive, is crucial [13, 38]. Many advanced tools have been developed to measure collaborative behavioral outcomes in interprofessional care [28, 30, 31, 37]. These instruments, which strongly focus on the key domain of patient involvement, underscore the significant role of patients in the collaborative care model. However, an important limitation of these tools is that their primary users are healthcare practitioners, not patients themselves. This raises the question of whether the tools genuinely capture the patient's voice or merely reflect the providers' perspectives.

While the principles behind this patient-centered care framework are well-defined, the instrument could benefit from incorporating more concrete, real-world examples that demonstrate how these theoretical concepts are applied in practice. For this reason, this newly developed instrument incorporates statements such as *the team including me in my care planning, the team making changes to my treatment plan based on my feedback,* or *the health practitioners focusing care on my most important issues.* Patient experiences regarding interprofessional care remain little studied [52]. Nonetheless, existing research shows that patients recognize the importance of their involvement in the care and care process and provide valuable feedback, which, in turn, can help caregivers develop a better understanding of them and the dynamics of the healthcare team [38, 52].

Throughout the construct validity process, the participants' responses to open-ended questions solidified the construct of patient-centered care proposed. Crucial constructs were confirmed, including patients being integral members of their care team, unlimited access to information as needed, and flexibility in treatment plans based on patient and family input; these constructs received strong reinforcement by the participants and were captured and included in the final construct of the instrument. Unfortunately, existing instruments related to TB patient outcomes or health-related quality of life do not prioritize patient involvement in their care as an essential outcome [15, 19, 53]. Consequently, there is no basis for comparison. In addition, it is important to note that most studies were conducted on patients, not with patients, highlighting the need for more inclusive instruments that engage patients as end users and involve them in the development process.

4-2-Strengths and Limitations

A key strength of this study is its robust, multi-step Delphi process, which involved international participants from different regions, followed by massive translational work for Indonesian participants. The Delphi rounds allowed the researchers to gather expert feedback on the proposed instrument items' relevance, clarity, and comprehensiveness [40, 41]. The Delphi study was chosen to meet COSMIN requirements on content validity, as this method allows a broader exploration of opinions, where participants can express their opinions anonymously and openly but in a controlled environment without feeling intimidated by other participants [39, 47].

This Delphi study resulted in a measure that can be used to assess the outcomes for TB patients after undergoing TB care with an interprofessional collaborative approach. The final measure comprised 44 items organized into five domains: *Patient-Centered Care* (*n*=10 items); *Team Collaboration* (*n*=8 items); *Team Communication* (*n*=4 items); *Respectful and Ethical* (*n*=9 items); and *Health Awareness* (*n*=13 items).

These domains reflect the core components of interprofessional collaborative practice while focusing on aspects most relevant to patient outcomes. Including domains like "Health Awareness" and "Respect and Ethics" is particularly notable as it highlights the ethical and cultural dimensions of TB care, which can often be overlooked in more traditional, disease-centered approaches.

Evaluation of the psychometric properties of the current measure is limited to content validity. A more detailed analysis of the instrument's remaining psychometric properties will be discussed after testing and validation in TB patients, which will be targeted in future research. The diversity of participants' professional backgrounds meets COSMIN's requirement to include as many relevant disciplines as possible in the research field of interest. However, the distribution was uneven, with medical doctors and nurses dominating the participant panel population. Conversely, this reflects the contextual circumstances, as these two professions comprise most of the health workforce [54] and, thus, are the leading contributors to TB care.

While the study provides a thorough and well-supported framework, there are inherent limitations. The focus on an international panel followed by Indonesian participants may not have fully accounted for regional variations in TB care practices, social structures, or healthcare system differences that could influence how patients in diverse settings experience collaborative care. Moreover, while the study emphasizes patient-centered care, the subjective nature of patient perspectives on interprofessional collaboration may vary widely across individuals, complicating the process of measuring these experiences. There may also be challenges in translating the instrument to other languages or contexts, especially if the TB healthcare workers are not familiar with the core concepts of interprofessional collaborative practice.

Future studies are needed to trial and validate this interprofessional TB care outcome instrument in patients to evaluate its psychometric properties using both classic test theory (CTT) and item response theory (IRT; Rasch analyses). The use of unvalidated measures in studies violates the principles of data reliability and validity [41, 42]. Measures that have not been validated can generate biased and inaccurate conclusions, the results of which cannot be generalized to represent the observed population. Some of the specific issues with unvalidated measures are that they limit the researcher's ability to draw clear conclusions and significantly hinder the interpretation and comparison of data [55, 56]; can alter the relationship with outcome variables, leading to an inadequate adjustment of treatment [57]; and generate inconclusive results, in which the causality of interventions and their impact on clinical therapy is complex to conclude with certainty [58, 59]. Unfortunately, many studies still use these unvalidated measures despite the well-established knowledge that they contravene evidence-based measurement [42, 55, 60]. COSMIN taxonomy and standards of psychometric properties [40-42] should be used to guide future analyses with patient participants, including evaluation of content validity regarding three aspects of items: relevance, comprehensibility, and comprehensiveness to ensure patients' voices are included in the instrument. The internal structure of the instruments (structural validity, internal consistency reliability, and cross- cultural validity/measurement invariance) and hypothesis testing for construct validity should also be evaluated. Finally, patients' responses before and after interprofessional TB care should be evaluated to determine the instrument's responsiveness to change.

5- Conclusion

Construct validity is crucial in developing and evaluating measurement tools, particularly in the context of interprofessional healthcare outcomes. In the case of tuberculosis (TB), an interprofessional TB outcome measure assesses the effectiveness of collaborative care strategies among diverse healthcare providers. This measure evaluates clinical outcomes and incorporates various dimensions of patient care, such as adherence to treatment, patient satisfaction, and acknowledgment of patient involvement in their care. Establishing construct validity involves demonstrating that the tool accurately reflects the theoretical concepts it intends to measure. For interprofessional tuberculosis care, this includes examining how well the outcome measure aligns with existing frameworks in TB treatment, healthcare collaboration, and patient-centered care.

This study presents the first step in developing and testing patient outcome measures for interprofessional TB care in Indonesia. This instrument consists of 44 items organized into five domains. The findings of this current study support COSMIN requirements regarding content validity; all items are relevant to the construct being measured, understandable, and comprehensive.

While communication and collaboration are foundational to successful interprofessional care, the challenge remains in adequately measuring these latent variables and linking them to patient outcomes. Outcome measures that focus on patient involvement, empowerment, and a collaborative approach to care are essential. Their limited inclusion in most measures underscores the difficulty in thoroughly evaluating the impact of collaborative practice on patient care. As collaborative practice continues to evolve, future research and outcome measures should aim to bridge these gaps and enhance the ability to assess both the process and the outcomes of interprofessional collaboration in healthcare. For the following process, instrument development will focus on validating the instrument in patients to evaluate its psychometric properties comprehensively. Through rigorous testing and validation processes, researchers can ensure that the measure effectively captures the complexities of TB management, facilitating improved communication and cooperation among healthcare professionals. Ultimately, a valid interprofessional tuberculosis outcome measure can enhance the quality of patient care, inform policy decisions, and guide future research in this critical area of public health.

6- Declarations

6-1-Author Contributions

Conceptualization, B.D.A., R.C., M.B., and D.P.; methodology, B.D.A., R.C., and M.B.; software, B.D.A. and R.C.; validation, B.D.A., R.C., M.B., and D.P.; formal analysis, B.D.A. and R.C.; investigation, B.D.A., R.C., M.B., and D.P.; resources, M.B. and D.P.; data curation, B.D.A.; writing—original draft preparation, B.D.A.; writing—review and editing, B.D.A., R.C., M.B., and D.P.; visualization, B.D.A., R.C., M.B., and D.P.; project administration, B.D.A.; funding acquisition, B.D.A. and R.C. All authors have read and agreed to the published version of the manuscript.

6-2-Data Availability Statement

The data presented in this study are available in the article.

6-3-Funding

The first author, a Ph.D. candidate, received funding from the Australia Awards and Curtin University Higher Research Degree scholarships. This manuscript is part of the first author's doctoral project. The other authors did not receive any funding for this manuscript.

6-4- Acknowledgements

We appreciate all participants who kindly volunteered their time and thoughts to contribute to this research.

6-5-Institutional Review Board Statement

Ethics approval for this study was obtained from the Curtin University Research Ethics Committee (HREC Approval number: HREC2021-0274) and the Medical Faculty of Hasanuddin University Ethics Board (Approval number: 170/UN4.6.4.5.31/PP36/2023).

6-6-Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

6-7- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

7- References

- WHO. (2022). Global Tuberculosis Report. World Health Organization (WHO), Rome, Italy. Available online: https://apps.who.int/iris/rest/bitstreams/1474924/retrieve (accessed on December 2024).
- [2] Mahendradhata, Y., Trisnantoro, L., Listyadewi, S., Soewondo, P., Marthias, T., Harimurti, P., & Prawira, J. (2017). The Republic of Indonesia health system review. Health Systems in Transition, WHO Regional Office for South-East Asia, New Delhi, India.
- [3] Directorate General of Prevention and Disease Control. (2022). Factsheet-Country-Profile-Indonesia-2022. Ministry of Health Republic of Indonesia, Jakarta, Indonesia. Available online: https://tbindonesia.or.id/wp-content/uploads/2023/02/Factsheet-Country-Profile-Indonesia-2022.pdf (accessed on December 2024).
- [4] Hafez, R., Harimurti, P., & Martin-Hughes, R. (2020). Tuberculosis in Indonesia: Epidemic Projections and Opportunities to Accelerate Control. World Bank, Washington, United States.
- [5] Mustikawati, D., Mahendradhata, Y., & Voskens, J. (2017). Breakthrough strategy for TB control in Indonesia. Handbook of Global Tuberculosis Control: Practices and Challenges, 2017, 47–59. doi:10.1007/978-1-4939-6667-7_5.

- [6] WHO. (2010). Framework for action on interprofessional education and collaborative practice. No. WHO/HRH/HPN/10.3, World Health Organization (WHO), Rome, Italy.
- [7] Hammick, M., Freeth, D., Koppel, I., Reeves, S., & Barr, H. (2007). A best evidence systematic review of interprofessional education: BEME Guide no. 9. Medical Teacher, 29(8), 735–751. doi:10.1080/01421590701682576.
- [8] Reeves, S., Perrier, L., Goldman, J., Freeth, D., & Zwarenstein, M. (2013). Interprofessional education: effects on professional practice and healthcare outcomes. Cochrane Database of Systematic Reviews, 3, CD002213. doi:10.1002/14651858.cd002213.pub3.
- [9] Oandasan, I., & Reeves, S. (2005). Key elements of interprofessional education. Part 2: Factors, processes and outcomes. Journal of Interprofessional Care, 19(Sup1), 39–48. doi:10.1080/13561820500081703.
- [10] Cox, M., Cuff, P., Brandt, B., Reeves, S., & Zierler, B. (2016). Measuring the impact of interprofessional education on collaborative practice and patient outcomes. Journal of Interprofessional Care, 30(1), 1–3. doi:10.3109/13561820.2015.1111052.
- [11] Oosterom, N., Floren, L. C., ten Cate, O., & Westerveld, H. E. (2019). A review of interprofessional training wards: Enhancing student learning and patient outcomes. Medical Teacher, 41(5), 547–554. doi:10.1080/0142159X.2018.1503410.
- [12] Reeves, S., Pelone, F., Harrison, R., Goldman, J., & Zwarenstein, M. (2017). Interprofessional collaboration to improve professional practice and healthcare outcomes. Cochrane Database of Systematic Reviews, 2017(6), CD000072. doi:10.1002/14651858.CD000072.pub3.
- [13] Shuyi, A. T., Zikki, L. Y. T., Mei Qi, A., & Koh Siew Lin, S. (2024). Effectiveness of interprofessional education for medical and nursing professionals and students on interprofessional educational outcomes: A systematic review. Nurse Education in Practice, 74, 103864. doi:10.1016/j.nepr.2023.103864.
- [14] Canadian Interprofessional Health Collaborative. (2012). An Inventory of Quantitative Tools Measuring Interprofessional Education and Collaborative Practice Outcomes. Canadian Interprofessional Health Collaborative, Ottawa, Canada. Available online: https://heller.brandeis.edu/relational-coordination/pdfs/canadian-interprofessional-health-collaborative-report.pdf (accessed in December 2024).
- [15] S Yasobant, S., Nazli Khatib, M., Syed, Z. Q., Gaidhane, A. M., Shah, H., Narkhede, K., Bhavsar, P., Patel, J., Sinha, A., Puwar, T., Saha, S., & Saxena, D. (2022). Health-Related Quality of Life (HRQoL) of Patients with Tuberculosis: A Review. Infectious Disease Reports, 14(4), 509–524. doi:10.3390/idr14040055.
- [16] Singh, C., Palladino, K. E., Karuza, J., Ampadu, L., & Fogarty, C. T. (2024). Opportunities and Challenges of Interprofessional Education: Postgraduate Nurse Practitioner and Physician Residency. Journal for Nurse Practitioners, 20(8). doi:10.1016/j.nurpra.2024.105086.
- [17] Cadet, T., Cusimano, J., McKearney, S., Honaker, J., O'Neal, C., Taheri, R., Uhley, V., Zhang, Y., Dreker, M., & Cohn, J. S. (2024). Describing the evidence linking interprofessional education interventions to improving the delivery of safe and effective patient care: a scoping review. Journal of Interprofessional Care, 38(3), 476–485. doi:10.1080/13561820.2023.2283119.
- [18] Aggarwal, A. (2010). Health-related quality of life: A neglected aspect of pulmonary tuberculosis. Lung India, 27(1), 1. doi:10.4103/0970-2113.59259.
- [19] Wong, Y. J., Noordin, N. M., Keshavjee, S., & Lee, S. W. H. (2021). Impact of latent tuberculosis infection on health and wellbeing: A systematic review and meta-analysis. European Respiratory Review, 30(159), 1–11. doi:10.1183/16000617.0260-2020.
- [20] IPEC. (2016). Core competencies for interprofessional collaborative practice: 2016 update. Interprofessional Education Collaborative (IPEC), Washington, United States. Available online: https://ipec.memberclicks.net/assets/2016-Update.pdf (accessed on December 2024).
- [21] Canadian Interprofessional Health Collaborative. (2010). A National Interprofessional Competency Framework. Canadian Interprofessional Health Collaborative, Ottawa, Canada.
- [22] Brewer, M. (2013). Interprofessional capability framework. Curtin University, Bentley, United Kingdom.
- [23] WHO. (2003). Adherence to long-term therapies: evidence for action. World Health Organization (WHO), Rome, Italy.
- [24] WHO. (2016). Patient engagement. World Health Organization (WHO), Rome, Italy.
- [25] WHO. (2009). WHO patient safety curriculum guide for medical schools. World Health Organization (WHO), Rome, Italy.
- [26] WHO. (2011). Patient safety curriculum guide: multi-professional. World Health Organization (WHO), Rome, Italy.
- [27] Schmitz, C., Atzeni, G., & Berchtold, P. (2017). Challenges in interprofessionalism in Swiss health care: the practice of successful interprofessional collaboration as experienced by professionals. Swiss Medical Weekly, 147(4344), w14525. doi:10.4414/smw.2017.14525.

- [28] Curran, V., Hollett, A., Casimiro, L. M., McCarthy, P., Banfield, V., Hall, P., Lackie, K., Oandasan, I., Simmons, B., & Wagner, S. (2011). Development and validation of the interprofessional collaborator assessment rubric (ICAR). Journal of Interprofessional Care, 25(5), 339–344. doi:10.3109/13561820.2011.589542.
- [29] Sigalet, E., Donnon, T., & Grant, V. (2012). Undergraduate students' perceptions of and attitudes toward a simulation-based interprofessional curriculum: The kidSIM Attitudes questionnaire. Simulation in Healthcare, 7(6), 353–358. doi:10.1097/SIH.0b013e318264499e.
- [30] Stutsky, B. J., & Spence Laschinger, H. K. (2014). Development and Testing of a Conceptual Framework for Interprofessional Collaborative Practice. Health and Interprofessional Practice, 2(2). doi:10.7710/2159-1253.1066.
- [31] Schroder, C., Medves, J., Paterson, M., Byrnes, V., Chapman, C., O'Riordan, A., Pichora, D., & Kelly, C. (2011). Development and pilot testing of the collaborative practice assessment tool. Journal of Interprofessional Care, 25(3), 189–195. doi:10.3109/13561820.2010.532620.
- [32] Pollard, K. C., & Miers, M. E. (2008). From students to professionals: Results of a longitudinal study of attitudes to pre-qualifying collaborative learning and working in health and social care in the United Kingdom. Journal of Interprofessional Care, 22(4), 399–416. doi:10.1080/13561820802190483.
- [33] McFadyen, A. K., Webster, V., Strachan, K., Figgins, E., Brown, H., & McKechnie, J. (2005). The Readiness for Interprofessional Learning Scale: A possible more stable sub-scale model for the original version of RIPLS. Journal of Interprofessional Care, 19(6), 595–603. doi:10.1080/13561820500430157.
- [34] Almås, S. H., & Ødegård, A. (2010). Impact of Professional Cultures on Students' Perceptions of Interprofessionalism: Some Norwegian Experiences. Journal of Allied Health, 39(3), 143-149.
- [35] Luetsch, K., & Rowett, D. (2016). Developing interprofessional communication skills for pharmacists to improve their ability to collaborate with other professions. Journal of Interprofessional Care, 30(4), 458–465. doi:10.3109/13561820.2016.1154021.
- [36] Oates, M., & Davidson, M. (2015). A critical appraisal of instruments to measure outcomes of interprofessional education. Medical Education, 49(4), 386–398. doi:10.1111/medu.12681.
- [37] Ardyansyah, B. D., Cordier, R., Brewer, M., & Parsons, D. (2024). An evaluation of the psychometric properties of the Australian Collaborative Practice Assessment Tool. PLoS ONE, 19(5 May). doi:10.1371/journal.pone.0302834.
- [38] Jensen, C. B., Iversen, A., Dahlgren, M. A., & Norbye, B. (2024). "Everyone who wants to can practice on me"- a qualitative study of patients' view on health profession students' learning in an interprofessional clinical placement. BMC Medical Education, 24(1). doi:10.1186/s12909-024-05194-8.
- [39] Diamond, I. R., Grant, R. C., Feldman, B. M., Pencharz, P. B., Ling, S. C., Moore, A. M., & Wales, P. W. (2014). Defining consensus: A systematic review recommends methodologic criteria for reporting of Delphi studies. Journal of Clinical Epidemiology, 67(4), 401–409. doi:10.1016/j.jclinepi.2013.12.002.
- [40] Mokkink, L. B., de Vet, H. C. W., Prinsen, C. A., & Terwee, C. B. (2023). COSMIN Methodology for Conducting Systematic Reviews of Patient-Reported Outcome Measures (PROMs). Encyclopedia of Quality of Life and Well-Being Research. Springer, Cham, Switzerland. doi:10.1007/978-3-319-69909-7_2972-2.
- [41] Mokkink, L. B., de Vet, H. C. W., Prinsen, C. A. C., Patrick, D. L., Alonso, J., Bouter, L. M., & Terwee, C. B. (2017). COSMIN Risk of Bias checklist for systematic reviews of Patient-Reported Outcome Measures. Quality of Life Research, 27(5), 1171– 1179. doi:10.1007/s11136-017-1765-4.
- [42] Prinsen, C. A. C., Mokkink, L. B., Bouter, L. M., Alonso, J., Patrick, D. L., de Vet, H. C. W., & Terwee, C. B. (2018). COSMIN guideline for systematic reviews of patient-reported outcome measures. Quality of Life Research, 27(5), 1147–1157. doi:10.1007/s11136-018-1798-3.
- [43] Qualtrics (2025). Qualtrics XM: The Leading Experience Management Software. Qualtrics XM, Washington, United States. Available online: https://www.qualtrics.com (accessed on December 2024).
- [44] Bradby, M. (1990). Status passage into nursing: another view of the process of socialization into nursing. Journal of Advanced Nursing, 15(10), 1220–1225. doi:10.1111/j.1365-2648.1990.tb01715.x.
- [45] WHO. (2012). WHODAS 2.0 translation package (version 1.0): Translation and linguistic evaluation protocol and sup-porting material. World Health Organization (WHO), Rome, Italy.
- [46] Pubcompare. (2023). SPSS Statistics for windows (version 26.0). Pubcompare, San Francisco, United States.
- [47] Belton, I., MacDonald, A., Wright, G., & Hamlin, I. (2019). Improving the practical application of the Delphi method in groupbased judgment: A six-step prescription for a well-founded and defensible process. Technological Forecasting and Social Change, 147, 72–82. doi:10.1016/j.techfore.2019.07.002.
- [48] Vaismoradi, M., Turunen, H., & Bondas, T. (2013). Content analysis and thematic analysis: Implications for conducting a qualitative descriptive study. Nursing & Health Sciences, 15(3), 398–405. doi:10.1111/nhs.12048.

- [49] Allen, M. S., Iliescu, D., & Greiff, S. (2022). Single Item Measures in Psychological Science. European Journal of Psychological Assessment, 38(1), 1–5. doi:10.1027/1015-5759/a000699.
- [50] Xyrichis, A., Reeves, S., & Zwarenstein, M. (2018). Examining the nature of interprofessional practice: An initial framework validation and creation of the InterProfessional Activity Classification Tool (InterPACT). Journal of Interprofessional Care, 32(4), 416–425. doi:10.1080/13561820.2017.1408576.
- [51] IPEC. (2016). Core competencies for interprofessional collaborative practice: 2016 update. Interprofessional Education Collaborative (IPEC), Washington, United States. Available online: https://ipec.memberclicks.net/assets/2016-Update.pdf (accessed on December 2024).
- [52] Morgan, K. H., Barroso, C. S., Bateman, S., Dixson, M., & Brown, K. C. (2020). Patients' Experiences of Interprofessional Collaborative Practice in Primary Care: A Scoping Review of the Literature. Journal of Patient Experience, 7(6), 1466–1475. doi:10.1177/2374373520925725.
- [53] Aggarwal, A. N. (2019). Quality of life with tuberculosis. Journal of Clinical Tuberculosis and Other Mycobacterial Diseases, 17(100121). doi:10.1016/j.jctube.2019.100121.
- [54] OECD. (2023). OECD Health Statistics. Organisation for Economic Co-operation and Development (OECD), Paris, France.
- [55] Chad-Friedman, E., Coleman, S., Traeger, L. N., Pirl, W. F., Goldman, R., Atlas, S. J., & Park, E. R. (2017). Psychological distress associated with cancer screening: A systematic review. Cancer, 123(20), 3882–3894. doi:10.1002/cncr.30904.
- [56] Course-Choi, J., & Hammond, L. (2021). Social Media Use and Adolescent Well-Being: A Narrative Review of Longitudinal Studies. Cyberpsychology, Behavior, and Social Networking, 24(4), 223–236. doi:10.1089/cyber.2020.0020.
- [57] Halvorson, J. J., Winter, S. B., Teasdall, R. D., & Scott, A. T. (2013). Talar Neck Fractures: A Systematic Review of the Literature. Journal of Foot and Ankle Surgery, 52(1), 56–61. doi:10.1053/j.jfas.2012.10.008.
- [58] Yerrakalva, D., Mullis, R., & Mant, J. (2015). The associations of fatness, fitness, and physical activity with all-cause mortality in older adults: A systematic review. Obesity, 23(10), 1944–1956. doi:10.1002/oby.21181.
- [59] Zywiel, M. G., Mahomed, A., Gandhi, R., Perruccio, A. V., & Mahomed, N. N. (2013). Measuring expectations in orthopaedic surgery: A systematic review. Clinical Orthopaedics and Related Research, 471(11), 3446–3456. doi:10.1007/s11999-013-3013-8.
- [60] Terwee, C. B., Prinsen, C. A. C., Chiarotto, A., Westerman, M. J., Patrick, D. L., Alonso, J., Bouter, L. M., de Vet, H. C. W., & Mokkink, L. B. (2018). COSMIN methodology for evaluating the content validity of patient-reported outcome measures: a Delphi study. Quality of Life Research, 27(5), 1159–1170. doi:10.1007/s11136-018-1829-0.