ORIGINAL ARTICLE

Factors associated with non-attendance at initial tuberculosis screening among contacts in Kudat, Sabah

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ABSTRACT

Introduction: Tuberculosis (TB) contact screening is a key strategy for early case detection and prevention of transmission. However, non-attendance at initial TB screening among contacts remains a persistent challenge, particularly in high-burden settings such as Sabah, Malaysia. This study aimed to determine factors associated with non-attendance at initial TB screening among contacts in Kudat, Sabah.

Materials and Methods: A case–control study was conducted using primary and secondary data from the National Tuberculosis Registry involving 468 TB contacts registered between June and December 2023. Cases were contacts who failed to attend initial screening within one month, while controls attended screening within the same period. Data were analysed using descriptive statistics and multiple logistic regression.

Results: Multivariable logistic regression analysis revealed that factors associated with lower odds of non-attendance included contacts of male TB index patients (OR: 0.30, 95% CI: 0.194–0.470), contacts of extrapulmonary TB index patients (OR: 0.09, 95% CI: 0.050–0.179), and higher attitude scores (OR: 0.88, 95% CI: 0.818–0.952). In contrast, contacts with secondary education had higher odds of non-attendance compared to those with no formal education (OR: 1.86, 95% CI: 1.080–3.209).

Conclusion: Non-attendance at initial TB screening among contacts was associated with index case sex and TB form, contact education level, and attitudes towards TB. Targeted interventions addressing behavioural and structural barriers are essential to improve TB contact screening uptake in high-burden settings.

KEYWORDS:
Tuberculosis; contact screening; non-attendance; risk factors; Sabah

INTRODUCTION

Tuberculosis (TB) remains one of the world's most persistent infectious diseases and a leading cause of death globally. According to the WHO Global Tuberculosis Report, Malaysia has an intermediate TB burden with an estimated incidence of 50–99 cases per 100,000 population per year, which is consistent with national notification data reporting 77.8 cases per 100,000 population.[1] The burden is disproportionately higher in certain states, with Sabah recording one of the highest TB notification rates in the country, largely attributed to socioeconomic factors, population density, and cross-border migration.[2]

A TB contact is defined as a person who has been exposed to an individual with infectious tuberculosis, typically through sharing airspace, including household members, coworkers, classmates, and other close contacts.[3] The effectiveness of contact screening programs largely depends on the active participation of identified contacts in the screening process. However, non-attendance at initial screening appointments has emerged as a critical barrier to successful TB control efforts globally.[4] Studies from various countries have reported non-attendance rates ranging from 20% to 60%, significantly undermining the potential impact of contact screening programs.[5] Delayed or missed screening opportunities are particularly concerning, as they may lead to undetected active TB cases continuing to transmit infection within communities, while individuals with latent TB infection (LTBI) lose the chance to benefit from preventive treatment.[6]

The factors influencing attendance at TB contact screening are complex and multifaceted, encompassing individual, social, economic, and health system-related determinants. Sociodemographic characteristics such as age, gender, education level, and socioeconomic status have been consistently identified as important predictors of screening attendance across different settings. Additionally, psychosocial factors including knowledge about TB, attitudes toward the disease and its prevention, and TB-related stigma play crucial roles in shaping health-seeking behaviors among TB contacts.[7]

In Malaysia, limited research has explored factors influencing TB contact screening attendance, particularly in high-burden areas such as Sabah. Kudat District, with its diverse ethnic communities, indigenous populations, and varied socioeconomic conditions, presents unique challenges for TB control. Identifying modifiable factors like knowledge, attitudes, and stigma, alongside non-modifiable factors such as demographics and index case characteristics, is crucial for designing targeted interventions. This study aims to address these gaps in Kudat using a case-control design, generating evidence to inform culturally appropriate strategies that enhance screening uptake and strengthen TB control efforts.

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MATERIALS AND METHODS

Study Design and Setting

A case-control study was conducted from February to June 2024 in Kudat District, Sabah, Malaysia. The study covered all five subdistricts of Kudat: Banggi, Tiga Papan, Tambuluran, Matunggong, and Dualog.

Study Population

Cases were defined as TB contacts who failed to attend their initial screening within one month of being listed as a contact on Tuberculosis Information System (TBIS 10C-1). Controls were TB contacts who attended their initial screening within the same one-month timeframe.

Although national TB guidelines recommend screening within two weeks of notification, this study utilised a one-month timeframe to better reflect real-world programme implementation in rural settings such as Kudat. Evidence from Sabah indicates that delays in health-seeking behaviour are common, with a proportion of TB contacts reporting that they would wait up to 3–4 weeks before seeking care.[8] In addition, operational challenges such as work commitments, time constraints, and accessibility barriers have been identified as key factors affecting timely attendance in TB contact investigation.[8] Therefore, a one-month timeframe was considered appropriate to capture actual screening behaviour and minimise misclassification of delayed attenders as non-attenders.

Study Variables

Variables in this study were categorised into TB index case characteristics and TB contact characteristics.

TB contacts were defined as individuals who had been exposed to a person with active TB disease, typically through shared airspace, including both household and non-household contacts identified through routine contact investigation.

TB index case variables included age, sex, form of tuberculosis, level of education, and nationality. The classification of TB form was based on the anatomical site of disease, categorised into pulmonary TB (PTB) and extrapulmonary TB (EPTB), in accordance with standard TB classification used in the National Tuberculosis Registry (NTBR). All forms of pulmonary TB, including smear-positive and smear-negative cases, were grouped under the PTB category, as both involve pulmonary disease and are relevant for contact investigation and transmission risk assessment.

TB contact variables included age, sex, nationality, category of contact (household or non-household), monthly income, level of education, and region. Education level was categorised into no formal education, primary education (7–12 years), secondary education (13–17 years), upper secondary education (pre-university level, including matriculation, STPM, O-Level, A-Level or equivalent), and tertiary education (diploma, bachelor's degree, master's degree, or doctoral level) based on the Malaysian education system. In addition, psychosocial variables including knowledge, attitude, and stigma towards TB were assessed using the validated KAPS-TB questionnaire.

The outcome variable was attendance at initial TB screening, categorised as non-attenders (cases) and attenders (controls).

Study Settings

TB contacts were identified from all five subdistricts of Kudat District, namely Matunggong, Banggi, Dualog, Tambuluran, and Tiga Papan, based on available registry data from the NTBR. The distribution of cases and controls across subdistricts reflected the actual distribution of TB contacts recorded during the study period, rather than a predetermined or equal sampling allocation. As such, cases and controls were included proportionately based on real-world programme data, ensuring that the study sample was representative of the underlying population of TB contacts in Kudat District.

Inclusion and Exclusion Criteria

Inclusion criteria included all adults aged 18 years and older, contacts of index TB cases with all forms of tuberculosis, contacts of deceased index TB cases, individuals able to understand Malay language, and consented participants. Exclusion criteria comprised contacts of TB patients with severe mental illness affecting ability to give informed consent.

Sample Size Calculation

The required sample size was estimated for an unmatched case-control design based on detecting a minimum mean difference in knowledge, attitude, and stigma scores between contacts who attended and those who did not attend the initial tuberculosis screening. Standard deviations from previous literature were used for estimation.[8] Using a two-sided α=0.05, power=80%, and a 1:1 control-to-case ratio, the largest calculated sample size across all domains was selected. After adding a 20% allowance for non-response, the final required sample size was 468 participants.

Data Collection

Both primary and secondary data were utilized. Secondary data were extracted from NTBR, while primary data were collected through both Google Forms and hard copy questionnaires. TB healthcare staff facilitated recruitment via WhatsApp, phone calls, or home visits. Participants were provided with study information and gave informed consent before participation.

Study Tools

Data was collected using a validated Malay version of the KAPS-TB (Knowledge, Attitude, Practice, and Stigma-TB) questionnaire. The questionnaire comprised four sections: sociodemographic characteristics, knowledge domain (25 items, Cronbach's alpha ≥0.65), attitude domain (5 items using 5-point Likert scale, Raykov's rho=0.557), and stigma domain (11 items using 5-point Likert scale, Raykov's rho=0.889).[9] Internal consistency of the KAPS-TB instrument was assessed using Cronbach's alpha.

Statistical Analysis

Data was entered and analyzed using SPSS Version 29.0. Descriptive statistics summarized characteristics of both index TB cases and their contacts. Univariable associations were first explored using simple logistic regression, with

Table I: Descriptive Analysis of the TB Index Characteristics

Variables	Frequency, n	Percentage, (%)
Age		
mean (SD)	43.6 (23.9)	-
Sex		
Male	45	60.0
Female	30	40.0
Nationality		
Malaysian	68	90.7
Non-Malaysian	7	9.3
Relationship		
Spouse	12	16.0
Father/mother/child/uncle / aunt	38	50.7
Sibling/ first cousin	7	9.3
Grandparent/Grandchildren	6	8.0
No family Relation	12	16.0
Form of TB		
Pulmonary	62	82.7
Extrapulmonary	13	17.3
Level of Education		
No formal education	26	34.7
Primary Education	18	24.0
Secondary Education	25	33.3
Upper Secondary Education	1	1.3
Tertiary Education	5	6.7
Region		
Matunggong	16	21.3
Banggi Dualog	7	9.3
Tambuluran	6	8.0
Tiga Papan	7	9.3
	39	52.0

SD= Standard Deviation

variables having p<0.25 included in the multivariable analysis.

Multivariable logistic regression was conducted using the Enter method, as well as comparisons with stepwise forward and backward LR methods. Model fitness was assessed using the Hosmer–Lemeshow test (p=0.668) and Nagelkerke R^2=0.357, indicating acceptable fit.

Ethical Considerations

The study adhered to the Declaration of Helsinki and Malaysian Good Clinical Practice Guidelines. Anonymity was maintained by replacing patient names with research IDs. All data was stored on password-protected systems. Ethical approval was obtained from MREC.NMRR ID-24-00193-JED.

RESULTS

A total of 75 TB index cases were included in the study. Table I presents the sociodemographic and clinical characteristics of the TB index cases.

Table II summarises the characteristics of TB contacts according to non-attendance at initial TB screening. Non-attenders were slightly younger (mean 40.1±13.3 years) compared to attenders (43.2±15.1 years). A higher proportion of non-attenders were female, had lower income, and were from non-household contact categories. Non-attenders also showed slightly lower knowledge scores and lower stigma scores compared to attenders, while attitude scores were similar between groups.

Reliability of the Questionnaire

The internal consistency of the KAPS-TB questionnaire was assessed using Cronbach's alpha. The knowledge domain demonstrated good reliability (Cronbach's alpha=0.84), while the stigma domain showed acceptable reliability (Cronbach's alpha=0.77). The attitude domain demonstrated lower internal consistency (Cronbach's alpha=0.54).

Inferential Analysis

Simple logistic regression was used to screen predictors of non-attendance at the initial TB screening (outcome coded 1=non-attender, 0=attender). Results are presented in Table III and Table IV. Odds ratios (OR), 95% confidence intervals (CI), and p-values are reported; OR > 1 indicates higher odds of non-attendance; OR < 1 indicates lower odds. Continuous variables were modelled for a per-unit increase. Variables with p<0.25 were carried forward to multivariable analysis.

Factors Associated with Non-Attendance at Initial Tuberculosis Screening

Simple logistic regression analysis identified several variables associated with non-attendance at initial TB screening. Variables with p-values < 0.25 were considered for inclusion in the multivariable analysis.[10] A total of 12 variables were included in the final model selection process using both forward and backward stepwise logistic regression. The enter method was used for the final model to adjust for potential confounding factors. The final model demonstrated good fit (Hosmer–Lemeshow p=0.668) with a Nagelkerke R^2 of 0.357, indicating that 35.7% of the variability in non-attendance was explained by the included predictors. Significant

Table II: Descriptive Analysis of TB Contact Sociodemographic and Psychosocial Characteristics

Variables	Case (Non-attender), n = 224 (%)	Control (Attender), n = 252 (%)
Age		
mean (SD)	40.1 (13.3)	43.2 (15.1)
Sex		
Male	115 (51.3)	150 (59.5)
Female	109 (49.7)	102 (40.5)
Nationality		
Malaysian	211 (94.0)	233 (92.5)
Non-Malaysian	13 (5.8)	19 (7.5)
Category of Contacts		
Household	92 (41.1)	109 (43.3)
non-household	132 (58.9)	143 (56.7)
Monthly Income		
<Rm 2500	175 (78.1)	167 (66.3)
Rm2500-Rm3169	31 (13.8)	37 (14.7)
Rm3170-Rm3969	4 (1.8)	32 (12.7)
Rm3970-Rm4846	11 (4.9)	11 (4.4)
>Rm4500	4 (1.8)	5 (2.0)
Level of Education		
Primary Education	26 (11.6)	49 (19.4)
Secondary Education	135 (60.3)	128 (50.8)
Upper Secondary Education	9 (4.0)	14 (5.6)
Tertiary Education	14 (6.3)	9 (3.6)
No formal education	40 (17.9)	52 (20.6)
Region		
Matunggong	53 (23.7)	45 (17.9)
Banggi	16 (7.1)	22 (8.7)
Dualog	1 (0.4)	14 (5.6)
Tambuluran	13 (5.8)	39 (15.5)
Tiga Papan	141 (62.9)	132 (52.4)
Knowledge		
median (IQR)	18.5 (6)	19.0 (4)
Attitude		
median (IQR)	21.0 (4)	21.0 (4)
Stigma		
median (IQR)	40.0 (9)	42.0 (6)

SD= Standard Deviation, IQR= Interquartile Range

predictors included index sex, index TB form, contact education level, and contact attitude. Relationship type and TB contact stigma were not statistically significant (Table V).

Contacts of male TB index cases were significantly less likely to be non-attenders compared to those of female index cases (AOR=0.300; 95% CI: 0.194–0.470; p<0.001). Similarly, contacts of extrapulmonary TB index cases had lower odds of non-attendance compared to those of pulmonary TB index cases (AOR=0.090; 95% CI: 0.050–0.179; p<0.001).

Among TB contact characteristics, secondary education was associated with higher odds of non-attendance compared to no formal education (AOR=1.860; 95% CI: 1.080–3.209; p=0.025). In contrast, higher attitude scores were significantly associated with lower odds of non-attendance (AOR=0.880; 95% CI: 0.818–0.952; p=0.001).

Other variables, including relationship type and stigma, were not statistically significant.

DISCUSSION

This study provides important insights into the factors associated with non-attendance at initial TB contact screening in Kudat, Sabah, contributing to the limited body of evidence on this critical public health issue in the Malaysian context. The findings reveal a complex interplay of demographic, clinical, educational, and psychosocial factors that influence screening attendance, with significant implications for TB control program design and implementation.

Index Case Gender and Contact Screening Attendance

This finding may reflect sociocultural dynamics within the local context of Sabah, where male household members often assume decision-making roles and greater authority in family matters.

Contacts of male TB index patients were significantly less likely to be non-attenders compared to those of female index patients, with approximately 70% lower odds of non-attendance.

This observation is consistent with findings from various settings, including low- and middle-income countries, where gender roles influence health-seeking behaviour and healthcare utilisation, particularly in relation to family decision-making and access to resources.[11] This may be particularly relevant in Asian contexts, where traditional gender roles can influence healthcare engagement.

Table III: Univariate Analysis of TB Contact Sociodemographic and TB Index Characteristics

Variables	COR	95% CI	p-value
	TB Contact Sociodemographic		
Age	0.990	0.973-0.998	0.027
Sex			
Male	0.720	0.499-1.032	0.073
Female			
Nationality			
Malaysian			
Non-Malaysian	0.760	0.364-1.567	0.451
Monthly income			
> Rm3170	0.360	0.200-0.640	<0.001*
Rm2500-Rm3169	0.800	0.474-1.348	0.401
<Rm2500			
Level of Education			
Secondary Education and above	1.360	0.851-2.174	0.198
Primary Education	0.690	0.368-1.294	0.247
No formal Education			
Category of contacts			
Household	1.090	0.759-1.575	0.630
Non-household			
	TB Index Characteristics		
Age	1.020	1.006-1.023	<0.001*
Sex			
Male	0.230	0.157-0.342	<0.001*
Female			
Relationship			
Spouse	0.460	0.183-1.153	0.098
Father/mother/child/Aunt/Uncle	1.080	0.715-1.620	0.731
Sibling/1stcousin/Grandfather/grandchildren	1.030	0.614-1.737	0.903
No Family relationship			
Form of TB			
Extrapulmonary	0.110	0.062-0.198	<0.001*
Pulmonary			
Level of Education			
Secondary Education and above	0.750	0.492-1.153	0.192
Primary Education	0.740	0.431-1.500	0.260
No formal education			
Nationality			
Malaysian	0.810	0.320-2.055	0.659
Non-Malaysian			

COR = Crude Odds Ratio; CI = Confidence Interval; *p < 0.05 indicates statistical significance
Reference categories: Female (Sex), Non-Malaysian (Nationality), B1 <RM2500 (Monthly income), No Formal Education (Level of Education), Non-household (Category of contacts), Female (Index Sex), Pulmonary TB (Index Form of TB), No Formal Education (Index Education), No Family Relationship (Relationships).

Table IV: Univariate Analysis of Knowledge, Attitude, and Stigma Among TB Contacts

Variables	COR	95%CI	p-value
Knowledge	0.960	0.920-1.004	0.075
Attitude	0.910	0.852-0.967	0.003*
Stigma	0.960	0.933-0.985	0.002*

COR = Crude odds ratio; CI = confidence interval; *p<0.05 indicates statistical significance

Several mechanisms may explain this association. First, male TB patients may possess greater authority and influence within family structures, enabling them to effectively encourage or mandate screening participation among their contacts.[12] Second, contacts may perceive greater urgency or seriousness when the index case is male, particularly if he is the primary breadwinner, leading to increased motivation for screening participation.[13] Third, male patients may have better access to information and resources, including healthcare navigation support, which they can share with their contacts.[14]

This finding contrasts with some studies from other settings that have reported no significant association between index case gender and contact screening attendance.[15] However, cultural and contextual factors likely play important roles in shaping these relationships, highlighting the importance of conducting locally relevant research to inform program development. The implications of this finding suggest that TB programs may need to provide additional support and targeted interventions for contacts of female TB patients to improve screening attendance rates.

Table V: Multivariate Logistic Regression Analysis of Factors Associated with Non-Attendance at Initial TB Screening

Variables	AOR	95% CI	p-value
Index Sex			
Male	0.300	0.194-0.470	<0.001*
Female			
Index Form of TB			
Extrapulmonary TB	0.090	0.050-0.179	<0.001*
Pulmonary TB			
TB Contact Education			
Secondary Education	1.860	1.080-3.209	0.025*
Primary Education	0.840	0.411-1.732	0.643
No Formal Education			
Relationships			
Sibling/1stCousin/Grandfather/Grandchildren	0.620	0.333-1.142	0.124
Father/Mother/Child/Aunt/Uncle	0.760	0.459-1.68	0.297
Spouse	0.380	0.131-1.112	0.078
No Family Relationship			
Attitude	0.880	0.818-0.952	0.001*
Stigma	0.970	0.938-1.002	0.069

AOR = adjusted odds ratio; CI = confidence interval; *p < 0.05 indicates statistical significance.
Reference categories: Female (Index sex), Pulmonary TB (Index form of TB), No formal education (TB contact education), No family relationship (Relationships).

Form of Tuberculosis and Risk Perception

The association between index case TB form and contact screening attendance is an important finding but should be interpreted with caution. Contacts of extrapulmonary TB (EPTB) index cases were less likely to be non-attenders compared to those of pulmonary TB (PTB) index cases. However, the proportion of EPTB cases in this study was relatively small (17.3%), which may affect the stability of the estimates and limit the generalisability of this finding.

Differences in perceived risk and understanding of TB transmission may partly explain this observation. Pulmonary TB is widely recognised as the more infectious form of TB due to airborne transmission through respiratory droplets.16 This awareness may influence how contacts perceive their susceptibility and the urgency of seeking screening.[17-18]

The finding that contacts of EPTB index cases were more likely to attend screening is somewhat counterintuitive, as lower perceived susceptibility would typically reduce health-seeking behaviour according to the Health Belief Model.[19] One possible explanation is that stigma associated with pulmonary TB, which is commonly perceived as infectious, may lead to concealment of the disease and reduced engagement with health services. In contrast, EPTB may be perceived as less stigmatising, potentially facilitating greater acceptance of screening.[17,20] Nevertheless, this interpretation should be approached cautiously given the relatively small number of EPTB cases.

However, as stigma was measured after the screening outcome, the temporal relationship cannot be established. It is possible that interactions with the healthcare system during screening may have influenced participants' perception or awareness of stigma.

Education and Structural Barriers

The relationship between education level and screening attendance was not linear. While secondary education was associated with higher odds of non-attendance, primary education did not show a significant association. This may reflect a balance between basic literacy, which facilitates understanding of health information, and competing demands such as employment and time constraints among individuals with higher education levels.[21]

The distinction between secondary and upper secondary education reflects the structure of the Malaysian education system, where upper secondary corresponds to pre-university level (e.g., matriculation, STPM, A-Level), which is often associated with different socioeconomic status, employment patterns, and time commitments compared to general secondary education. This differentiation allows for a more nuanced understanding of how educational attainment influences screening behaviour.

Structural barriers, including work commitments and limited time availability, may further contribute to non-attendance. Evidence from Sabah indicates that logistical challenges can significantly affect TB contact screening participation,8 particularly among working individuals who may find it difficult to attend scheduled appointments.

These findings highlight the need for tailored health education and flexible service delivery approaches that account for varying education levels and structural constraints. TB programmes should consider strategies such as extended clinic hours, workplace-friendly screening options, and targeted communication to improve attendance among higher-risk groups.

Relationship Dynamics and Family Support

Although not statistically significant, the finding that spouses had 61.8% lower odds of non-attendance compared to other relationship types provides insights into the role of family dynamics and social support in healthcare utilization. Spousal relationships are characterized by unique features,

including shared living spaces, intimate physical contact, emotional support, and mutual care responsibilities, which may enhance motivation for screening participation.[22]

The non-significant nature of this association may reflect the relatively small number of spousal contacts in the study or the heterogeneity within this relationship category. However, the magnitude of the effect suggests that relationship type may be clinically meaningful even if not statistically significant in this sample size.[23]

Understanding relationship dynamics is important for TB program implementation, as different types of contacts may require different engagement strategies. Spousal contacts may be more easily reached and motivated through direct communication with index cases, while more distant contacts may require additional outreach efforts.[8]

Health System and Program Implications

The findings of this study have important implications for TB control programme design and implementation in Malaysia and similar settings. Identifying specific factors associated with non-attendance allows for the development of targeted interventions tailored to the needs of different contact groups. Contacts of female TB index patients, who demonstrated higher non-attendance, may benefit from enhanced outreach strategies, including more frequent follow-up, flexible appointment scheduling, and involvement of family members or community leaders to support screening participation. These approaches should be culturally sensitive and aligned with local social structures to promote equitable access to healthcare services.[24]

While differences in screening attendance were observed according to the form of TB, these findings should be interpreted cautiously due to the relatively small proportion of extrapulmonary TB cases in this study. As such, programmatic recommendations should primarily focus on more robust and modifiable factors influencing screening attendance, including knowledge, attitudes, and structural barriers. Interventions such as pre-screening counselling, peer support, and clear communication regarding screening procedures may help alleviate concerns and improve attendance.[25-26]

Interventions aimed at improving attitudes towards TB represent a particularly promising strategy, given the strong association observed in this study. These should be evidence-based, culturally appropriate, and delivered through multiple channels to maximise reach and effectiveness.[27] Community health workers, peer educators, and mass media platforms may play key roles in promoting positive health-seeking behaviours and increasing screening uptake.[28]

Strengths and Limitations

This study has several methodological strengths, including the case-control design, which allows efficient identification of factors associated with non-attendance, the use of validated instruments to assess knowledge, attitudes, and stigma, and the inclusion of participants from all subdistricts within Kudat District, enhancing the representativeness of the study population.

However, several limitations should be considered. First, knowledge, attitudes, and stigma were measured at a single point in time after the outcome had occurred. As such, the temporal relationship between these psychosocial factors and screening attendance cannot be clearly established, raising the possibility of reverse causality. Individuals who attended screening may have subsequently developed greater awareness or more positive attitudes through interaction with healthcare services.

Second, the relatively short study duration (approximately four months) may limit the ability to capture temporal variations in screening behaviour and may affect the generalisability of the findings.

Third, selection bias may be present, as only participants who consented to participate were included in the study. Individuals who declined participation may differ systematically in their health-seeking behaviour and attitudes towards TB, potentially influencing the observed associations.

Recall bias is also possible, as participants' responses regarding knowledge, attitudes, and stigma may have been influenced by their screening attendance status. In addition, social desirability bias may have affected responses, particularly for sensitive topics such as stigma and attitudes towards TB.

Although a validated instrument was used, the attitude domain demonstrated relatively low internal consistency in this study, which may be attributed to the limited number of items and the multidimensional nature of attitudes towards TB.

Finally, the study was conducted in a single district in Sabah, which may limit the generalisability of the findings to other regions of Malaysia or different settings. However, the diversity within Kudat District, including multiple ethnic communities and varying socioeconomic conditions, strengthens the internal validity of the study.

CONCLUSION

This study demonstrates that multiple factors influence TB contact screening attendance in Kudat, Sabah, with significant implications for public health program development. The identification of index case sex and TB form, contact education level, and attitudes as significant predictors of attendance provides evidence for targeted intervention development. The complex relationships observed, including the counterintuitive association between secondary education and higher non-attendance, highlight the importance of context-specific research and culturally appropriate program design.

Public health interventions should prioritize addressing modifiable factors such as attitudes through evidence-based educational programs while considering non-modifiable characteristics for risk stratification and targeted outreach efforts. The development of comprehensive approaches that address both individual-level factors and structural barriers

may improve TB contact screening effectiveness and contribute to better TB control outcomes.

The findings contribute to the growing evidence base on TB contact screening challenges and provide a foundation for program improvement efforts in Malaysia and similar settings. Continued research and program evaluation will be essential for optimizing TB control strategies and achieving the goals of the End TB Strategy.

Recommendations for Future Research

Qualitative or mixed-method studies are recommended to further explore the underlying reasons for non-attendance, including individual, social, and health system-related barriers. Such evidence would support the development of targeted and context-specific interventions to improve TB contact screening uptake.

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CONFLICT OF INTEREST

The authors declare that there are no conflicts of interest regarding the publication of this study.

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