# Knowledge, Attitude, and Practices Regarding Childhood Tuberculosis Screening and Management among Healthcare Providers in Al-Medinah Al-Munawara, Saudi Arabia

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## Abstract

Among infectious illnesses, tuberculosis (TB) has the highest fatality rate. The likelihood of infection spreading from patients to healthcare providers is two times higher than in the general population. The primary risk factor for contracting TB is close proximity to an infected individual prior to diagnosis. The research assessed health workers' knowledge, attitude, and practice of TB infection control in Saudi Arabia. The study used a cross-sectional approach based on an online survey. The research was carried out throughout the months of May to July 2022 in Al Madinah Al-Munawara. The questionnaire included demographic's and work variables, knowledge regarding pediatric TB etiology, transmission, symptoms, lymph node characteristics, and diagnostic criteria. Also, the participants' perspectives and practice patterns on contact investigation, TB diagnostic tools, laboratory services, presumptive TB diagnostic referrals, and TB treatment were evaluated. The study included 558 healthcare workers (HCWs) from various specialists. HCWs exhibited sound knowledge, and positive attitudes in comparison to those with minimal experience in diagnosing TB in children TB as 31.2% had excellent knowledge, 22.6% good, 18.5% mediocre, and 27.8% bad. The majority of responders (49.1%) had a positive attitude, while only 33.2% had correct and full practice routines. Immediate action is required to increase HCW awareness, capacity, and skills to ensure an accurate diagnosis. In the identification of TB cases, certain crucial information gaps were discovered. This study also highlights the significance of clinical experience and frequent interactions with tuberculosis patients in clinical practice as a pathway to competency-based learning by practice.

Keywords: healthcare workers, knowledge, tuberculosis, diagnosis, practice, KSA.

## Introduction

Over 600 children worldwide lose their lives to tuberculosis (TB) daily. Among one million children who had active TB in 2019, it is expected that 70% of those cases have been missed by doctors or misdiagnosed [1]. Due to the non-specific symptoms and challenging identification of TB in children under the age of 15, the treatment of this disease remains a problem. Children's TB is difficult to diagnose, despite recent breakthroughs in the field [2]. Diagnostics for pediatric tuberculosis using stool samples and the Xpert MTB/RIF test have been investigated [3]. Diagnoses of children's TB have been made using a variety of processes due to the difficulty of making an accurate diagnosis; however, none of these procedures are now regularly employed [4].

Saudi Arabia is the third-largest nation in the Middle East, occupying most of the Arabian Peninsula. Saudi Arabia, which the WHO classifies as having a moderate TB burden, reported an annual TB incidence rate of 18 per 100,000 people in 2012 [1].

Despite attempts by the Saudi Arabian government to eliminate tuberculosis, public statistics suggest that the illness is not entirely under control in the country. A directly observed therapy (DOTS) programme was launched as part of the national TB control programme (NTP) in the country in 1999, and although treatment success rates reached 62% they remain below the WHO objective (85%) [5]. As a result, the current case detection rate is similarly at 87%. TB mortality rates in Saudi Arabia have fallen from 7.2% to 6.1% in the recent decade, whereas they have remained stable for non-Saudis (5.4%) [6, 7].

Many countries have difficulties in recognizing instances of childhood tuberculosis. According to the WHO, most countries have incorporated contact investigation in their national recommendations for detecting children's TB infections. Despite this, several of these activities have yet to be consistently implemented or expanded [8]. Some studies have shown that healthcare workers' lack of understanding about children's tuberculosis (TB) diagnosis, treatment, and prevention is a problem [9-11]. HCWs working in Hajj have been shown to have inadequate knowledge and attitudes toward infection prevention and control, especially TB control [12]. According to several studies, healthcare workers (HCWs) have a lack of understanding and attitudes about tuberculosis (TB) diagnosis and treatment, as well as poor practices that increase their risk of infection and which have a detrimental effect on patients and the community [13-16]. This study intended to study healthcare workers' knowledge, attitudes, and practice regarding diagnosing and managing tuberculosis (TB) among children. The findings may be used to identify problems, constraints, opportunities for improvement, and allocate resources and efforts to the most effective initiatives.

## Methods

**1. Study Design, Setting and Sample Size**

It is a quantitative cross-sectional study based on an online questionnaire sheet. The study was conducted at Al Madinah Al-Munawwarah from May 2022 to July 2022. The study included healthcare providers with various specialized services. The sample size was calculated using a web calculator as the proportions of questionnaire accuracy is 50%, and a margin of error of 5%, with a confidence interval of 95%; thus, about 378 records were enroled in the study. The Institutional Review Board (IRB) provided written approval regarding the aim of the study (22-051). Also, online consent was taken from the participants in the study.

**2. Data Collection and Instrument:**

The National Tuberculosis Program (NTP) in February 2020 and other previous studies led to the development of a structured questionnaire [9, 11] to assess the knowledge, attitude and practice (KAP) of healthcare providers regarding TB among children. The questionnaire included four parts. The Social factors included age, gender, education, years of experience, position, and training on pediatric TB. The second part included knowledge regarding pediatric TB as to the causes of TB, transmission pathways, symptoms, features of lymph nodes that indicate TB, and diagnostic criteria for childhood TB. Also, the participants' attitude was measured by studying their views on contact investigation, training on pediatric tuberculosis, TB diagnostic instruments, laboratory services, and human resources for childhood tuberculosis. Contact investigation performance, presumptive TB referrals for diagnostic work-ups, and TB treatment were all included in the information on practices.

**3. Data Management and Analysis Plan:**

The data was entered into the computer using the latest IBM SPSS software program (24.0) version. The use of numbers and percentages characterized the qualitative data. The Chi-square test was used to examine the degree of similarity between several groups concerning categorical variables. The significance test results are presented in the form of a two-tailed probability. At the 5% level, the significance of the findings was evaluated.

The scores for the KAP responses were determined. According to the most recent research, incorrect, improper, or unclear answers received a score of 0 points, while those that were right and appropriate were granted 1 point. For the multiple-choice questions that included more than one correct option, the score was determined by whether or not HCWs selected the correct response.

## Results

Of the 589 collected questionnaires, a total of 558 sheets were completed. The demographics and characteristics of included subjects are shown in Table 1. More than half of the respondents (59.5%) were aged between 25-34 years followed by 26% in the age group of 35-44 years. The majority of respondents worked at hospitals (66.7%) while 33.3% worked at health centres. Additionally, 62% had fewer than 10 years experience and 38% had more than 10 years experience. As for the educational level, 56.8% had a bachelor's degree, 20.1% had a diploma, 14% had a master's degree, and 9.1% had a PhD degree. Physicians (36.2%), nurses, and paramedics (33.7%), followed by pharmacists (13.1%) were the major positions of most of the healthcare workers. Regarding the training on childhood TB status, only 25.1% of respondents had received previous TB training.

**Table 1: Demographic and characteristic features of the HCWs.**

| Demographic and characteristic features of the HCWs | No | % |
|---|---|---|
| Age | | |
| 25-34 | 332 | 59.5 |
| 35-44 | 145 | 26.0 |
| 45-54 | 52 | 9.3 |
| >55 | 29 | 5.2 |
| Marital status | | |
| Single | 225 | 40.3 |
| Married | 302 | 54.1 |
| Divorced | 31 | 5.6 |
| Experience | | |
| Less than 10 years old | 346 | 62.0 |
| more than 10 years | 212 | 38.0 |
| Workplace | | |
| Health center | 186 | 33.3 |
| Hospital | 372 | 66.7 |
| Have isolation in your work | | |
| No | 96 | 17.2 |
| Yes | 462 | 82.8 |
| Isolation area is | | |
| Ward | 62 | 13.4 |
| Room | 400 | 86.6 |
| Position | | |
| Physician | 202 | 36.2 |
| Physician Dentist | 7 | 1.3 |
| Pharmacist | 73 | 13.1 |
| Nursing/Paramedic | 188 | 33.7 |
| Lab, Radiologist | 53 | 9.5 |
| Non-medical job | 35 | 6.3 |
| Education levels | | |
| Bachelor | 317 | 56.8 |
| Consultant/ PhD | 51 | 9.1 |
| Diploma | 112 | 20.1 |
| Master/ Senior | 78 | 14.0 |
| Training on childhood TB | | |
| No | 418 | 74.9 |
| Yes | 140 | 25.1 |
| **Total** | **558** | **100.0** |

The questions relating to the knowledge of healthcare workers are presented in Table 2. The majority of respondents (62.5%, 65.4%) correctly answered the question that TB is a transmissible disease caused by bacteria, respectively. Also, more than half of healthcare workers had sound knowledge regarding the methods of transmission and the exact length of treatment for reducing transmission. The low level of knowledge was associated with the definition of high-risk groups of children, duration of cough, temperature, general symptoms, and the characteristics of enlarged lymph nodes and screening criteria.

The attitude of healthcare workers regarding TB diagnosis is illustrated in Table 3. The diagnostic criteria and laboratory services of childhood TB were evaluated as adequate among 57.6% of the participants. More than half of healthcare workers had a positive attitude toward the provision of proper training (62.9%), sufficient staff (52.9%), and sufficient drugs (51.4%). On the other hand, the negative attitudes were related to bringing close contact to smear + PTB to HF for TB screening and referring suspected TB cases to diagnostic workup.

The practice pattern for children's TB screening was improper among most participants, as only 25.4% always asked index TB patients to bring their close contacts to health facilities for TB screening, while 19.7% did this often. About 29.6% and 26% will always and often perform contact investigations in the community. Less than 50% of the respondents would always and often treat childhood TB. As for the protective measures, only 23.5% will always wear personal protective equipment before contact with children with TB or presumptive TB (Table 4).
Table (4): Practice pattern of TB diagnosis and screening.

**Table 2: Questions related to HCWs' knowledge**

| Knowledge | Frequency | Percentage |
|---|---|---|
| TB is caused by bacteria | | |
| Yes | 351 | 62.9 |
| No | 207 | 37.1 |
| TB is a transmissible disease | | |
| Yes | 365 | 65.4 |
| No | 193 | 34.6 |
| TB is spread through expectorated droplet | | |
| Yes | 290 | 52.0 |
| No | 268 | 48.0 |
| Transmission is reduced after a smear-positive PTB received treatment for two weeks | | |
| Yes | 305 | 54.7 |
| No | 253 | 45.3 |
| Knew at least two out of three groups of children at high risk of developing TB below | | |
| Age lessthan 1-year-old | 205 | 36.7 |
| Living with smear-positive PTB | 165 | 29.6 |
| Living with HIV | 188 | 33.7 |
| Knew at least four out of eight childhood TB symptoms/signs below | | |
| Chronic cough | 298 | 53.4 |
| Persistent fever | 214 | 38.4 |
| Weight loss or no weight gain | 102 | 18.3 |
| Night sweats | 144 | 25.8 |
| Bone deformity | 95 | 17.0 |
| Enlarged lymph nodes | 88 | 15.8 |
| Arthralgia | 98 | 17.6 |
| Asthenia | 80 | 14.3 |
| Knew duration of cough that implies TB (≥2 weeks): | | |
| 1 week | 240 | 43.0 |
| 2 weeks | 166 | 29.7 |
| More than 2 weeks | 182 | 32.6 |
| Knew level of fever that implies TB (>38.0 °C) | | |
| 37 | 201 | 36.0 |
| 38 | 196 | 35.1 |
| More than 38 | 191 | 34.2 |
| Knew at least three out of six characteristics of enlarged lymph nodes implying TB below | | |
| Enlarged ≥2 cm | 149 | 26.7 |
| Painless | 144 | 25.8 |
| Asymmetric | 136 | 24.4 |
| Firm, matted or discreet | 152 | 27.2 |
| Persistent (>2 weeks) | 121 | 21.7 |
| Unresponsive to other treatments (such as antibiotics) | 109 | 19.5 |
| Knew at least four out of seven screening criteria for childhood TB below | | |
| Enlarged lymph nodes | 112 | 20.1 |
| Persistent cough | 298 | 53.4 |
| Persistent wheezing | 201 | 36.0 |
| Weight loss or not gaining weight | 142 | 25.4 |
| Fever | 214 | 38.4 |

**Table 3: Distribution of the studied group regarding their attitude**

| | Strongly agree | | Agree | | Disagree | | Strongly disagree | |
|---|---|---|---|---|---|---|---|---|
| | No. | % | No. | % | No. | % | No. | % |
| Diagnostic tools are adequate for diagnosis of childhood TB | 165 | 29.6 | 156 | 28.0 | 85 | 15.2 | 152 | 27.2 |
| Laboratory services are adequate for the diagnosis of childhood TB | 204 | 36.6 | 142 | 25.4 | 95 | 17.0 | 117 | 21.0 |
| Majority of staff in charge of TB have adequate training on childhood TB | 241 | 43.2 | 110 | 19.7 | 103 | 18.5 | 104 | 18.6 |
| Sufficient staff to treat childhood TB | 165 | 29.6 | 130 | 23.3 | 122 | 21.9 | 141 | 25.3 |
| Always sufficient drugs to treat childhood TB | 145 | 26.0 | 142 | 25.4 | 110 | 19.7 | 161 | 28.9 |
| Would ask to bring close contact to smear + PTB to HF for TB screening | 149 | 26.7 | 122 | 21.9 | 163 | 29.2 | 124 | 22.2 |
| Would refer children who might have TB for TB diagnostic workup | 136 | 24.4 | 106 | 19.0 | 133 | 23.8 | 183 | 32.8 |

**Table 4: Practice pattern of TB diagnosis and screening.**

| Practice | Frequency | Percentage |
|---|---|---|
| Ask index TB patients to bring their close contacts to health facilities for TB screening | | |
| Always | 142 | 25.4 |
| Often | 110 | 19.7 |
| Sometimes | 114 | 20.4 |
| Never | 192 | 34.4 |
| Perform contact investigation in the community | | |
| Always | 165 | 29.6 |
| Often | 145 | 26.0 |
| Sometimes | 117 | 21.0 |
| Never | 131 | 23.5 |
| Treat childhood TB | | |
| Always | 127 | 22.8 |
| Often | 149 | 26.7 |
| Sometimes | 132 | 23.7 |
| Never | 150 | 26.9 |
| Do you wear personal protective equipment before contact with children with TB or presumptive TB? | | |
| Always | 131 | 23.5 |
| Often | 98 | 17.6 |
| Sometimes | 124 | 22.2 |
| Never | 205 | 36.7 |

Table 5 presents the KAP level of HCWs. The level of knowledge was excellent among 31.2%, good among 22.6%, fair among 18.5%, and poor among 27.8%. The attitude score was positive among the majority of respondents (49.1%) and the practice score was right and complete among 33.2% while about half had wrong practice patterns.

**Table 5: KAP level of HCWs**

| KAP | No | % |
|---|---|---|
| Knowledge | | |
| Excellent | 174 | 31.2 |
| Good | 126 | 22.6 |
| Fair | 103 | 18.5 |
| Poor | 155 | 27.8 |
| Attitude | | |
| Positive | 274 | 49.1 |
| Neutral | 152 | 27.2 |
| Negative | 132 | 23.7 |
| Practice | | |
| Right and complete | 185 | 33.2 |
| Right but not complete | 92 | 16.5 |
| Wrong | 281 | 50.4 |

Table 6 showed the variables predicting good knowledge as physicians, educational levels, previous TB training, and having an isolation ward in the hospital were significantly associated with better knowledge scores

**Table 6: Factors associated with HCWs' knowledge of childhood tuberculosis.**

| | Level of knowledge | | | | | | | | Total | $X^2$ P value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Excellent "n=174" | | Good "n=126" | | Faire "n=103" | | Poor "n=155" | | | |
| Age | No. | % | No. | % | No. | % | No. | % | | |
| 25-34 | 105 | 60.3 | 88 | 69.8 | 52 | 50.5 | 87 | 56.1 | 332 | |
| 35-44 | 45 | 25.9 | 20 | 15.9 | 32 | 31.1 | 48 | 31.0 | 145 | 15.9 |
| 45-54 | 15 | 8.6 | 10 | 7.9 | 15 | 14.6 | 12 | 7.7 | 52 | 0.06N.S |
| >55 | 9 | 5.2 | 8 | 6.3 | 4 | 3.9 | 8 | 5.2 | 29 | |
| Experience | | | | | | | | | | |
| Less than 10 years old | 102 | 58.6 | 85 | 67.5 | 65 | 63.1 | 94 | 60.6 | 346 | 2.61 |
| More than 10 years | 72 | 41.4 | 41 | 32.5 | 38 | 36.9 | 61 | 39.4 | 212 | 0.45N.S |
| Workplace | | | | | | | | | | |
| Health center | 62 | 35.6 | 44 | 34.9 | 36 | 35.0 | 44 | 28.4 | 186 | 2.38 |
| Hospital | 112 | 64.4 | 82 | 65.1 | 67 | 65.0 | 111 | 71.6 | 372 | 0.49N.S |
| Have isolation ward in your work | | | | | | | | | | 112.8 |
| No | 10 | 5.7 | 8 | 6.3 | 9 | 8.7 | 69 | 44.5 | 96 | 0.001* |
| Yes | 164 | 94.3 | 118 | 93.7 | 94 | 91.3 | 86 | 55.5 | 462 | |
| Position | | | | | | | | | | |
| Physician | 152 | 87.4 | 50 | 39.7 | 0 | 0.0 | 0 | 0.0 | 202 | |
| Physician Dentist | 2 | 1.1 | 5 | 4.0 | 0 | 0.0 | 0 | 0.0 | 7 | |
| Pharmacist | 10 | 5.7 | 32 | 25.4 | 20 | 19.4 | 11 | 7.1 | 73 | 407.8 |
| Nursing/Paramedic | 10 | 5.7 | 38 | 30.2 | 70 | 68.0 | 70 | 45.2 | 188 | 0.001* |
| Lab, Radiologist | 0 | 0.0 | 1 | 0.8 | 12 | 11.7 | 40 | 25.8 | 53 | |
| Non-medical job | 0 | 0.0 | 0 | 0.0 | 1 | 1.0 | 34 | 21.9 | 35 | |
| Education levels | | | | | | | | | | |
| Bachelor | 51 | 29.3 | 108 | 85.7 | 86 | 83.5 | 72 | 46.5 | 317 | |
| Consultant/ PhD | 51 | 29.3 | 0 | 0.0 | 0 | 0.0 | 0 | 0.0 | 51 | 414.7 |
| Diploma | 0 | 0.0 | 12 | 9.5 | 17 | 16.5 | 83 | 53.5 | 112 | 0.001* |
| Master/ Senior | 72 | 41.4 | 6 | 4.8 | 0 | 0.0 | 0 | 0.0 | 78 | |
| Training on childhood TB | | | | | | | | | | 341.6 |
| No | 42 | 24.1 | 118 | 93.7 | 103 | 100.0 | 155 | 100.0 | 418 | 0.001* |
| Yes | 132 | 75.9 | 8 | 6.3 | 0 | 0.0 | 0 | 0.0 | 140 | |

The positive attitude was related to having an isolation room at hospital, being a younger age, being physicians, working at hospitals, having higher educational levels, and having received TB training (Table 7). The level of practice showed a significant correlation with younger age, physician, working at hospitals, higher educational levels, and TB

**Table 7: Relation between basic demographic and characteristic feature of HCWs group with the level of attitude.**

| | Level of attitude | | | | | | Total | $X^2$ P value |
|---|---|---|---|---|---|---|---|---|
| | Positive "n=274" | | Neutral "n=152" | | Negative "n=132" | | | |
| Age | No. | % | No. | % | No. | % | | |
| 25-34 | 178 | 65.0 | 112 | 73.7 | 42 | 31.8 | 332 | 60.3 0.001* |
| 35-44 | 65 | 23.7 | 24 | 15.8 | 56 | 42.4 | 145 | |
| 45-54 | 20 | 7.3 | 12 | 7.9 | 20 | 15.2 | 52 | |
| >55 | 11 | 4.0 | 4 | 2.6 | 14 | 10.6 | 29 | |
| Experience | | | | | | | | |
| Less than 10 years old | 185 | 67.5 | 98 | 64.5 | 63 | 47.7 | 346 | 15.4 0.001* |
| more than 10 years | 89 | 32.5 | 54 | 35.5 | 69 | 52.3 | 212 | |
| Workplace | | | | | | | | |
| Health center | 60 | 21.9 | 40 | 26.3 | 86 | 65.2 | 186 | 79.6 0.001* |
| Hospital | 214 | 78.1 | 112 | 73.7 | 46 | 34.8 | 372 | |
| Have isolation in your work | | | | | | | | |
| No | 10 | 3.6 | 15 | 9.9 | 71 | 53.8 | 96 | 165.1 0.001* |
| Yes | 264 | 96.4 | 137 | 90.1 | 61 | 46.2 | 462 | |
| Position | | | | | | | | |
| Physician | 167 | 60.9 | 32 | 21.1 | 3 | 2.3 | 202 | 230.7 0.001* |
| Physician Dentist | 4 | 1.5 | 3 | 2.0 | 0 | 0.0 | 7 | |
| Pharmacist | 36 | 13.1 | 28 | 18.4 | 9 | 6.8 | 73 | |
| Nursing/Paramedic | 62 | 22.6 | 66 | 43.4 | 60 | 45.5 | 188 | |
| Lab, Radiologist | 4 | 1.5 | 18 | 11.8 | 31 | 23.5 | 53 | |
| Non-medical job | 1 | 0.4 | 5 | 3.3 | 29 | 22.0 | 35 | |
| Education levels | | | | | | | | |
| Bachelor | 210 | 76.6 | 65 | 42.8 | 42 | 31.8 | 317 | 279.9 0.001* |
| Consultant/ PhD | 45 | 16.4 | 6 | 3.9 | 0 | 0.0 | 51 | |
| Diploma | 1 | 0.4 | 75 | 49.3 | 36 | 27.3 | 112 | |
| Master/ Senior | 18 | 6.6 | 6 | 3.9 | 54 | 40.9 | 78 | |
| Training on childhood TB | | | | | | | | |
| No | 136 | 49.6 | 150 | 98.7 | 132 | 100.0 | 418 | 180.1 0.001* |
| Yes | 138 | 50.4 | 2 | 1.3 | 0 | 0.0 | 140 | |

**Table 8: Relation between characteristics of HCWs with the level of practice.**

| | Level of practice | | | | | | Total | $X^2$ P value |
|---|---|---|---|---|---|---|---|---|
| | Right complete "n=185" | | Right incomplete "n=92" | | Wrong "n=281" | | | |
| Age | No. | % | No. | % | No. | % | | |
| 25-34 | 132 | 71.4 | 44 | 47.8 | 156 | 55.5 | 332 | |
| 35-44 | 42 | 22.7 | 26 | 28.3 | 77 | 27.4 | 145 | 133.5 |
| 45-54 | 10 | 5.4 | 20 | 21.7 | 22 | 7.8 | 52 | 0.001* |
| >55 | 1 | 0.5 | 2 | 2.2 | 26 | 9.3 | 29 | |
| **Experience** | | | | | | | | |
| Less than 10 years old | 122 | 65.9 | 65 | 70.7 | 159 | 56.6 | 346 | 7.6 |
| more than 10 years | 63 | 34.1 | 27 | 29.3 | 122 | 43.4 | 212 | 0.021* |
| **Workplace** | | | | | | | | |
| Health center | 30 | 16.2 | 42 | 45.7 | 114 | 40.6 | 186 | 37.295 |
| Hospital | 155 | 83.8 | 50 | 54.3 | 167 | 59.4 | 372 | 0.001* |
| **Have isolation in your work** | | | | | | | | |
| No | 32 | 17.3 | 21 | 22.8 | 43 | 15.3 | 96 | 2.75 |
| Yes | 153 | 82.7 | 71 | 77.2 | 238 | 84.7 | 462 | 0.25N.S |
| **Position** | | | | | | | | |
| Physician | 171 | 92.4 | 31 | 33.7 | 0 | 0.0 | 202 | |
| Physician Dentist | 4 | 2.2 | 3 | 3.3 | 0 | 0.0 | 7 | |
| Pharmacist | 0 | 0.0 | 25 | 27.2 | 48 | 17.1 | 73 | 442.8 |
| Nursing/Paramedic | 10 | 5.4 | 25 | 27.2 | 153 | 54.4 | 188 | 0.001* |
| Lab, Radiologist | 0 | 0.0 | 8 | 8.7 | 45 | 16.0 | 53 | |
| Non-medical job | 0 | 0.0 | 0 | 0.0 | 35 | 12.5 | 35 | |
| **Education levels** | | | | | | | | |
| Bachelor | 48 | 25.9 | 56 | 60.9 | 213 | 75.8 | 317 | |
| Consultant/ PhD | 49 | 26.5 | 2 | 2.2 | 0 | 0.0 | 51 | 308.6 |
| Diploma | 12 | 6.5 | 32 | 34.8 | 68 | 24.2 | 112 | 0.001* |
| Master/ Senior | 76 | 41.1 | 2 | 2.2 | 0 | 0.0 | 78 | |
| **Training on childhood TB** | | | | | | | | |
| No | 52 | 28.1 | 86 | 93.5 | 280 | 99.6 | 418 | 323.9 |
| Yes | 133 | 71.9 | 6 | 6.5 | 1 | 0.4 | 140 | 0.001* |

The association between knowledge score with attitude and practice is presented in Table 9. The better the knowledge score, the more significant impact on positive attitude and correct and complete practice.

**Table 9: Relation between level of knowledge and both attitude and practice among health care workers.**

| | Level of knowledge | | | | | | | | Total | $X^2$ P value |
|---|---|---|---|---|---|---|---|---|---|---|
| | Excellent "n=174" | | Good "n=126" | | Fair "n=103" | | Poor "n=155" | | | |
| | No. | % | No. | % | No. | % | No. | % | | |
| Attitude | | | | | | | | | | |
| Positive | 142 | 81.6 | 85 | 67.5 | 42 | 40.8 | 5 | 3.2 | 274 | 488.5 |
| Neutral | 30 | 17.2 | 40 | 31.7 | 61 | 59.2 | 21 | 13.5 | 152 | 0.001* |
| Negative | 2 | 1.1 | 1 | 0.8 | 0 | 0.0 | 129 | 83.2 | 132 | |
| Practice | | | | | | | | | | |
| Right and complete | 154 | 88.5 | 31 | 24.6 | 0 | 0.0 | 0 | 0.0 | 185 | 583.4 |
| Right but not complete | 20 | 11.5 | 65 | 51.6 | 7 | 6.8 | 0 | 0.0 | 92 | 0.001* |
| Wrong | 0 | 0.0 | 30 | 23.8 | 96 | 93.2 | 155 | 100.0 | 281 | |

## Discussion

The primary findings of the present study were that HCWs had proper knowledge of TB patient characteristics, diagnosis, and treatment. There was a positive attitude regarding diagnosis and screening while practice competencies were limited.

The level of knowledge was excellent and good among 53.8% of participants. This was also found in the results of investigations conducted in major African centres [16, 17]. This result is similar to the 52% median International Standards for Tuberculosis Care (ISTC) score seen among medical professionals during the 2016 Hajj [17], which is lower than the 67.3% shown in Lima, Peru [18], but higher than the 14 % seen in India and the 10.5 to 48 % seen in Pakistan [19, 20]. However, this conclusion contradicts the low levels of TB knowledge across all occupational groups [14].

The results of the knowledge portion showed that, as was to be expected, doctors had the greatest overall knowledge scores, while nurses and pharmacists had lower overall knowledge scores. Naidoo et al. also identified a knowledge gap amongst occupations. Since doctors create care plans that nurses follow, it is crucial that nurses have a firm grasp of the fundamentals underlying clinical decisions [21].

On the other hand, healthcare professionals in trials involving public hospitals or clinicians who merged public and private practices seemed to have higher knowledge ratings, maybe as a result of their greater exposure to training materials in the public sector. As was previously found [19], this shows that public physicians at hospitals have a deeper understanding of TB than their private counterparts.

Aside from Côte d'Ivoire, all nations scored somewhat higher than average on global knowledge. Results improved dramatically when HCWs provided direct care for tuberculosis [22]. These results are consistent with previous research showing that frontline HCWs (physicians, nurses) know more about tuberculosis than other HCWs [17, 23].

The majority of responders (49.1%) had a positive attitude, while only 33.2% had correct and full practice routines. It is consistent with the results of a recent study Surveying the Knowledge and Practices of Health Professionals in China, India, Iran, and Mexico on Treating Tuberculosis [15] that found some problematic behaviours among HCWs. However, HCWs globally had generally positive attitudes; a good indicator that they were ready and able to identify and treat pediatric tuberculosis [22]. Also, the overall mean score for practice was greater than the scores for knowledge and attitude [14, 24]. Of the HCWs, almost 62% were given passing marks for their overall practice, while only 1% were given failing marks. In this study, we found that HCWs' TB knowledge increased with age, employment in hospitals, years of experience, and experience with TB patients. Similar factors affecting TB awareness among HCWs were observed across global studies [14, 18, 24]. Attitude ratings were substantially correlated with both age and profession. Researchers in Peru discovered that healthcare workers' attitudes regarding tuberculosis varied by the position of HCW [13], while in Thailand, researchers found that HCWs age was substantially correlated to their attitude toward the disease [25]. There was a statistically significant difference in practice scores according to education level, and there were also significant differences relating to the length of work experience and by occupation. Mozambican research indicated that HCWs TB practice ratings were significantly correlated to their educational attainment, profession, and years of experience caring for TB patients [14, 16]. However, work experience with TB, TB training, and education level were found to be independent predictors of excellent TB infection control practice among HCWs in Ethiopia [24]. There was a favourable association between knowledge and attitude, as well as between attitude and practice [17]. Nonetheless, the connection was tenuous, nd results on either the knowledge or practice quizzes did not show any statistically significant correlation among previous studies. There is no straightforward correlation between HCWs' knowledge, attitudes, and behaviors in regards to TB management, as suggested by reports in the literature [14, 16, 24].

There were some limitations in this survey. In the context of a prospective project launch and group KAP questionnaire-filling sessions, social desirability may influence results. Some participants may have answered questions as if they were factual or policy-based. Good practices among HCWs may have been overstated since they were self-reported and not observed.

This study has several strength factors including a proper sample size that could provide a base for the KAP of HCWs in KSA. Also, the survey results reveal the essential next stages in the decentralization of child TB diagnosis, including the continuous improvement of HCW capabilities and skills to identify, diagnose, and treat TB in children; and the improvement of availability of simple, rapid, and effective diagnostic equipment.

## Conclusion

Overall, HCWs exhibited proper knowledge and positive attitudes in comparison with minimal experience in diagnosing children TB. Immediate action is required to increase HCW awareness, capacity, and skills, as well as access to an accurate diagnosis. In the fields of TB case identification and management, certain crucial information gaps were discovered. This study also highlights the significance of clinical experience and frequent interactions with tuberculosis patients in clinical practice as a pathway to competency-based learning by practice.

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## References

1. Organization WH. Global tuberculosis report 2020: World Health Organization; 2020.
2. Coghlan R, Gardiner E, Amanullah F, Ihekweazu C, Triasih R, Grzemska M, et al. Understanding Market Size and Reporting Gaps for Paediatric TB in Indonesia, Nigeria and Pakistan: Supporting Improved Treatment of Childhood TB in the Advent of New Medicines. PloS one. 2015;10(10).
3. Kabir S, Rahman SMM, Ahmed S, Islam MS, Banu RS, Shewade HD, et al. Xpert Ultra Assay on Stool to Diagnose Pulmonary Tuberculosis in Children. Clinical infectious diseases : an official publication of the Infectious Diseases Society of America. 2021;73(2):226-34.
4. Cartaxo CG, Rodrigues LC, Braga CP, Ximenes RA. Measuring the accuracy of a point system to diagnose tuberculosis in children with a negative smear or with no smear or culture. J Epidemiol Glob Health. 2014;4(1):29-34.
5. Al-Hajoj S, Varghese B. Tuberculosis in Saudi Arabia: the journey across time. J Infect Dev Ctries. 2015;9(3):222-31.
6. Abouzeid MS, Al RF, Memish ZA. Mortality among tuberculosis patients in Saudi Arabia (2001-2010). Annals of Saudi medicine. 2013;33(3):247-52.
7. Aljohaney AA. Mortality of patients hospitalized for active tuberculosis in King Abdulaziz University Hospital, Jeddah, Saudi Arabia. Saudi medical journal. 2018;39(3):267-72.
8. Organization WH. Roadmap towards ending TB in children and adolescents. https://appswhoint/iris/bitstream/handle/10665/275422/9789241514798-engpdf. 2018.
9. Fazli GS, Creatore MI, Matheson FI, Guilcher S, Kaufman-Shriqui V, Manson H, et al. Identifying mechanisms for facilitating knowledge to action strategies targeting the built environment. BMC public health. 2017;17(1):1. doi:10.1186/s12889-016-3954-4.
10. van Oort PM, Nijsen T, Weda H, Knobel H, Dark P, Felton T, et al. BreathDx - molecular analysis of exhaled breath as a diagnostic test for ventilator-associated pneumonia: protocol for a European multicentre observational study. BMC pulmonary medicine. 2017;17(1):1. doi:10.1186/s12890-016-0353-7.
11. An Y, Teo AKJ, Huot CY, Tieng S, Khun KE, Pheng SH, et al. Knowledge, attitude, and practices regarding childhood tuberculosis detection and management among health care providers in Cambodia: a cross-sectional study. BMC Infect Dis. 2022;22(1):317-. doi:10.1186/s12879-022-07245-1.
12. Ghabrah TM, Madani TA, Albarrak AM, Alhazmi MA, Alazraqi TA, Alhudaithi MA, et al. Assessment of infection control knowledge, attitude and practice among healthcare workers during the Hajj period of the Islamic year 1423 (2003). Scand J Infect Dis. 2007;39(11-12):1018-24.
13. Wahab FA, Abdullah S, Abdullah JM, Jaafar H, Noor SS, Mohammad WM, et al. Updates on Knowledge, Attitude and Preventive Practices on Tuberculosis among Healthcare Workers. Malays J Med Sci. 2016;23(6):25-34.
14. Noé A, Ribeiro RM, Anselmo R, Maixenchs M, Sitole L, Munguambe K, et al. Knowledge, attitudes and practices regarding tuberculosis care among health workers in Southern Mozambique. BMC pulmonary medicine. 2017;17(1):2. doi:10.1186/s12890-016-0344-8.
15. Hoffman SJ, Guindon GE, Lavis JN, Randhawa H, Becerra-Posada F, Dejman M, et al. Surveying the Knowledge and Practices of Health Professionals in China, India, Iran, and Mexico on Treating Tuberculosis. The American journal of tropical medicine and hygiene. 2016;94(5):959-70. doi:10.4269/ajtmh.15-0538.
16. Engelbrecht M, Janse van Rensburg A, Kigozi G, van Rensburg HD. Factors associated with good TB infection control practices among primary healthcare workers in the Free State Province, South Africa. BMC Infect Dis. 2016;16(1):633. doi:10.1186/s12879-016-1984-2.
17. Alotaibi B, Yassin Y, Mushi A, Maashi F, Thomas A, Mohamed G, et al. Tuberculosis knowledge, attitude and practice among healthcare workers during the 2016 Hajj. PloS one. 2019;14(1):e0210913. doi:10.1371/journal.pone.0210913.
18. Minnery M, Contreras C, Pérez R, Solórzano N, Tintaya K, Jimenez J, et al. A cross sectional study of knowledge and attitudes towards tuberculosis amongst front-line tuberculosis personnel in high burden areas of Lima, Peru. PloS one. 2013;8(9):e75698. doi:10.1371/journal.pone.0075698.

19. Naseer M, Khawaja A, Pethani AS, Aleem S. How well can physicians manage tuberculosis? A public-private sector comparison from Karachi, Pakistan. BMC Health Serv Res. 2013;13:439. doi:10.1186/1472-6963-13-439.
20. Achanta S, Jaju J, Kumar AM, Nagaraja SB, Shamrao SR, Bandi SK, et al. Tuberculosis management practices by private practitioners in Andhra Pradesh, India. PloS one. 2013;8(8):e71119. doi:10.1371/journal.pone.0071119.
21. Naidoo S, Taylo M, Esterhuizen T, Nordstrom D, Mohamed O, Knight S, et al. Changes in healthcare workers' knowledge about tuberculosis following a tuberculosis training programme. Education for Health. 2011;24(2):514.
22. Joshi B, Font H, Wobudeya E, Nanfuka M, Kobusingye A, Mwanga-Amumpaire J, et al. Knowledge, attitudes and practices on childhood TB among healthcare workers. Int J Tuberc Lung Dis. 2022;26(3):243-51. doi:10.5588/ijtld.21.0317.
23. Dramowski A, Whitelaw A, Cotton MF. Healthcare-associated infections in children: knowledge, attitudes and practice of paediatric healthcare providers at Tygerberg Hospital, Cape Town. Paediatr Int Child Health. 2016;36(3):225-31. doi:10.1179/2046905515y.0000000032.
24. Demissie Gizaw G, Aderaw Alemu Z, Kibret KT. Assessment of knowledge and practice of health workers towards tuberculosis infection control and associated factors in public health facilities of Addis Ababa, Ethiopia: A cross-sectional study. Archives of public health = Archives belges de sante publique. 2015;73(1):15. doi:10.1186/s13690-015-0062-3.
25. Lertkanokkun S, Okanurak K, Kaewkungwal J, Meksawasdichai N. Healthcare providers' knowledge, attitudes & practices regarding tuberculosis care. JItMM2012 PrOcEEDInGs. 2013;2:1-10.