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Delayed Tuberculosis Detection in Healthcare Workers: Lessons from a Tuberculosis Outbreak in a Tertiary Care Hospital

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Abstract

In March 2024, a healthcare worker (HCW) at a tertiary care hospital was confirmed with pre-extensively drug-resistant tuberculosis (pre-XDR-TB) after a delay of over 30 days following an abnormal chest X-ray (CXR). We investigated to verify the outbreak and diagnosis, describe its characteristics, review the HCW TB screening program, and identify factors associated with adequate CXR follow-up. We reviewed TB cases among HCWs in the hospital and conducted contact investigations via TB symptoms, CXR screening, and sputum GeneXpert tests. Confirmed cases were defined by positive bacteriological test, while probable cases were defined otherwise. We interviewed stakeholders to identify possible causes of delayed TB detection. We confirmed three HCWs with pulmonary TB (one pre-XDR-TB) and identified one probable case. There were three females and one male, all aged 30–39, and three had delayed detection. The attack rate among 90 contacts was 3.3%. In 2023, 32 out of 310 HCWs with abnormal CXRs (10%) completed CXR follow-up and 19 (6%) underwent sputum testing. The TB screening program faced challenges due to deviations from national guidelines, reliance on clinician judgment, and limited resources, contributing to delayed detection. A history of TB treatment and receiving sputum test for TB were significantly associated with adequate CXR follow-up, while good tuberculosis knowledge was probably associated with adequate CXR follow-up. This outbreak highlights the need to improve TB screening processes and education to reduce delayed detection in HCWs.

Keywords: tuberculosis, healthcare workers, outbreak, knowledge, delayed detection, screening

Introduction

Pulmonary tuberculosis (PTB) is a contagious disease caused by *Mycobacterium tuberculosis* (MTB), spreading through the air.[1] Its incubation period ranges from weeks to years.[2] Symptoms include prolonged cough, chest pain, and hemoptysis. Drug-susceptible tuberculosis (DS-TB) is treatable with a 6-month standard regimen. Drug-resistant tuberculosis (DR-TB) arises from improper TB medication use (acquired drug resistance), or exposure to DR-TB strains (primary drug resistance).[3,4] Multidrug-resistant tuberculosis (MDR-TB) is resistant to rifampicin and isoniazid. Pre-extensively drug-resistant TB (pre-XDR-TB) is MDR/rifampicin-resistant TB with fluoroquinolone resistance, while extensively drug-resistant TB (XDR-TB) is additionally resistant to other Group A drugs.[5] MDR-TB treatment lasts at least 9 months with 75% success rate, while XDR-TB requires 20 months with 50% success rate.[6] Post-TB complications are more common in DR-TB cases.[3]

In 2022, there were approximately 400,000 MDR/rifampicin-resistant TB cases globally, including

170,000 in Southeast Asia.[7,8] In 2023, Thailand reported 948 DR-TB cases, including 56 pre-XDR-TB and 6 XDR-TB cases.[9]

Delayed detection, especially treatment delays exceeding 60 days, worsens disease progression.[10] Early detection and treatment are critical for control, with systematic screening of high-risk groups using chest X-rays (CXR) recommended.[11] A positive test result should trigger further investigation.[12] While increased screening identifies more presumptive cases, access to diagnostic services remains crucial.[13] Patient delay is the time from symptom onset to first consultation. Health system delay is from first consultation to diagnosis. In low- and middle-income countries, median delays are 27 days for patient delay, 18 days for health system delay, and 57 days for total delay.[14]

Healthcare workers (HCWs) have a threefold higher TB incidence than the general population.[15] Annual CXR screening is recommended, or biannual if working directly with TB patients. Abnormal CXR results warrant a sputum test and follow-up CXR in six months.[16,17] While TB prevalence in HCWs has been studied, challenges in HCW screening remain unexplored.

On 1 Mar 2024, a pre-XDR-TB case in an HCW at a tertiary care (Hospital A) was reported. During 5–29 Mar 2024, we investigated to verify the diagnosis, confirm the outbreak, identify contacts and possible source cases, and describe the epidemiological characteristics. The investigation also reviewed the HCW TB screening program at Hospital A, assessed factors influencing follow-up of abnormal CXRs, and provided recommendations.

Methods

Operational Definitions

An HCW is Hospital A employee. Front-line HCWs have patient contact, while back-office HCWs do not. TB contact, case, and outbreak definitions are as follows:

- Household contact: a person living with a probable/confirmed case from 1 Jan 2023 to 5 Mar 2024.
- Close contact: a person who was not a household contact but spent ≥8 hours per day or ≥120 hours per month with a probable/confirmed case from 1 Jan 2023 to 5 Mar 2024.
- Suspected case: index case or contact with one of following criteria: chronic cough, fever >2 weeks, hemoptysis, significant weight loss, abnormal CXR.
- Probable case: a suspected case with negative bacteriological test but TB diagnosed by physician.
- Confirmed case: a suspected case with bacteriologically confirmed TB.
- Confirmed pre-XDR-TB case: confirmed case with sputum drug sensitivity resistant to isoniazid, rifampicin, and fluoroquinolone.
- Tuberculosis outbreak: a cluster of ≥2 TB cases within three months with epidemiological linkage.
- Abnormal CXR: CXR showing active TB or other abnormalities.
- Delayed TB detection: a period >30 days between first abnormal CXR and TB diagnosis.
- Adequate CXR follow-up: repeat CXR within six months after abnormal CXR.

Descriptive Study

We reviewed the National Tuberculosis Information Program and the paper-based HCW TB registry at Hospital A for TB cases diagnosed between 2019 and 2023. The index case was interviewed on symptoms, medical history, and previous TB contacts. DR-TB medical records in the index case's workplace from 2020-2023 were reviewed. Active case finding involved: (1) reviewing admission records to identify HCWs exposed to the index case; (2) symptom screening and CXR for all contacts; (3) sputum GeneXpert MTB/rifampicin testing for contacts with abnormal CXRs and selected contacts with normal CXRs based on hospital's risk and cost consideration such as increased time spent with the index case, absence of using protective equipment, or having health insurance from the civil service medical benefit scheme; (4) MTB culture for probable/confirmed TB cases. Data were collected via structured questionnaire including age, gender, occupation, symptoms, contact type, CXR, laboratory results, and treatment. Data were summarized by frequency, proportion, ratio, interquartile range (IQR), and median.

We reviewed the TB screening program at Hospital A and interviewed a physician, laboratory technician, nurse, and public health officer, regarding the HCW screening processes and staff roles. We described the HCW TB screening workflow, identifying potential gaps contributing to delayed TB detection, and screening results in 2023.

Environmental Study

We surveyed the index case' s household and workplace to assess the TB transmission risk. Household

assessment included location, housing type, ventilation, sun exposure, and living areas. Workplace assessment included reviewing ventilation assessment report, bed capacity, and active beds number.

Analytical Study

A retrospective cohort study was conducted to analyze factors associated with adequate CXR follow-up after the 2023 CXR screening (January–March). Eligible HCWs had radiologist-reported lung abnormalities and responded to our questionnaire. We excluded active TB cases, follow-up CXR for comorbidities, and positive sputum test for TB. The questionnaire adapted from the World Health Organization guidelines, a previous study, and then reviewed by a TB medical epidemiologist.[18,19] The questionnaire covered socio-demographics, TB knowledge (34 questions on causes, symptoms, transmission, risk factors, diagnosis, treatment, and prevention). Correct answers scored 1, incorrect 0, with total scored from 0–34. Scores >20 (10% more than the reference) were categorized as "good" TB knowledge and "poor" otherwise.[19] The questionnaire' s reliability (Cronbach' s alpha) was 0.86. Other variables included age, gender, education, HCW type, comorbidities, TB treatment history, history of TB exposure, TB symptoms, and receiving a sputum test for TB.[14] Univariable analysis used chi-square tests, and multivariable analysis using Poisson regression with robust standard errors was calculated for an adjusted risk ratio (RR) for variables with p-value <0.2 in univariable analysis.[20] Statistical significance was defined as p-value <0.05, using STATA version 16.

Ethics

This study was part of routine outbreak response and did not require ethics approval.

Results

Descriptive Study

Hospital A is a 914-bed regional hospital employing 2,935 HCWs. During 2019–2023, there were 718, 738, 615, 636, 476 new TB cases annually, respectively (total 3,183), of which 4, 7, 7, 6, 6 were HCWs, respectively (total 30) with the first pre-XDR-TB case reported in 2023.

The index case was a 31-year-old Thai female with mild anemia and no other comorbidities nor prior TB history, working as a patient care assistant at Hospital A since 2020. Her initial CXR was normal. In March 2023, she developed an intermittent cough with reticular opacities CXR, but sputum acid-fast bacillus (AFB) and polymerase chain reaction (PCR) tests were negative, and no follow-up CXR was done. By mid-January 2024, she experienced fever and fatigue and sought medical care on 1 February. After several visits, she was diagnosed with PTB on 8 Feb 2024 after miliary opacities appeared on her CXR. Initial sputum AFB and PCR tests were negative for TB, and she started standard TB treatment. A GeneXpert MTB/XDR test on 27 February confirmed pre-XDR-TB, and she was switched to a drug-resistant TB regimen on 10 Mar 2024. In May 2024, a sputum liquid culture grew nontuberculous mycobacteria, but no drug susceptibility testing was performed.

The index case had no known close TB contacts in the past two years but regularly interacted with TB patients at work, while wearing only a surgical mask. Between 2020 and 2023, two pre-XDR-TB patients (possible source cases) were admitted to the isolation room, where the index case worked. Her tasks included recording vital signs, feeding, and bathing these patients, spending 10–30 minutes per session, three times daily.

Contact investigation identified eight household contacts and 82 close contacts: 47 HCWs from the same ward as the index case and 35 HCWs from the wards where she was hospitalized. Among household contacts, one had an abnormal CXR but a negative sputum GeneXpert test. Among the close contacts, 77 underwent CXR with eight showing abnormalities, 49 underwent sputum GeneXpert MTB/rifampicin test with two having MTB detected (Table 1). One close contact with an abnormal CXR tested negative for MTB on sputum but was diagnosed with PTB based on a lung computed tomography scan (CT-scan). Therefore, among the 90 contacts, two confirmed TB cases, one probable case, and seven suspected cases were identified.

Table 1. Active case finding results and tuberculosis case detection among household and close contacts

Type of contact	Number	CXR screening (abnormal/total)	GeneXpert (detected/total)	Tuberculosis cases identified
Household contact	8	1/8 (13%)	0/8 (0%) (1 abnormal CXR, 7 normal CXR)	1 suspected case
Close contact	82	8/77 (10%)	2/49 (4%) (8 abnormal CXR, 41 normal CXR)	2 confirmed cases 1 probable case 6 suspected cases

Among close contacts, 5 who had no CXR screening included 1 pregnant woman (4 could not be contacted). Among GeneXpert MTB detected, 1 had a normal CXR. CXR: chest X-ray. MTB: Mycobacterium tuberculosis.

This outbreak included 11 PTB cases: one confirmed pre-XDR-TB, two confirmed TB cases, one probable case, and seven suspected cases. Among PTB cases, three were male (male-to-female ratio was 1:2.7), with a median age of 34 (IQR 30.0–42.5). Six were nurses, four were patient care assistants, and one was unemployed. Nine were asymptomatic and two had a chronic cough. Ten had abnormal CXRs. Among the confirmed TB cases, one had an abnormal CXR and MTB detected, while the other had a normal CXR and MTB detected. The probable case had an abnormal CXR and MTB was not detected (diagnosed by lung CT-scan). Among probable and confirmed cases, three had delayed TB detection. No phenotypic drug susceptibility testing was done because no MTB culture showed drug resistance (Table 2). Eight household contacts of confirmed TB cases were identified, all asymptomatic with normal CXRs.

Table 2. Characteristics of probable and confirmed TB cases in a tertiary care hospital, 2024

Characteristic	Case 1 (index)	Case 2	Case 3	Case 4
Type of case	Pre-XDR-TB	Confirmed TB	Confirmed TB	Probable
Gender	Female	Female	Female	Male
Age (years)	31	30	34	39
Position	Patient care assistant	Nurse	Nurse	Patient care assistant
TB Symptom	Chronic cough, dyspnea	Chronic cough	No symptom	No symptom
Onset	January 2024	February 2024	-	-
Past CXR screening (lesion)	Abnormal, March 2023 (Ground-glass and reticular opacities left lung)	Normal last, March 2023	Abnormal, March 2023 (Reticular opacity right upper lung)	Abnormal, March 2023 (Reticulonodular left upper lung)
Latest CXR result	Abnormal	Abnormal	Normal	Abnormal
GeneXpert MTB/RIF	MTB detected/ RIF resistant	MTB detected/ RIF susceptible	MTB detected/ RIF intermediate resistant	MTB not detected
GeneXpert MTB/XDR	FLQ resistant	Not done	Not done	Not done
Line probe assay	INH resistant/ RIF resistant/ FLQ invalid	Not done	INH susceptible/ RIF susceptible	Not done
CT scan	Not done	Not done	Not done	Abnormal suggest TB
Culture	NTM	No growth	MTBC	No growth
Phenotypic DST	Not done	Not done	Not done	Not done
Treatment regimen	BPaL	IRZE	IRZE	IRZE

Pre-XDR-TB: pre-extensively drug-resistant tuberculosis. CXR: chest X-ray. MTB: Mycobacterium tuberculosis. MTBC: Mycobacterium tuberculosis complex. NTM: nontuberculous mycobacteria. RIF: rifampicin. INH: isoniazid. FLQ: fluoroquinolone. CT: computed tomography. DST: drug susceptibility test. BPal: bedaquiline, pretomanid, linezolid. IRZE: isoniazid, rifampicin, pyrazinamide, ethambutol.

Environmental Study

The index case lived in two one-story concrete houses in a low-density community with good ventilation and sun exposure. In the first house, she lived with five family members, sharing a room with her husband and son and rarely interacted with neighbors. In the second, she lived with three family members in a shared hall.

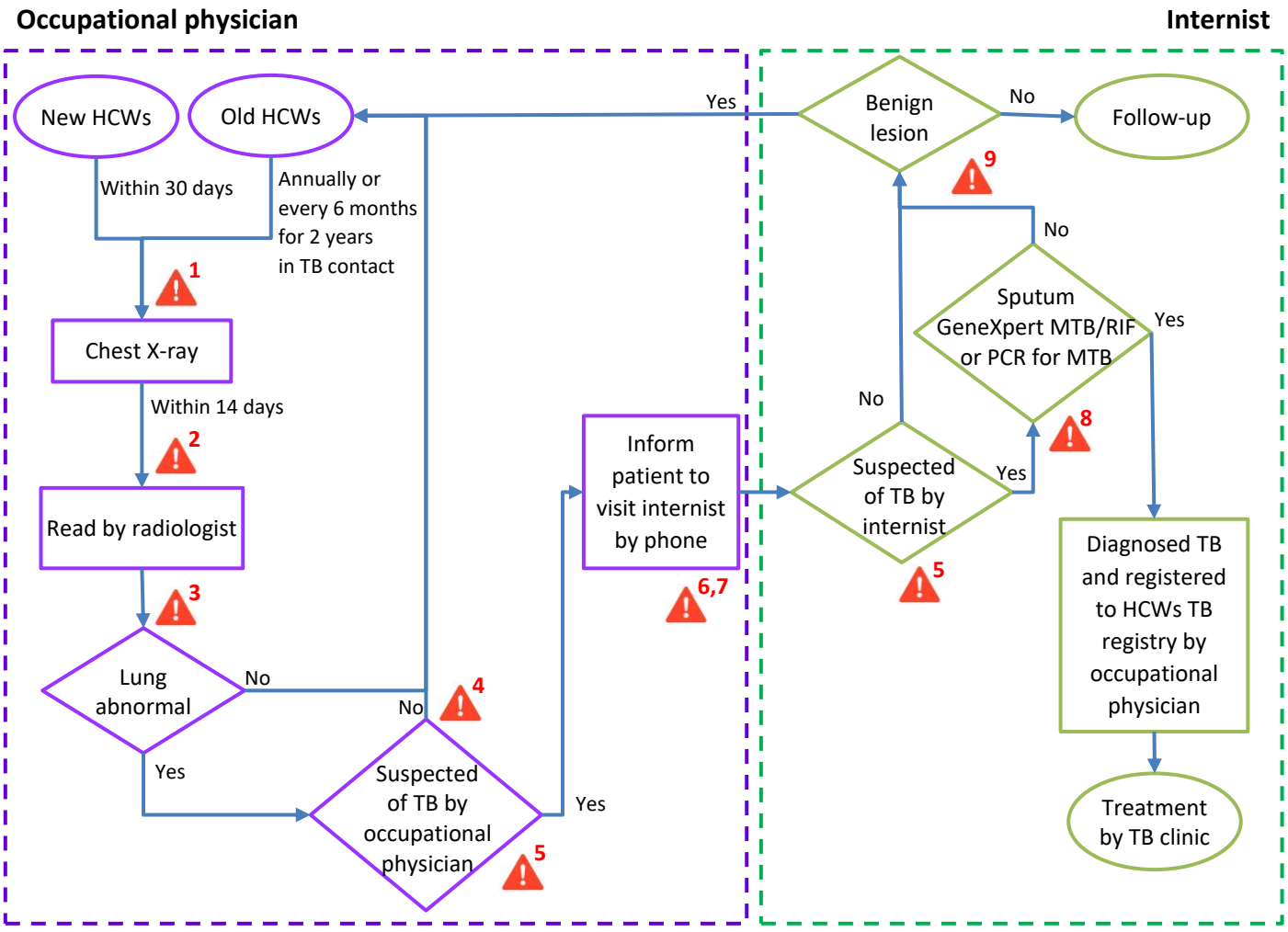
She worked in a 30-bed ward, operating as a 60-bed ward (200% occupancy rate), with two isolation rooms lacking anterooms, airflow control, or filtration. Air changes per hour (ACH) in the nurse' s station, general zone, semi-intensive care unit, general isolation room, and TB isolation room ranged from 0 to 4.2, and most exhaust fan were nonfunctional.

TB screening for HCWs at Hospital A

In 2023, new HCWs were required to undergo CXR screening within 30 days of recruitment, while existing HCWs were required to have annual CXR, or biannually if their TB infection risk was high. Radiologists initially

reported CXR results, and all abnormal reports were re-evaluated by an occupational physician. The occupational medicine department contacted HCWs with TB-compatible CXR results by phone, advising them to see an internist. The internist reinterpreted CXR and, if TB was suspected, ordered sputum investigations with GeneXpert or PCR, rarely using AFB. If TB was not suspected, HCW had no follow-up until the next CXR screening. HCWs diagnosed with TB were registered by the occupational medicine department and treated in the TB clinic. Possible deficiencies in these processes, such as no verbal screening, low use of sputum tests, and no mandatory repeat CXR for those with an abnormal result, may have led to delays in TB detection (Figure 1).

In 2023, out of 2,935 HCWs at Hospital A, 2,608 (88.9%) underwent CXR screening. Of these, radiologists reported lung abnormal findings in 310 cases (11.9%). Of these, 32 (10.3%) visited an internist or general physician, and 19 (6.1%) received a sputum test for TB, resulting in 6 (1.9%) confirmed TB cases.



HCW: health care worker. TB: tuberculosis. MTB: Mycobacterium tuberculosis. RIF: rifampicin. PCR: polymerase chain reaction. CXR: chest X-ray.

Possible causes of delayed TB detection:

1. CXR-based protocol, lack of verbal screening in the protocol.
2. Delayed CXR formal reporting due to lack of radiologists.
3. No alert system if the patient has an abnormal CXR.
4. Patients with abnormal lung lesions and not suspected of TB by occupational physician not receiving follow-up CXR within 6 months.
5. Suspected tuberculosis by occupational physician and internist based on clinical decisions, no specific criteria.
6. No formal appointment for suspected tuberculosis patients.
7. No screening result recorded in the medical record in the health information system.
8. GeneXpert or PCR tests were performed for suspected TB cases, but the laboratory capacity was insufficient due to dysfunctional machines and a shortage of test kits.
9. Individuals with an abnormal lung lesion defined as benign by the clinician, based on their judgment, will have no follow-up CXR.

Figure 1. TB screening for HCWs in Hospital A in 2023 and possible causes of delayed TB detection

Analytical study

Among 310 HCWs with lung abnormal CXR, 248 (59.6%) answered our questionnaire (Figure 2). Among all participants, the median (IQR) age was 43 (36-48) years, the male-to-female ratio was 1:3.6, 187 (75.4%) were front-line workers, 185 (74.6%) demonstrated good TB knowledge, and 24 (9.7%) received adequate CXR follow-up. Among 63 HCWs with poor TB knowledge, 39 (61.9%) worked in back-office. They scored poorly (<25% correct) regarding TB risk factors and symptoms. Results of univariable and multivariable analyses are shown in Table 3. History of TB treatment and receiving a sputum test for TB were significantly associated with adequate CXR follow-up with RRs (95% CI) of 2.93 (1.31–6.54) and 4.14 (1.96–8.77), respectively. Good TB knowledge was associated with adequate CXR follow-up with a RR (95% CI) of 2.26 (0.75–6.83), however not statistically significant.

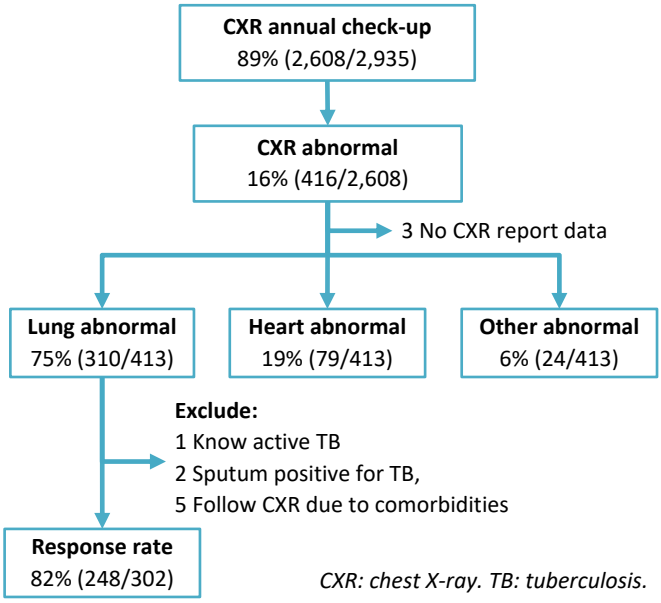


Figure 2. Flowchart of eligible participants for the analytical study

Table 3. Factors associated with adequate chest X-ray follow-up among healthcare workers with abnormal chest X-ray in 2023 (n=248)

Characteristics	Adequate CXR follow-up (n=24)	Inadequate CXR follow-up (n=224)	Chi-square *p*-value	Adjusted risk ratio (95% CI)
Age (years)				
≤40	14 (14%)	86 (86%)	Ref	
>40	10 (7%)	138 (93%)	0.06	0.67 (0.31–1.48)
Gender				
Female	20 (10%)	174 (90%)	Ref	
Male	4 (7%)	50 (93%)	0.52	
Education				
Below bachelor' s degree	6 (8%)	74 (92%)	Ref	
Bachelor' s degree or higher	18 (11%)	150 (89%)	0.42	
Type of healthcare worker				
Front-line	22 (12%)	165 (88%)	Ref	
Back-office	2 (3%)	59 (97%)	0.05	0.53 (0.12–2.25)
Comorbidities				
No	15 (10%)	128 (90%)	Ref	
Yes	9 (9%)	96 (91%)	0.61	
History of tuberculosis treatment				
No	19 (8%)	211 (92%)	Ref	
Yes	5 (28%)	13 (72%)	<0.01	2.93 (1.31–6.54)*
History of tuberculosis in family, neighbor or workplace				
No	9 (5%)	158 (95%)	Ref	
Yes	15 (19%)	66 (81%)	<0.01	2.06 (0.90–4.69)
Symptoms of tuberculosis				
No	24 (10%)	218 (90%)	Ref	
Yes	0 (0%)	6 (100%)	0.42	
Receiving sputum test for tuberculosis				
No	18 (8%)	215 (92%)	Ref	
Yes	6 (40%)	9 (60%)	<0.01	4.14 (1.96–8.77)*
Tuberculosis knowledge				
Poor	3 (5%)	60 (95%)	Ref	
Good	21 (11%)	164 (89%)	0.13	2.26 (0.75–6.83)

**Statistically significant. CI: confidence interval. Ref: reference.*

Action Taken

The index case was treated with a DR-TB regimen in the isolation room until sputum conversion. Contact investigations and TB screening were conducted. Confirmed TB cases received treatment, and sputum samples were sent for MTB culture. Non-case contacts were scheduled for repeat CXRs every six months for two years, annually thereafter. Recommendations included improving ventilation, aligning TB screening guidelines with national guidelines and streamlining processes.

Discussion

The index case, a 31-year-old woman, was confirmed as a primary pre-XDR-TB case, with resistance detected 19 days after initiating TB treatment, which is shorter than the median of 142 days to develop acquired drug resistance reported in another study.[21] She had mild symptoms and an abnormal CXR in March 2023, noticeable symptoms in January 2024, but was diagnosed in February 2024. Indicating an 11-months detection delay from her initial abnormal CXR and a 1-month delay from noticeable symptoms. A systematic review reported a median total delay in TB detection in low- and middle-income countries of 57 days.[14] Mild symptoms and good functional status may delay care-seeking, while multiple provider visits and protocol issues, contribute to health system delay.[22,23]

Confirmed TB cases had epidemiological links with the index case, suggesting that the outbreak occurred at Hospital A, although drug-resistance patterns varied. This may be due to multiple TB strains within a host or exposure to different TB sources in a high-risk setting.[24] Subclinical cases significantly contribute to transmission, especially in healthcare facilities with high exposure risks.

Among 90 contacts, the probable and confirmed TB rate was 3.7%, which is higher than other studies (1.4%–1.8%).[25,26] Two of the three confirmed TB cases were asymptomatic, aligning with findings that 56.4% of TB cases in Asia are subclinical.[27] Subclinical TB is concerning, contributing to an estimated 68% of global TB transmission.[28] MTB was detected in an HCW with a normal CXR, consistent with findings that 2–9% of PTB cases present with normal CXRs.[29–31] Intensive screening using symptoms, CXR and sputum AFB test in high-risk groups could support early detection and reduce subclinical TB transmission.

All workplace rooms showed substandard ACH, indicating poor ventilation. A minimum of 6 ACH is required to reduce TB transmission.[33] Inadequate ACH likely increased the risk of TB exposure in this setting.

Hospital A' s TB screening program for HCWs showed deficiencies that likely contributed to delayed TB detection, including lack of verbal screening, radiologists shortage, informal appointment scheduling, absence of record in health information system, and limited sputum AFB testing, deviating from national guideline.[16] Decisions on further investigations require multiple clinician reviews, creating delays that could be minimized using standard guidelines and simplifying decision-making steps. We recommend that the screening program adhere closely to national guidelines, and streamline processes by reducing decision steps, and ensure consistent application at the operational level.

History of TB treatment and receiving sputum test for TB likely reflect a higher level of concern about TB infection or re-infection, which may motivate more CXR follow-up. Although TB knowledge was adjusted for in the analysis, these experiences might independently influence health-seeking behavior beyond knowledge alone.

HCWs with abnormal CXRs and good TB knowledge were more likely to receive adequate follow-up. Lack of TB knowledge is linked to delays in care-seeking and diagnosis, underscoring the importance of educating HCWs on TB.[14,23,32] Emphasis should be placed on TB symptoms and risk factors as knowledge in these areas was relatively low among those with poor TB knowledge overall, especially in back-office HCWs.

Limitations

No specimens were available from possible source cases for genome sequencing to confirm a link with the index case. We, therefore, could not establish a connection between the index case and possible source cases, especially given the high TB risk in their workplace. We did not interview HCWs about the screening program so reasons for adequate follow-up were not elicited. The study period was insufficient for long-term active TB assessment in contacts.

Recommendations

Hospital A should strengthen its TB screening program by adhering to national guideline, streamlining decision-making, and ensure consistent implementation through guideline dissemination and practice evaluations. Emphasis should be placed on conducting sputum testing for TB within two weeks and performing follow-up CXR after six months for individuals with abnormal CXRs to prevent diagnostic delays. To reduce TB transmission risks, ventilation in the wards should be improved by increasing ACH to at least 6.0.[33] Additionally, TB education should be

provided, covering symptoms and TB risk factors, particularly for back-office HCWs.

HCWs in other hospitals should undergo annual screening for TB symptoms and CXR. Those working directly with TB patients should be screened biannually. Any abnormal CXR findings require diagnostic testing, such as sputum GeneXpert or AFB, within two weeks, followed by repeat CXR six months later. Hospitals should ensure at least annual TB screening and provide educational programs for HCWs. Clear protocols should be implemented to facilitate timely follow-up and minimize TB detection delays.

National and regional authorities for TB control and prevention programs, including the Division of Tuberculosis and the Offices of Disease Prevention and Control, should supervise and monitor the implementation of a national guideline for submitting laboratory tests to hospitals capable of detecting tuberculosis genetic material. The TB screening protocol should emphasize that individuals with lung abnormalities on CXR must undergo sputum testing and follow-up CXR.

Conclusion

A front-line HCW was confirmed to have work-related primary pre-XDR-TB, likely contracted from pre-XDR-TB patients in her workplace. Ninety contacts were identified, of which 85 received a CXR. A TB outbreak occurred at Hospital A, involving one confirmed pre-XDR-TB case, two confirmed TB cases, one probable case, and seven suspected cases. Potential risk factors of the outbreak included inadequate TB patient isolation, overcrowded workplace, and poor ventilation. A history of TB treatment and receiving sputum test for TB were significantly associated with adequate follow-up while good TB knowledge HCWs were more likely to receive adequate follow-up after an abnormal CXR. Optimizing TB screening process, educating HCWs, and reinforcing national guidelines are essential steps toward timely TB detection and reducing transmission risks in high-exposure settings.

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Conflicts of Interest

The authors declare no conflict of interest.

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