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Tuberculosis treatment outcomes among hospital workers at a public teaching and national referral hospital in Kenya

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Setting: Kenyatta National Hospital (KNH), Nairobi, Kenya, a large referral and teaching hospital.

Objective: 1) To document tuberculosis (TB) case notification rates and trends; 2) to describe demographic, clinical and workplace characteristics and treatment outcomes; and 3) to examine associations between demographic and clinical characteristics, HIV/AIDS (human immunodeficiency virus/acquired immune-deficiency syndrome) treatment and anti-tuberculosis treatment outcomes among hospital workers with TB at KNH during the period 2006–2011.

Design: A retrospective cohort study involving a review of medical records.

Results: The TB case notification rate among hospital staff ranged between 413 and 901 per 100 000 staff members per year; 51% of all cases were extra-pulmonary TB; 74% of all cases were among medical, paramedical and support staff. The TB-HIV coinfection rate was 60%. Only 75% had a successful treatment outcome. Patients in the retreatment category, those with unknown HIV status and those who were support staff had a higher risk of poor treatment outcomes.

Conclusion: The TB case rate among hospital workers was unacceptably high compared to that of the general population, and treatment outcomes were poor. Infection control in the hospital and management of staff with TB requires urgent attention.

In sub-Saharan Africa, the burden of tuberculosis (TB) and human immunodeficiency virus (HIV) is high, and this poses a substantial risk for TB among health care workers exposed to patients in heath care facilities. Kenya, ranked fifteenth by the World Health Organization (WHO) among the high TB burden countries, has a generalised HIV epidemic, with a prevalence of 6.2% among the adult population.[1,2] Several studies in Africa and elsewhere in the world have shown conclusively that the risk of latent tuberculous infection and TB disease is substantially higher among health care workers than in the general population, with greater risks among health workers involved in the direct care of TB patients, those with HIV infection and those with poor living conditions.[3–10]

A study conducted at the Kenyatta National Hospital (KNH) in 2005 assessed TB disease among hospital staff between 2001 and 2005 and reported TB case notification rates ranging from 645 to 1115 per 100 000 population compared with the national rate of 301/100 000 in 2004.[3] This study was followed by recommendations for the implementation of infection control measures to protect health workers; however, since then anecdotal evidence has shown that these measures have been poorly implemented. Information on the clinical characteristics of TB among health care workers and their treatment outcomes, including the relationship with HIV status and antiretroviral therapy (ART), is lacking.

The objectives of this study were 1) to document TB case notification rates and trends; 2) to describe the demographic, clinical and workplace characteristics and treatment outcomes; and 3) to examine associations between demographic and clinical characteristics, HIV/AIDS treatment and anti-tuberculosis treatment outcomes among hospital workers at the KNH in Nairobi, Kenya, during the period 2006–2011.

METHODS

Design

This was a retrospective cohort study involving a review of records routinely maintained by the KNH TB programme.

Setting

Kenya has a high TB and HIV burden. This study was conducted at the KNH, the largest teaching and referral hospital in Kenya, which houses two academic medical institutions, the University of Nairobi (UON) School of Medicine and the Kenya Medical Training College. It has a bed capacity of 2000, a bed occupancy rate of up to 200% and a staff complement of 4500–5000. About 2000 out-patients are managed daily, and there are over 10 000 people on the premises every day. On average about 200–300 TB cases are diagnosed in the hospital each month; over 95% are referred to peripheral health facilities for follow-up. Only hospital workers and their dependents are treated and followed up in the hospital. While most hospital staff members with TB receive treatment in the hospital TB clinic, some opt for the private health sector. Anti-tuberculosis treatment at this hospital consists of WHO-recommended regimens 2HRZE/4HR* for new TB patients and 2HRZES/1HRZE/5HRE* for retreatment patients.[11] Diagnostic and treatment services are provided free of charge.

Study population and study period

Hospital staff who worked in KNH during the period January 2005–December 2011, including TB patients,

*H = isoniazid; R = rifampicin; Z = pyrazinamide; E = ethambutol; S = streptomycin. Numbers before the letters indicate the duration in months of the phase of treatment.

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KEY WORDS
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constituted the study population. The study was conducted between March and April 2013.

Data variables, entry and analysis

Information on the following variables was extracted from the hospital staff TB registers: age, sex, type of TB (pulmonary/extrapulmonary), history of treatment (new/retreatment), HIV status, ART initiation, cotrimoxazole preventive therapy (CPT) initiation and treatment outcomes. Outcomes were categorised as favourable (cured and treatment completed) and unfavourable. For the purposes of analysis, hospital staff members were grouped into three categories: 1) medical and paramedical staff, which included doctors, nurses, clinicians, therapists, pharmacists and laboratory staff; 2) support staff, including cleaners, porters and messengers; and 3) administrators and others who included engineers, security guards, drivers, cooks and laundry staff.

Data were double-entered using EpiData version 3.1 (EpiData Association, Odense, Denmark) by two independent data operators, validated for inconsistencies and analysed using EpiData Analysis version 2.2.2.180. Year-specific case notification rates were calculated. We used all TB cases occurring among hospital workers and notified in a given year as the numerator and mid-year staff population data received from the Human Resources Department of KNH as the denominator. The mid-year staff population was used as an approximate estimate of person-time exposure, as we did not have access to data regarding the exact entry and exit time for each of the hospital staff members. It may be noted that mid-year population is routinely used as denominator by the WHO for calculating TB case notification rates at population level.

Univariate analysis was performed and appropriate proportions were calculated to describe demographic and clinical profiles. Bivariate analysis was performed to examine possible associations of demographic and clinical variables with treatment outcomes. Relative risks (RRs) and 95% confidence intervals were calculated. χ^2 test was used to compare proportions and $P \leqslant 0.05$ was considered statistically significant. To assess the independent effects of each variable after adjusting for other variables, a multivariate analysis using log-binomial regression was performed and adjusted RRs were calculated using STATA 12.1 (Stata Corp, College Station, TX, USA). All factors found to be significantly associated ($P < 0.1$) during bivariate analysis in our study, along with age and sex (found to be important confounders in previous studies), were included in the multivariate analysis.

Ethics

Approval was obtained from the Ethics Review Committees of KNH and UON and the Ethics Advisory Group of the International Union Against Tuberculosis and Lung Disease, Paris, France.

TABLE 1 Hospital staff TB case notification rates by year, Kenyatta National Hospital, Nairobi, Kenya, 2006–2011

Year	TB cases *n*	Total hospital staff *n*	Rate /100 000
2006	42	4660	901
2007	35	4637	755
2008	34	4593	740
2009	19	4602	413
2010	25	4630	540
2011	35	4536	772

TB = tuberculosis.

RESULTS

The TB case notification rate for each of the 6 years studied is shown in Table 1. This ranged from 413 to 901/100 000 per year, with a mean for the period of 687/100 000/year. Table 2 details the demographic and clinical characteristics of the patients. Of the 190 TB patients, 60% were female and nearly 75% were in the 35–54 years age group. The median age was 38 (interquartile range 34–44). About half the cases had extra-pulmonary TB (EPTB), and three quarters were new cases; 60% of EPTB occurred at three sites: lymph nodes, pleural effusion and disseminated TB. Of the 164 (84%) participants with HIV test results, 60% were HIV-positive. Most of those who were HIV-positive were receiving CPT and ART; 74% of all cases were among medical, paramedical and support staff.

TABLE 2 Demographic and clinical characteristics of TB among hospital workers, Kenyatta National Hospital, Nairobi, Kenya, 2006–2011

	n (%)
Total	190 (100)
Sex	
Male	77 (41)
Female	113 (59)
Age, years	
<35	50 (26)
35–54	137 (72)
⩾55	3 (2)
Type of TB	
Smear-positive PTB	52 (27)
Smear-negative PTB	39 (21)
EPTB	99 (52)
Category of treatment	
New	144 (76)
Retreatment	46 (24)
Site (EPTB only)	
Lymph node	24 (24)
Pleural effusion	18 (18)
Disseminated TB	18 (18)
Miliary TB	15 (15)
TB meningitis	4 (4)
Genito-urinary TB	4 (4)
TB of the spine	2 (2)
Others	13 (13)
Job designation*	
Medical and paramedical staff	74 (39)
Support staff	67 (35)
Administration and others	49 (26)
HIV status	
Negative	66 (35)
Positive	98 (52)
Unknown	26 (14)
CPT†	
Received	88 (90)
Not received	5 (5)
Not recorded	5 (5)
ART†	
Received	75 (77)
Not received	10 (10)
Not recorded	13 (13)

*Medical and paramedical staff included doctors, nurses, clinicians, therapists, pharmacists and laboratory staff; support staff included cleaners, porters and messengers; others included engineers, security guards, drivers, cooks and laundry staff.
†This analysis is restricted to HIV-positive patients ($n = 98$).
TB = tuberculosis; PTB = pulmonary TB; EPTB = extra pulmonary TB; HIV = human immunodeficiency virus; CPT = cotrimoxazole preventive therapy; ART = antiretroviral therapy.

TABLE 3 Tuberculosis treatment outcomes among hospital workers, Kenyatta National Hospital, Nairobi, Kenya, 2006–2011

Outcome	*n* (%)
Favourable	
Cured	33 (17)
Treatment completed	109 (58)
Total	142 (75)
Unfavourable	
Loss to follow-up	19 (10)
Died	18 (9)
Failure	4 (2)
Transfer out	4 (2)
Unknown	3 (2)
Total	48 (25)

Treatment outcomes are shown in Table 3. Unfavourable outcomes occurred in 25% of cases, with high death and loss to follow-up rates. Of the 18 deaths, 16 (89%) had a positive or unknown HIV status. Demographic and clinical characteristics associated with treatment outcomes are shown in Table 4. Retreatment TB patients, support staff and those with unknown HIV status had a statistically significantly higher risk of unfavourable treatment outcomes. During multivariate analysis, only retreatment TB was independently associated with unfavourable outcomes, after adjusting for the confounding effect of other variables.

DISCUSSION

This is the first study in Kenya to describe treatment outcomes of hospital workers with TB, and it provides an opportunity to compare the case notification rates with those from an earlier period. Compared with the results of a previous study in the same hospital conducted in 2001–2005, where the case notification rate ranged from 645 to 1115/100 000,[3] we observed a similar rate (413–901/100 000) in our study. The rate remains unacceptably high, confirming that health workers are at a higher risk of developing TB than the general population (261/100 000 in 2011).[12] While the different rates in the general population and the hospital worker population can be partially explained by the differing age and sex distributions with varied strata-specific risks, the effect of work exposure in hospitals has been widely acknowledged.[3–10] It should be noted that some of the TB patients who were diagnosed among hospital staff may have chosen to receive treatment in the private health sector; our reported case notification rate could therefore be an underestimate.

Most TB cases among hospital staff occurred in those involved in patient care (medical and paramedical staff, accounting for nearly 40% of cases). A substantial proportion (35%) was among administrative staff members, including clerks, who would be exposed to people with undiagnosed TB in unprotected situations. The previous study identified several risk factors for developing TB among health workers and recommended the implementation of several infection control measures.[3] Our study provides indirect

TABLE 4 Association of demographic and clinical characteristics with treatment outcomes among hospital workers with TB, Kenyatta National Hospital, Nairobi, Kenya, 2006–2011

	Unfavourable* *n* (%)	Favourable* *n* (%)	Unadjusted RR (95%CI)	Adjusted RR (95%CI)
Sex				
Male	21 (27)	56 (73)	1.1 (0.7–1.9)	1.1 (0.7–1.8)
Female	27 (24)	86 (76)	Reference	Reference
Age, years				
<40	30 (29)	74 (71)	1.4 (0.8–2.3)	1.4 (0.9–2.4)
⩾40	18 (21)	68 (79)	Reference	Reference
Type of TB				
PTB	25 (28)	66 (72)	Reference	Reference
EPTB	23 (23)	76 (77)	0.9 (0.5–1.4)	1.0 (0.6–1.6)
Category				
New	30 (21)	114 (79)	Reference	Reference
Retreatment	18 (39)	28 (61)	1.9 (1.2–3.0)†	1.7 (1.1–2.8)†
Job cadre‡				
Medical and paramedical staff	13 (18)	61 (82)	Reference	Reference
Support staff	23 (34)	44 (66)	1.9 (1.1–3.5)†	1.5 (0.8–2.9)
Administrators and others	12 (25)	37 (75)	1.4 (0.7–2.8)	1.3 (0.6–2.7)
HIV status				
Negative	12 (18)	54 (82)	Reference	Reference
Positive	26 (27)	72 (73)	1.5 (0.8–2.7)	1.3 (0.7–2.5)
Unknown	10 (38)	16 (62)	2.1 (1.1–4.3)†	1.8 (0.9–3.7)
CPT§				
Received	22 (25)	66 (75)	Reference	
Not received	4 (40)	6 (60)	1.6 (0.7–3.7)	
ART§				
Received	17 (23)	58 (77)	Reference	
Not received	9 (39)	14 (61)	1.7 (0.9–3.3)	

*Unfavourable (died, failure, transfer out and loss to follow-up); favourable (cured and treatment completed).
†Statistically significant ($P \leqslant 0.05$) associations.
‡Medical and paramedical staff included doctors, nurses, clinicians, therapists, pharmacists and laboratory staff; support staff included cleaners, porters, messengers; others included engineers, security guards, drivers, cooks and laundry staff.
§This analysis is restricted to HIV-positive patients ($n = 98$).
TB = tuberculosis; RR = relative risk; CI = confidence interval; PTB = pulmonary TB; EPTB = extra pulmonary TB; HIV = human immunodeficiency virus; CPT = cotrimoxazole preventive therapy; ART = antiretroviral therapy.

evidence that infection control measures have not been optimally implemented, as there has been little change in the case notification rate since the previous study. This calls for an urgent need to implement infection control measures, including periodic, active surveillance of TB among hospital staff.

Nearly half of the TB patients had extra-pulmonary involvement. This is higher than the national average (~17% in 2010), and is likely to be due to greater access to better diagnostic modalities at the hospital. It could also be due to other factors such as the higher proportion of young patients, female patients and a higher measured prevalence of HIV infection (60%) than in general TB patients in Kenya (40%)—all of whom are known to have a higher prevalence of extra-pulmonary TB.[12] About 15% of the TB patients among hospital staff had unknown HIV status compared to <10% reported nationally. ART and CPT coverage were higher among HIV-infected TB patients in our study compared to national data. Given the high risk of morbidity and mortality among HIV-infected TB patients, it is important to test all health workers, including TB patients, for HIV status.

The overall treatment success rates for TB patients registered under the Kenya National Leprosy and TB Programme in 2010 were 87% for new smear-positive pulmonary TB, 85% for smear-negative pulmonary TB, 84% for EPTB and 77% among retreatment TB patients.[12] The treatment success rates in our study were poor across all categories of TB patients compared with national data. This is surprising and unacceptable in an academic hospital setting. The poor outcomes were mainly death and loss to follow-up and could be related to lack of direct observation of treatment among hospital staff. Nearly 90% of the deaths occurred among those who were either HIV-positive or HIV-unknown, indicating the vulnerability of HIV-positive TB patients and the need for prioritised attention, which includes early diagnosis of HIV and linkage to ART. Outcomes were worse among retreatment TB cases and those who had not ascertained their HIV status, re-emphasising the need for early HIV testing and linkage to HIV care. Previous recommendations for self-testing for HIV among hospital staff appear not to have been implemented.[3] While being HIV-positive and not being initiated on ART and CPT were associated with poor outcome, this was not statistically significant due to the small sample numbers.

TB cases among support staff had a significantly worse outcome compared with outcomes among medical and paramedical staff. The support staff category included cleaners, patient porters, messengers and those who served patient food in the hospital. These individuals may be of lower socio-economic status and have less knowledge about TB and the need to complete treatment, and should therefore be targeted for education and support.

This study had some limitations. First, there may have been limitations in calculation and interpretation of case notification rates to describe the magnitude of the problem in hospital workers. We calculated TB case notification rates in our study rather than estimating prevalence or incidence. While case notification rates cannot be used as a direct measure of risk, they are often used as a proxy, and are independently a programmatically important indicator. The numerator consists of all TB cases notified from a given population in a given period. It is vital to note that this is related to notification and not occurrence of cases. This is not perfect, but a good approximation nevertheless—some cases that occurred in the previous year may be notified in the current year and some cases occurring in the current year may be notified in the next year. Denominators may also vary greatly depending on the birth, death and migration rates in the area. Mid-year population is thus used as a proxy, and is routinely used by the WHO to describe caseloads in different countries. Given the operational nature of the study and limitations in accessing data, we used a similar approach. The methodological issues of quantifying the magnitude of TB in fluctuating populations (such as those in prisons) have been described in detail elsewhere.[13] We note that the hospital population is not as fluctuant as that of prisons, and the case notification rates calculated here are a good measure of the disease burden in this vulnerable group. Second, some staff may have opted for private sector treatment and hence were not included in this study. Third, information on CPT and ART was self-reported by patients and could not be verified. A final limitation is related to the small sample size, which may have blurred the association between certain parameters and treatment outcomes.

In conclusion, TB case notification rates among hospital staff were high and treatment outcomes were worse than for the general population. There is an urgent need to prioritise staff in this large hospital as a vulnerable group for TB disease and to institute effective infection control measures.

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Contexte : Kenyatta National Hospital (KNH), centre hospitalier universitaire situé à Nairobi, Kenya.
Objectif : 1) Documenter le taux de notification des cas et son évolution ; 2) décrire les caractéristiques démographiques, cliniques et professionnelles et les résultats du traitement ; et 3) examiner les associations entre les caractéristiques démographiques et cliniques, les résultats du traitement du virus de l'immunodéficience humaine (VIH)/syndrome de l'immunodéficience acquise et de la tuberculose (TB) parmi le personnel de l'hôpital atteint de TB au KNH de 2006 à 2011.
Schéma : Etude rétrospective de cohorte par revue des dossiers médicaux.
Résultats : Le taux de notification des cas de TB dans le personnel de l'hôpital était de 413 à 901/100 000 personnes par an ; 51% des TB étaient extra-pulmonaires ; 74% des cas concernaient le personnel médical, paramédical et de soutien. Le taux de coïnfection TB-VIH atteignait 60%. Seulement 75% des malades ont eu un bon résultat thérapeutique. Les patients en deuxième traitement, ceux dont le statut VIH était inconnu et le personnel de soutien avaient plus souvent des résultats médiocres.
Conclusion : Le taux de TB dans le personnel hospitalier est très élevé comparé à la population générale et les résultats du traitement sont médiocres. Il est urgent de lutter contre les infections à l'hôpital et d'assurer une bonne prise en charge du personnel atteint de TB.

Marco de referencia: El Hospital Nacional Kenyatta (KNH), un importante hospital universitario de referencia en Nairobi, Kenia.
Objetivo: 1) Documentar las tasas de notificación de casos de tuberculosis (TB) y su tendencia; 2) describir las características demográficas y clínicas de los pacientes, el tipo del puesto de trabajo y los desenlaces terapéuticos; y 3) examinar la relación entre las características clínicas y demográficas, el tratamiento de la infección por el virus de la inmunodeficiencia humana (VIH) y el síndrome de inmunodeficiencia adquirida y los desenlaces del tratamiento antituberculoso de los trabajadores del KNH en quienes se estableció el diagnóstico de TB entre el 2006 y el 2011.
Método: Fue este un estudio retrospectivo de cohortes con base en el examen de las historias clínicas.
Resultados: La tasa de notificación de casos de TB en los trabajadores del hospital osciló entre 413 y 901 por 100 000 trabajadores por año. El 51% de todos los casos presentó TB extrapulmonar. El 74% de los casos correspondió al personal médico, paramédico y subalterno. El índice de coinfección por el VIH y la TB fue 60%. Solo 75% de los pacientes alcanzó desenlaces terapéuticos favorables. Los pacientes en la categoría de retratamiento, los que desconocían su situación frente al VIH y los pacientes que formaban parte del personal subalterno presentaron un riesgo más alto de obtener un desenlace terapéutico desfavorable.
Conclusión: La tasa de casos de TB en el personal de planta del hospital fue inaceptablemente alta, en comparación con la tasa de la población general y los desenlaces terapéuticos fueron deficientes. Existe una necesidad apremiante de establecer un control adecuado de las infecciones y prestar una atención adecuada al personal aquejado de TB.

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