Does Tuberculosis Increase HIV Load?

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Background. The effect that tuberculosis (TB) has on human immunodeficiency virus (HIV) disease progression is not clearly understood.

Methods. In an observational cohort study of HIV-infected adults in South Africa, baseline and final HIV load were compared between individuals who experienced an episode of TB (n = 30) during follow-up and control subjects (n = 56) matched by baseline CD4 cell count and follow-up time; linear regression modeling was used to control for confounding.

Results. Mean HIV load was higher in the TB group than in the non-TB control group for both baseline (4.73 vs. 4.24 log10 copies/mL; P = .003) and final values (5.02 vs. 4.34 log10 copies/mL; P < .001). After adjustment for baseline HIV load and World Health Organization HIV stage, the difference in final HIV load was 0.24 log10 copies/mL (95% confidence interval, −0.01 to 0.50 log10 copies/mL; P = .06).

Conclusions. Poor prognosis for HIV-infected individuals after TB may be due to preexisting high HIV load rather than to the TB event itself. An episode of TB was associated with a small adjusted increase in HIV load at the end of the study—an increase that would not be regarded as clinically significant in an individual but could have some effect on HIV disease progression or HIV transmission at the population level. Prevention of TB is important for the reduction of HIV-related morbidity and mortality; however, antiretroviral therapy is required to have a major effect on survival in individuals with HIV disease.

The HIV pandemic is causing a resurgence of tuberculosis (TB), with TB incidence increasing rapidly in countries with a high burden of HIV infection [1]. It has been estimated that, unless TB control is further strengthened, between 2002 and 2020 a billion people will be newly infected with Mycobacterium tuberculosis, >150 million people will develop active disease, and 36 million people will die of TB [2]. HIV infection is the strongest risk factor for the development of active TB [3], as it increases both the risk for rapid progression from recently acquired TB to active disease [4, 5] and the risk for reactivation of latent TB [3, 6–8]. HIV infection also increases TB case fatality [9].

The effect that active TB has on HIV infection is less well understood. In vitro studies have shown that M. tuberculosis induces HIV-1 replication [10–13]. However, the clinical and public-health implications of this finding are unclear [14, 15]. It has been suggested that active TB accelerates HIV disease progression, but few data are available to confirm or refute this hypothesis. Virus load is higher in HIV-infected patients with active TB than in HIV-infected patients without active TB [13, 16] and remains high throughout TB treatment [17–19]. Three clinical studies have examined HIV load before, during, and after an episode of TB [13, 16, 19], but the studies included very small numbers of patients and did not compare HIV load before and after TB with changes over the same time period in control groups.

Epidemiological studies addressing this question are also inconclusive. Among HIV-infected individuals, TB [20–22] and other opportunistic infections [23–25] are associated with shorter survival; however, among individuals with known dates of seroconversion in industrialized countries, the risk for death was no higher in individuals with TB than in individuals with other
initial AIDS-defining conditions [26]. Furthermore, data from cohort studies of individuals with known dates of seroconversion suggest that, in the period before effective antiretroviral therapy (ART) was widely used, there was little difference in rates of HIV disease progression between developing countries with high TB incidence and industrialized countries, where TB incidence was (and is) much lower [27, 28]. If TB accelerates HIV disease progression, then TB preventive therapy should prolong survival [29]. However, the largest meta-analysis of randomized trials of TB preventive therapy found no such overall effect [30].

Given the large numbers of individuals worldwide with HIV infection and TB, an understanding of the interaction between TB and HIV infection is of considerable public-health importance. If active TB results in higher HIV load, this could increase the risk for transmission of HIV infection and thus “fuel” the epidemic in countries where TB is common. At the individual level, if TB results in more-rapid progression of HIV disease, then strategies to prevent a first episode of TB should be given particular high priority.

The aim of the present study was to determine whether an episode of TB influences the risk for HIV disease progression by examining its effect on both plasma HIV load and the rate of CD4 cell count decrease. As an additional comparison, we also examined the effect that bacterial pneumonia (another common HIV-related disease in this population) has on virus load and rate of CD4 cell count decrease.

PARTICIPANTS, MATERIALS, AND METHODS

Study design. We conducted an observational cohort study and compared HIV-infected individuals who experienced an episode of TB or bacterial pneumonia during the follow-up period with control subjects who did not.

Study setting and participants. The study was conducted within the health service of a gold-mining company in Free State, South Africa, between May 1999 and April 2002. The health service provided 22,000 employees with free, comprehensive health care and managed the TB control program. Its regional hospital was the sole source of secondary care for employees. A clinic providing specialized care for HIV-infected employees was established in 1999. Patients were seen routinely every 6 months. In accordance with international guidelines, prophylaxis against TB (isoniazid for 6 months) was offered to those individuals with no history of TB and no evidence of active TB on screening (by symptom questionnaire, chest radiography, sputum microscopy, and culture). Cotrimoxazole prophylaxis was offered indefinitely to those individuals with CD4 cell counts <200 cells/μL or, if they had symptomatic HIV disease, <250 cells/μL. Neither ART nor quantification of HIV load were routinely available at the time of the present study.

At each routine visit, consenting clinic attendees provided an extra blood sample, from which plasma was separated and stored for later estimation of HIV load. In addition, plasma samples were collected and stored from study participants with TB or pneumonia who were admitted to the hospital, both at the time of admission and 2 weeks later.

Detection of disease events. All hospital admissions of study participants were detected by use of the hospital’s data-management system. Participants were seen during admission by the study team, and diagnoses were assigned by use of predetermined case definitions. Participants experiencing episodes of TB and bacterial pneumonia who were not admitted to the hospital were identified at the subsequent routine clinic visit. To ensure that all episodes of TB and pneumonia were identified, primary health records and the hospital’s TB database were reviewed.

Case definitions. Participants were classified as having pulmonary TB if they had compatible clinical or radiological features and either (1) were positive for M. tuberculosis by sputum culture or (2) experienced clinical and radiological improvement after 2 months of TB treatment and were either positive for acid-fast bacilli by sputum smear or had new radiological changes suggestive of TB but no response to 5 days of antibiotic treatment. Participants were classified as having extrapulmonary TB if they had compatible clinical features and either (1) had M. tuberculosis isolated from a relevant site or (2) improved after 2 months of TB treatment and had other diagnostic evidence, such as typical radiological or histological features (acid-fast bacilli, caseation, or granuloma) or characteristic changes in cerebrospinal fluid. Participants were classified as having bacterial pneumonia if they had compatible acute symptoms, signs, and radiological evidence and either culture of bacteria that typically cause pneumonia or remission of fever and radiological improvement after antibiotic therapy.

Selection of TB and pneumonia groups. In the TB and pneumonia groups, we included participants who had a disease episode during the study period that met the relevant case definition. To be sure that our baseline samples (i.e., samples collected at study entry) were collected before a disease episode, we excluded (1) any episode of TB detected by screening at clinic entry or within 3 months of entering the study and (2) any episode of pneumonia within a month of entering the study (figure 1). Any participant who had >1 episode of TB or pneumonia either was censored before the second disease event (at least 3 months before for TB and at least 1 month before for pneumonia) or was excluded if the follow-up period was then insufficient. Likewise, any participant who had a lower respiratory tract infection, nontuberculous mycobacterial disease, or any other infection requiring hospital admission during the follow-up period either was censored at least 1 month before the infectious episode or was excluded if the follow-up period was then insufficient.
We included in the analysis participants from whom a baseline plasma sample was collected for estimation of HIV load at the time of study entry, who had a CD4 cell count performed within 2 weeks of the collection of the baseline plasma sample, and from whom a final plasma sample was collected a minimum of 5 months after the date treatment for TB or pneumonia was started. We considered the final plasma sample to be the latest sample stored for each participant before follow-up was censored, as described above.

**Selection of control groups.** The control groups were drawn from cohort members who were not diagnosed with TB or nontuberculous mycobacterial disease between 3 months before study entry and 3 months after the final plasma sample had been collected (figure 1). Neither could control subjects have had bacterial pneumonia, lower respiratory tract infection, or any other infection necessitating hospital admission between 1 month before study entry and 1 month after the final plasma sample had been collected.

For each participant in the TB and pneumonia groups, we selected, at random, 2 control subjects of the same sex who had similar durations of follow-up (within 42 days) and similar baseline CD4 cell counts (in strata of 50 cells/µL: 0–49, 50–99, 100–149, etc.). If a suitable match could be found, a third control subject was selected for each participant with pneumonia.

**World Health Organization (WHO) HIV staging.** At study entry, participants were classified according to WHO HIV stage [31]. In brief, stage 1 represents asymptomatic HIV infection, stage 2 represents mild HIV-related disease, stage 3 represents moderate disease, and stage 4 represents severe disease. Stage 4 is broadly equivalent to AIDS, except that pulmonary TB during the past year is classified as stage 3 and extrapulmonary TB during the past year is classified as stage 4.

**Laboratory methods.** Plasma was separated from blood collected in EDTA and was frozen at −70°C within 24 h of collection. HIV RNA quantification was performed at the National Institute for Communicable Diseases, Johannesburg, South Africa, by use of the branched-DNA HIV-1 RNA 3.0 assay (Bayer Versant), according to the manufacturer’s instructions. Coded samples from the TB, pneumonia, and control groups were assayed concurrently, and laboratory staff were blinded to clinical status.

**Sample size.** In estimating the required sample size, we assumed that a clinically relevant difference in final HIV load between the TB group and the non–TB control group would be 0.5 log_{10} copies/mL. Assuming 2 control subjects for every 1 participant experiencing an episode of TB, a type I error of 0.05, and an SD of 0.66 log_{10} copies/mL, we estimated that 28 participants in the TB group and 56 participants in the non–TB control group would be required to have 90% power to detect a difference in final HIV load of 0.5 log_{10} copies/mL, assuming an unmatched study.

**Statistical methods.** Statistical analysis was conducted by use of Stata (version 8.0; StataCorp) and SAS (version 8.02; SAS Institute) software. To compare baseline variables between the TB group and the non–TB control group in the context of a matched design with 1 control subject/participant experiencing an episode of TB, we used linear regression to compare continuous variables (age and baseline HIV load after log_{10} transformation), using fixed effects for the matched groups. We compared categorical baseline variables (previous TB and baseline WHO stage, the latter grouped as stage 1/2 vs. 3/4) using conditional logistic regression.

To analyze the effect that TB has on HIV load, we used a linear regression model to compare final HIV loads (the main outcome) between the TB group and the non–TB control group, controlling for baseline HIV load, baseline WHO stage, age, and the matched groups. As an additional measure of the rate of HIV disease progression, we estimated the rate of CD4 cell count decrease over the follow-up period, adjusting for baseline
HIV load, baseline WHO stage, and age. We used all CD4 cell count values from the follow-up period, excluding any measurements made within 2 weeks of the date of TB diagnosis, both to minimize any effect of acute changes at the time of diagnosis and because we had no equivalent data for the non-TB control group. Because there were >2 data points for all participants, we used random-effects linear regression, with a random intercept and slope. To compare baseline characteristics and final HIV loads between the pneumonia and the nonpneumonia control groups and to estimate the rate of CD4 cell count decrease, we used the same methods.

**Ethics approval.** Approval for the present study was granted by the research ethics committees of Anglogold Health Service, Orkney, South Africa, and the London School of Hygiene and Tropical Medicine, London, United Kingdom. All participants provided either written, informed consent or witnessed, oral, informed consent.

**RESULTS**

**TB group compared with non-TB control group.** Between May 1999 and October 2001, 1480 individuals were enrolled in the present study. By the end of the study, 158 participants had experienced an episode of TB that fulfilled the study’s case definition; of these, 51 had adequate follow-up time before and after the episode, and, of these, 30 met the remaining inclusion criteria for the TB group. For 4 of these participants, only 1 suitable control subject could be identified, such that, in total, there were 56 participants in the non-TB control group. The baseline characteristics of these groups are shown in table 1. The groups were similar with respect to the matched variables (baseline CD4 cell count and duration of follow-up). At baseline, the TB group was slightly older than the non-TB control group (40.6 vs. 37.3 years; *P* = .013) and had more-advanced HIV disease (40% vs. 20% WHO stage 3/4; *P* = .04). Mean baseline HIV load was significantly higher in the TB group than in the non-TB control group (4.73 vs. 4.24 log<sub>10</sub> copies/mL; *P* < .001). Of the 30 episodes of TB, 20 were pulmonary only, 5 were extrapulmonary only, and 5 were both pulmonary and extrapulmonary. Twenty (80%) of the 25 cases of pulmonary TB were confirmed by culture. Among the 18 participants in the TB group for whom a CD4 cell count was measured at the time of the episode, the median count was 192 cells/μL.

Final HIV load was higher in the TB group than in the non-TB control group (unadjusted mean, 5.02 vs. 4.34 log<sub>10</sub> copies/mL; *P* < .001). Figure 2 shows the mean baseline and final HIV loads for the TB group and the non-TB control group and illustrates higher mean baseline HIV loads in the participants who subsequently experienced an episode of TB and the trend for HIV load to increase over time in both groups.

Table 1 shows the results of the linear regression analysis examining final HIV load. After adjustment for matched sets but before adjustment for any potential confounding variables, the difference in mean final HIV load between the TB group and the non-TB control group was 0.61 log<sub>10</sub> copies/mL (95% confidence interval [CI], 0.30 to 0.92 log<sub>10</sub> copies/mL; *P* < .001). However, after adjustment for baseline HIV load, the difference

Table 1. Characteristics of the tuberculosis (TB) group, the non-TB control group, the pneumonia group, and the nonpneumonia control group.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>TB comparison</th>
<th>Pneumonia comparison</th>
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<tbody>
<tr>
<td></td>
<td>TB group (n = 30)</td>
<td>Non-TB control group (n = 56)</td>
</tr>
<tr>
<td>Age, mean (SD), years</td>
<td>40.6 (6.4)</td>
<td>37.3 (5.9)</td>
</tr>
<tr>
<td>Previous TB</td>
<td>6 (20)</td>
<td>6 (11)</td>
</tr>
<tr>
<td>Started isoniazid prophylaxis</td>
<td>19 (63)</td>
<td>51 (91)</td>
</tr>
<tr>
<td>Previous pneumonia</td>
<td>…</td>
<td>…</td>
</tr>
<tr>
<td>WHO HIV stage 3/4 at baseline</td>
<td>12 (40)</td>
<td>11 (20)</td>
</tr>
<tr>
<td>Follow-up, median (IQR), days</td>
<td>560.5 (399 to 672)</td>
<td>560 (371 to 658)</td>
</tr>
<tr>
<td>Baseline CD4 cell count, median (IQR), cells/μL</td>
<td>295 (210 to 366)</td>
<td>296.5 (221 to 362)</td>
</tr>
<tr>
<td>Time from study entry to episode of TB/pneumonia, median (IQR), days</td>
<td>259 (140 to 459)</td>
<td>…</td>
</tr>
<tr>
<td>Baseline HIV load, mean (95% CI), log&lt;sub&gt;10&lt;/sub&gt; copies/mL</td>
<td>4.73 (4.48 to 4.98)</td>
<td>4.24 (4.04 to 4.45)</td>
</tr>
<tr>
<td>Final HIV load, mean (95% CI), log&lt;sub&gt;10&lt;/sub&gt; copies/mL</td>
<td>5.02 (4.77 to 5.26)</td>
<td>4.34 (4.15 to 4.54)</td>
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</table>

**NOTE.** Data are no. (%) of participants, unless otherwise noted. CI, confidence interval; IQR, interquartile range; WHO, World Health Organization.

<sup>a</sup> By linear regression (controlling for matched groups).

<sup>b</sup> By conditional logistic regression (controlling for matched groups).

<sup>c</sup> Matched variable.
Effect of TB on HIV Load

Figure 2. Means and 95% confidence intervals of final and baseline plasma HIV loads, for the tuberculosis (TB) group and the non-TB control group (A) and the pneumonia group and the nonpneumonia control group (B).

in mean final HIV load was 0.29 log₁₀ copies/mL (95% CI, 0.03 to 0.54 log₁₀ copies/mL; \( P = .03 \), likelihood ratio test). After further adjustment for baseline WHO stage, the difference in mean final HIV load was 0.24 log₁₀ copies/mL (95% CI, −0.01 to 0.50; \( P = .06 \)). Further adjustment for age and previous TB did not alter the results. We considered whether the effect of an episode of TB on final HIV load could be modified by a history of TB before study entry. However, exclusion of individuals with a history of TB did not affect the results (data not shown).

To determine whether the effect of TB on HIV load differed by baseline CD4 cell count, we repeated the analysis, considering participants with baseline CD4 cell counts \( \geq 200 \) cells/µL separately. The mean difference in final HIV load between the TB group and the non-TB control group (after adjustment for matched group and baseline HIV load) was 0.39 log₁₀ copies/mL (95% CI, −0.35 to 1.13 log₁₀ copies/mL) in those with CD4 cell counts <200 cells/µL and was 0.26 log₁₀ copies/mL (95% CI, −0.02 to 0.54 log₁₀ copies/mL) in those with CD4 cell counts \( \geq 200 \) cells/µL. This difference was not statistically significant (\( P = .97 \)), suggesting no interaction between baseline CD4 cell count and final HIV load; however, for this analysis the power to detect a statistically significant difference was low.

The mean rate of CD4 cell count decrease per year for the TB group and the non-TB control group was 53.0 and 6.7 cells/µL/year, respectively, a difference of 46.3 cells/µL/year (95% CI, 10.9 to 81.8 cells/µL/year; \( P = .012 \)). After adjustment for potential confounding variables (baseline HIV load, baseline WHO stage, and age), the difference was 47.1 cells/µL/year (95% CI, 11.8 to 82.3 cells/µL/year; \( P = .010 \)). To provide further comparison, among 778 other participants enrolled in the study for a minimum of 6 months who were not treated for TB or included in the pneumonia or control groups, the rate of CD4 cell count decrease was 17.4 cells/µL/year (95% CI, 11.5 to 23.4 cells/µL/year).

**Pneumonia group compared with nonpneumonia control group.** During the study period, 80 participants experienced at least 1 episode of pneumonia. Of these, 42 had adequate follow-up time before and after the episode, and, of these, 14 met the remaining inclusion criteria for the bacterial pneumonia group. Thirty-five suitable participants were identified for inclusion in the nonpneumonia control group. The baseline characteristics of these groups are shown in table 1. They did not significantly differ with respect to the matched variables (baseline CD4 cell count and duration of follow-up), age, or proportion with a history of bacterial pneumonia before study entry. Figure 2 shows the mean baseline and final HIV loads in the pneumonia group and the nonpneumonia control group. Although final HIV load was higher in the pneumonia group than in the nonpneumonia control group, it was neither clinically nor statistically significant (unadjusted mean, 4.51 vs. 4.22 log₁₀ copies/mL; \( P = .25 \)). Table 2 shows that most of the difference in final HIV load between the pneumonia group and the nonpneumonia control group was accounted for by the difference in baseline HIV load.

The mean rates of CD4 cell count decrease were similar in the pneumonia group and the nonpneumonia control group (0.9 vs. 12.3 cells/µL/year; \( P = .7 \)); adjusting for baseline HIV load, baseline WHO stage, and age did not alter this result.

**DISCUSSION**

In the present study, HIV-infected participants who experienced an episode of TB had higher HIV loads before the onset of TB than did control subjects with similar CD4 cell counts; HIV-
infected participants who experienced an episode of pneumonia also had higher HIV loads at baseline than did control subjects, but the difference was not statistically significant. Previous work has shown that severe HIV-related disease events, such as TB [20–22, 32, 33] and those caused by other opportunistic infections [24, 25], are associated with a higher incidence of subsequent disease events and/or shorter survival. These studies have been interpreted as suggesting that TB and other opportunistic infections accelerate HIV disease progression. The present study suggests that part of this effect is attributable to higher HIV load before the disease episode. Our data, consistent with data for other opportunistic infections [34–37], also show that high HIV load is a risk factor for TB independent of CD4 cell count. In the present study, after adjustment for the difference in baseline HIV load and other potentially confounding variables, an episode of TB was associated with a small increase in HIV load at the end of the study, and the increase was of borderline statistical significance. Our findings were similar for comparisons between participants with pneumonia and control subjects without pneumonia, although the differences were smaller and not statistically significant.

Three previous studies have investigated HIV load before and after episodes of TB [13, 16, 19]. Goletti et al. studied 7 patients with TB, but only 1 patient had HIV load measurements both before and after the episode of TB [13]. In this individual, a large increase in HIV load was observed at the time TB was diagnosed; 10 months after the diagnosis, the patient’s HIV load was similar to that at baseline. Toossi et al. studied 10 patients before, during, and after an episode of TB [16]. They found an average 2.7-fold increase in HIV load at the time of the episode of TB, compared with that at baseline, but they did not compare HIV load before and after the episode of TB. In an uncontrolled study of an Ethiopian cohort, Wolday et al. found that 10 HIV-infected individuals who developed TB during the study had high HIV loads both before and after treatment for TB [19]. Three clinical studies in the United States have examined the effect that bacterial pneumonia has on HIV load, but none of them made comparisons with control subjects [38–40]. The study with the largest number of patients with pneumonia (n = 13) [38] found a transient increase in HIV load at the time of pneumonia but no significant difference in HIV load before and after the disease episode.

A difference in final HIV load of the magnitude found in the present study (0.24 log10 copies/mL) between individuals experiencing an episode of TB and control subjects would not be regarded as clinically significant in an individual patient but could have some effect on disease progression or transmission at the population level. By extrapolation from studies from the pre-ART era of the effect that HIV load has on survival [41–44] and on the risk of heterosexual HIV transmission [45], we estimate that a difference in HIV load of 0.25 log10 copies/mL could equate to a difference of ~1 year in the time to severe HIV disease or death and a 1.6-fold increase in the rate of heterosexual HIV transmission.

How do the HIV-infected patients with TB in the present study compare with others in African countries? The median CD4 cell count at the time of the episode of TB was 192 cells/μL (data from 18 participants), and published median values for individuals with TB in African countries range from 27 to 339 cells/μL [9, 46–49]. Because we recruited our study population from a workforce, they may have been healthier than other populations studied. However, our non-TB control group was drawn from the same working population, and hence any such effect would apply equally to the TB group and the non-TB control group and should not affect the comparison between them. There were significant redundancies from the workforce during the study period; most losses from the clinic cohort were due to termination of employment on nonmedical grounds (A. D. Grant, personal communication). In our study population, nontuberculous mycobacterial pulmonary disease was also common [50], but the majority of patients included in the present study had culture-confirmed M. tuberculosis.

We examined rates of CD4 cell count decrease as an alternative measure of HIV disease progression. The unadjusted rate of CD4 cell count decrease in participants with TB (53 cells/μL/year) was similar to that observed in HIV-infected individ-

Table 2. Mean differences in final HIV load between the tuberculosis (TB) group and the non-TB control group and between the pneumonia group and the nonpneumonia control group.

<table>
<thead>
<tr>
<th>Adjusted for</th>
<th>TB group and non-TB control group</th>
<th>P</th>
<th>Pneumonia group and nonpneumonia control group</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Matched groups</td>
<td>0.61 (0.30 to 0.92)</td>
<td>&lt;.001</td>
<td>0.23 (−0.17 to 0.63)</td>
<td>.25</td>
</tr>
<tr>
<td>Plus baseline HIV load</td>
<td>0.29 (0.03 to 0.54)</td>
<td>.03</td>
<td>0.09 (−0.22 to 0.40)</td>
<td>.57</td>
</tr>
<tr>
<td>Plus baseline WHO HIV stage</td>
<td>0.24 (−0.01 to 0.50)</td>
<td>.06</td>
<td>−0.03 (−0.34 to 0.27)</td>
<td>.83</td>
</tr>
<tr>
<td>Plus age</td>
<td>0.24 (−0.05 to 0.53)</td>
<td>.10</td>
<td>−0.01 (−0.33 to 0.31)</td>
<td>.96</td>
</tr>
</tbody>
</table>

NOTE. CI, confidence interval; WHO, World Health Organization.
tics in industrialized countries in the pre-ART era [51]. The rate of CD4 cell count decrease in all study participants who were neither treated for TB nor included as control subjects was 17 cells/µL/year, suggesting that the non-TB control group, whose rate of CD4 cell count decrease was 7 cells/µL/year, may have been unusually healthy, because we excluded all individuals who had intercurrent disease events. However, we applied these same exclusion criteria (other than the index TB or pneumonia event) to both disease and control groups.

Because both CD4 cell count and HIV load are independent prognostic indicators, ideally we would have matched control subjects and individuals with TB or pneumonia using both CD4 cell count and HIV load at baseline. However, because estimations of HIV load were not routinely available at the time of the present study, it was not possible to match on the basis of baseline HIV load.

This study was designed to exclude, as far as was possible, active TB and other serious infections at the time of study entry, to ensure that the measurement of baseline HIV load was truly done before the disease episode. Screening for TB and other infections is routinely performed during the first visit to the clinic. We could not be certain for how long TB was active before diagnosis, and so we assumed that anyone who had no clinical, radiological, or microbiological evidence of active TB on screening did not have active disease at that point if their episode of TB was at least 3 months after that date. In fact, the median time between study entry and diagnosis of TB was 8 months.

In conclusion, poor prognosis for HIV-infected individuals with TB may be attributable to preexisting high HIV load rather than to the TB event itself. Strategies for the reduction of TB incidence must remain a high priority, because of the high morbidity and mortality attributable to TB in both HIV-infected and -uninfected individuals. However, in itself the prevention of TB may have a limited effect on the subsequent course of HIV disease; presently, only widespread implementation of ART would achieve this.

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References


