



Discrepancies Between Routine Tuberculosis/HIV Mortality Reporting and Medically Certified Causes of Death, Uganda, 2020–2024.

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Summary

Background: Accurate cause-of-death ascertainment is essential for monitoring the impact of HIV and tuberculosis (TB) programs. In Uganda, aggregate TB/HIV death counts are routinely reported through the Health Management Information System (HMIS) 106a, while HMIS 100 records medically certified causes of death (MCCOD). Because medically certified cause-of-death information provides a more specific basis for determining underlying and contributing causes of death, we used HMIS 100 as the reference source. We assessed the extent to which routine TB/HIV mortality reporting corresponded with medically certified deaths in Uganda during 2020–2024.

Methods: We conducted a national retrospective evaluation using HMIS 106a and HMIS 100 data for 2020–2024. Tuberculosis/HIV deaths were defined as deaths among people living with HIV in which TB was recorded as an underlying or contributing cause of death. We compared TB/HIV death counts at national and health-facility levels; district-year was the unit of analysis. We calculated the certification ratio as HMIS 100 divided by HMIS 106a, expressed as a percentage. We calculated absolute differences and reporting ratios, and assessed agreement at the district-year level using Bland-Altman analysis, reported as mean bias and 95% limits of agreement (LOA).

Results: From 2020–2024, overall certification ratio was 5.4% (145/2,693). Annual certification ratio increased from 0.2% in 2020 to 12.9% in 2024. The absolute difference between systems remained large, declining from 547 deaths in 2020 to 481 in 2024. Marked geographic disparities were observed, with Busoga, Karamoja, and Teso regions recording no certified TB/HIV deaths, and no certification was documented at health center IV or lower-level facilities. Bland-Altman analysis showed a mean bias of 8.7 deaths per district-year (95% LOA: -23.7–41.0), with HMIS 106a reporting approximately nine more TB/HIV deaths per district-year than HMIS 100.

Conclusion: Substantial and persistent discordance exists between routine TB/HIV mortality reporting and medically certified causes of death in Uganda, primarily driven by incomplete certification. Strengthening decentralized medical certification and integrating medical certification of causes of death into routine surveillance could improve the accuracy of TB/HIV mortality monitoring and decision-making.



Background

Tuberculosis (TB) remains a major cause of death among people living with HIV (PLHIV) (1). Globally, TB caused approximately 1.25 million deaths in 2023, and PLHIV are substantially more likely to develop TB and die during TB treatment than people without HIV. Tuberculosis accounts for nearly one-third of AIDS-related deaths worldwide (2, 3).

Uganda remains a high-burden country for both TB and HIV, with an estimated 96,000 new TB cases annually, about one-third occurring among PLHIV (4). Despite expanded access to antiretroviral therapy and TB preventive treatment, TB remains an important cause of mortality among PLHIV (5, 6). Accurate monitoring of TB/HIV deaths is therefore essential for assessing disease burden and guiding TB/HIV programme interventions(6).

In Uganda, TB/HIV deaths are routinely reported through the District Health Information System 2 using Health Management Information System (HMIS) 106a (7), while medically certified causes of death are recorded using the Medical Certificate of Cause of Death in HMIS 100 according to International Classification of Diseases standards (8, 9). However, incomplete medical certification and variation in diagnostic and certification practices may result in discrepancies between the two reporting systems.

We described trends in TB/HIV mortality reported through HMIS 106a and HMIS 100 in Uganda from 2020 to 2024 and quantified discrepancies between the two data sources by time, place, health facility level, and facility ownership.

Methods

We conducted a national descriptive evaluation of TB/HIV mortality data reported in Uganda from 2020–2024, covering all districts and health facilities. Data were extracted from DHIS2 using HMIS 106a for routinely reported TB/HIV deaths and HMIS 100 for medically certified causes of death coded according to ICD-10/ICD-11 standards. In HMIS 100, TB/HIV deaths were defined as deaths among people living with HIV in which TB was recorded as an underlying or contributing cause. All TB/HIV deaths reported in HMIS 106a were included.

Health management information system 100 data were aggregated to district-year level and used as the reference for cause-of-death attribution. Data were harmonized by year, region, district, health-facility level, and facility ownership. Discrepancy was defined as the difference in deaths reported by HMIS 106a and HMIS 100 for the same district-year and was assessed using reporting ratios, absolute differences, and Bland–Altman analysis. Positive differences indicated higher reporting in HMIS 106a. The certification ratio was calculated as HMIS 100 deaths divided by HMIS 106a deaths. Forty-six incomplete district-year observations were excluded from certification-ratio visualization. Trends and district-level choropleth maps were used to summarize mortality patterns. Bland–Altman analysis

estimated the mean difference and 95% limits of agreement (mean difference ± 1.96 SD), with linear regression used to assess magnitude-dependent disagreement. Analyses were descriptive, with no hypothesis testing.

The study used routinely collected programmatic data. Health management information system 100 records were de-identified before access, and no individual identifiers were analyzed. Ministry of Health clearance was obtained to access and analyze DHIS2 data. Formal ethical review was not required under national guidance for public health surveillance activities. The analysis was also reviewed by the US CDC and conducted in accordance with applicable data-protection requirements and US federal regulations.

Results

Certification coverage and absolute difference in death reporting through Health Management Information System 106a compared to Health Management Information System 100, Uganda, 2020–2024

Across 2020-2024, HMIS 106a reported 2,693 TB/HIV deaths compared to 145 in HMIS 100, an absolute difference of 2,548 (94.6%) and an overall certification of 5.4% (Figure 1). Routine reporting exceeded medically certified deaths in every year. The annual difference decreased from 547 deaths in 2020 to 481 in 2024, while certification ratio increased from 0.2% (1/548) to 12.9% (71/552).

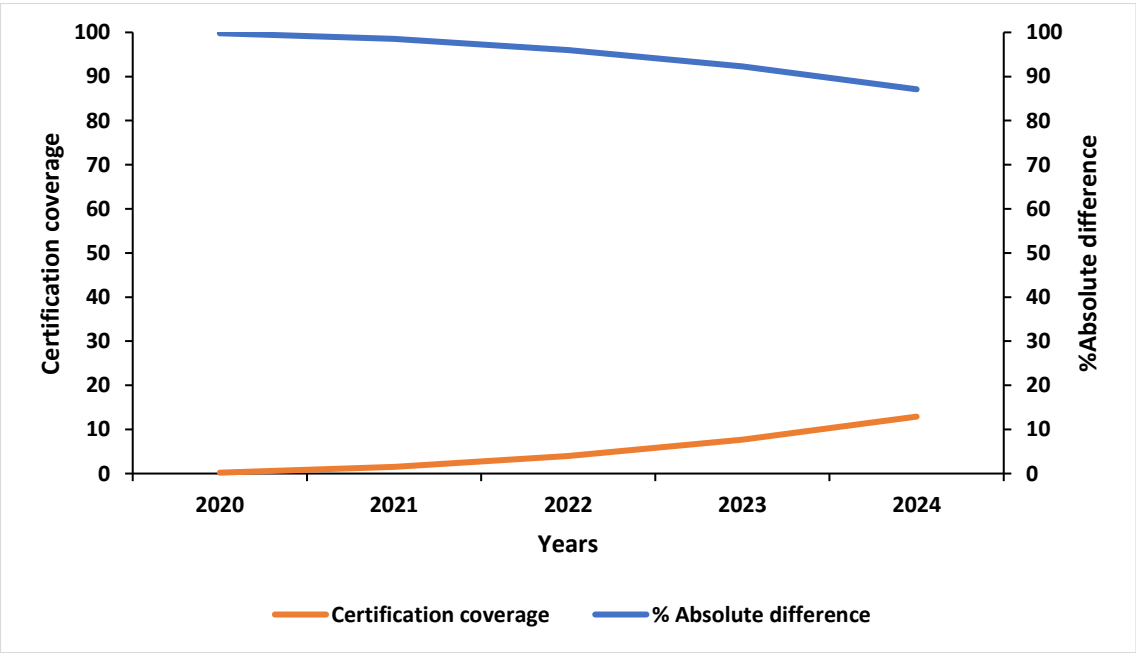


Figure 1: Certification coverage and absolute difference in death reporting through Health Management Information System 106a compared to Health Management Information System 100, Uganda, 2020–2024



Spatial Distribution of Certification ratio for tuberculosis/HIV mortality at district Level, Uganda, 2020–2024

Marked geographic variation was observed in certification ratio (Figure 2). In 2020–2021, most districts had either no medically certified TB/HIV deaths or ratio below 5%. From 2022 onward, districts with moderate certification ratio emerged, particularly those hosting higher-level referral facilities. By 2023–2024, some districts exceeded 20% ratio, although many remained below 10%. Busoga, Karamoja and Teso recorded no medically certified TB/HIV deaths during the five-year period.

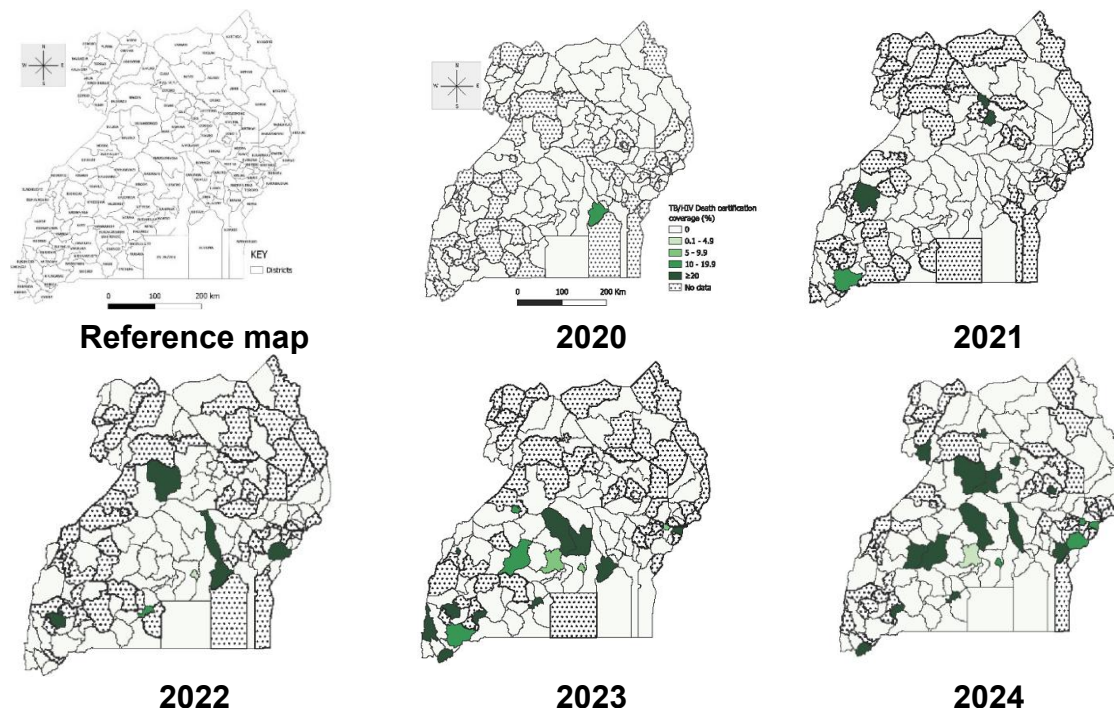


Figure 2: Spatial Distribution of Certification ratio for tuberculosis/HIV mortality at district Level, Uganda, 2020–2024

Trends in the number of tuberculosis/HIV deaths reported through Health Management Information System 106a and 100, by health facility, Uganda, 2020–2024

Certification was concentrated in higher-level health facilities. National and regional referral hospitals and general hospitals showed increasing numbers of medically certified deaths over time, with regional referral hospitals demonstrating a narrower reporting gap. No medically certified TB/HIV deaths were recorded in Health Centres IV or lower-level facilities during the study period (Figure 3).

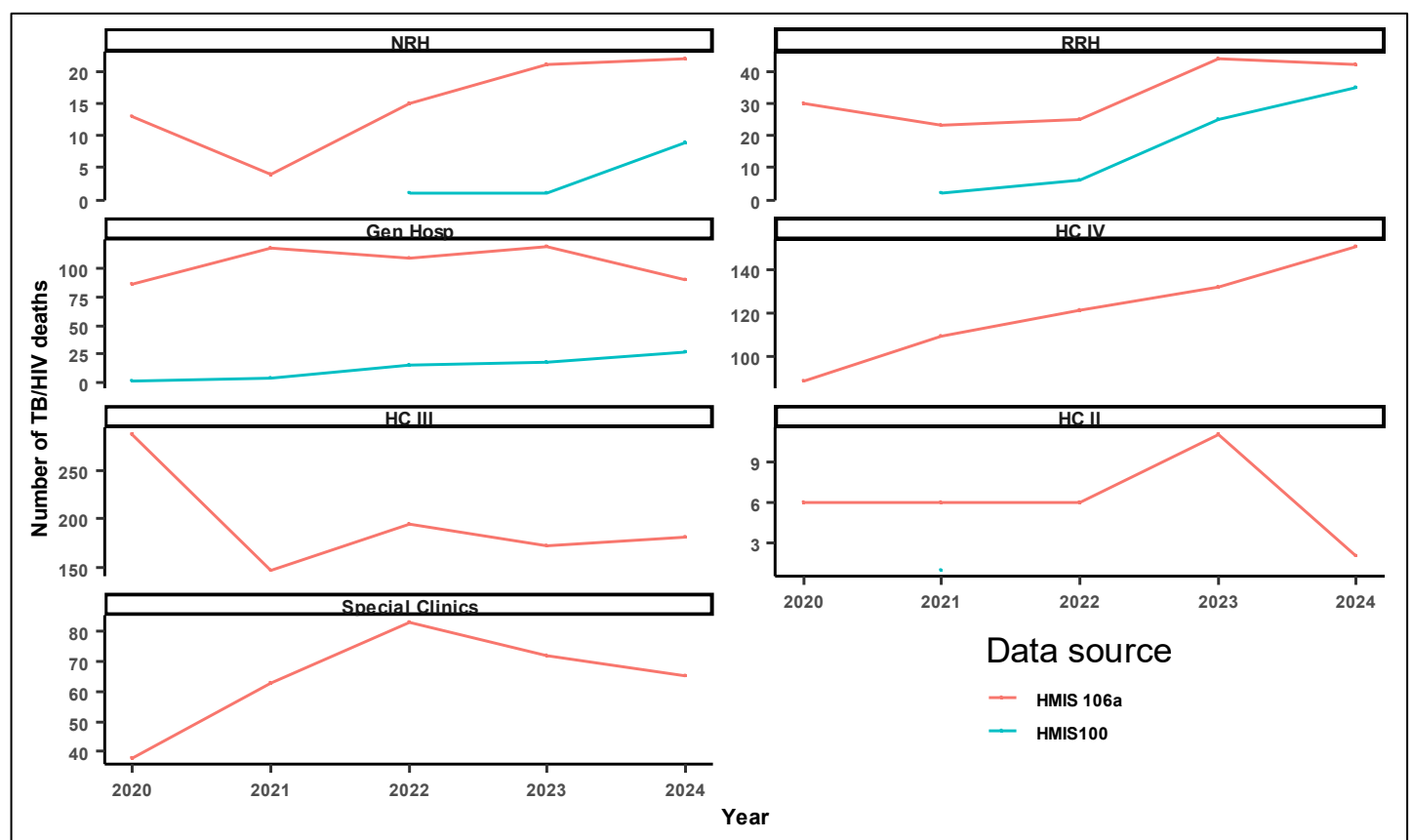


Figure 3: Trends in the number of tuberculosis/HIV deaths reported through Health Management Information System 106a and 100, by health facility, Uganda, 2020–2024

Trends in concordance between Health Management Information System 106a and 100 in Uganda, by health facility ownership, 2020–2024

Ownership-based analysis showed greater convergence between the two systems over time among government-owned health facilities, while private-for-profit facilities had no recorded medically certified TB/HIV deaths (Figure 4).

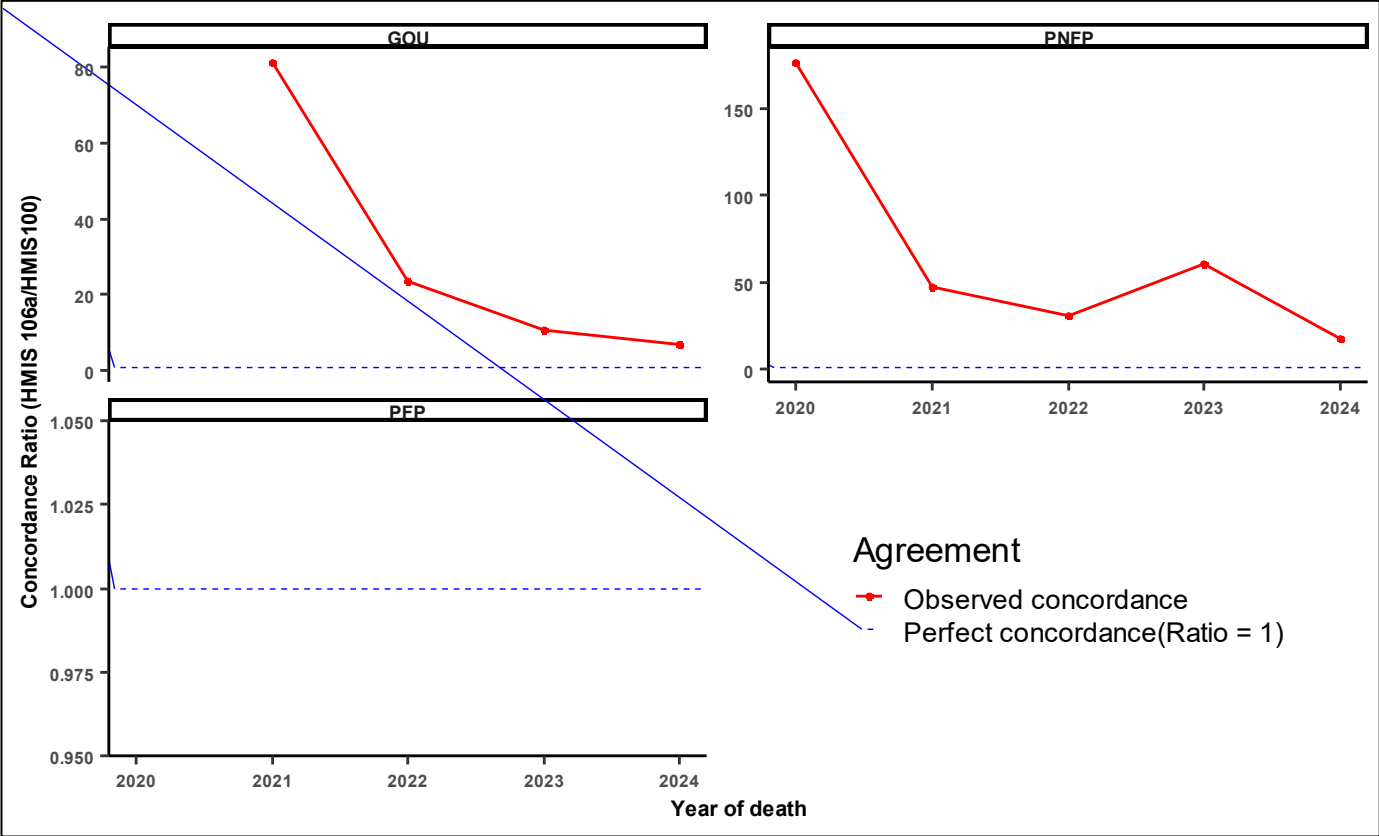


Figure 4: Trends in concordance between HMIS 106a and HMIS 100 in Uganda, by health facility ownership, 2020–2024

Assessment of disagreement between routine tuberculosis/HIV mortality reporting through Health Management Information System 106a and 100 at district-year level, Uganda, 2020–2024

At the district-year level, Bland-Altman analysis demonstrated systematic disagreement between the reporting systems. The mean bias was 8.7 deaths per district-year (95% LOA: -23.7–41.0), indicating that HMIS 106a reported approximately nine more TB/HIV deaths per district-year on average. The wide limits of agreement indicated substantial variability between districts, while increasing dispersion at higher mortality levels suggested magnitude-dependent disagreement (Figure 5).

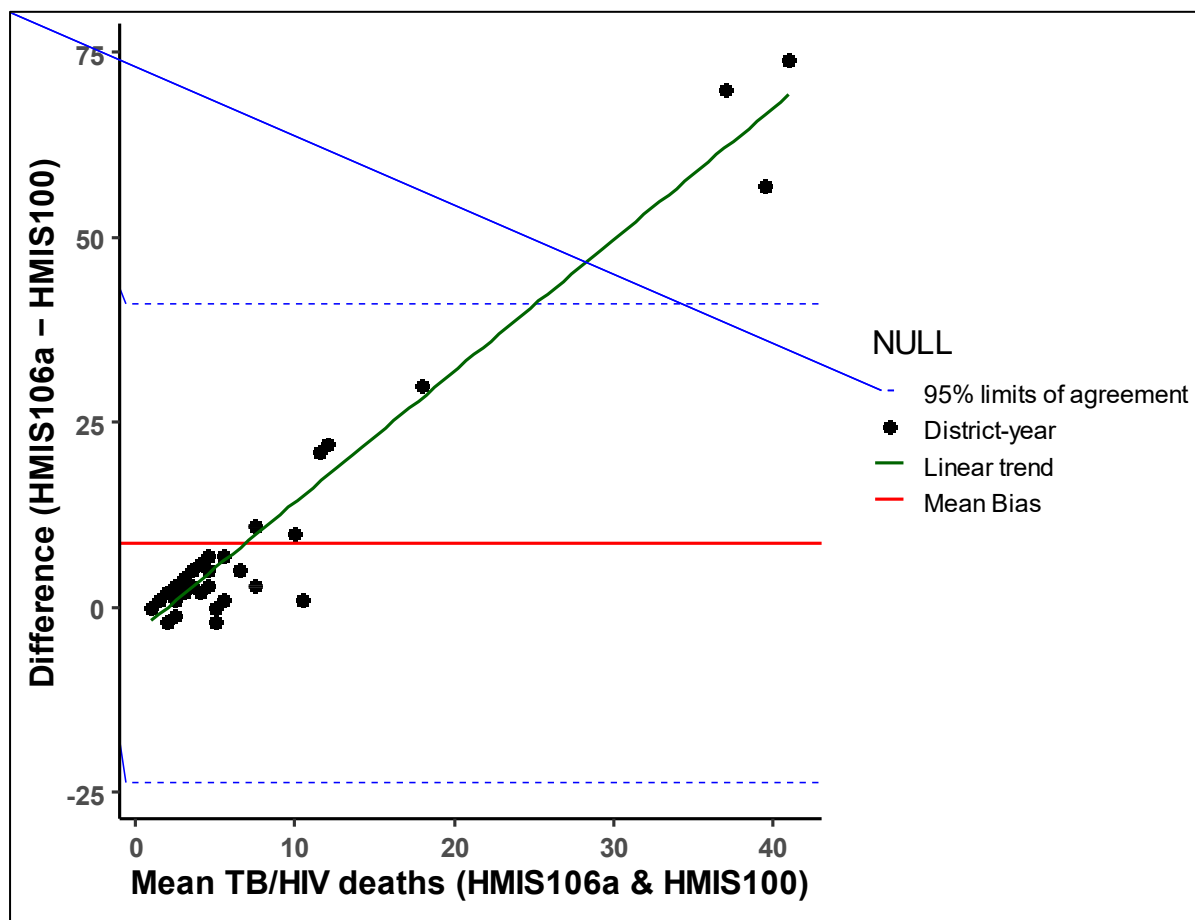


Figure 5: Bland-Altman plot assessing disagreement between routine tuberculosis/HIV mortality reporting through Health Management Information System 106a and 100 at district-year level, Uganda, 2020–2024

Discussion

This national analysis found substantial discrepancies between TB/HIV mortality reported through HMIS 106a and medically certified TB/HIV deaths recorded in HMIS 100 during 2020–2024. HMIS 106a consistently reported more deaths, while the certification ratio increased from 0.2% in 2020 to 12.9% in 2024, with an overall ratio of 5.4%.

The increase in medically certified TB/HIV deaths coincided with implementation of Uganda's national mortality surveillance roadmap, which aims to strengthen death notification and medical certification (9). However, certification remained uneven across districts and facility levels. No medically certified TB/HIV deaths were recorded below general hospitals, suggesting important gaps in implementation of medical certification rather than absence of TB/HIV mortality at lower-level facilities.

Bland–Altman analysis showed systematic differences between the two systems, with larger discrepancies in districts reporting higher mortality. However, because HMIS 100 certification remains incomplete and the analysis used aggregate data, the observed differences cannot be attributed solely to over-reporting in HMIS 106a.



They may reflect incomplete certification, differences in case ascertainment, reporting practices, or a combination of these factors (10).

Strengths and limitations: The study benefited from national coverage and comparison of two routine mortality reporting systems. Limitations included potential data-quality and classification errors, incomplete medical certification, exclusion of community deaths not captured by health facilities, and instability of estimates where certified deaths were few.

Conclusion: Substantial discrepancies existed between TB/HIV mortality reported through HMIS 106a and HMIS 100 in Uganda during 2020–2024. Although medical certification improved over time, certified TB/HIV deaths represented only 5.4% of deaths reported through HMIS 106a, with major gaps at lower-level health facilities. The Ministry of Health should strengthen medical certification training and supportive supervision, expand MCCOD reporting across facility levels, conduct routine data-quality audits, and improve linkage between medical certification and DHIS2 mortality reporting systems.

Conflict of interest: The authors declare that they have no conflict of interest.

Author's contributions: NM conceptualized, led data collection, analysis, and report writing. IK, KDA, JM, IL supported data collection and review of draft report. RM, BK, YN, and FN supported technical review of data analysis, and report writing. NM and RM contributed to writing and reviewing the bulletin article to ensure scientific rigor and intellectual content. All authors reviewed and approved the final bulletin article for submission.

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