



Medical certification of cause of death as an emerging source for malnutrition mortality surveillance alongside District Health Information Software 2, Uganda, 2020–2025

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Summary

Background: Uganda mainly monitors malnutrition-related deaths through the District Health Information Software 2 (DHIS2), which captures deaths among children treated for severe (SAM) and moderate (MAM) acute malnutrition. The Medical Certificate of Cause of Death (MCCD) system captures certified causes of death across all ages and may identify malnutrition as an underlying, intermediate, or contributing cause. We described malnutrition-related deaths captured through MCCD and examined what additional information it provides alongside DHIS2 treatment-outcome data in Uganda during 2020–2025.

Methods: We analysed MCCD records from January 2020 to December 2025 and identified deaths in which malnutrition was the underlying cause, part of the causal sequence, or a contributing condition. We calculated annual MCCD-recorded death rates per 1,000,000 population and counted the facilities certifying malnutrition-related deaths each year. From DHIS2, we extracted deaths during SAM and MAM treatment and calculated case fatality rates. We described each system separately and assessed trends using the Mann–Kendall test.

Results: Of 56,443 MCCD records screened, 857 (1.5%) were malnutrition-related; in 447 (52.2%), malnutrition was not the underlying cause. Facilities certifying at least one malnutrition-related death increased from 1 in 2020 to 57 in 2024. The MCCD-recorded death rate rose from 0.02 per 1,000,000 population in 2020 to 7.21 in 2024; 2022–2025 ($\tau=0.67$, $p=0.31$). Children aged 1–4 years accounted for 273/744 (36.7%) deaths with known age. Regional referral hospitals certified 463 (54.0%) deaths. DHIS2 recorded 2,898 deaths during SAM/MAM treatment; the case fatality rate showed no significant trend ($\tau=0.07$, $p=1.0$) and was highest at the national referral hospital (2.32%).

Conclusion: More than half of malnutrition-related deaths identified through MCCD had malnutrition recorded as an intermediate or contributing condition rather than the underlying cause, demonstrating the additional information available from cause-of-death certification. MCCD also identified malnutrition-related deaths across age groups beyond those routinely captured through SAM/MAM treatment reporting. However, certification remained concentrated in referral hospitals and coverage was incomplete. Continued expansion of MCCD could provide a broader picture of malnutrition-related mortality alongside DHIS2 treatment-outcome surveillance.



Background

Malnutrition remains an important contributor to child mortality (1). In Uganda, 25.4% of children under five were stunted, 10.0% underweight, and 3.6% wasted in 2022 (2), while in-hospital mortality among children with severe acute malnutrition (SAM) has ranged from about 10% to 25% (3,4).

Malnutrition-related deaths among children receiving treatment are routinely reported through the District Health Information Software 2 (DHIS2), which captures aggregate severe acute malnutrition (SAM) and moderate acute malnutrition (MAM) cases and treatment outcomes but does not record certified causes of death (5). The Medical Certificate of Cause of Death (MCCD) system captures causes of death across all ages, coded using the International Classification of Diseases, 11th Revision (ICD-11) (6,7), and is still being expanded across health facilities in Uganda (8,9).

We described malnutrition-related deaths captured through MCCD during 2020–2025 alongside DHIS2 treatment outcomes to assess what MCCD currently contributes to malnutrition mortality surveillance and identify gaps as the system continues to expand.

Methods

We conducted a descriptive analysis of routinely collected malnutrition-related mortality data from the MCCD system and DHIS2 in Uganda during 2020–2025.

For MCCD, we screened coded and free-text cause-of-death fields for malnutrition-related ICD-11 codes and terms. Deaths were classified into three mutually exclusive categories: Category A, malnutrition recorded as the underlying cause of death; Category B, malnutrition recorded elsewhere in the causal sequence; and Category C, malnutrition recorded only as a contributing condition. We described deaths by age, sex, facility level, district, and year, and calculated annual recorded-death rates per 1,000,000 population using Uganda Bureau of Statistics population projections. We also tracked the number of facilities certifying at least one malnutrition-related death each year.

From DHIS2, we extracted SAM and MAM cases and deaths occurring during treatment and calculated case fatality rates. The two systems capture complementary aspects of malnutrition mortality: DHIS2 reflects treatment outcomes among children identified with SAM or MAM, while MCCD captures malnutrition as an underlying, intermediate, or contributing cause among medically certified deaths across all ages. Because the systems differ in purpose, coverage, and case definitions and could not be linked at individual level, they were analysed separately rather than directly comparing death counts.

Temporal trends were assessed using the Mann–Kendall test and Sen's slope, with MCCD trends also examined for 2022–2025 because coverage was limited in earlier years.

The analysis used de-identified routine surveillance data and was conducted as non-research public health practice with Ministry of Health authorization and U.S. CDC granting non-research determination.



Results

Malnutrition-related deaths captured through MCCD, Uganda, 2020–2025

Of 56,443 MCCD death records screened, 857 (1.5%) were malnutrition-related. Malnutrition was the underlying cause of death (Category A) in 410 (47.8%), part of the causal sequence (Category B) in 210 (24.5%), and a contributing condition only (Category C) in 237 (27.7%). Annual certified malnutrition-related deaths rose from 1 in 2020 to a peak of 325 in 2024 and were 243 in 2025, while the number of facilities certifying at least one malnutrition-related death rose from 1 in 2020 to 57 in 2024 (Figure 1).

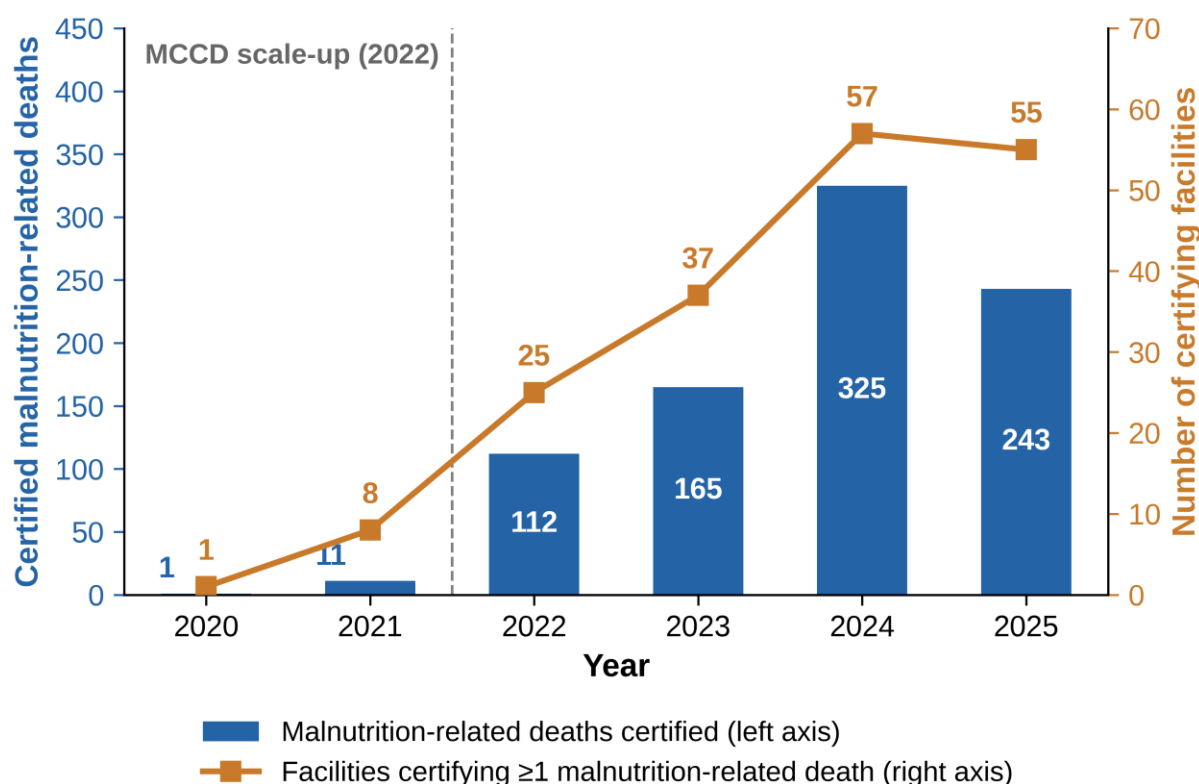


Figure 1: Annual malnutrition-related deaths certified and facilities certifying at least one malnutrition-related death, Medical Certificate of Cause of Death system, Uganda, 2020–2025

The MCCD-recorded malnutrition-related death rate rose from 0.02 per 1,000,000 population in 2020 to a peak of 7.21 in 2024, before declining to 5.11 in 2025 ($\tau=0.87$, $p=0.024$; Sen's slope 1.21 per 1,000,000 population per year); when restricted to 2022–2025, after scale-up began, the trend was not statistically significant ($\tau=0.67$, $p=0.31$). DHIS2 recorded 2,898 deaths during treatment for SAM ($n=2,210$) and MAM ($n=688$). Neither annual DHIS2 deaths



($\tau=0.33$, $p=0.45$) nor the DHIS2 case fatality rate ($\tau=0.07$, $p=1.0$) showed a significant trend, including for 2020–2024 ($\tau=0.60$, $p=0.22$).

Malnutrition-related deaths by health facility level, MCCD and DHIS2, Uganda, 2020–2025

In MCCD, regional referral hospitals certified more than half of malnutrition-related deaths (463/857; 54.0%) and general hospitals about one-third (308; 35.9%); lower-level facilities certified few. (Figure 2). Kayunga Regional Referral Hospital (79; 9.2%) and Butabika National Referral Hospital, Uganda's national referral facility for mental health (61; 7.1%), certified the most deaths. In DHIS2, the case fatality rate increased with facility level; from 0.24% at Health Centre II, to 2.32% at the national referral hospital.

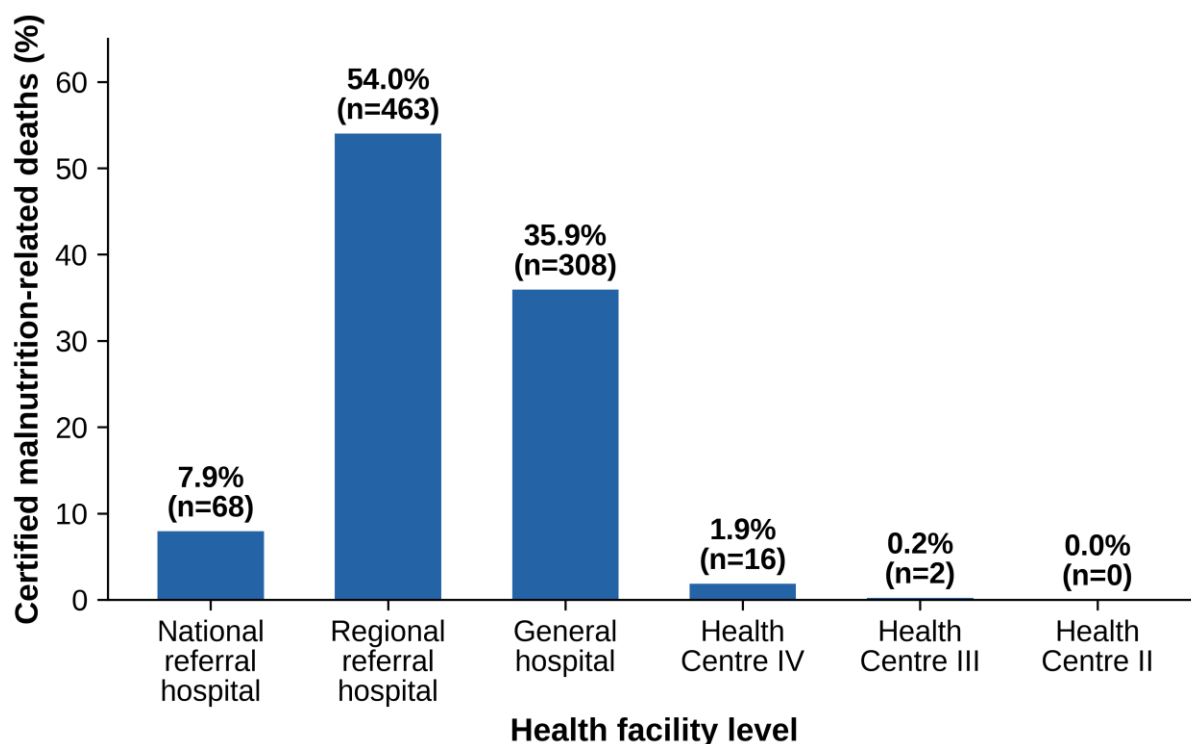


Figure 2: Distribution of malnutrition-related deaths certified in the Medical Certificate of Cause of Death system by health facility level, Uganda, 2020–2025

Age, sex, and geographical distribution of malnutrition-related deaths, DHIS2 and MCCD, Uganda, 2020–2025

In MCCD, children aged 1–4 years accounted for the largest share of deaths with known age (273/744; 36.7%) and adults aged 25–64 years for 215 (28.9%). The cumulative 2020–2025 recorded-death rate was higher among males (22.5 per 1,000,000 population) than females (15.1 per 1,000,000). Severe acute malnutrition was the most commonly certified type (441/857; 51.5%), followed by unspecified undernutrition (362/857; 42.2%). Cumulative



MCCD-recorded deaths per 1,000,000 residents during 2021–2025 were highest in Kampala (48.5), Kigezi (32.3), Bunyoro (30.4), and North Buganda (30.2) regions, and the highest district values were in Kayunga, Moroto, Nebbi, Lira, and Hoima. 65 of Uganda's 146 districts (44.5%) recorded at least one certified death. In DHIS2, children aged 6–23 months accounted for the largest share of SAM/MAM deaths (1,165/2,898; 40.2%) and had the highest case fatality rate (0.72%), and case fatality was higher among males (0.54%) than females (0.39%).

Discussion

This analysis shows that MCCD is beginning to provide information on malnutrition-related mortality that is not available from routine SAM/MAM treatment reporting alone. Of the 857 malnutrition-related deaths identified through MCCD, only 47.8% had malnutrition recorded as the underlying cause; in the remaining 52.2%, malnutrition appeared elsewhere in the causal sequence or as a contributing condition. This demonstrates the value of reviewing the full medical cause-of-death sequence rather than relying only on deaths in which malnutrition is recorded as the underlying cause ([1](#)).

MCCD also captured malnutrition-related deaths across a broader age range. Although children aged 1–4 years accounted for the largest proportion of deaths with known age, almost one-third occurred among adults aged 25–64 years. In contrast, DHIS2 malnutrition mortality reporting reflects deaths occurring among children identified and treated for SAM or MAM. These findings highlight the complementary roles of the two systems: DHIS2 provides information on outcomes among children receiving acute-malnutrition treatment, while MCCD can describe the contribution of malnutrition to medically certified deaths across the life course. The death counts from the two systems should therefore not be interpreted as directly comparable measures of the same mortality burden.

The increase in MCCD-recorded malnutrition-related deaths over time occurred alongside a substantial expansion in the number of facilities certifying such deaths. The number of certifying facilities increased from one in 2020 to 57 in 2024, while the recorded death rate increased from 0.02 to 7.21 per million population. However, when the trend analysis was restricted to 2022–2025, after expansion of the system began, the increase was not statistically significant. This suggests that much of the observed increase in recorded mortality may reflect improving MCCD coverage and implementation rather than a true increase in malnutrition-related mortality. MCCD rates should therefore be interpreted as rates of recorded certified deaths, rather than estimates of the national mortality burden.

Coverage also remained concentrated in higher-level facilities. Regional referral hospitals and general hospitals accounted for nearly 90% of MCCD-recorded malnutrition-related deaths, while only 65 of Uganda's 146 districts recorded at least one certified death. This concentration likely reflects the current stage of MCCD implementation ([8](#)) and limits geographic comparisons, since areas with stronger certification may appear to have higher mortality simply because more deaths are being medically certified. A similar concentration in referral hospitals was reported for certified neonatal sepsis deaths ([10](#)). Continued expansion of medical certification to additional hospitals and lower-level facilities would improve the representativeness and usefulness of MCCD for malnutrition mortality surveillance.



Overall, the findings suggest that MCCD should not replace DHIS2 malnutrition treatment-outcome reporting. Rather, the systems provide different but complementary information: DHIS2 monitors outcomes among identified SAM/MAM cases, while MCCD provides information on how malnutrition contributes to medically certified deaths, including deaths outside childhood and those in which malnutrition is not the underlying cause. Strengthening MCCD coverage could therefore broaden Uganda's understanding of malnutrition-related mortality while DHIS2 continues to monitor programme-based treatment outcomes (8).

Study limitations: MCCD included only medically certified deaths from participating facilities, and facility coverage changed over time; therefore, MCCD counts and recorded-death rates should not be interpreted as national mortality estimates. Deaths were attributed to the certifying facility rather than the deceased person's residence, so referral patterns may have influenced geographic distributions. Cause-of-death information may also have been affected by incomplete documentation and variation in certification and coding practices.

For DHIS2, the case fatality denominator comprised SAM/MAM cases identified at screening rather than only those admitted for treatment. Changes in the reporting form also affected one year's case fatality estimate; however, restricting the trend analysis to 2020–2024 did not change the overall conclusion.

Conclusion: More than half of malnutrition-related deaths identified through MCCD had malnutrition recorded outside the underlying-cause position, demonstrating information that is not available from routine SAM/MAM treatment-outcome reporting alone.

However, MCCD coverage remains incomplete and concentrated in referral and general hospitals, and the increase in recorded deaths over time largely reflects expansion of medical certification rather than a demonstrated rise in population mortality. As coverage expands, the Ministry of Health should strengthen certification beyond higher-level facilities and routinely review MCCD findings alongside DHIS2 treatment outcomes to provide a broader understanding of malnutrition-related mortality in Uganda.

Conflict of interest: The authors declare no competing interests.

Author Contributions: WN conceptualised the study, led data collection, analysis, and interpretation and wrote the draft article. RM and BK reviewed the draft and made multiple edits for intellectual content. SN, JW, SN, TE, PEO, CN and IK reviewed the article for intellectual content and scientific integrity. All authors read and approved the final article.

Acknowledgements: We acknowledge the Ministry of Health Division of Health Information for granting access to the data used in this study, and the National Identification and Registration Authority for its role in Uganda's civil registration and vital statistics system. We also thank the Uganda Public Health Fellowship Program for technical support.

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