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Adoption of Verbal Autopsy in Civil Registration Systems in Tanzania: Implementation Challenges and Recommendations

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ABSTRACT

The adoption and use of Verbal Autopsy (VA) play a vital role in providing causes of death information in places where such information is not available due to the limitations in reporting, recording and processing vital statistics. Many Low and Middle Income Countries (LMICs) including Tanzania are still struggling to yield quality and adequate data for Civil Registration and Vital Statistics (CRVS), thus the wide-scale implementation of VA continues to be indefensible. This study highlights VA implementation challenges and recommends wide-scale VA adoption strategies to help countries rapidly yield quality and adequate mortality statistics for making timely and informed decisions on healthcare interventions. This study involved 41 key informants' semi-structured interviews in 5 municipalities of the Iringa region in Tanzania and analysis of 12 VA project documents across LMICs. In addition, observation took place between June 2021 and September 2022 to further gather insights from the field. Content Analysis was used to identify the presence of emerging themes. The study findings indicated that there exists a weak death notification system, lengthy VA questionnaire, inaccurate and duplicate records, shortage of skills, poor coordination, poor financial mechanism, and lack of feedback loop. The study recommends the following strategies for effective adaptation and use of VAs: Reinforce or implement legislative procedures towards the legal requirement for death notification, engage key stakeholders on the overall implementation of VAs, build capacity for data collection, monitoring, processing and use of VA data, improve the VA questionnaire for optimal use in data collection, create sustainable financing mechanism and institutionalization of VA implementation. The adaptation of VA into routine CRVS should be well-planned. Furthermore, key stakeholders must be involved, the legal CRVS framework has to be instituted at the design stage, and local professionals have to be trained to yield high-quality and adequate data for CRVS.

Keywords: verbal autopsy, VA adoption, VA implementation, VA challenges, VA strategies

Summary

What is already known on this topic?

- VA can play a vital role in filling in the gap in vital statistics in Low-Middle-Income Countries (LMICs).
- Many LMICs are still struggling to yield quality and adequate data for Civil Registration and Vital Statistics (CRVS) which affects the wide-scale implementation of VA.
- There is extensive literature on VA in research settings, but limited studies have focused on practical implementation settings and context-specific experiences on the adoption of VA into CRVS.

What are this study add?

- Weak death notification systems, shortage of skilled personnel, poor coordination and lengthy VA questionnaires are among the key challenges that affect the wide-scale implementation of VA into CRVS.
- The sustainable implementation of VA into routine CRVS depends on proper governing structures and procedures, engagement of all key stakeholders, VA workforce's capacity and content of VA questionnaires.
- Countries would need to design VA integration strategies and assess their impact on the overall CRVS to implement VA beyond research settings.

How this study might affect research practice or policy?

- The coordinated actions of key stakeholders can eventually factor out organizational, technical, and behavioural challenges which affect the overall performance of the VA implementation.

INTRODUCTION

Cause of Death (CoD) statistics reflect society's conditions of morbidity and provide persistent patterns of health risks in communities. Though CoD indicators play a vital role in countries' healthcare interventions, globally, only one out of two deaths is certified with CoD [1]. The situation is worse in Low-Middle-Income Countries (LMICs), where the majority die without hospital care [2-5].

The struggle to generate reliable and adequate CoD statistics led to the development of the Verbal Autopsy (VA) method in the 1950s [1]. VA is an alternative method which can lead to the processing of CoD information using the series and duration of signs and symptoms leading to death [2]. Countries like Tanzania, Malawi, Ghana, Myanmar, Papua New Guinea, Bangladesh, and the Philippines have used these VA tools to generate reliable CoD statistics which demonstrate the value of VA adoption in LMICs [6, 7]. There is extensive literature on VA in research settings

focusing on the automation of CoD computation [3, 8-12] and exploration of international standards and concepts on the use of VA in augmenting CRVS systems [6, 8], but limited studies have focused on practical implementation settings and context-specific experiences on the adoption of VA in CRVS. Many LMICs are still struggling to yield sustainable quality and adequate data for routine CRVS [13, 14], thus the wide-scale implementation of VA continues to be indefensible [12].

VA history in Tanzania goes back over three decades [15, 16]. In 1992, as part of a new research collaboration with the Tanzanian Ministry of Health, the country started to collect VA documents through the Adult Morbidity and Mortality Project in three Demographic Surveillance Sites (DSS) [17]. From 2002 to 2007, more VAs were conducted with the Ifakara Health Institute (https://www.ihi.or.tz) under HDSS research settings [16, 18]. In 2009, the country through IHI received a five-year project under the code name SAmple Vital events registration and Verbal Autopsy (SAVVY) to strengthen the capacity of the government to collect and use mortality surveillance data to assist in managing the national HIV/AIDS program by expanding community-based identification, reporting and processing death events to produce COD information [19, 20]. SAVVY used statistical sampling techniques to produce nationally representative data on levels and causes of mortality from 23 councils in Tanzania. SAVVY implementation ended in 2014. At the beginning of the year 2017, the country embarked on another multi-phased approach funded by Bloomberg Philanthropies Data for Health Initiative to promote CRVS and use VA data to provide information on national mortality statistics [21]. The phases were 1) the pre-test phase in the ten wards in the Pwani Region, 2) the demonstration phase in the Iringa region and currently 3) the scale-up phase using a national sampling approach.

A typical VA implementation in each of these phases is conducted in four steps; (i) Sensitization of the local community leaders to report death events. (ii) Recruitment and training of the VA interviewers to conduct mortality surveillance. (iii) Implementation of the VA interviews through a guided mobile application and data submission to an online server managed by the Ministry of Health (MoH) which has day-to-day Monitoring and Evaluation (M&E) aspects of the overall VA data collection processes. (iv) Analysis and feedback dissemination which plays a vital role in intervention design, informing decisions and creating policies. Such a series of tasks from different players and sectors have interlinked dependencies and is further exposed to performance and data quality constraints. Despite the investment, Tanzania reached 26% of all deaths registered in the country [22]. Thus, this study intends to shed light on existing VA practical implementation challenges and recommended strategies for the effective adoption of VA. The contribution of this study is twofold: First, inform researchers, local authorities, and related stakeholders in the healthcare system on the practical challenges of VA to improve its operationalization. Second, inform policymakers on the VA implementation strategies beyond surveillance systems or research environments to the routine application in CRVSs.

METHODS

This study adopted a cross-sectional research design from June 2021 to September 2022 through document review and key informants' semi-structured interviews in 5 municipalities of the Iringa region. Iringa is the pilot region for the VA implementation in Tanzania.

Data Collection

Data collection involved key informant semi-structured interviews to unfold how the VA is practically implemented in the field. Document analysis provided background information on the VA implementation and helped in formulating potential interview questions, validating the claims of interviews, and discerning themes in findings.

(i) Documents Review

Prior to semi-structured interviews, a document review was conducted to enhance the credibility of the findings. Documents related to VA project implementation were skimmed from open-access journals and archives of the MoH. Thirty-seven documents related to VA implementation were identified and read thoroughly by researchers in pairs. Content analysis was adopted to scrutinize the appearance of themes. The themes that appeared in more than one document were recorded. Ultimately findings from 12 documents were included in the study: (a) Vital Statistics Reports (b) CRVS Fellowship report: A national scale-up strategy for Tanzania (c) VA Questionnaires for Tanzania and WHO VA Data Collection tool of 2016 (d) Sample Vital Registration with VA (SAVVY) report [22] (e) WHO CRVS strategic implementation plan 2021-2025 (f) Published articles related to the VA implementation projects in Tanzania [16] and other LMICs including India [23], Ethiopia [24], Sierra Leone [25], Uganda [26], Zambia [27], and Brazil [5].

(ii) Key Informant Semi-Structured Interviews

Face-to-face and virtual interviews with key informants took place immediately after the document analysis. Potential participants were identified using snowball sampling and categorized as respondents from Community Health Workers (CHWs) of the Iringa Municipal, Kilolo District, and Nzihi Ward representing urban, peri-urban, and rural councils respectively and respondents from the National Mortality and CoD Task Force. Data were collected from 41 respondents. Early findings of the document review were discussed with the key informants to supplement more information and confirm the findings on the data and tools used for VA data collection. Twenty-one interviews were conducted at the workplaces of the interviewees, and the remaining twenty interviews were conducted by telephone. Interviewees were free to respond and elaborate their answers in the language of their choice (English or Swahili). Data was gathered by administering a questionnaire with a set of open-ended questions. Questions were devised based on three categories: (a) VA adoption and implementation process (b) Challenges (c) Strategies. The CHWs were interviewed to understand how the VA data is being collected, the routine operation procedures of pre-and post-conducting VA, and share the challenges faced in administering VA surveys. Interviews for the National CRVS task force focused on understanding how they derive diagnoses from VA questionnaires, monitoring the quality of VA implementation, and interviewers' training; generally, the purpose was to get a high-level national overview of the implementation of VA into routine vital statistics.

(iii) Observation
The researchers participated in administering the questionnaire and observed the challenges while administering the WHO's VA questionnaire in the field.

Data analysis
A thematic approach was employed to analyze the collected data to identify insights related to the implementation challenges and recommendations for the adoption of VA in CRVS. The thematic analysis provides a flexible mechanism for data interpretation by identifying themes [19, 27]. Themes were developed through an iterative process between the outputs of document analysis and semi-structured interviews. Initially, each author critically analyzed and examined data to generate all potential themes. Brainstorming sessions were conducted by the authors to identify key themes. Key informants were consulted to gather the richest and most in-depth information regarding the first deduced list of themes. After further review and consolidation of comments from key informants, the final lists of the key themes on the implementation challenges and recommendations for the VA adoption in CRVS were produced.

To formulate strategies, we employed two methods. The first method utilized individual brainstorming techniques proposed by Almutairi [28] to identify effective strategies for implementing VA. The second method involved validating the brainstormed strategies through consultation with the National Mortality and CoD Task Force to obtain their contributions and recommendations on how to enhance VA implementation.

Patient and Public Involvement
The research question intended to respond to the LMICs efforts to integrate mortality statistics from the community to routine CRVS. Hence, the study interviewed CHWs on the use of VA tools to establish COD information of the deceased through verbal interviews. The study did not involve patients. The respondents were the caretakers or relatives of the deceased. Verbal consent was sought for participants to engage in the interview. The permission to conduct the study was granted by the Tanzania National Medical Research Institute (NIMR). The study findings and recommendations will be disseminated through the Tanzania Mortality and Cause of Death Task Force meeting which convenes bi-annually as a platform to discuss ways to improve the national cause of death statistics.

RESULTS
The findings of this study are reported in two categories; (i) implementation challenges and (ii) recommended strategies. Both categories aim to inform the effective adoption of VA in CRVS. Details of the findings are summarized in Figure 1.

VA implementation challenges
Eight themes emerged under the category of VA implementation challenges.

(i) Weak Death Notification System

For deaths that occur outside health facilities, the nearest relatives or caretakers of the deceased are required by law to notify the authority. This process triggers death documentation to the Tanzania Registration Insolvency and Trusteeship Agency (RITA) at the local level and puts a provision for issuing death certificates. However, in most rural areas, the notification process does not take place. Most people who die are directly buried at home or on farms, contrary to designated burial areas which could have enforced the need for the notification process. If VA is conducted, they are often conducted weeks or months after the death has occurred and therefore responses to the VA interview may suffer recall bias and affect the overall quality of the VA document.

(ii) Lengthy VA Questionnaire

The length of time required to conduct a VA interview is among the barriers to the widespread implementation of VA in CRVS. About 67% of the participants were not happy with the length of the VA questionnaire or the time spent interviewing a single person. The VA implementation exercise in Iringa used the standard WHO 2016 VA questionnaire with 481 questions. MoH added 10 extra country-specific questions relating to health insurance. This questionnaire was adapted and translated into Swahili to fit into the local context. An average of 45 minutes is required to administer one VA interview.

(iii) Inaccurate Records

Inappropriate selection of interviewees can yield incorrect information to support assigning probable CoD information. This happens when the family selects a respondent other than a caretaker. For instance, family members could not allow the wife (caretaker of her husband) to speak on behalf of the family due to local traditions and taboos. CHWs noticed that some families select a different person other than caretakers as they were expecting financial support from the interviewer or the government from the VA interview. Challenges also were observed when the caretaker was too old to recall important information which led to death.

(iv) Lack of clarity in the inclusion criteria

It was not clear among VA interviewers who should be counted for VA interviews. Either the residents of their locality or anyone buried in the locality. On the other hand, residents, both hospital and community deaths were interviewed. This was thought to be a challenge as hospitals also report mortality statistics through health facility reporting channels. Different interviewers provided a different duration for a person to be considered a resident ranging from three months to six months.

(v) Poor commitment to roles and responsibilities

Most positions in VA implementation, particularly VA interviewers (CHWs and Agricultural Officers, (AO)), Village Executive Officers (VEO) and other coordination positions, are often perceived as secondary commitments. In this perspective, several tasks are easily left behind or

accumulated over time. Over time, this affects attrition, where most of these positions pick other responsibilities and VA work remains undone.

(vi) Poor Coordination

During SAVVY implementation in Tanzania, Zambia, and Malawi, challenges were unanimously reported when integrating VA data into routine CRVS systems such as interoperability challenges to integrating SAVVY into CRVS systems and countries' unreliable infrastructure such as power grid [29].

(vii) Poor Financing Mechanism

Key informants expressed that poor financing mechanisms affect the efficiency of the VA interviews. During the VA implementation pre-testing and demonstration phase, Tanzania commissioned pay for performance modality to incentivize and compensate for time effort. The approach was successful as more VAs were reached. However, the financial component relied on donor funds, hence, was not sustainable. Furthermore, this modality motivated quantity but not quality. Interviewers were paid flat rates without considering transport costs and geographical coverage. When this modality was changed to a flat compensation within a defined period, other issues of quality and coordination arose. VA implementation in the Iringa suffers from low production of VA data as interviewers have not been receiving their tokens consistently. They tend to ignore reporting some of the deaths or visit the families of descendants when they have official duties in the area. Untimely visits to families affect the response quality due to recall bias and some caretakers depart when the mourning period is over. This resulted in over 50% underreporting in most areas.

(viii) No or delayed feedback to VA implementers

Key Informants (KI) noted that the VA implementation lacked a feedback mechanism. Despite conducting notifications for over a year, none had received feedback on their contribution. The KI and leaders of the local government authorities reported not to have received any feedback on the number of VA collected and analysis performed on the data. This means they are hosting the VA exercise as curriers and thus unmotivated.

Strategies for effective adoption of VA

Five themes emerged under the category of strategies for effective VA adoption.

(i) Legislative Procedures on Death Notification

Key informants indicated that the sustainable implementation of VA into routine CRVS requires proper governing structures and procedures. Without legislation, VA will only be utilized as an ad hoc means. Countries should establish and supervise legislative procedures that bind the family members to report deaths to the relevant authorities. A CRVS legal framework should be established at the national level to bind coordination among responsible authorities. In Tanzania,

the national VA program is hosted by the MoH and has members from the National Bureau of Statistics (NBS), RITA, the President's Office of Regional Administration, Local Government (PoRALG), and other stakeholders. However, there is no linkage in data collection systems. To improve data efficiency and reduce data quality gaps, it is recommended that MoH and RITA should link their data systems and data collection services.

(ii) Stakeholder Engagement

Stakeholder engagement is a cornerstone of quality VA data collection. Informants observed that some families did not provide enough cooperation which eventually affected the quality of VA data. Most of the ongoing community engagements are limited to creating awareness, little attention is being paid to the feedback which has significant potential to create community ownership of the VA exercise. There is a need to conduct a thorough investigation using tailored approaches to engage communities with the intention of increasing awareness and acceptance of the unfamiliar nature of VA in the community.

(iii) Capacity Building

A. Collection of Quality VA Data

Informants emphasized the strengthening of the VA workforce's capacity for yielding high-quality data for routine CRVS. Staff turnover witnessed during the VA pre-testing and demonstration phase in Tanzania necessitated ongoing training opportunities. Therefore, the MoH developed a sustainable training program by integrating the VA module into the VA interviewer training syllabi. Training is provided to council-level supervisors (one per council), regional supervisors, and one dedicated national supervisor. Informants recommended refresher programs to deliver ongoing support and feedback to VA interviewers.

B. Analysis and Interpretation of VA Data

Data needs to be translated to action immediately among policymakers, local government authorities, and communities for timely interventions. Hospital and community death need to be integrated and local governments should be able to translate the data into actions so that they are not left behind as couriers of data rather than development partners. The CHWs should be able to engage timely with the VA results and incorporate insights into their healthcare interventions. VA data is analyzed and interpreted at the MoH. Generally, less than 10% of deaths have a medically certified CoD in Tanzania and only half of these have a usable CoD for healthcare interventions [19, 30].

(iv) Optimal VA Questionnaire and Quality Control Mechanism

Informants identified the short VA questionnaire as the most significant feature for improved CoD prediction. Obtaining information about potentially informative co-occurrences of signs or symptoms is essential and will involve changes to future data collection efforts and eventually, pave the way for the formulation of short, dynamic and personalized questionnaires. Meanwhile,

it is crucial to put in place quality control mechanisms to ensure accurate data is captured. The MoH has tasked VA supervisors (WEOs) to ensure that standard guidelines and operating procedures are used during interviews, the right respondents are interviewed, consent is received, counselling is offered, and privacy and confidentiality are maintained.

(v) Sustainable Financing Mechanism

VA interviews are usually conducted by the CHWs who have other core responsibilities. The additional scope to conduct VA interviews needs to be financed. A healthy and sustainable approach would be to include the cost of VA interviews in local government financial plans. Key informants also recommend the use of incentives such as support for children's welfare, to attract communities to cooperate in VA interviews.

DISCUSSION

Figure 1 highlighted the challenges that need to be addressed and strategies to be considered for the effective adoption of VA into routine CRVS based on four stages of VA implementation; (i) A weak death notification system is observed that affects the quality of interviews. Conducting VA interviews beyond the recall period suggests that the chance of getting a correct diagnosis of CoD decreased by 0.55 % per month in the period after death [27]. Additional studies have suggested that among the motivations for notifying death, the authority is to obtain a death certificate of the deceased to later claim for inheritance and other related benefits. This drive may not exist if the deceased is a neonate, child, or adult who does not have dependents. Furthermore, some of the local taboos and religious beliefs are against reporting deaths for neonates and children. (ii) The length of time required to conduct a VA interview affects the widespread implementation of VA in CRVS, shortening the VA questionnaire will improve the overall efficiency of VA interviews [14]. (iii) The quality of data analysis may be compromised by inefficiencies observed at lower levels. Challenges associated with the quality of VA interviews could result in the wrong assignment of CoD. A study by Serina et al. [31] suggested that sufficient accurate and consistent subsets of symptoms are required to enable VA models to assign the right CoD. Inaccurate records such as the area of death or residence of the deceased can result in false CoD assignments as symptoms/signs of diseases change rapidly with geographical settings [3]. (iv) Data use and dissemination, to trigger the use of VA data by local leaders for informed healthcare interventions in the communities, the VA analysis reports should be digested for consumption at the local levels. There is considerable evidence that a few countries like Brazil [5], Uganda [23], Zambia [24], and South Africa [32] managed to integrate and use VA data into routine health systems. Countries would need to design VA integration strategies and assess their impact on the overall CRVS to implement VA beyond research settings.

CONCLUSION

VA data has significant potential to fill the vital statistics gap in LMICs. Therefore, this paper discusses challenges in the practical implementation of VA in LMICs and provides strategies for

successfully adopting the VA into routine CRVS. Wide-scale implementation of VA should be well planned, key players must be involved, local experts have to be trained and interviewers have to be compensated for their efforts in order to yield quality and adequate data for sustainable health interventions. Thus, the coordinated actions of key stakeholders will eventually factor out organizational, technical, and behavioural challenges which affect the performance of the VA.

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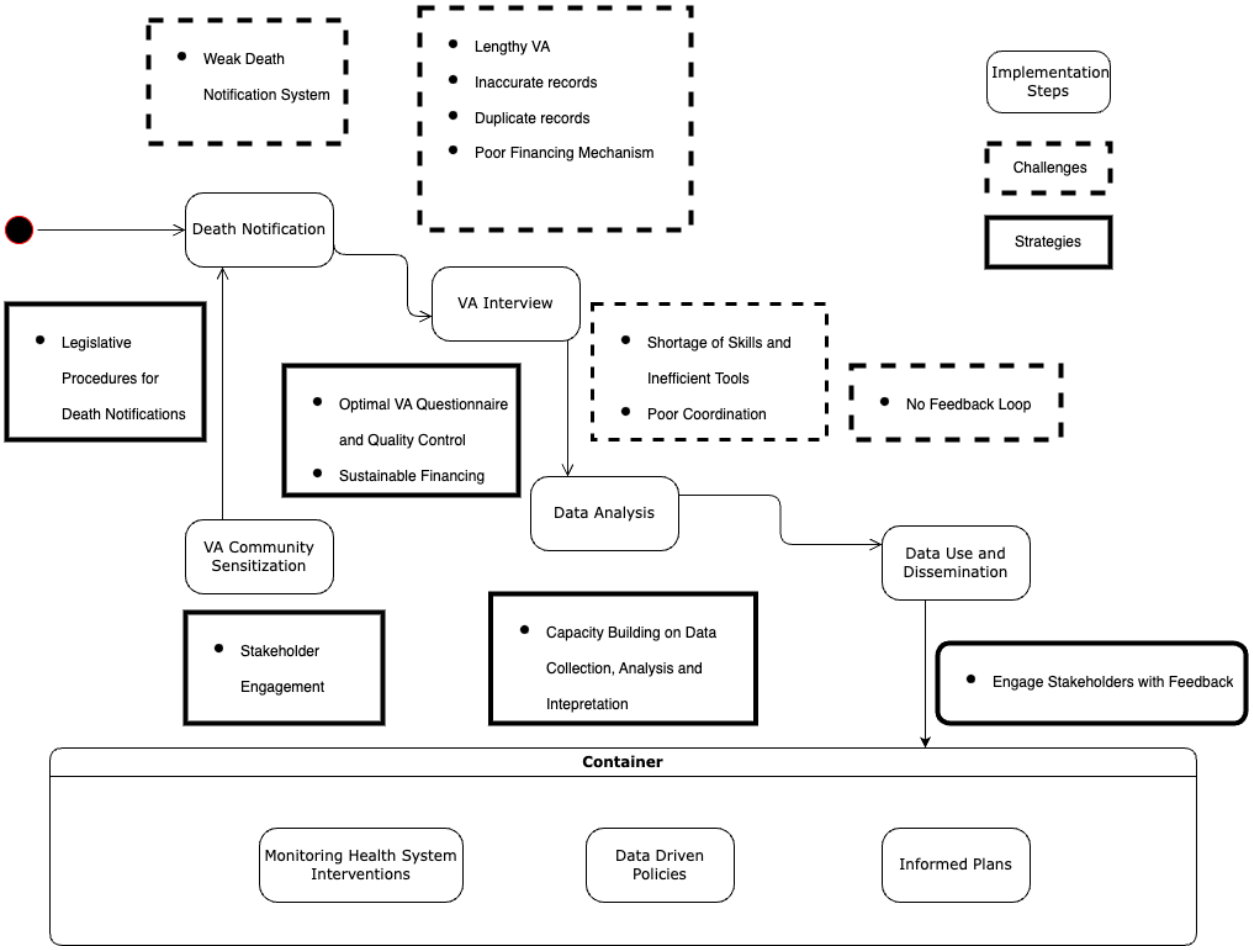

Figure 1: Overview of VA Implementation Challenges and Recommendations

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Exploring Challenges and Recommendations for VA Implementation in Low-and Middle-Income Countries: A Cross-Sectional Study of Iringa Region - Tanzania

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Exploring Challenges and Recommendations for VA Implementation in Low-and Middle-Income Countries: A Cross-Sectional Study of Iringa Region - Tanzania

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ABSTRACT

Objectives: Verbal Autopsy (VA) plays a vital role in providing cause-of-death information in places where such information is not available. Many Low- and Middle-Income Countries (LMICs) including Tanzania are still struggling to yield quality and adequate cause-of-death data for Civil Registration and Vital Statistics (CRVS). This study highlights challenges and recommendations for VA implementation to support LMICs yield quality and adequate mortality statistics for informed decisions on healthcare interventions.

Methods: The study was conducted in Iringa Tanzania, during the Verbal Autopsy (VA) demonstration phase implemented by the Ministry of Health Tanzania. The study encompassed 41 key informants' semi-structured interviews in 5 municipalities and an analysis of 12 VA project documents across LMICs. In addition, observation took place between June 2021 and September 2022 to further gather insights from the field. Content analysis was used to identify and categorise the findings of the research into themes.

Results: The perceived challenges of key informants include a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, lack of clarity in the inclusion criteria, poor commitment to roles and responsibilities, poor coordination, poor financial mechanism and no or delayed feedback to VA implementers. Based on these findings, we recommend the following strategies for effective adaptation and use of VAs: (1) Reinforce or implement legislative procedures towards the legal requirement for death notification. (2) Engage key stakeholders in the overall implementation of VAs. (3) Build capacity for data collection, monitoring, processing and use of VA data. (4) Improve the VA questionnaire and quality control mechanism for optimal use in data collection. (5) Create sustainable financing mechanisms and institutionalization of VA implementation. (6) Integrating VA Implementation in CRVS. These strategies will enhance the overall process of collecting and disseminating VA data and results, ultimately leading to a successful implementation of VA.

Strengths and limitations of this study

- The participation of both the National Mortality and CoD Task Force and CHWs offers insights into the execution and supervisory levels of the VA implementation strategies.
- The inclusion of reviews from various low- and middle-income countries (LMICs) where VA has been implemented broadens the study's perspective.
- This study contributes to the limited literature on the VA implementation for practical implementation of VA data collection in resource-limited settings.
- The study focused on the Iringa Region as a case study during the CRVS demonstration phase in Tanzania. Iringa Region is just one of the 31 administrative regions in Tanzania.
- While the study findings could be limited to this specific region, lessons learnt can be applied to other similar regions in Tanzania and beyond.

INTRODUCTION

Cause of Death (CoD) statistics reflect society's conditions of morbidity and provide persistent patterns of health risks in communities. Though CoD indicators play vital roles in countries' healthcare interventions, globally, only one out of two deaths are certified with CoD [1]. The situation is worse in Low-Middle-Income Countries (LMICs), where the majority die without hospital care [2-5].

The struggle to generate reliable and adequate CoD statistics led to the development of the Verbal Autopsy (VA) method in the 1950s [1]. VA is an alternative method which can lead to the processing of CoD information using the series and duration of signs and symptoms leading to death [2]. Countries like Tanzania, Malawi, Ghana, Myanmar, Papua New Guinea, Bangladesh, and the Philippines have used these VA tools to generate reliable CoD statistics which demonstrate the value of VA adoption in LMICs [6, 7]. There is extensive literature on VA in research settings focusing on the automation of CoD computation [3, 8-12] and exploration of international standards and concepts on the use of VA in augmenting CRVS systems [6, 8], but limited studies have focused on practical implementation settings and context-specific experiences on the adoption of VA in CRVS. Many LMICs are still struggling to yield sustainable quality and adequate data for routine CRVS [13, 14], thus implementation of VA continues to be challenging [12].

VA history in Tanzania goes back over three decades [15, 16]. Figure 1 summarizes the different implementations. In 1992, as part of a new research collaboration with the Tanzanian Ministry of Health, the country started to collect VA documents through the Adult Morbidity and Mortality Project in three Demographic Surveillance Sites (DSS) [17]. From 2002 to 2007, more VAs were conducted with the Ifakara Health Institute (IHI) under Health and Demographic Surveillance Systems (HDSS) research settings [16, 18]. In 2009, through IHI the country received a five-year project under the code name Sample Vital Events Registration and Verbal Autopsy (SAVVY) to

strengthen the capacity of the government to collect and use mortality surveillance data to assist in managing the national HIV/AIDS program by expanding community-based identification, reporting and processing death events to produce COD information [19, 20]. SAVVY used statistical sampling techniques to produce nationally representative data on levels and causes of mortality from 23 councils in Tanzania. SAVVY implementation ended in 2014. At the beginning of the year 2017, the country embarked on another multi-phased approach funded by Bloomberg Philanthropies Data for Health Initiative to promote CRVS and use VA data to provide information on national mortality statistics [21]. The phases were (1) the pre-test phase in the ten wards in the Pwani Region, (2) the demonstration phase in the Iringa region and currently (3) the scale-up phase using a national sampling approach.

A typical VA implementation in each of these phases is conducted in four steps: (i) Sensitization of the local community leaders to report death events; (ii) Recruitment and training of the VA interviewers to conduct mortality surveillance; (iii) Implementation of the VA interviews through a guided mobile application and data submission to an online server managed by the Ministry of Health (MoH) which has day-to-day Monitoring and Evaluation (M&E) aspects of the overall VA data collection processes; (iv) Analysis and feedback dissemination which plays a vital role in intervention design, informing decisions and creating policies. Such a series of tasks from different players and sectors have interlinked dependencies and are further exposed to performance and data quality constraints. Despite the investment, Tanzania reached 26% of all deaths registered in the country [22]. Thus, this study intends to shed light on existing VA practical implementation challenges and recommended strategies for the effective adoption of VA. The contribution of this study is twofold: First, inform researchers, local authorities, and related stakeholders in the healthcare system on the practical challenges of VA to improve its operationalization. Second, inform policymakers on the VA implementation strategies beyond surveillance systems or research environments to the routine application in CRVSs.

METHODS

This study adopted a cross-sectional research design from June 2021 to September 2022 through document review and key informants' semi-structured interviews in 5 municipalities of the Iringa region. Iringa is the demonstration region for the VA implementation in Tanzania.

Patient and Public Involvement: Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

Data Collection

Data collection involved key informant semi-structured interviews to unfold how the VA is practically implemented in the field. Document analysis provided background information on the VA implementation and helped in formulating potential interview questions, validating the claims of interviews, and discerning themes in findings.

(i) Documents Review

Prior to semi-structured interviews, a document review was conducted to enhance the credibility of the findings. Documents related to VA project implementation were extracted from open-access journals and archives of the MoH. Thirty-seven documents related to VA implementation were identified and read thoroughly by researchers in pairs. Content analysis was adopted to scrutinize the appearance of themes. Themes that appeared in more than one document were recorded.

(ii) Key Informant Semi-Structured Interviews

Face-to-face and virtual interviews with key informants took place immediately after the document analysis. Potential participants were identified using snowball sampling. The first group came from the National Mortality and CoD Task Force (N=7), which then recommended a VA regional supervisor (N=1) as the second group. The regional supervisor then recommended community health care workers (CHW) (N=11), one for each urban, peri-urban and rural ward, making a total of 33 wards represented.

Early findings of the document review were discussed with the key informants to supplement more information and confirm the findings on the data and tools used for VA data collection. Data was gathered by administering a questionnaire with a set of open-ended questions. Questions were devised based on three categories: (a) VA adoption and implementation process (b) Challenges (c) Strategies. The CHWs were interviewed to understand how the VA data is being collected, the routine operation procedures of pre- and post-conducting VA, and the challenges faced in administering VA surveys. Interviews for the National CRVS task force focused on understanding how they derive diagnoses from VA questionnaires, monitoring the quality of VA implementation, and interviewers' training; generally, the purpose was to get a high-level national overview of the implementation of VA into routine vital statistics.

(iii) Observation

The researchers participated in administering the questionnaire and observed the challenges while administering the WHO's VA questionnaire in the field.

Data analysis

A thematic approach was employed to analyze the collected data and identify insights related to the implementation challenges and recommendations for the adoption of VA in CRVS. The thematic analysis provides a flexible mechanism for data interpretation by identifying themes [19, 23]. Themes were developed through an iterative process between the outputs of document analysis and semi-structured interviews. Initially, each author critically analyzed and examined data to generate all potential themes. Brainstorming sessions were conducted by the authors to identify key themes. Key informants were consulted to gather the richest and most in-depth information regarding the first deduced list of themes. After further review and consolidation of comments from key informants, the final lists of the key themes on the implementation challenges and recommendations for the VA adoption in CRVS were produced.

To formulate strategies, we employed two methods. The first method utilized individual brainstorming techniques proposed by Almutairi [24] in order to identify effective strategies for implementing VA. The second method involved validating the brainstormed strategies through consultation with the National Mortality and CoD Task Force and obtaining their contributions and recommendations on how to enhance VA implementation.

RESULTS

In total, 41 participants were engaged, (33 CHWs, one VA national coordinator, five national task force members, one VA regional coordinator and one from the VA data management team). All of the selected CHWs participated in the stated VA implementation and had conducted at least five VA interviews. CHW with no VA interviews were excluded. CHW were grouped by location and residency representing three councils: Iringa Municipal, Kilolo District, and Iringa Rural District and further urban, peri-urban, and rural councils respectively. Twenty-one interviews were conducted in person. The remaining twenty interviews were done by telephone. Interviewees were free to respond and elaborate their answers in the language of their choice (English or Swahili).

A total of 12 documents were reviewed to complement the insights gained from the interviews. The documents included, (a) Vital Statistics Reports (b) CRVS Fellowship report: A national scale-up strategy for Tanzania (c) VA Questionnaires for Tanzania and WHO VA Data Collection tool of 2016 (d) Sample Vital Registration with VA (SAVVY) report [22] (e) WHO CRVS strategic implementation plan 2021-2025 (f) Published articles related to the VA implementation projects in Tanzania [16] and other LMICs including India [25], Ethiopia [26], Sierra Leone [27], Uganda [28], Zambia [23], and Brazil [5].

Two major themes emerged from the preliminary analysis, (i) implementation challenges and (ii) recommendations. These are summarized in Table 1 below,

Table 1: Summary of VA Implementation Challenges and Recommendations

VA Implementation Step	Death Notification	VA Interview	Data Analysis	Data Use and Dissemination
Challenges	• Weak Death Notification	• Lengthy VA • Poor data quality and inconsistent responses • Poor Financing Mechanism • Lack of clarity in the inclusion criteria	• Poor commitment to roles and responsibilities • Poor Coordination	• No Feedback Loop
Recommendations	• Legislative Procedures for Death Notification • Effective Stakeholder Engagement	• Optimal VA Questionnaire and Quality Control • Sustainable Financing Mechanism	• Integrating VA Implementation in CRVS	• Engage Stakeholders with Feedback • Effective Capacity Building on Data Collection, Analysis and Interpretation

VA implementation challenges

From the semi-structured interviews, the implementation challenges as perceived by CHW and the national task force members included the following sub-themes, (i) weak death notification system, (ii) lengthy VA questionnaire, (iii) lack of clarity in the inclusion criteria for VA interviews, and (iv) no or delayed feedback to VA implementers. Conversely, the task force members highlighted (v) poor VA data quality, (vi) poor commitment to roles and responsibilities, and (vii) poor financing mechanisms as main VA implementation challenges. Both CHW and task force members pointed out that the weak death notification system and lack of clarity in terms of interview inclusion criteria (community vs. facility deaths, residence vs. non-residence deaths) are among the VA implementation challenges. The document's review indicated that there is poor coordination in VA implementation in most LMICs.

(i) Weak Death Notification System

This theme relates to the perspective on how deaths are being notified. For deaths that occur outside health facilities, the nearest relatives or caretakers of the deceased are required by law to notify the authorities. This process triggers death documentation to the Tanzania Registration Insolvency and Trusteeship Agency (RITA) at the local level and puts a provision for issuing death certificates. However, many key informants reported that the notification process does not take place in most rural areas. Most people who die are directly buried at home or on farms, contrary to designated burial areas which could have enforced the need for the notification process. If VA is conducted, they are often conducted weeks or months after the death has occurred and therefore responses to the VA interview may suffer recall bias and affect the overall quality of the VA document.

In most villages, the majority of the people die in their residences and are buried on farms or other rural dedicated properties/areas without formal notification to the responsible authorities. (CHW, Iringa Rural District)

(ii) Lengthy VA Questionnaire

This theme relates to perspectives on the length of VA questionnaire instruments. The length of time required to conduct a VA interview is among the barriers to the widespread implementation of VA in CRVS. About 67% of the key informants were not happy with the length of the VA questionnaire or the time spent interviewing a single person. The VA implementation exercise in Iringa used the standard WHO 2016 VA questionnaire with 481 questions. MoH added 10 extra country-specific questions relating to health insurance coverage. This questionnaire was adapted and translated into Swahili to fit into the local context. An average of 45 minutes has been observed as required to administer one complete VA interview.

The VA interview guide is too long, sometimes it takes 1 hour to finish one interview (CHW, Iringa Municipal)

(iii) Poor data quality and inconsistent responses

This theme relates to the usage of VA data particularly in assigning the probable CoD. Despite built-in data quality control and question-by-question skip logic measures, some VA records were encountered with no or inconsistent responses. This includes, for example, missing age or unknown age information, inconsistent signs and symptoms for a given sex or age group and poor completion of the narrative section. Our results indicate that the inappropriate selection of interviewees may have contributed to this behavior. This may happen when the family selects a respondent other than the designated one (a close relative who provided care to the deceased during the final days before death). CHWs noticed that some families selected a different person other than caretakers as they were expecting financial support from the interviewer or the government from the VA interview. Challenges were also observed when the caretaker was too old to recall important information which led to death.

Some of the local traditions do not allow women to speak on behalf of the family (National Task Force member).

These inefficiencies observed at a lower level compromise the quality of VA data.

(iv) Lack of clarity in the inclusion criteria

This theme relates to perspectives on who is supposed to be included in the VA interviews. It was not clear who should be included in the VA interviews. Either the residents of their locality or anyone buried in the locality. Furthermore, people who died at health facilities versus community. Notably, health facilities also report mortality statistics through routine health facility reporting channels. Reporting health facility deaths in the VA module could result in double counting in reports. In addition, different VA interviews provided contradicting information about the duration a person must reside in a specific location before their death to be considered a resident. The responses ranged from three months to six months.

Normally, we interview deaths that have occurred within the last one month. We allow the family to mourn for two weeks before we can engage for an interview. However, when we started this program, we were interviewing deaths that had occurred up to two months back (CHW, Iringa Municipal)

(v) Poor commitment to roles and responsibilities

This theme relates to perspectives on the commitment of accountable personnel in VA implementation. Specific concerns regarding volunteering versus specific job accountability in VA implementation were raised by key informants. Most positions, particularly VA interviewers (CHWs and Agricultural Officers, (AO)), Ward Executive Officers (WEO) and other coordination positions, are often perceived as secondary commitments. In this perspective, several tasks are

easily left behind or accumulated over time and result in attrition, where most of these positions pick other responsibilities and VA work remains undone.

This is an additional task that does not have any incentive, I have primary responsibilities which often require my immediate attention (WEO, Iringa Rural District)

(vi) Poor Coordination

This theme relates to perspectives on the coordination of VA implementation. Documents review revealed different uncoordinated initiatives by the different stakeholders in the country including vertical programs, government entities (the Ministry of Health, National Statistics Office, and the Registration Office) and local governments. The disconnection between death events, notification, registration, certification and ascertaining the cause of death. SAVVY implementation in Tanzania, Zambia, and Malawi unanimously reported challenges stemming from poor coordination among public institutions. For instance, attempts to integrate VA data into routine CRVS were often unsuccessful due to a lack of interoperability among different national systems.

(vii) Poor Financing Mechanism

This theme relates to perspectives on finances in VA implementation. Some key informants, mainly national task force members, expressed that poor financing mechanisms affect the efficiency of the VA interviews. During the VA implementation pre-testing and demonstration phase, Tanzania commissioned pay for performance modality to incentivize and compensate for time effort. The approach was successful as more VAs were reached. However, the financial component relied on donor funds and, hence, was not sustainable. Furthermore, this modality motivated quantity but not quality. Interviewers were paid flat rates without considering transport costs and geographical coverage. When this modality was changed to a flat compensation within a defined period, other issues of quality and coordination arose. VA implementation in the Iringa suffers from low production of VA data as interviewers have not been receiving their tokens consistently. They tend to ignore reporting some of the deaths or visit the families of descendants until when they have official duties in the area. This resulted in over 50% underreporting in most areas. Furthermore, limited resources for digital implementation such as poor internet connectivity and limited electricity to power digital devices also have been a barrier to VA implementation in LMICs [29].

(viii) No or delayed feedback to VA implementers

This theme relates to perspectives on the dissemination of feedback to VA implementers. Key informants noted that the VA implementation lacked a feedback mechanism. Despite conducting event notifications for over a year, none had received feedback on their contribution. The key informants and leaders of the local government authorities reported not having received any feedback on the number of VAs collected and analysis performed on the data. This means they are hosting the VA exercise as couriers and thus unmotivated. Similar to many programs at national

levels or with global interest, little attention and resources are often put into disseminating results to local or to the ground where the data originate. Much of the focus and resources are narrowed and directed to influencing policies at the ministry or government level. It appears much easier logistically and financially to have one dissemination at the ministry level versus multiple dissemination at regions, councils or ward levels. In addition, the language starts to differ as you move down to different levels, and therefore this requires a different packaging or communication strategy.

We have been conducting VA interviews for years, but we have received no feedback or insights regarding the results of the analysis

Strategies for effective adoption of VA

Recommendations were extrapolated from the analysis of the key informants' feedback and insights obtained from reviewing documents. These recommendations were articulated from the authors' perspectives forming six themes under the category of strategies for effective VA adoption: (i) Legislative Procedures for Death Notification (ii) Stakeholder Engagement (iii) Effective Capacity Building (iv) Optimal VA questionnaire instruments and quality control mechanism (v) Sustainable financing mechanism and (vi) Integrating VA Implementation in CRVS.

(i) Legislative Procedures for Death Notification

The sustainable implementation of VA into routine CRVS requires proper governing structures and procedures. Without legislation, the VA will only be utilized as an ad hoc means. Countries should establish and supervise legislative procedures that bind the family members to report deaths to the relevant authorities. A CRVS legal framework should be established at the national level to bind coordination among responsible authorities. In Tanzania, the national VA program is hosted by the MoH and has members from the National Bureau of Statistics (NBS), RITA, the President's Office of Regional Administration, Local Government (PoRALG), and other stakeholders. However, there is no linkage between the implementation and data collection systems. To improve data efficiency and reduce data quality gaps, it is recommended that MoH and RITA should link their data systems and processes.

(ii) Stakeholder Engagement

Stakeholder engagement is a cornerstone of quality VA data collection. It is observed that some families did not provide enough cooperation which eventually affected the quality of VA data. Most of the ongoing community engagements are limited to creating awareness, little attention is being paid to the feedback which has significant potential to create community ownership of the VA exercise. There is a need to conduct a thorough investigation using tailored approaches to engage communities with the intention of increasing awareness and acceptance of the unfamiliar nature of VA in the community.

(iii) Effective Capacity Building

A. Collection of Quality VA Data

Informants emphasized the strengthening of the VA workforce's capacity for yielding high-quality data for routine CRVS. Staff turnover witnessed during Tanzania's VA pre-testing and demonstration phase necessitated ongoing training opportunities. Therefore, the MoH developed a sustainable training program by integrating the VA module into the VA interviewer training syllabi. Training is provided to council-level supervisors (one per council), regional supervisors, and one dedicated national supervisor. Informants recommended refresher programs to deliver ongoing support and feedback to VA interviewers.

B. Analysis and Interpretation of VA Data

Data needs to be translated to action immediately among policymakers, local government authorities, and communities for timely interventions. Hospital and community death need to be integrated and local governments should be able to translate the data into actions so that they are not left behind as couriers of data rather than development partners. The CHWs should be able to promptly access the VA results and incorporate insights into their healthcare interventions. VA data is analyzed and interpreted at the MoH.

(iv) Optimal VA Questionnaire and Quality Control Mechanism

The key informants identified that the lengthy questionnaire is among limitations of the current VA implementation. The questions should be reduced by removing questions that appeared repeated but asked differently. In addition, introduce a dynamic flow of questions to guide the VA interview administration. The MoH has emphasized the use of standard operating procedures (SOPs) and put emphasis on refresher training to continually support VA implementation at the ground level. Ultimately, this will contribute to reducing the duration of the VA interview and improve the overall VA implementation experience.

(v) Sustainable Financing Mechanism

VA interviews are usually conducted by the CHWs who have other core responsibilities. The additional scope to conduct VA interviews needs to be financed. A healthy and sustainable approach would be to include the cost of VA interviews in local government financial plans. The key informants also recommend the use of incentives such as support for children's welfare, to attract communities to cooperate in VA interviews.

(vi) Integrating VA Implementation in CRVS

Countries would need to design VA integration strategies and assess their impact on the overall CRVS to implement VA beyond research settings. Integration strategies should adopt an intersectoral approach, ensuring interoperability is at the forefront of considerations. There is considerable evidence that a few countries like Brazil [5], Uganda [23], Zambia [24], and South Africa [30] managed to integrate and use VA data into routine health systems.

DISCUSSION

This study explored the prevailing challenges in the practical implementation of VA in Iringa region in Tanzania and proposed strategies to enhance its effective adoption. The study fills an important gap in the literature regarding the effective implementation of VA beyond research settings. By exploring the novel challenges faced during the VA implementation in Iringa, this study offers valuable recommendations for effective VA implementation. The insights gained from these challenges and experiences have the potential to enhance VA implementation not only in Tanzania but also across LMICs. However, it is important to acknowledge that these findings may be influenced by interviewees' biases. Also due to the limited peer-reviewed publications on the implementation of VA in real-world settings, we have incorporated grey literature into our document review to enhance its breadth. However, this grey literature may exhibit varying levels of consistency and be accessible online only temporarily.

The study discovered that despite the extensive experience of VA implementation in Tanzania which dates back to the 1990s [15, 16], there are still noticeable gaps, which present opportunities for enhancing current implementation methods. The study showed that a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, poor coordination, poor financial mechanism, and lack of feedback loop were the main perceived VA implementation challenges that hindered its operationalization in Tanzania. Some of the aforementioned challenges, such as poor data quality, inconsistent responses and poor financial mechanisms have been previously raised by Aborigo et al. [31] and persist to this day beyond due to systemic inefficiencies.

Further, while different factors shape VA implementation, this study has unveiled poor coordination and the absence of a feedback loop as prevalent challenges in LMICs. These challenges were also observed during SAVVY implementation in Zambia, and Malawi. The absence of a feedback mechanism, as pointed out by the Key Informants (KI) in Iringa, results in a significant operational gap. Even after a year of performing VA interviews, no feedback was received, and they feel disconnected from the results of their work. Local government authorities also reported a lack of feedback on VA data collection and analysis, suggesting that stakeholders operate merely as data couriers. VA insights should be digested for consumption at the local levels. Otherwise, such a scenario can demotivate stakeholders, compromise data quality, and undermine VA implementation goals.

The study proposed various strategies encompassing four key aspects of the VA implementation process (as summarized in Table 1) aimed at promoting the successful integration of VA in the region; (i) Legislative procedure for death notification: It was observed that the motive to notify death is often to secure certificates for inheritance. This incentive may not apply to deceased

without dependents, and where local beliefs oppose reporting child deaths. (ii) The length of time required to conduct a VA interview using the WHO 2016 questionnaire is over 45 minutes. A study by Serina et al. [32] suggested that sufficient accurate and consistent subsets of symptoms are required to enable VA models to assign the right CoD. The study by Serina et al. [33] reported that the length of a VA questionnaire was shortened by almost 50% without a significant drop in the performance of CoD computation. Shortening the VA questionnaire will improve the overall efficiency of VA implementation [14] (iii) Integrating VA Implementation into CRVS is vital for a holistic view of mortality data. However, it is a complex task demanding intersectoral considerations. There is notable tension regarding the standardization of digital tools to ensure interoperability across systems [34, 35]. (iv) Engaging stakeholders with feedback is a cornerstone to VA data collection quality; however, consistent and timely feedback mechanisms often remain a challenge, leading to potential gaps in data integrity and stakeholder motivation.

CONCLUSION

VA data has significant potential to fill the vital statistics gap in LMICs. This paper discusses challenges in the practical implementation of VA and provides strategies for successfully integrating VA into routine CRVS. Effective VA implementation demands through planning, stakeholder engagement, upskilling of local experts and fair compensation for interviewers. Such coordinated endeavors will overcome systemic, technical, and behavioral challenges hindering VA's successful implementation.

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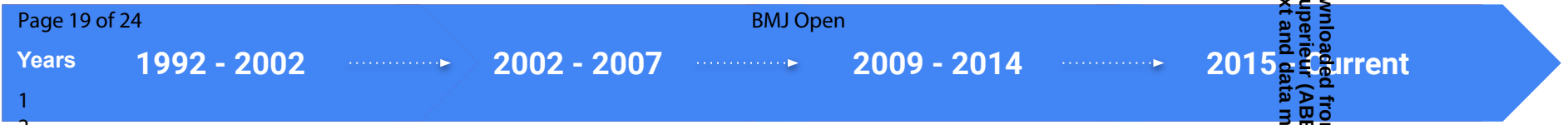
Figure Legend:

Figure 1 - VA Implementation Phases in Tanzania



Phases				
	Adult Morbidity and Mortality Project (AMMP). This was a research implementation which aimed to establish cause-specific death rates among adults and link community-based mortality surveillance to evidence based health planning. AMMP was implemented in selected areas in Dar-es-Salaam, Hai and Morogoro Rural (and later Igunga & Kigoma Urban).	Various Health & Demographic Surveillance Sites (DSS or HDSS) implementations. This includes Dar-es-Salaam, Ifakara, Magu and Rufiji DSS. DSS gathers longitudinal health and demographic data for a dynamic cohort of the total population in a specified geographic area. DSS offers an opportunity for nesting VA implementation. Some DSS date back to late 1980's.	SAmple Vital events registration with Verbal autopsY (SAVVY) under the Ifakara Health Institute. SAVVY was implemented in 23 national samples. SAVVY aimed at strengthening the capacity of the government of Tanzania to collect and use mortality data and assist in managing the national HIV/AIDS programs.	Multi-phased approach funded by Bloomberg Philanthropies Data for Health Initiative under the Ministry of Health aimed at strengthening national routine CRVS system. The phases are 1. Pre-test phase in ten Wards in Pwani Region, 2. Demonstration phase in the Iringa Region, and 3. Scale up phase using the national sampling approach.

Research Reporting Guideline Checklist

Item Name	Item Description
Title and Abstract	
1. Title	Exploring Challenges and Recommendations for VA Implementation in Low- and Middle-Income Countries: A Cross-Sectional Study of Iringa Region - Tanzania
2. Abstract	The adoption and use of Verbal Autopsy (VA) plays a vital role in providing causes of death information in places where such information is not available, due to the limitations in reporting and processing vital statistics. Many Low and Middle-Income Countries (LMICs) including Tanzania are still struggling to yield quality and adequate data for Civil Registration and Vital Statistics (CRVS), thus the wide-scale implementation of VA continues to be indefensible. This study highlights challenges and recommendations for wide-scale VA implementation to help LMICs yield quality and adequate mortality statistics for making timely and informed decisions on healthcare interventions. The study was conducted in Iringa Tanzania, during the Verbal Autopsy (VA) demonstration phase implemented by the Ministry of Health Tanzania. The study encompassed 41 key informants' semi-structured interviews in 5 municipalities and analysis of 12 VA project documents across LMICs. In addition, observation took place between June 2021 and September 2022 to further gather insights from the field. Content analysis was used to identify and categorise the findings of the research into themes. The perceived challenges of key informants include; a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, lack of clarity in the inclusion criteria, poor commitment to roles and responsibilities, poor coordination, poor financial mechanism and no or delayed feedback to VA implementers. Based on these findings, we recommend the following strategies for effective adaptation and use of VAs: (1) Reinforce or implement legislative procedures towards the legal requirement for death notification. (2) engage key stakeholders on the overall implementation of VAs. (3) build capacity for data collection, monitoring, processing and use of VA data. (4) improve the VA questionnaire for optimal use in data collection. (5) create sustainable financing mechanisms and institutionalization of VA implementation. (6) Integrating VA Implementation in CRVS. These strategies will enhance the overall process of collecting and disseminating VA data and results, ultimately leading to successful wide-scale implementation of VA.
Introduction	
3. Problem Description	While extensive literature exists on VA in research contexts, emphasizing automation of cause of cause-of-death computation, there is a noticeable gap concerning its practical implementation and adoption in real-world settings. Despite VA's potential, many LMICs face challenges in integrating it

	sustainably into routine CRVS, resulting in ongoing struggles to produce consistent, quality data on cause of death information.
4. Available knowledge	What is already known on this topic? • VA can play a vital role in filling in the gap in vital statistics in Low-Middle-Income Countries (LMICs). • Many LMICs are still struggling to yield quality and adequate data for Civil Registration and Vital Statistics (CRVS) which affects the wide-scale implementation of VA. • There is extensive literature on VA in research settings, but limited studies have focused on practical implementation settings and context-specific experiences on adopting VA into CRVS. What does this study add? • Weak death notification systems, shortage of skilled personnel, poor coordination and lengthy VA questionnaires are among the key challenges that affect the wide-scale implementation of VA into CRVS. • The sustainable implementation of VA into routine CRVS depends on proper governing structures and procedures, engagement of all key stakeholders, VA workforce's capacity and content of VA questionnaires. • Countries would need to design VA integration strategies and assess their impact on the overall CRVS to implement VA beyond research settings.

5. Specific aims	The main objective of the study is to shed light on existing VA practical implementation challenges and recommended strategies for the effective adoption of VA in LMICs.
Methods	
6.Participant selection:	Key informants from the Verbal Autopsy (VA) demonstration phase implemented by the Ministry of Health Tanzania.
7. Setting:	5 municipalities in Iringa, Tanzania.
8. Data collection:	Data was collected using semi-structured interviews with 41 key informants and an analysis of 12 VA project documents. Observations were also made between June 2021 and September 2022.
9. Analysis	Content analysis was employed to identify and categorise research findings into themes.
10. Ethical Considerations	Ethics Approval: Formal ethical approval was granted by the National Medical Research Institute (NIMR). All participants gave informed consent prior to taking part in the study. Patient and Public Involvement: Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research. Refer to the Methods section for further details. Patient Consent for Publication: Not applicable. Provenance and Peer Review: Not commissioned; externally peer-reviewed. Competing Interests: None.
Results	
11. Results	Challenges included a weak death notification system, a lengthy VA questionnaire, poor data quality and inconsistent responses, lack of clarity in the inclusion criteria, and poor commitment to roles and responsibilities. Recommendations encompassed legislative reinforcement, stakeholder engagement, capacity building, improvement of the VA questionnaire, creation of sustainable financing mechanisms and institutionalization of VA implementation, and Integration of VA Implementation in CRVS. Anonymous quotes from a key informant have been added to emphasize identified themes.
Discussion	
12. Summary	This study explored the prevailing challenges in the practical implementation of VA in the Iringa region in Tanzania and proposed strategies to enhance its effective adoption. The study fills an important gap in the literature regarding the effective implementation of VA beyond research settings. The study

showed that a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, poor coordination, poor financial mechanism, and lack of feedback loop were the main perceived VA implementation challenges that hindered its operationalization in Tanzania. Some of the aforementioned challenges, such as poor data quality, inconsistent responses and poor financial mechanisms have been previously raised by Aborigo et al.[1] persist to this day beyond due to systemic inefficiencies. This study has unveiled poor coordination and the absence of a feedback loop as prevalent challenges in LMICs. These challenges were also observed during SAVVY implementation in Zambia, and Malawi. The absence of a feedback mechanism, as pointed out by the Key Informants (KI) in Iringa, results in a significant operational gap. Even after a year of performing VA interviews, no feedback was received, and they feel disconnected from the results of their work. Local government authorities also reported a lack of feedback on VA data collection and analysis, suggesting that stakeholders operate merely as data couriers. VA insights should be digested for consumption at the local levels. Otherwise, such a scenario can demotivate stakeholders, compromise data quality, and undermine VA implementation goals.

The study proposed various strategies aimed at promoting the successful integration of VA in the region; (i) Legislative procedure for death notification: It was observed that the motive to notify death is often to secure certificates for inheritance. This incentive may not apply to deceased without dependents, and where local beliefs oppose reporting child deaths. (ii) The length of time required to conduct a VA interview using the WHO 2016 questionnaire is over 45 minutes. A study by Serina et al. [2] suggested that sufficient accurate and consistent subsets of symptoms are required to enable VA models to assign the right CoD. The study by [3] reported that the length of a VA questionnaire was shortened by almost 50% without a significant drop in the performance of CoD computation. Shortening the VA questionnaire will improve the overall efficiency of VA implementation[4] (iii) Integrating VA Implementation into CRVS is vital for a holistic view of mortality data. However, it is a complex task demanding intersectoral considerations. There is notable tension regarding the standardization of digital tools to ensure interoperability across systems [5, 6]. (iv) Engaging stakeholders with feedback is a cornerstone to VA data collection quality; however, consistent and timely feedback mechanisms often remain a challenge, leading to potential gaps in data integrity and stakeholder motivation.

The insights gained from these challenges and experiences have the potential to enhance VA implementation not only in Tanzania but also across LMICs.

13. Limitations	The study focussed on the Iringa Region as a case study during the CRVS demonstration phase in Tanzania. Iringa Region is just one of the 31 administrative regions in Tanzania. While the study findings could be limited to this specific region, lessons learnt can be applied to other similar regions in Tanzania and beyond.
14. Conclusions	VA data can bridge the vital statistics gap in LMICs. This paper outlines VA implementation challenges and strategies for its integration into routine CRVS. Successful VA implementation requires planning, stakeholder involvement, and proper interviewer compensation
Other information	
15. Funding	This study was conducted as part of the PhD program and partially funded by the International Development Research Centre (IDRC) and the Swedish International Development Cooperation Agency (SIDA).
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Exploring Challenges and Recommendations for Verbal Autopsy Implementation in Low-and Middle-Income Countries: A Cross-Sectional Study of Iringa Region - Tanzania

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Exploring Challenges and Recommendations for Verbal Autopsy Implementation in Low- and Middle-Income Countries: A Cross-Sectional Study of Iringa Region - Tanzania

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ABSTRACT

Background Verbal Autopsy (VA) plays a vital role in providing cause-of-death information in places where such information is not available. Many Low-and Middle-Income Countries (LMICs) including Tanzania are still struggling to yield quality and adequate cause-of-death data for Civil Registration and Vital Statistics (CRVS).

Objective To highlight challenges and recommendations for VA implementation to support LMICs yield quality and adequate mortality statistics for informed decisions on healthcare interventions.

Design Cross-sectional study.

Study Setting Iringa region in Tanzania.

Participants 41 people including 33 Community Health Workers (CHWs), 1 VA national coordinator, 5 national task force members, 1 VA regional coordinator and 1 member of the VA data management team.

Results The perceived challenges of key informants include a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, lack of clarity in the inclusion criteria, poor commitment to roles and responsibilities, poor coordination, poor financial mechanism and no or delayed feedback to VA implementers. Based on these findings, we recommend the following strategies for effective adaptation and use of VAs: (1) Reinforce or implement legislative procedures towards the legal requirement for death notification. (2) Engage key stakeholders in the overall implementation of VAs. (3) Build capacity for data collection, monitoring, processing and use of VA data. (4) Improve the VA questionnaire and quality control mechanism for optimal use in data collection. (5) Create sustainable financing mechanisms and institutionalization of VA implementation. (6) Integrating VA Implementation in CRVS.

Conclusion Effective VA implementation demands through planning, stakeholder engagement, upskilling of local experts and fair compensation for interviewers. Such coordinated endeavors will overcome systemic, technical, and behavioral challenges hindering VA's successful implementation.

Strengths and limitations of this study

- The participation of both the National Mortality and CoD Task Force and CHWs offers insights into the execution and supervisory levels of the VA implementation strategies.

- The inclusion of reviews from various low- and middle-income countries (LMICs) where VA has been implemented broadens the study's perspective.
- This study contributes to the limited literature on the VA implementation for practical implementation of VA data collection in resource-limited settings.
- The study focused on the Iringa Region as a case study during the CRVS demonstration phase in Tanzania. Iringa Region is just one of the 31 administrative regions in Tanzania.
- While the study findings could be limited to this specific region, lessons learnt can be applied to other similar regions in Tanzania and beyond.

INTRODUCTION

Cause of Death (CoD) statistics reflect society's conditions of morbidity and provide persistent patterns of health risks in communities. Though CoD indicators play vital roles in countries' healthcare interventions, globally, only one out of two deaths are certified with CoD [1]. The situation is worse in Low-Middle-Income Countries (LMICs), where the majority die without hospital care [2-5].

The struggle to generate reliable and adequate CoD statistics led to the development of the Verbal Autopsy (VA) method in the 1950s [1]. VA is an alternative method which can lead to the processing of CoD information using the series and duration of signs and symptoms leading to death [2]. Countries like Tanzania, Malawi, Ghana, Myanmar, Papua New Guinea, Bangladesh, and the Philippines have used these VA tools to generate reliable CoD statistics which demonstrate the value of VA adoption in LMICs [6, 7]. There is extensive literature on VA in research settings focusing on the automation of CoD computation [3, 8-12] and exploration of international standards and concepts on the use of VA in augmenting CRVS systems [6, 8], but limited studies have focused on practical implementation settings and context-specific experiences on the adoption of VA in CRVS. Many LMICs are still struggling to yield sustainable quality and adequate data for routine CRVS [13, 14], thus implementation of VA continues to be challenging [12].

VA history in Tanzania goes back over three decades [15, 16]. Figure 1 summarizes the different implementations. In 1992, as part of a new research collaboration with the Tanzanian Ministry of Health, the country started to collect VA documents through the Adult Morbidity and Mortality Project in three Demographic Surveillance Sites (DSS) [17]. From 2002 to 2007, more VAs were conducted with the Ifakara Health Institute (IHI) under Health and Demographic Surveillance Systems (HDSS) research settings [16, 18]. In 2009, through IHI the country received a five-year project under the code name Sample Vital Events Registration and Verbal Autopsy (SAVVY) to strengthen the capacity of the government to collect and use mortality surveillance data to assist in managing the national HIV/AIDS program by expanding community-based identification, reporting and processing death events to produce COD information [19, 20]. SAVVY used

statistical sampling techniques to produce nationally representative data on levels and causes of mortality from 23 councils in Tanzania. SAVVY implementation ended in 2014. At the beginning of the year 2017, the country embarked on another multi-phased approach funded by Bloomberg Philanthropies Data for Health Initiative to promote CRVS and use VA data to provide information on national mortality statistics [21]. The phases were (1) the pre-test phase in the ten wards in the Pwani Region, (2) the demonstration phase in the Iringa region and currently (3) the scale-up phase using a national sampling approach.

A typical VA implementation in each of these phases is conducted in four steps: (i) Sensitization of the local community leaders to report death events; (ii) Recruitment and training of the VA interviewers to conduct mortality surveillance; (iii) Implementation of the VA interviews through a guided mobile application and data submission to an online server managed by the Ministry of Health (MoH) which has day-to-day Monitoring and Evaluation (M&E) aspects of the overall VA data collection processes; (iv) Analysis and feedback dissemination which plays a vital role in intervention design, informing decisions and creating policies. Such a series of tasks from different players and sectors have interlinked dependencies and are further exposed to performance and data quality constraints. Despite the investment, Tanzania reached 26% of all deaths registered in the country [22]. Thus, this study intends to shed light on existing VA practical implementation challenges and recommended strategies for the effective adoption of VA. The contribution of this study is twofold: First, inform researchers, local authorities, and related stakeholders in the healthcare system on the practical challenges of VA to improve its operationalization. Second, inform policymakers on the VA implementation strategies beyond surveillance systems or research environments to the routine application in CRVSs.

METHODS

This study adopted a cross-sectional research design from June 2021 to September 2022 through document review and key informants' semi-structured interviews in 5 municipalities of the Iringa region. Iringa is the demonstration region for the VA implementation in Tanzania.

Patient and Public Involvement: Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research.

Data Collection

Data collection involved key informant semi-structured interviews to unfold how the VA is practically implemented in the field. Document analysis provided background information on the VA implementation and helped in formulating potential interview questions, validating the claims of interviews, and discerning themes in findings.

(i) Documents Review

Prior to semi-structured interviews, a document review was conducted to enhance the credibility of the findings. Documents related to VA project implementation were extracted from open-access

journals and archives of the MoH. Thirty-seven documents related to VA implementation were identified and read thoroughly by researchers in pairs. Content analysis was adopted to scrutinize the appearance of themes. Themes that appeared in more than one document were recorded.

(ii) Key Informant Semi-Structured Interviews

Face-to-face and virtual interviews with key informants took place immediately after the document analysis. Potential participants were identified using snowball sampling. The first group came from the National Mortality and CoD Task Force (N=7), which then recommended a VA regional supervisor (N=1) as the second group. The regional supervisor then recommended community health care workers (CHW) (N=11), one for each urban, peri-urban and rural ward, making a total of 33 wards represented.

Early findings of the document review were discussed with the key informants to supplement more information and confirm the findings on the data and tools used for VA data collection. Data was gathered by administering a questionnaire with a set of open-ended questions. Questions were devised based on three categories: (a) VA adoption and implementation process (b) Challenges (c) Strategies. The CHWs were interviewed to understand how the VA data is being collected, the routine operation procedures of pre- and post-conducting VA, and the challenges faced in administering VA surveys. Interviews for the National CRVS task force focused on understanding how they derive diagnoses from VA questionnaires, monitoring the quality of VA implementation, and interviewers' training; generally, the purpose was to get a high-level national overview of the implementation of VA into routine vital statistics.

(iii) Observation

The researchers participated in administering the questionnaire and observed the challenges while administering the WHO's VA questionnaire in the field.

Data analysis

A thematic approach was employed to analyze the collected data and identify insights related to the implementation challenges and recommendations for the adoption of VA in CRVS. The thematic analysis provides a flexible mechanism for data interpretation by identifying themes [19, 23]. Themes were developed through an iterative process between the outputs of document analysis and semi-structured interviews. Initially, each author critically analyzed and examined data to generate all potential themes. Brainstorming sessions were conducted by the authors to identify key themes. Key informants were consulted to gather the richest and most in-depth information regarding the first deduced list of themes. After further review and consolidation of comments from key informants, the final lists of the key themes on the implementation challenges and recommendations for the VA adoption in CRVS were produced.

To formulate strategies, we employed two methods. The first method utilized individual brainstorming techniques proposed by Almutairi [24] in order to identify effective strategies for implementing VA. The second method involved validating the brainstormed strategies through consultation with the National Mortality and CoD Task Force and obtaining their contributions and recommendations on how to enhance VA implementation.

RESULTS

In total, 41 participants were engaged, (33 CHWs, one VA national coordinator, five national task force members, one VA regional coordinator and one from the VA data management team). All of the selected CHWs participated in the stated VA implementation and had conducted at least five VA interviews. CHW with no VA interviews were excluded. CHW were grouped by location and residency representing three councils: Iringa Municipal, Kilolo District, and Iringa Rural District and further urban, peri-urban, and rural councils respectively. Twenty-one interviews were conducted in person. The remaining twenty interviews were done by telephone. Interviewees were free to respond and elaborate their answers in the language of their choice (English or Swahili).

A total of 12 documents were reviewed to complement the insights gained from the interviews. The documents included, (a) Vital Statistics Reports (b) CRVS Fellowship report: A national scale-up strategy for Tanzania (c) VA Questionnaires for Tanzania and WHO VA Data Collection tool of 2016 (d) Sample Vital Registration with VA (SAVVY) report [22] (e) WHO CRVS strategic implementation plan 2021-2025 (f) Published articles related to the VA implementation projects in Tanzania [16] and other LMICs including India [25], Ethiopia [26], Sierra Leone [27], Uganda [28], Zambia [23], and Brazil [5].

Two major themes emerged from the preliminary analysis, (i) implementation challenges and (ii) recommendations. These are summarized in Table 1 below,

Table 1: Summary of VA Implementation Challenges and Recommendations

VA Implementation Step	Death Notification	VA Interview	Data Analysis	Data Use and Dissemination
Challenges	• Weak Death Notification	• Lengthy VA • Poor data quality and inconsistent responses • Poor Financing Mechanism • Lack of clarity in the inclusion criteria	• Poor commitment to roles and responsibilities • Poor Coordination	• No Feedback Loop
Recommendations	• Legislative Procedures for Death Notification • Effective Stakeholder Engagement	• Optimal VA Questionnaire and Quality Control • Sustainable Financing Mechanism	• Integrating VA Implementation in CRVS	• Engage Stakeholders with Feedback • Effective Capacity Building on Data Collection, Analysis and Interpretation

VA implementation challenges

From the semi-structured interviews, the implementation challenges as perceived by CHW and the national task force members included the following sub-themes, (i) weak death notification system, (ii) lengthy VA questionnaire, (iii) lack of clarity in the inclusion criteria for VA interviews, and (iv) no or delayed feedback to VA implementers. Conversely, the task force

members highlighted (v) poor VA data quality, (vi) poor commitment to roles and responsibilities, and (vii) poor financing mechanisms as main VA implementation challenges. Both CHW and task force members pointed out that the weak death notification system and lack of clarity in terms of interview inclusion criteria (community vs. facility deaths, residence vs. non-residence deaths) are among the VA implementation challenges. The document's review indicated that there is poor coordination in VA implementation in most LMICs.

(i) Weak Death Notification System

This theme relates to the perspective on how deaths are being notified. For deaths that occur outside health facilities, the nearest relatives or caretakers of the deceased are required by law to notify the authorities. This process triggers death documentation to the Tanzania Registration Insolvency and Trusteeship Agency (RITA) at the local level and puts a provision for issuing death certificates. However, many key informants reported that the notification process does not take place in most rural areas. Most people who die are directly buried at home or on farms, contrary to designated burial areas which could have enforced the need for the notification process. If VA is conducted, they are often conducted weeks or months after the death has occurred and therefore responses to the VA interview may suffer recall bias and affect the overall quality of the VA document.

In most villages, the majority of the people die in their residences and are buried on farms or other rural dedicated properties/areas without formal notification to the responsible authorities. (CHW, Iringa Rural District)

(ii) Lengthy VA Questionnaire

This theme relates to perspectives on the length of VA questionnaire instruments. The length of time required to conduct a VA interview is among the barriers to the widespread implementation of VA in CRVS. About 67% of the key informants were not happy with the length of the VA questionnaire or the time spent interviewing a single person. The VA implementation exercise in Iringa used the standard WHO 2016 VA questionnaire with 481 questions. MoH added 10 extra country-specific questions relating to health insurance coverage. This questionnaire was adapted and translated into Swahili to fit into the local context. An average of 45 minutes has been observed as required to administer one complete VA interview.

The VA interview guide is too long, sometimes it takes 1 hour to finish one interview (CHW, Iringa Municipal)

(iii) Poor data quality and inconsistent responses

This theme relates to the usage of VA data particularly in assigning the probable CoD. Despite built-in data quality control and question-by-question skip logic measures, some VA records were encountered with no or inconsistent responses. This includes, for example, missing age or

unknown age information, inconsistent signs and symptoms for a given sex or age group and poor completion of the narrative section. Our results indicate that the inappropriate selection of interviewees may have contributed to this behavior. This may happen when the family selects a respondent other than the designated one (a close relative who provided care to the deceased during the final days before death). CHWs noticed that some families selected a different person other than caretakers as they were expecting financial support from the interviewer or the government from the VA interview. Challenges were also observed when the caretaker was too old to recall important information which led to death.

Some of the local traditions do not allow women to speak on behalf of the family (National Task Force member).

These inefficiencies observed at a lower level compromise the quality of VA data.

(iv) Lack of clarity in the inclusion criteria

This theme relates to perspectives on who is supposed to be included in the VA interviews. It was not clear who should be included in the VA interviews. Either the residents of their locality or anyone buried in the locality. Furthermore, people who died at health facilities versus community. Notably, health facilities also report mortality statistics through routine health facility reporting channels. Reporting health facility deaths in the VA module could result in double counting in reports. In addition, different VA interviews provided contradicting information about the duration a person must reside in a specific location before their death to be considered a resident. The responses ranged from three months to six months.

Normally, we interview deaths that have occurred within the last one month. We allow the family to mourn for two weeks before we can engage for an interview. However, when we started this program, we were interviewing deaths that had occurred up to two months back (CHW, Iringa Municipal)

(v) Poor commitment to roles and responsibilities

This theme relates to perspectives on the commitment of accountable personnel in VA implementation. Specific concerns regarding volunteering versus specific job accountability in VA implementation were raised by key informants. Most positions, particularly VA interviewers (CHWs and Agricultural Officers, (AO)), Ward Executive Officers (WEO) and other coordination positions, are often perceived as secondary commitments. In this perspective, several tasks are easily left behind or accumulated over time and result in attrition, where most of these positions pick other responsibilities and VA work remains undone.

This is an additional task that does not have any incentive, I have primary responsibilities which often require my immediate attention (WEO, Iringa Rural District)

(vi) Poor Coordination

This theme relates to perspectives on the coordination of VA implementation. Documents review revealed different uncoordinated initiatives by the different stakeholders in the country including vertical programs, government entities (the Ministry of Health, National Statistics Office, and the Registration Office) and local governments. The disconnection between death events, notification, registration, certification and ascertaining the cause of death. SAVVY implementation in Tanzania, Zambia, and Malawi unanimously reported challenges stemming from poor coordination among public institutions. For instance, attempts to integrate VA data into routine CRVS were often unsuccessful due to a lack of interoperability among different national systems.

(vii) Poor Financing Mechanism

This theme relates to perspectives on finances in VA implementation. Some key informants, mainly national task force members, expressed that poor financing mechanisms affect the efficiency of the VA interviews. During the VA implementation pre-testing and demonstration phase, Tanzania commissioned pay for performance modality to incentivize and compensate for time effort. The approach was successful as more VAs were reached. However, the financial component relied on donor funds and, hence, was not sustainable. Furthermore, this modality motivated quantity but not quality. Interviewers were paid flat rates without considering transport costs and geographical coverage. When this modality was changed to a flat compensation within a defined period, other issues of quality and coordination arose. VA implementation in the Iringa suffers from low production of VA data as interviewers have not been receiving their tokens consistently. They tend to ignore reporting some of the deaths or visit the families of descendants until they have official duties in the area. This resulted in over 50% underreporting in most areas. Furthermore, limited resources for digital implementation such as poor internet connectivity and limited electricity to power digital devices also have been a barrier to VA implementation in LMICs [29].

(viii) No or delayed feedback to VA implementers

This theme relates to perspectives on the dissemination of feedback to VA implementers. Key informants noted that the VA implementation lacked a feedback mechanism. Despite conducting event notifications for over a year, none had received feedback on their contribution. The key informants and leaders of the local government authorities reported not having received any feedback on the number of VAs collected and analysis performed on the data. This means they are hosting the VA exercise as couriers and thus unmotivated. Similar to many programs at national levels or with global interest, little attention and resources are often put into disseminating results to local or to the ground where the data originate. Much of the focus and resources are narrowed and directed to influencing policies at the ministry or government level. It appears much easier logistically and financially to have one dissemination at the ministry level versus multiple dissemination at regions, councils, or ward levels. In addition, the language starts to differ as you

move down to different levels, and therefore this requires a different packaging or communication strategy.

We have been conducting VA interviews for years, but we have received no feedback or insights regarding the results of the analysis (CHW, Iringa MC)

Strategies for effective adoption of VA

Recommendations were extrapolated from the analysis of the key informants' feedback and insights obtained from reviewing documents. These recommendations were articulated from the authors' perspectives forming six themes under the category of strategies for effective VA adoption: (i) Legislative Procedures for Death Notification (ii) Stakeholder Engagement (iii) Effective Capacity Building (iv) Optimal VA questionnaire instruments and quality control mechanism (v) Sustainable financing mechanism and (vi) Integrating VA Implementation in CRVS.

(i) Legislative Procedures for Death Notification

The sustainable implementation of VA into routine CRVS requires proper governing structures and procedures. Without legislation, the VA will only be utilized as an ad hoc means. Countries should establish and supervise legislative procedures that bind the family members to report deaths to the relevant authorities. A CRVS legal framework should be established at the national level to bind coordination among responsible authorities. In Tanzania, the national VA program is hosted by the MoH and has members from the National Bureau of Statistics (NBS), RITA, the President's Office of Regional Administration, Local Government (PoRALG), and other stakeholders. However, there is no linkage between the implementation and data collection systems. To improve data efficiency and reduce data quality gaps, it is recommended that MoH and RITA should link their data systems and processes.

(ii) Stakeholder Engagement

Stakeholder engagement is a cornerstone of quality VA data collection. It is observed that some families did not provide enough cooperation which eventually affected the quality of VA data. Most of the ongoing community engagements are limited to creating awareness, little attention is being paid to the feedback which has significant potential to create community ownership of the VA exercise. There is a need to conduct a thorough investigation using tailored approaches to engage communities with the intention of increasing awareness and acceptance of the unfamiliar nature of VA in the community.

(iii) Effective Capacity Building

A. Collection of Quality VA Data

Informants emphasized the strengthening of the VA workforce's capacity for yielding high-quality data for routine CRVS. Staff turnover witnessed during Tanzania's VA pre-testing and demonstration phase necessitated ongoing training opportunities. Therefore, the MoH developed

a sustainable training program by integrating the VA module into the VA interviewer training syllabi. Training is provided to council-level supervisors (one per council), regional supervisors, and one dedicated national supervisor. Informants recommended refresher programs to deliver ongoing support and feedback to VA interviewers.

B. Analysis and Interpretation of VA Data

Data needs to be translated to action immediately among policymakers, local government authorities, and communities for timely interventions. Hospital and community death need to be integrated and local governments should be able to translate the data into actions so that they are not left behind as couriers of data rather than development partners. The CHWs should be able to promptly access the VA results and incorporate insights into their healthcare interventions. VA data is analyzed and interpreted at the MoH.

(iv) Optimal VA Questionnaire and Quality Control Mechanism

The key informants identified that the lengthy questionnaire is among the limitations of the current VA implementation. The questions should be reduced by removing questions that appeared repeated but asked differently. In addition, introduce a dynamic flow of questions to guide the VA interview administration. The MoH has emphasized the use of standard operating procedures (SOPs) and put emphasis on refresher training to continually support VA implementation at the ground level. Ultimately, this will contribute to reducing the duration of the VA interview and improve the overall VA implementation experience.

(v) Sustainable Financing Mechanism

VA interviews are usually conducted by the CHWs who have other core responsibilities. The additional scope to conduct VA interviews needs to be financed. A healthy and sustainable approach would be to include the cost of VA interviews in local government financial plans. The key informants also recommend the use of incentives such as support for children's welfare, to attract communities to cooperate in VA interviews.

(vi) Integrating VA Implementation in CRVS

Countries would need to design VA integration strategies and assess their impact on the overall CRVS to implement VA beyond research settings. Integration strategies should adopt an intersectoral approach, ensuring interoperability is at the forefront of considerations. There is considerable evidence that a few countries like Brazil [5], Uganda [23], Zambia [24], and South Africa [30] managed to integrate and use VA data into routine health systems.

DISCUSSION

This study explored the prevailing challenges in the practical implementation of VA in the Iringa region in Tanzania and proposed strategies to enhance its effective adoption. The study fills an

important gap in the literature regarding the effective implementation of VA beyond research settings. By exploring the novel challenges faced during the VA implementation in Iringa, this study offers valuable recommendations for effective VA implementation. The insights gained from these challenges and experiences have the potential to enhance VA implementation not only in Tanzania but also across LMICs. However, more studies in different areas should be conducted to provide a comprehensive view of diverse challenges that exist across LMICs since the study focused only on one region in Tanzania as a case study during the CRVS demonstration phase. Also, due to the limited peer-reviewed publications on the implementation of VA in real-world settings, we have incorporated grey literature into our document review to enhance its breadth. However, this grey literature may exhibit varying levels of consistency and be accessible online only temporarily.

The study discovered that despite the extensive experience of VA implementation in Tanzania which dates back to the 1990s [15, 16], there are still noticeable gaps, which present opportunities for enhancing current implementation methods. The study showed that a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, poor coordination, poor financial mechanism, and lack of feedback loop were the main perceived VA implementation challenges that hindered its operationalization in Tanzania. Some of the aforementioned challenges, such as poor data quality, inconsistent responses and poor financial mechanisms have been previously raised by Aborigo et al. [31] and persist to this day beyond due to systemic inefficiencies.

Further, while different factors shape VA implementation, this study has unveiled poor coordination and the absence of a feedback loop as prevalent challenges in LMICs. These challenges were also observed during SAVVY implementation in Zambia, and Malawi. The absence of a feedback mechanism, as pointed out by the Key Informants (KI) in Iringa, results in a significant operational gap. Even after a year of performing VA interviews, no feedback was received, and they feel disconnected from the results of their work. Local government authorities also reported a lack of feedback on VA data collection and analysis, suggesting that stakeholders operate merely as data couriers. VA insights should be digested for consumption at the local levels. Otherwise, such a scenario can demotivate stakeholders, compromise data quality, and undermine VA implementation goals.

The study proposed various strategies encompassing four key aspects of the VA implementation process (as summarized in Table 1) aimed at promoting the successful integration of VA in the region; (i) Legislative procedure for death notification: It was observed that the motive to notify death is often to secure certificates for inheritance. This incentive may not apply to deceased without dependents, and where local beliefs oppose reporting child deaths. (ii) The length of time required to conduct a VA interview using the WHO 2016 questionnaire is over 45 minutes. A study by Serina et al. [32] suggested that sufficient accurate and consistent subsets of symptoms

are required to enable VA models to assign the right CoD. The study by Serina et al. [13] reported that the length of a VA questionnaire was shortened by almost 50% without a significant drop in the performance of CoD computation. Shortening the VA questionnaire will improve the overall efficiency of VA implementation [14] (iii) Integrating VA Implementation into CRVS is vital for a holistic view of mortality data. However, it is a complex task demanding intersectoral considerations. There is notable tension regarding the standardization of digital tools to ensure interoperability across systems [33, 1]. (iv) Engaging stakeholders with feedback is a cornerstone to VA data collection quality; however, consistent, and timely feedback mechanisms often remain a challenge, leading to potential gaps in data integrity and stakeholder motivation.

CONCLUSION

VA data has significant potential to fill the vital statistics gap in LMICs. This paper discusses challenges in the practical implementation of VA and provides strategies for successfully integrating VA into routine CRVS. Effective VA implementation demands through planning, stakeholder engagement, upskilling of local experts and fair compensation for interviewers. Such coordinated endeavors will overcome systemic, technical, and behavioral challenges hindering VA's successful implementation.

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Patient Consent for Publication: Not applicable.

Provenance and Peer Review: Not commissioned; externally peer-reviewed.

Competing Interests: None.

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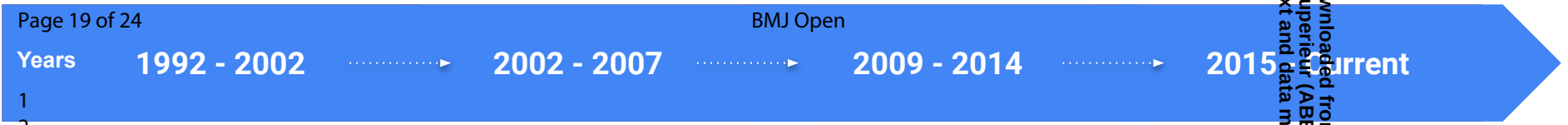
Figure Legend:
Figure 1 - VA Implementation Phases in Tanzania



Phases				
	Adult Morbidity and Mortality Project (AMMP). This was a research implementation which aimed to establish cause-specific death rates among adults and link community-based mortality surveillance to evidence based health planning. AMMP was implemented in selected areas in Dar-es-Salaam, Hai and Morogoro Rural (and later Igunga & Kigoma Urban).	Various Health & Demographic Surveillance Sites (DSS or HDSS) implementations. This includes Dar-es-Salaam, Ifakara, Magu and Rufiji DSS. DSS gathers longitudinal health and demographic data for a dynamic cohort of the total population in a specified geographic area. DSS offers an opportunity for nesting VA implementation. Some DSS date back to late 1980's.	SAmple Vital events registration with Verbal autopsY (SAVVY) under the Ifakara Health Institute. SAVVY was implemented in 23 national samples. SAVVY aimed at strengthening the capacity of the government of Tanzania to collect and use mortality data and assist in managing the national HIV/AIDS programs.	Multi-phased approach funded by Bloomberg Philanthropies Data for Health Initiative under the Ministry of Health aimed at strengthening national routine CRVS system. The phases are 1. Pre-test phase in ten Wards in Pwani Region, 2. Demonstration phase in the Iringa Region, and 3. Scale up phase using the national sampling approach.

Research Reporting Guideline Checklist

Item Name	Item Description
Title and Abstract	
1. Title	Exploring Challenges and Recommendations for VA Implementation in Low- and Middle-Income Countries: A Cross-Sectional Study of Iringa Region - Tanzania
2. Abstract	The adoption and use of Verbal Autopsy (VA) plays a vital role in providing causes of death information in places where such information is not available, due to the limitations in reporting and processing vital statistics. Many Low and Middle-Income Countries (LMICs) including Tanzania are still struggling to yield quality and adequate data for Civil Registration and Vital Statistics (CRVS), thus the wide-scale implementation of VA continues to be indefensible. This study highlights challenges and recommendations for wide-scale VA implementation to help LMICs yield quality and adequate mortality statistics for making timely and informed decisions on healthcare interventions. The study was conducted in Iringa Tanzania, during the Verbal Autopsy (VA) demonstration phase implemented by the Ministry of Health Tanzania. The study encompassed 41 key informants' semi-structured interviews in 5 municipalities and analysis of 12 VA project documents across LMICs. In addition, observation took place between June 2021 and September 2022 to further gather insights from the field. Content analysis was used to identify and categorise the findings of the research into themes. The perceived challenges of key informants include; a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, lack of clarity in the inclusion criteria, poor commitment to roles and responsibilities, poor coordination, poor financial mechanism and no or delayed feedback to VA implementers. Based on these findings, we recommend the following strategies for effective adaptation and use of VAs: (1) Reinforce or implement legislative procedures towards the legal requirement for death notification. (2) engage key stakeholders on the overall implementation of VAs. (3) build capacity for data collection, monitoring, processing and use of VA data. (4) improve the VA questionnaire for optimal use in data collection. (5) create sustainable financing mechanisms and institutionalization of VA implementation. (6) Integrating VA Implementation in CRVS. These strategies will enhance the overall process of collecting and disseminating VA data and results, ultimately leading to successful wide-scale implementation of VA.
Introduction	
3. Problem Description	While extensive literature exists on VA in research contexts, emphasizing automation of cause of cause-of-death computation, there is a noticeable gap concerning its practical implementation and adoption in real-world settings. Despite VA's potential, many LMICs face challenges in integrating it

	sustainably into routine CRVS, resulting in ongoing struggles to produce consistent, quality data on cause of death information.
4. Available knowledge	What is already known on this topic? • VA can play a vital role in filling in the gap in vital statistics in Low-Middle-Income Countries (LMICs). • Many LMICs are still struggling to yield quality and adequate data for Civil Registration and Vital Statistics (CRVS) which affects the wide-scale implementation of VA. • There is extensive literature on VA in research settings, but limited studies have focused on practical implementation settings and context-specific experiences on adopting VA into CRVS. What does this study add? • Weak death notification systems, shortage of skilled personnel, poor coordination and lengthy VA questionnaires are among the key challenges that affect the wide-scale implementation of VA into CRVS. • The sustainable implementation of VA into routine CRVS depends on proper governing structures and procedures, engagement of all key stakeholders, VA workforce's capacity and content of VA questionnaires. • Countries would need to design VA integration strategies and assess their impact on the overall CRVS to implement VA beyond research settings.

5. Specific aims	The main objective of the study is to shed light on existing VA practical implementation challenges and recommended strategies for the effective adoption of VA in LMICs.
Methods	
6.Participant selection:	Key informants from the Verbal Autopsy (VA) demonstration phase implemented by the Ministry of Health Tanzania.
7. Setting:	5 municipalities in Iringa, Tanzania.
8. Data collection:	Data was collected using semi-structured interviews with 41 key informants and an analysis of 12 VA project documents. Observations were also made between June 2021 and September 2022.
9. Analysis	Content analysis was employed to identify and categorise research findings into themes.
10. Ethical Considerations	Ethics Approval: Formal ethical approval was granted by the National Medical Research Institute (NIMR). All participants gave informed consent prior to taking part in the study. Patient and Public Involvement: Patients and/or the public were not involved in the design, conduct, reporting, or dissemination plans of this research. Refer to the Methods section for further details. Patient Consent for Publication: Not applicable. Provenance and Peer Review: Not commissioned; externally peer-reviewed. Competing Interests: None.
Results	
11. Results	Challenges included a weak death notification system, a lengthy VA questionnaire, poor data quality and inconsistent responses, lack of clarity in the inclusion criteria, and poor commitment to roles and responsibilities. Recommendations encompassed legislative reinforcement, stakeholder engagement, capacity building, improvement of the VA questionnaire, creation of sustainable financing mechanisms and institutionalization of VA implementation, and Integration of VA Implementation in CRVS. Anonymous quotes from a key informant have been added to emphasize identified themes.
Discussion	
12. Summary	This study explored the prevailing challenges in the practical implementation of VA in the Iringa region in Tanzania and proposed strategies to enhance its effective adoption. The study fills an important gap in the literature regarding the effective implementation of VA beyond research settings. The study

showed that a weak death notification system, lengthy VA questionnaire, poor data quality and inconsistent responses, poor coordination, poor financial mechanism, and lack of feedback loop were the main perceived VA implementation challenges that hindered its operationalization in Tanzania. Some of the aforementioned challenges, such as poor data quality, inconsistent responses and poor financial mechanisms have been previously raised by Aborigo et al.[1] persist to this day beyond due to systemic inefficiencies. This study has unveiled poor coordination and the absence of a feedback loop as prevalent challenges in LMICs. These challenges were also observed during SAVVY implementation in Zambia, and Malawi. The absence of a feedback mechanism, as pointed out by the Key Informants (KI) in Iringa, results in a significant operational gap. Even after a year of performing VA interviews, no feedback was received, and they feel disconnected from the results of their work. Local government authorities also reported a lack of feedback on VA data collection and analysis, suggesting that stakeholders operate merely as data couriers. VA insights should be digested for consumption at the local levels. Otherwise, such a scenario can demotivate stakeholders, compromise data quality, and undermine VA implementation goals.

The study proposed various strategies aimed at promoting the successful integration of VA in the region; (i) Legislative procedure for death notification: It was observed that the motive to notify death is often to secure certificates for inheritance. This incentive may not apply to deceased without dependents, and where local beliefs oppose reporting child deaths. (ii) The length of time required to conduct a VA interview using the WHO 2016 questionnaire is over 45 minutes. A study by Serina et al. [2] suggested that sufficient accurate and consistent subsets of symptoms are required to enable VA models to assign the right CoD. The study by [3] reported that the length of a VA questionnaire was shortened by almost 50% without a significant drop in the performance of CoD computation. Shortening the VA questionnaire will improve the overall efficiency of VA implementation[4] (iii) Integrating VA Implementation into CRVS is vital for a holistic view of mortality data. However, it is a complex task demanding intersectoral considerations. There is notable tension regarding the standardization of digital tools to ensure interoperability across systems [5, 6]. (iv) Engaging stakeholders with feedback is a cornerstone to VA data collection quality; however, consistent and timely feedback mechanisms often remain a challenge, leading to potential gaps in data integrity and stakeholder motivation.

The insights gained from these challenges and experiences have the potential to enhance VA implementation not only in Tanzania but also across LMICs.

13. Limitations	The study focussed on the Iringa Region as a case study during the CRVS demonstration phase in Tanzania. Iringa Region is just one of the 31 administrative regions in Tanzania. While the study findings could be limited to this specific region, lessons learnt can be applied to other similar regions in Tanzania and beyond.
14. Conclusions	VA data can bridge the vital statistics gap in LMICs. This paper outlines VA implementation challenges and strategies for its integration into routine CRVS. Successful VA implementation requires planning, stakeholder involvement, and proper interviewer compensation
Other information	
15. Funding	This study was conducted as part of the PhD program and partially funded by the International Development Research Centre (IDRC) and the Swedish International Development Cooperation Agency (SIDA).
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