THE UNITED REPUBLIC OF TANZANIA

MINISTRY OF HEALTH TANZANIA

CAUSES OF DEATHS FROM COMMUNITY SETTINGS IN TANZANIA

2018 - 2021

JUNE 2024

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Foreword

The Tanzanian (Mainland) Ministry of Health aspires to provide up-to-date information on health services offered in the country to all stakeholders. To facilitate evidence-based plans and decisions within the sector, the Ministry produces various reports aimed at simplifying the sharing of data across a broader spectrum of stakeholders. One such report is the Causes of Death from the Community Settings in Tanzania, which offers a summary of mortality indicators spanning from 2018 to 2021. These indicators adhere to the calendar years, running from January to December each year.

The Causes of Death from the Community Settings in Tanzania 2018-2021 report is the first publication since the introduction of the collection of mortality data from communities using VA in 2018 in the Iringa region. Tanzania is estimated to have a population of 57.724 million with a crude death rate (CDR) of 6.0 and an estimated number of deaths of 346,344 per annum (for the year 2021). Of all the deaths, an estimated 70% occur in the community and 30% occur in health facilities. This raises an alert for the country to implement interventions for documenting deaths that occur in the community.

VA is a WHO-recommended method for collecting mortality data and providing a cause of death for the deaths that have not been seen by clinicians. VA interviews are conducted by trained workers from the ward level using questionnaires with a series of questions that will later enable clinicians or algorithms to provide a cause of death for evidence-based decisions.

This report presents a summary of mortality information from the community, narrating the leading causes of mortality, major and specific causes of mortality, neonatal causes of mortality, maternal causes of mortality, external causes of mortality (injuries), and leading causes of mortality disaggregated by rural and urban areas and others. This report has also explained the care-seeking behaviors of the deceased and whether they had health insurance or not. Furthermore, the report compares the results of causes of mortality provided by clinicians with those provided by computerized diagnostic algorithms.

This report will be relevant to Government Ministerial Departments and Agencies, decision-makers, academic institutions, planners, development partners, international organizations, research scientists, and other interested parties. The CRVS-VA report will provide a better understanding of the country's community mortality status. I invite all to use it in a productive way.

Dr. John A.K. Jingu
Permanent Secretary, Ministry of Health, Dodoma, Tanzania

Acknowledgement

Preparation of this technical report describing mortality statistics in tables and figures is a combined effort of the Monitoring and Evaluation Unit of the Ministry of Health, health programs from the Ministry of Health, and other key stakeholders in the sector. I highly acknowledge the overall sectoral guidance provided by the Permanent Secretary, Dr. John A.K. Jingu. I also recognize the contribution of all organizations, institutions, and individuals who participated directly or indirectly in the preparation of this report.

The preparation process was very inclusive, involving many key players in one way or another. It is not possible to mention everyone, but the Ministry of Health acknowledges their significant input. My special appreciation goes to Mr. Claud J. Kumalija, the Acting Director of the Monitoring and Evaluation Unit, a team of report writers led by Ms. Trust Nyondo, Mr. Gisbert Msigwa, and program officers for their technical contributions to the development and production of this report.

Nevertheless, the Ministry recognizes the significant contribution of the National Bureau of Statistics (NBS), PORALG (President's Office, Regional Administration, and Local Government), RITA (Registration, Insolvency, and Trusteeship Agency), University of Dar es Salaam led by Mahadia Tunga, Muhimbili National Hospital (MNH) led by Joyce Mugasa and Mr. Geofrey Semu, Ifakara Health Institute (IHI) led by Sigilbert Mrema and Isaac Lyatuu, the African Academy for Public Health (AAPH) led by Imani Irema, and Technical Advisor Don de Savigny from the Swiss Tropical and Public Health Institute in pushing the implementation of CRVS interventions in the country and production of this important report.

Preparation of this report was made possible by the financial and technical support from Vital Strategies (Bloomberg Philanthropies D4H Initiative) led by Philip Setel, Martin Bratschi, James Mwanza, and Robert Mswia. The contribution of all partners through funding, technical support, and strengthening of routine data is highly acknowledged.

Prof. Tumaini J. Nagu
Chief Medical Officer, Ministry of Health, Dodoma, Tanzania

Abbreviations

AAPH	African Academy for Public Health
AAR	Against All Risk, Private Health Insurance
AI	Artificial Intelligence
CCVA	Computer Coded Verbal Autopsy
CHF	Community Health Fund Insurance
COD	Cause of Death
COPD	Chronic obstructive pulmonary disease
CHF	Community Health Fund
CRVS	Civil Registration and Vital Statistics
CRVS-VA	VA linked to CRVS
CSMF	Cause-specific mortality fraction
DHIS2	District Health Information System
DHS	Demographic and Health Survey
eGOV	Tanzania e-Government Agency
GBD	Global Burden of Disease
GHE	WHO Global Health Estimates
GHE Group 1	Communicable Diseases
GHE Group 2	Non-communicable Diseases
GHE Group 3	External (Injury) Causes
HDSS	Health and Demographic Surveillance System
ICD-10	WHO International Classification of Disease, 10th Revision
ICD-11	WHO International Classification of Disease, 11th Revision
iCHF	Improved Community Health Fund
IHI	Ifakara Health Institute
MCCD	Medical Certificate of Cause of Death
MOH	Ministry of Health
NCD	Non-communicable Disease
NHIF	National Health Insurance Fund
NLP	Natural Language Processing
NMCP	National Malaria Control Programme
ODK	Open Data Kit
PCVA	Physician Coded Verbal Autopsy
PORALG	Prime Minister's Office for Regional Administration and Local Government
PPS	Sampling proportional to population size
RITA	Registration, Insolvency & Trusteeship Agency
RTF	Road Traffic Fatality
SAVVY	Sample Vital Events with Verbal Autopsy
TDHS	Tanzania Demographic Health Survey
uCOD	Underlying Cause of Death

VAMan	VA Manager Platform
VMan	Verbal Autopsy Manager
VA	Verbal autopsy
WEO	Ward Executive Office
WHO	World Health Organization

Executive Summary

This report presents the findings of the experience covering the first 3,601 verbal autopsies conducted as part of routine CRVS and DHIS2 operations provides sound evidence that the WHO standard verbal autopsy methodologies work well in Tanzania and can be taken to the next level of integration into the national CRVS and health information ecosystem.

- Verbal Autopsy is practical and can be used to estimate cause specific mortality fractions of the underlying cause of death at community level in Tanzania where medical certification is not currently possible.

- Successful integration of VA in CRVS depends on robust death notification of community deaths in CRVS. In this work there was relatively good completeness of civil death registration (69%) by RITA.

- Summary findings of the Verbal Autopsy integrated in CRVS indicated that 46% of deaths were due to Communicable diseases, 40% due to non-communicable diseases, and 10% due to Injuries. Only 4% of deaths were undetermined as to the underlying cause. (See Section 3.2).

- The five leading causes of death were HIV/AIDS, cardiac conditions, malaria, pulmonary tuberculosis, and diabetes. Road traffic fatalities have moved into the leading ten causes of death. (See Section 3.3).

- Results quantify important differences between the pattern of causes of death recorded at community level by VA and the pattern of causes of death recorded at health facility level by MCCD in DHIS2. For example, there are more cancer deaths seen in the community than at health facilities. Such results when appropriately combined will change the overall ranking of some causes of death in national vital statistics. (See Sections 3.2, 4.4, and 6.5).

- Practical experience with both the technical and operational processes of VA have been tested and optimized for scaling-up into a national verbal autopsy cluster sample system integrated in CRVS and HMIS processes.

- The diagnostic algorithm of choice, performing best in relation to physician-coded VA is the InSilicoVA method with a Cause Specific Mortality Fraction concordance with physicians of 83%. (See Section 4.2).

- A number of policy relevant contextual health system and public health risk factor issues were documented in VAs of the deceased (e.g. tobacco and alcohol use among the deceased, low use of health insurance for life-threatening conditions, high frequency of care-seeking delays starting at the household level, etc). (See Chapter 5).

- A statistical stratified cluster sampling strategy to provide nationally representative estimates of the leading 20 cause specific fractions of mortality to a sufficient level of precision has been developed based on the Ward level as the sample Unit. For such a national scale VA, only 260 of the approximately 4,000 wards in mainland Tanzania are sufficient if VAs are done on 52% of all community deaths. (See Section 1.5)

Chapter 1: Introduction

1.1 Brief overview of mortality statistics in Tanzania

Since the year 2000, mortality rates in Tanzania have been steadily declining and life expectancy has been increasing each year although empirical data on trends in the pattern of Causes of Death is lacking [1–3]. Along with this rapid change in mortality rates, there is an expected marked change in the mix and patterns of the causes of mortality. For example, there is a declining number of communicable diseases, and a rising number of non-communicable diseases, with a relative stagnation in maternal and neonatal causes. To address this rapidly changing environment and enable a well-informed future for policy and planning purposes, it is crucial to know the dynamics of the leading causes of the changing burden of ill health and mortality.

Where there is no physician to certify a death. A key feature of mortality in Tanzania is the fact that the majority of deaths (approximately 70%) occur outside health facilities, at home, or on the road, particularly in rural settings or in communities where there is no clinician [4]. Such deaths may go unrecorded, or may be registered in the civil registry, but may not have a medically certified cause of death. Presently health planning and policy in Tanzania are based on mortality statistics from only 10% to 15% of the population (Table 1.1). These represent mainly hospital and health facility deaths which may not be representative of the country as a whole [4]. It is difficult to plan strategies without reliable data on the causes of death from the population. The only source of cause of death data from the community is verbal autopsy. This report summarizes the findings of the first phase of integrating verbal autopsy into the Civil Registration and Vital Statistics (CRVS) system of Tanzania via the Ministry of Health's Health Management Information System (HMIS).

Table 1.1 Current status of completeness of death registration and cause of death statistics in Tanzania.

Indicator	Value
Tanzania Population (2021)	57.724 million *
Deaths expected (at a CDR of 6.0/1,000)	346,344*
Deaths with MCCD medically certified cause	51,906 (15%) ** from health facilities
Deaths with MCCD valid for vital statistics	42,142 (12%) **
Deaths registered by CRVS	35,573 (10%) ***
* National Bureau of Statistics Population projection for the mainland in 2021 ** Tanzania MoH from DHIS2 and ANACoD3 *** Tanzania RITA CRVS Authority	

1.2 Sources of mortality data in Tanzania

Mortality data related to rates (crude and age-standardized mortality rates, life tables, and life expectancy) are provided every ten years from the decennial census and projected for future years (projections available for the period of this work was from the 2012 census). However, the cause of death is not collected in the census. Likewise, the periodic Demographic and Health surveys conducted every four to five years (latest one was in 2015) provide mortality rates (neonatal, infant, child, under-five and maternal mortality ratios to live births), but do not provide causes of death. In the past, Health and Demographic Surveillance Systems (HDSS) [1,5–10] and Sample Vital Events with Verbal Autopsy (SAVVY) [11,12] sentinel sites provided rates and causes of death in selected districts but these systems were mainly for research, were not integrated into CRVS or HMIS, and are no longer active in Tanzania. The CRVS system receives mortality information on legally registered deaths but cannot provide details on rates or causes of death. The only remaining routine source of empirical cause of death (COD) data is the Medically Certified Cause of Death (MCCD) data provided by clinicians attending to the deceased in hospitals or health facilities.

The MCCD in Tanzania adheres to the WHO Medical Certificate of Cause of Death standard form. This form is in digital format as part of the Ministry of Health's District Health Information System (DHIS2) digital platform used in all district hospitals and health facilities. The form collects information on the age and sex of the deceased, the manner of death, and the timing and sequence of the immediate, intermediate, and underlying causes of death in the causal pathway leading to death. It is the underlying cause of death (uCOD) that is needed and used for policy and planning, as it is the uCOD that is the target of health interventions aimed at reducing the risk and burden of disease at a population level. In DHIS2 all causes are coded according to the 10th revision of the WHO standard International Classification on Disease (ICD-10). National, Zonal, and Specialized referral hospitals use different systems for reporting death and causes of death other than DHIS2. Such data are kept at the hospital level and may or may not be provided to the Civil Registration Authority (RITA). Hence this contributes to low completeness of the MCCD data [2,3]. Furthermore, health facility deaths may not reflect the full picture of national mortality since the type of deaths that occur in facilities are not representative. For example, terminally ill patients with a chronic communicable disease (e.g. HIV/AIDS or TB) or non-communicable diseases (e.g. cancers) often die at home. As shown in Table 1.1, less than 10% of deaths in Tanzania have an uCOD of acceptable quality for policy making and for use by other stakeholders needing such vital statistics (Fig. 1.1).

1.3 The challenge of documenting COD for community deaths

Currently, the only method to reliably document the leading causes of death at the community level in the absence of attending clinicians is the verbal autopsy (VA) [13]. The VA is a WHO-standardized interview questionnaire administered digitally on a tablet computer by a lay

interviewer at the household level after a suitable bereavement period (commonly 1 month) to the family or caregivers who witnessed the final illness or circumstances leading to death[1]. The VA documents the associated signs, symptoms, severity, and sequence of events. The filled digital questionnaire is then transmitted electronically to a central server at the Ministry of Health (MOH) where it can be assessed online by a panel of physicians or by computer algorithms to impute the most probable underlying COD.

Tanzania has a rich and 30-year long experience with VA in the research community starting in 1992 with the Ministry of Health's Adult Morbidity and Mortality Project (AMMP) monitoring over 350,000 population in several districts (Hai, Kinondoni, Ilala, Temeke, and Morogoro Rural Districts) [6–9], the Tanzania Essential Health Interventions Program (TEHIP) monitoring a similar number in Rufiji, Ulanga, and Kilombero Districts [10], and the TANESA project in Magu District [14], all using Health and Demographic Surveillance Systems with verbal autopsy on all deaths. These were knitted together by the Ministry of Health to establish a National Sentinel Mortality Surveillance System (NSS) which later was re-organized across 23 district councils in the Sample Vital Events with Verbal Autopsy (SAVVY) system [12,15]. Verbal autopsy in such research settings in Tanzania has provided a wealth of health policy-relevant evidence over many years [3,6,8-11,16-33].

This experience with VA has been instrumental to Tanzania, the global community, and WHO, leading to improvements and standardization of VA instruments and methods. In 2015, with the development of the electronic VA questionnaires and automated diagnostic algorithms to determine the uCOD, it became feasible, practical, and affordable to move VA from the research realm into the routine information systems of the country (CRVS and HMIS) [16,17].

[1] https://www.who.int/standards/classifications/other-classifications/verbal-autopsy-standards-ascertaining-and-attributing-causes-of-death-tool

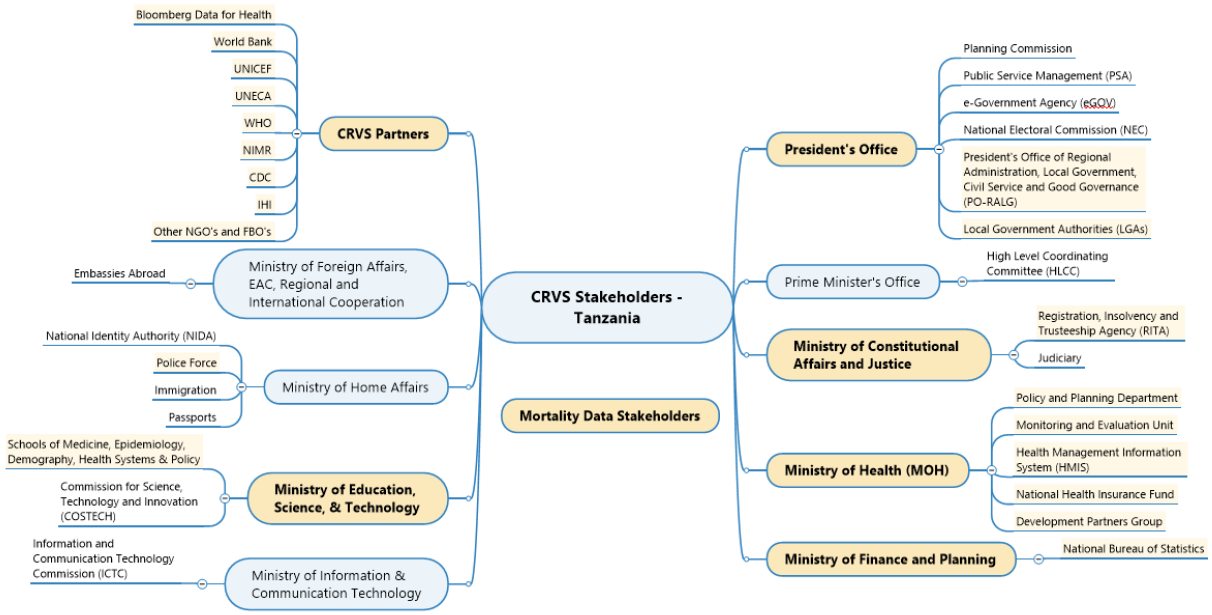

Fig. 1.1 CRVS stakeholder institutions. Those highlighted in yellow are producers or users of mortality data from the Civil Registration and Vital Statistics ecosystem in Tanzania.

1.4 Phased Strategy towards a National CRVS Verbal Autopsy System

The integration of VA into the CRVS and HMIS systems has taken a four-phase approach; Pre-test, Pilot, Demonstration, and Scale-up Phase.

Table 1.2 Pathways to scaling up verbal autopsy as part of CRVS.

Phase	Purpose	Example	Scale
Pre - Test	For technical issues	Adapting and testing technologies, instruments, translations, etc.	~ 100 VAs Local scale
Pilot	For process issues	Developing training, supervision, communications, IT processes, initial costing, and SOPs.	~ 1,000 VAs District scale (10 wards)
Demonstration	For systems integration issues	Developing integration with CRVS and HMIS information systems, conducting costing, and developing sampling strategies.	> 1,000's VAs Regional scale. emulating proposed national scenarios (~ 100 wards, Iringa Region)
Scale up	For institutionalization	Scaling up to national or sub-national CRVS - VA Sample implementation	~10,000 VAs per year at national sample scale

Pre-test and Pilot Phases (Technical issues)

The two phases were combined together to establish, adapt and test the main technical issues required for the future system such as the Kiswahili translation of the questionnaire and training materials, the hardware and software required to collect, transmit and process data, and determine the plausibility of results. It required the conduct of a few hundred VAs at the administrative level of ten wards distributed across three Regions (Pwani, Morogoro, and Tanga) in five district councils (Mkuranga, Kisarawe, Morogoro MC, Chalinze DC, and Tanga CC) in Eastern Tanzania. A table showing the ten wards is provided in Annex 4.

Demonstration Phase (Process and systems issues)

The second phase was a demonstration phase that combined work on establishing the VA processes for integration in the system based on process mapping (Annex) leading to testing within the CRVS and HMIS systems. This required the conduct of a few thousand VAs. It was conducted in all 106 wards of the five districts of the Iringa Region. See the Annex for a list of all Iringa Districts and wards participating in the Demonstration Phase. This report provides the results from both the Pre-test and the Demonstration Phases.

National Scale-up Phase (Institutionalization)

The third phase is presently underway and devoted to national scale-up and rollout of the CRVS-VA strategy.

During this phase, the government aims at scaling VA to all regions in the country, given the evaluation results obtained from the previous two phases, while ensuring institutionalization and sustainability during the implementation process. The government also aims to ensure that the collected VAs are linked with Civil Registration Systems in different aspects (notification, registration, and causes of death data). Therefore, the Ministry of Health in collaboration with partners through the technical lead from the National Bureau of Statistics (NBS) established a national representative sample with 29 councils and 258 wards to which the implementation of VA is being scaled up in stages. Once VA is implemented in all areas of this sample, it will gather cause of death data from community deaths that are representative of national, regional, and selected districts as represented in Annex 5.

1.5 Rationale for a National Verbal Autopsy Sample System for community deaths

Annually, about 350,000 deaths are expected in Tanzania (Fig. 1.1). Given about 70% of those deaths occur in the community without the MCCD, this hinders a comprehensive overview of the national mortality and cause of death data [4]. To estimate the national and regional picture, a VA sampling strategy is recommended to reduce operational and implementation costs. WHO recommends a stratified, multi-stage, cluster proportional to population size sampling design for routine VA implementation linked to national systems including CRVS [18].

The cluster size recommended by WHO is between 5,000 and 25,000 population size. In Tanzania, this corresponds to the 4th administrative level, i.e. the Ward (Kata). Conveniently, this is also the level of decentralization for CRVS and death registration in Tanzania. The cluster definition is driven by operational, logistical, and statistical considerations. A cluster is the geographic catchment population for a single VA-trained and equipped interviewer to be able to reach all eligible community deaths in their catchment area. The populations of one cluster will experience 2-4 deaths per month which is an ideal workload to be added to the other ward-level duties of a single part-time, ward-level VA interviewer.

The sample size calculation in Tanzania has made certain adjustment assumptions: 1) VA will be done only on community deaths without an MCCD in each sample ward (approximately 70% of all deaths in most rural wards), and 2) expect an under-notification of death of 25%.

The final stratified sample randomly selected one District (including Municipal, Town, and District Councils) from each of the 26 Regions in mainland Tanzania (Fig 1.2). It then drew a sample of 10 wards from each district by probability-proportional-to-size (PPS) sampling resulting in 258

wards in the National CRVS-VA strategy. One selected district had less than 10 wards hence not 260 wards. The full list of selected Wards by Councils and Regions is provided in Annex 5.

This sample is expected to conduct slightly over 9,000 VAs per year (about 25 deaths per day across the country or 3 deaths per ward per month) (Table 1.3). This will provide the leading 20 Cause-Specific Mortality Fractions at the national level separately for males and females, both urban and rural (self-weighted). The sample will also provide the top 10 CSMFs for males at the sample district level and the top 5 CSMFs for all ages at each regional level.

Table 1.3 Demographics of selected wards in the CRVS-VA sample. *

Indicator	Indicator Value
Total population of 30 selected Councils	12,042,726 people
Total population of 258 selected Wards	4,319,735 (36 % of population under surveillance)
Total Population of 170 selected Rural Wards	2,699,427 (62 % of population)
Total Population of 88 selected Urban Wards	1,620,308 (38 % of population)
Mean Population Density of Rural Wards	15,879 per ward
Mean Population Density of Urban Wards	18,413 per ward
Mean population density of all wards	16,743 per ward
Estimated total number of expected annual deaths in the sample	18,135 per year
Estimated total number of annual VA's per national sample	9,521 per year
Estimated total number of monthly VA's per national sample	793 per month
Estimated total number of monthly VA's per District in sample	31 per month
Estimated total number of monthly VA's per Ward in sample	3.1 per month (the Ideal number for VA workload for part time interviewer)

* Note: There are 30 selected councils since, in Dar es Salaam Region, the 10 selected large population wards are distributed across the five municipal councils.

Finally, as a principle, it is recognized that conducting VA on a sample of community deaths is only a temporary measure until such time as medical certification of deaths is available to all. Implementation of VA must not compete with strengthening MCCD in CRVS.

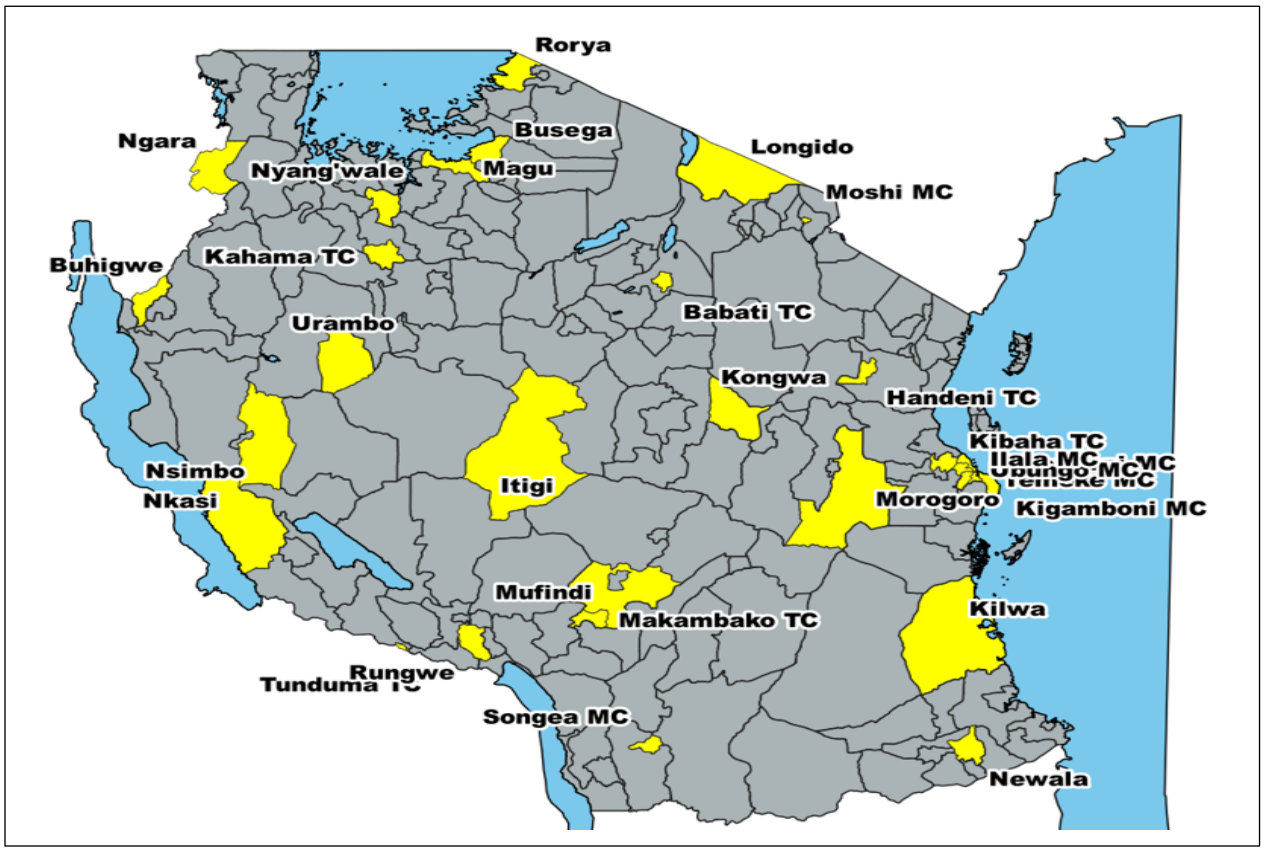

Fig. 1.2 Location of districts (rural, town, and municipal councils) (yellow) hosting ten wards each in the proposed national CRVS-VA system.

Chapter 2: Methods

2.1 VA Fieldwork

Ten Ward Pre-test Phase

The Ten Ward Pre-test Phase was conducted in the Northern and Eastern Zones of Tanzania (Tanga, Morogoro, and Pwani Regions) from May 2017 to December 2019. In this phase the technical procedures necessary for VA data collection were tested. The Ministry of Health used Community Health Workers (CHWs) to conduct verbal autopsy interviews in the household, as it was stipulated in the national health policy of the year 2007, that this cadre should be engaged in all community health-related interventions. Only 2 out of 20 identified verbal autopsy interviewers were government employees. The Ministry of Health paid for VAs conducted on a monthly basis. The CHWs reported directly to the Community Based Health Programs Coordinator (CBHPCo) at the Council level.

Iringa Demonstration Phase

The VA demonstration phase was conducted from October 2018 to December 2020 in the Iringa Region (Southern Highlands Zone). The demonstration phase aimed at testing processes and systems integration issues for VA implementation, and determining whether it could be possible to implement VA in each ward in all regions of the country. It was also decided to collect VA data for all deaths that occurred in health facilities as well as those that occurred in the community. Given the decentralization of CRVS to the Ward level, and given the purpose of enhancing institutionalization and sustainability of VA activities, the MoH and PoRALG decided to use government employees (Community Development Officers, Environmental Health Officers, and Ward Executive Officers) for VA data collection exercise. They received monthly incentives for the VA conducted.

2.2 Source populations and demographics

The ten wards participating during the Pre-test Phase were selected from both rural and urban councils of Mkuranga DC, Kisarawe DC, Morogoro MC, Chalinze DC, and Tanga CC. The total population of the Ten Ward Pre-test Phase in 2017 was 143,670 (rural - 107,355 and urban - 36,315). The urban: rural ratio was 0.34 as presented in the Annex 3. The 106 Wards participating in the Iringa Demonstration Phase were from (Iringa MC, Iringa DC, Kilolo DC, Mafinga TC, and Mufindi DC). The total population in 2019 was 1,122,131. The urban: rural ratio was 1:3. During the demonstration phase, all wards from urban and rural councils were implementing VA. The population and status of all Demonstration wards are provided in Annex 4.

2.3 CRVS Death notification

Death notification to relevant authorities is the required gateway step to facilitate official legal civil registration and certification of death, and also to the determination of the cause of death using MCCD and VA [19]. The Tanzania Births and Deaths Registration Act (CAP.108 Amended June 23, 2019) requires each death to be notified to the civil registry at the ward or health facility level. Deaths in the community are notified to the Ward Executive Office (WEO) and provided with a unique notification ID number. The notification ID is later used to register the death event and to obtain a death certificate. This ID number is also carried forward into the VA questionnaire.

Table 2.1 shows the completeness of VA data collected in the 10 pre-test wards in the year 2018. Tanga CC was the leading Council with many deaths conducted in VA interviews, followed by Kisarawe DC. At the same time, Chalinze DC was the one that submitted the least number of verbal autopsy events through the VA Manager System. Overall completeness was 38.3%.

Table 2.1 VA Completeness in 10 Pre-test wards (2018)

District	Population	CDR	Expected Deaths in 2018	No. of Submitted VAs	Completeness
Mkuranga DC	38,343	6.5	249	66	26.5%
Kisarawe DC	12,705	6.5	83	60	72.7%
Chalinze DC	56,307	6.5	366	74	20.2%
Morogoro MC	22,292	6.5	145	91	62.8%
Tanga CC	14,023	6.5	91	67	73.5%
Total	**143,670**	**6.5**	**934**	**358**	**38.3%**

Table 2.2 shows the completeness of VA data collected in the 106 Demonstration wards in the year 2019. Kilolo DC was the district that had the most verbal autopsy events interviewed and submitted into the VA Manager System, followed by Iringa DC, while Iringa MC was the district submitting the least number of verbal autopsy events into the VA Manager System. Overall completeness was 22.7%.

Table 2.2 VA Completeness in 106 Demonstration wards in Iringa Region

District	Population	CDR	Expected Deaths in 2018	Number of Submitted VAs	Completeness
Mafinga TC	87,714	6.5	570	73	12.8%
Kilolo DC	255,787	6.5	1,663	587	35.3%
Iringa MC	186,140	6.5	1,210	88	7.3%
Mufindi DC	291,919	6.5	1,897	340	17.9%
Iringa DC	300,571	6.5	1,954	571	29.2%
Total	**1,122,131**	**6.5**	**7,294**	**1,659**	**22.7%**

2.4 VA Cause of death tabulation and ICD coding

The WHO Standard VA instrument allows ascertainment of the causes of death using 68 aggregated target cause lists using CCVA (Table 2.3). However, with PCVA, Physicians can either use the WHO target cause list or country-specific CoD tabulation list based on ICD-10 [Annex 7] for ascertaining the probable underlying cause of death. See Chapter 3 and 4 for PCVA and CCVA results respectively.

Table 2.3. WHO Verbal Autopsy target cause list sorted by ICD-10 code and colour coded to major cause groups*.

	WHO 2016 VA Target Causes (68 causes)				
No.	Cause	ICD-10	No.	Cause	ICD-10
1	Diarrheal diseases	**A09**	35	Ectopic pregnancy	**O00**
2	Pulmonary tuberculosis	**A16**	36	Other and unspecified maternal cause	**O05**
3	Neonatal tetanus	**A33**	37	Abortion-related death	**O06**
4	Tetanus	**A34**	38	Pregnancy-induced hypertension	**O13**
5	Tetanus Obstetric	**A35**	39	Pregnancy-induced hypertension (eclampsia)	**O15**
6	Pertussis	**A37**	40	Obstetric haemorrhage (ante partum)	**O46**
7	Sepsis	**A41**	41	Obstructed labour	**O66**
8	Dengue fever	**A90**	42	Ruptured uterus	**O71**

	WHO 2016 VA Target Causes (68 causes)				
9	Haemorrhagic fever	**A99**	43	Obstetric haemorrhage (post partum)	**O72**
10	Measles	**B05**	44	Pregnancy-related sepsis (ante partum)	**O75**
11	HIV/AIDS related death	**B24**	45	Pregnancy-related sepsis (post partum)	**O85**
12	Malaria	**B54**	46	Anemia of pregnancy	**O99**
13	Unspecified infectious disease	**B99**	47	Prematurity	**P07**
14	Oral neoplasm	**C06**	48	Birth asphyxia	**P21**
15	Digestive neoplasms	**C26**	49	Neonatal pneumonia	**P23**
16	Respiratory neoplasms	**C39**	50	Neonatal sepsis	**P63**
17	Breast neoplasms	**C50**	51	Fresh stillbirth	**P95**
18	Female reproductive neoplasms	**C57**	52	Macerated stillbirth	**P95**
19	Male reproductive neoplasms	**C63**	53	Other and unspecified perinatal cause of death	**P96**
20	Other and unspecified neoplasms	**C80**	54	Congenital malformation	**Q89**
21	Sickle cell with crisis	**D57**	55	Acute abdomen	**R10**
22	Severe anemia	**D64**	56	Other and unspecified non-communicable disease	**R99**
23	Diabetes mellitus	**E14**	57	Cause of death unknown	**R99**
24	Severe malnutrition	**E46**	58	Road traffic accident	**V89**
25	Meningitis and encephalitis	**G03/04**	59	Other transport accident	**V99**
26	Epilepsy	**G40**	60	Accidental fall	**W19**
27	Acute cardiac disease (ischemic)	**I24**	61	Accidental drowning and submersion	**W74**
28	Stroke	**I64**	62	Accidental exposure to smoke, fire and flames	**X09**
29	Other and unspecified cardiac disease	**I99**	63	Contact with venomous animals and plants	**X29**
30	Acute respiratory infection, Pneumonia	**J18/22**	64	Exposure to force of nature	**X39**
31	Chronic obstructive pulmonary disease (COPD)	**J44**	65	Accidental poisoning and exposure to noxious substances	**X49**
32	Asthma	**J45**	66	Other and unspecified external cause of death	**X59**
33	Liver cirrhosis	**K74**	67	Intentional self-harm	**X84**
34	Renal failure	**N19**	68	Assault	**Y09**

Colour codes:
Group 1 Communicable (14 causes)
Group 1 Neonatal (9 causes)
Group 1 Maternal (13 causes)
Group 2 Non-communicable (21 causes)
Group 3 Injuries (11 causes).

2.5 VA Data Collection

The Pre-Test Phase (ten wards) of the VA implementation used the WHO 2016 VA Instrument version 1.4 and the demonstration phase (106 Iringa Region wards) used the 2016 WHO VA Instrument version 1.5.1. Both versions of the WHO VA instruments were translated to Kiswahili and the local context and were localized to include administrative location hierarchy lookup values (ward names, etc.). In addition, the team added a specific question to capture the death notification number from the death notification report, a question to capture whether the deceased was taken to a health facility, a question to indicate the GPS location of the interview, and an extra set of questions to capture health insurance utilization.

2.6 VA Interviewer Training

Training of the verbal autopsy interviewers was conducted at the beginning of each VA data collection phase. Each training session lasted for approximately five days and was divided into two parts, Part one for in-class theory which included a session on 1) an introduction to CRVS and VA; 2) the roles and responsibilities of each key stakeholders for VA and CRVS implementation which includes RITA, PORALG, MOH, NBS, NIDA, the community, the family, and collaborating partners; 3) tools for conducting VA; 4) how to identify a death event; and 5) how the notification process is completed. Part two covered field practical which included: 1) mock/field interviews, 2) use of tables for VA interviews and 3) feedback and modifying the processes. The training also covered the overall aspect of VA and its relevance to vital statistics. During VA training, participants read question by question the VA questionnaire and discussed how to properly probe and capture responses from interviewees. The second part covered the use of digital devices (tablets) to conduct VA interviews. Training participants were taught: 1) how to manage and operate the tablet device (power on, off, and charging); 2) how to conduct VA interviews using a tablet and the installed Open Data Kit (ODK) application, and 3) tablet configurations and data transmission to the central MoH server.

2.7 VA Informed Consent

Before each VA interview, the interviewees read the informed consent (Annex 8) and were explained the significance of collecting VA data. The summary of the informed consent is also provided on the tablet for easy reference. The digital VA questionnaire is programmed such that

only after the consent is received, specific parts of the VA are opened up, otherwise the questionnaire goes to the end and terminates.

2.8 VA Data technologies

The VA data is collected digitally using Android tablet devices. Tablet devices are installed with an Open Data Kit (ODK) application which further allows the programming of the VA instrument with logic, validation, and skip patterns. After a complete VA interview, the interviewer pushes a submit button which sends the data to the ODK central server at the Ministry of Health.

2.9 VA Data flow, management and processing

Verbal Autopsy Manager (VMan)

VA questionnaire data is processed and stored in an online ODK Aggregate server. Verbal Autopsy Manager (VMan, https://vatools.net/vman) is an online tool used for viewing and analyzing VA data. VMan connects to the ODK Aggregate Server and provides human-readable content of VA documents. In addition, VMan provides summary statistics of VA data by date, location of the interview, gender and age groups defined in the VA instrument. VMan can also use geo-location coordinates gathered in the VA instrument to display a map showing interview locations. An example of a VMan dashboard is displayed in Figure 2.1. The VMan gives data managers the ability to filter and search VA records using different data dimensions and also gives the ability to open a single VA document for reading and analyzing data qualities.

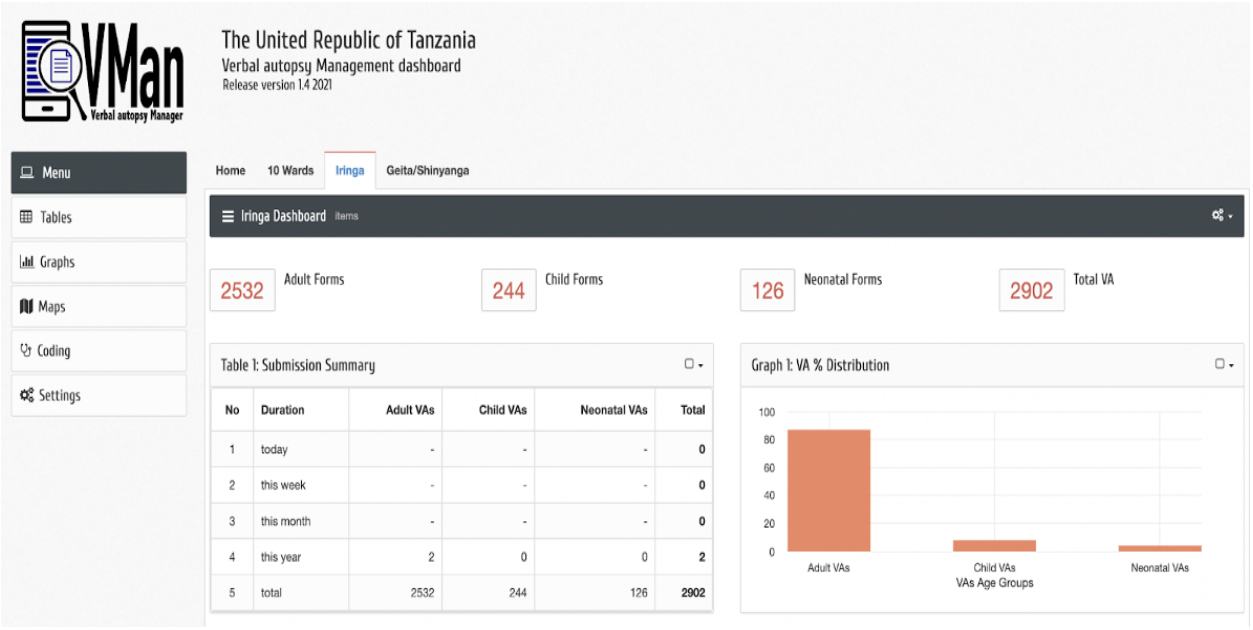

Fig 2.1 VMan Dashboard

openVA

openVA (https://www.openVA.net) is a compilation of tools, software, and algorithms for processing VA data to obtain cause of death information. openVA can be downloaded and run on a local machine using R statistical software, using docker container technology, or Python scripts [20]. openVA uses as input, the WHO VA questionnaire response data from ODK in comma-separated (CSV) format and outputs individual-level causes and cause-specific mortality fractions in tables and graphics as computed by a choice of three types of CCVA diagnostic algorithms (InSilicoVA, InterVA5, and Tariff2).

Computer-coded VA (CCVA)

Computer-coded VA uses algorithms assessing signs, symptoms, and other variables from VA data to assign the most probable underlying cause of death information to VA records. The VA data in CSV format is downloaded from the ODK Aggregate server. VA data is then processed in openVA using either of the three algorithms defined above. The result is a list of VA records together with the assigned cause of death information. Three CCVA algorithms were used in this reporting period (InterVA5, InSilicoVA, and Tariff2) and compared with PCVA.

InterVA5

InterVA is a computer model to facilitate interpretation of the verbal autopsies and provides cause of death information. InterVA was developed by Peter Byass at the Umea University Centre for Global Health Research, Sweden in the 1990s and has benefited from extensive development in Africa and Asia. Basic information on InterVA can be found at http://www.byass.uk/interva/ and in this working paper [21]. InterVA5 is the latest release of InterVA with backward compatibility with its predecessor versions. InterVA inputs data collected using the WHO standard VA Instrument and the SmartVA instrument. It outputs respective CSMFs for each of the WHO Standard VA target causes (Table 2.1). InterVA is a computational model inspired by Bayes' Theorem. It uses symptom-cause information (SCI) elicited from experts to compute propensities associated with each cause for each death. Cause-specific mortality fractions (CSMF) are calculated by adding up the individual-level propensities. InterVA identifies 'indeterminate' as a cause of death when none of the cause-specific propensities for a death exceed 0.4.

InSilicoVA

InSilicoVA is a VA cause-coding algorithm developed by Richard Li, Tyler McCormick, and Samuel J. Clark. [22] It is among the VA algorithms distributed in the openVA suite of tools for processing VA data (https://openVA.net/). Similar to InterVA, InSilicoVA input data are collected using the same standard WHO VA interviews. InSilicoVA computes individual causes of death and the population-level cause-specific mortality fractions (CSMF). InSilicoVA uses a probabilistic

mathematical model to combine symptom-cause information (either elicited from experts or derived from reference deaths) with verbal autopsy symptoms to classify deaths by cause. InSilicoVA uses information on both the presence and absence of symptoms and produces: 1) at the individual level, estimated distributions of the probabilities of being associated with each cause, and 2) at the population level, distributions for each CSMF. These distributions are consistent with one another by design and relay information about both central tendency and uncertainty. InSilicoVA reports the mean cause-specific probabilities and mean CSMFs, along with uncertainty about both. InSilicoVA does not identify 'indeterminate' as a cause of death; rather, deaths that are hard to classify receive more uncertain cause classifications, and that uncertainty is propagated to the corresponding CSMFs.

Tariff2

Tariff 2.0 is another method for assigning COD information using the VA questionnaire responses. Tariff uses a score method for items in the questionnaire based on the number of times a respondent answered 'yes' to a symptoms question for a particular COD. The Tariff method does not rely on expert opinion on symptom-cause association but uses the PHMRC Gold Standard VA dataset [23,24]. More details about Tariff methods are available at https://www.healthdata.org/data-tools-practices/verbal-autopsy.

Physician-coded VA (PCVA)

For PCVA, VMan user accounts were created for each physician coder, and instructions provided on how to log in to the VMan online portal were communicated. For each of the two paired physician coders, an initial set of VA forms was assigned. Physicians were given access to login into the VMan portal and complete the VA coding exercise. The VMan portal was pre-loaded with WHO ICD-10 codes according to a cause list provided by the Government of Tanzania. The list of PCA causes with ICD-10 codes is provided in Annex 7B. For each of the assigned VA documents, a physician could complete up to four probable causes of death, selecting from the supplied list of causes and ICD-10 codes.

Determining the underlying cause of death by PCVA

Each single VA document was assigned to two physician coders. The physician coding work was done independently and blinded by reviewing VA data and assigning the probable cause of death according to the protocols based on WHO ICD-10. If the final cause of death from two coders was the same, then the underlying cause of death is derived along with the ICD-10 code. If otherwise, the two coders use the built-in messaging feature to resolve the discordance. A complete coded VA contains the agreed final cause of death from the two coders. The coding window is presented in Figure 2.2.

The rationale for moving from PCVA to CCVA is driven by the increasing success of CCVA in closely emulating the CSMFs produced by PCVA but at a lower cost and faster turnaround time. This also frees physicians time to care for the living.

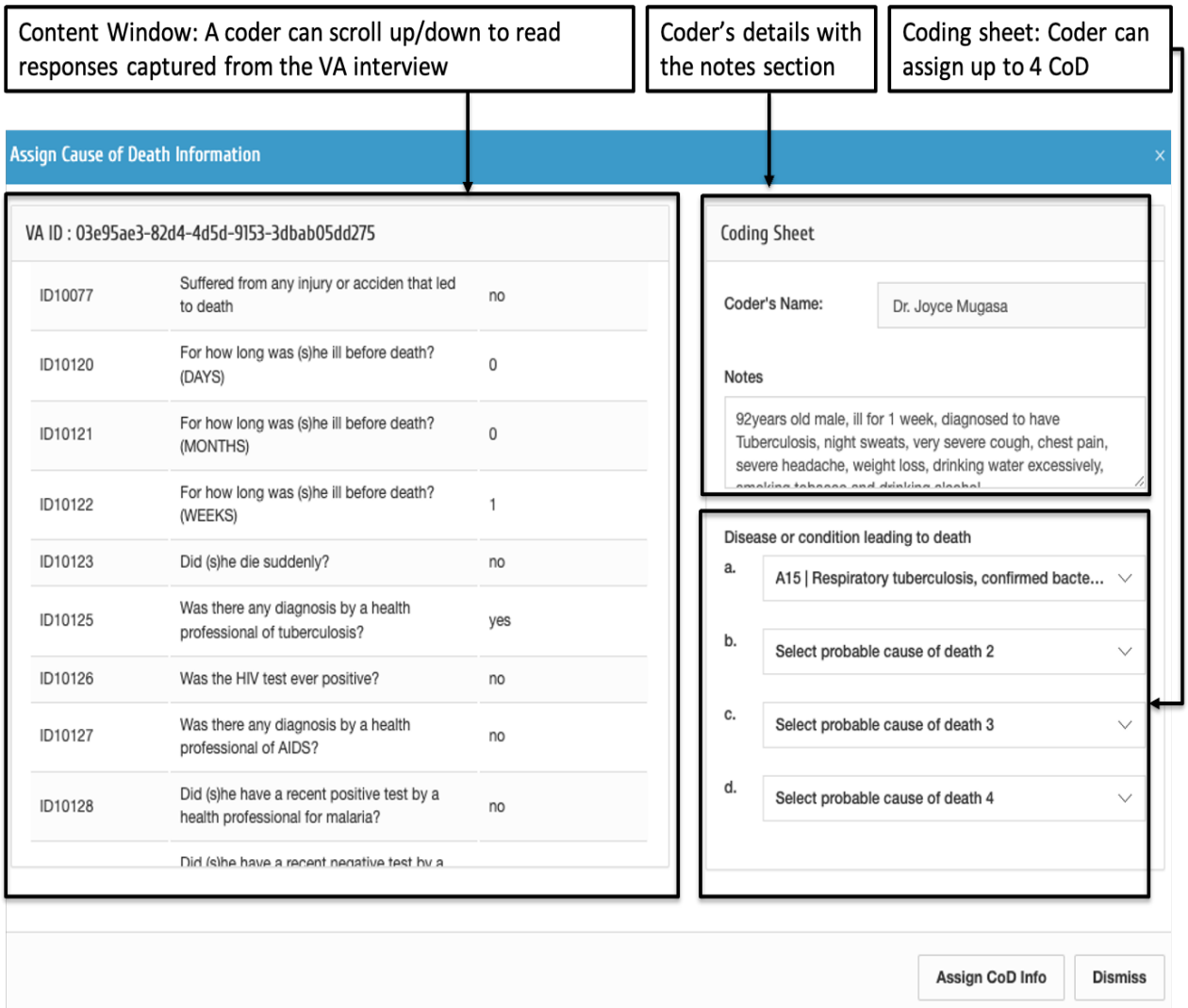

Figure 2.2: PCVA Coding Windows. Source: VMan Version 1.4

Discordant cause of death occurs when a single VA receives unmatched final causes of death from the two physician coders. When this happens, the VA document is marked as discordant and presented back to the physician coder for a second review. The discordant review allows the coder to re-examine the VA document, revise coding notes, and update the underlying cause of death. The discordant review also allows a coder to exchange notes (through the VMan built-in SMS functionality) with the counterpart coder, who remains anonymous. Discordant VAs can be resolved as they occur.

2.10 VA Data security

The CRVS VA data collection and management follows the Tanzania HIS guidelines for data security and data sharing [25]. VA interviews are done using tablet devices which are configured for two-level password authentication. 1) A device login using a device password, and 2) application login using application specific credentials. Only authenticated devices can submit data to the data repository. In addition, the VA interview gathers additional security metadata such as mobile device identification (IMEI), interview GPS coordinate locations and timestamps. This information can be used to enrich the security assessment and authentication of the CRVS data.

The CRVS VA data server is housed within the MOH server clusters. This further ensures that the system complies with the MOH server securities for data and equipment protection. The server is installed with HTTPS for safer transmission of data and only authorized personnel can access and configure server resources. The CRVS server is also configured with a routine backup mechanism in order to safeguard against data loss.

Chapter 3: Cause of Death Results from Physician-Coded Verbal Autopsies (PCVA)

3.1 Introduction

The PCVA certification and coding exercises were completed according to the International Classification of Disease version 10 (ICD-10) which was adapted to the Tanzania settings through the Ministry of Health.

3.2 Major causes of death

The distribution of causes of death aggregated into the three main broad causes according to the WHO standard classification is displayed in Figure 3.1. The broad cause Group 1 represents all deaths due to communicable, maternal, neonatal, and nutritional diseases; Group 2 represents those due to non-communicable diseases and Group 3 represents deaths from injuries and external causes. Groups 1 and 2 account for almost 90% of all deaths in the VA data set. The ratio of Group 2 to Group 1 is 0.88. The ratio seen in mortality data for health facilities (collected in DHIS2) for the same time period is 0.50 in the year 2020 (ANACoD3) indicating that this series of community deaths have a higher degree of non-communicable disease causes compared with health facility deaths. This is an interesting finding and may be explained if cases with terminal chronic non-communicable diseases may be returning home at end of life rather than dying in health facilities. Hence the true burden of NCDs may be more evident in community data as seen with verbal autopsy. Injuries constitute over 10% of deaths. Again, this is a much higher share than seen in the health facility deaths where physicians code only 3.2% of deaths due to injury in 2021 (ANACoD3). This is possible because at the hospital and health facility level, physicians often erroneously code the specific trauma as the cause of death and not the cause of the trauma (specified external cause) as the underlying cause of death.

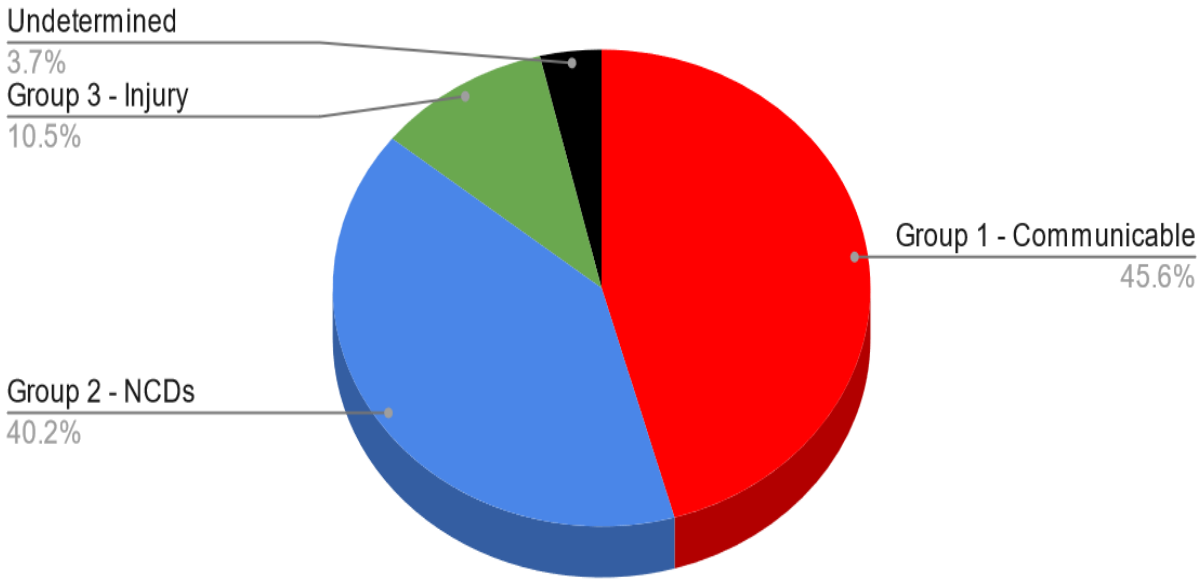

Fig 3.1 Broad causes of death for community deaths

The distribution of broad causes of death disaggregated by sex is in Table 3.1. It shows that the majority of deaths in the data set are in males (54%). Although males have a higher risk of age-specific premature mortality, the total number of male and female deaths in a population in any given common time period should be roughly equal. This suggests that there is possibly a bias against female deaths being notified to the civil registrar or available for verbal autopsy. It is well known that in many CRVS systems, there is a gender bias in recording deaths. If this is so here, it merits follow-up with RITA.

Table 3.1 Causes of death by broad causes disaggregated by sex.

Broad group	Female (N, %l)	Male (N, %)	Total (N, %)
Group 1 Communicable	787 (21.9%)	856 (23.8%)	1643 (45.6%)
Group 2 NCDs	729 (20.2%)	717 (19.9%)	1446 (40.2%)
Group 3 Injuries	93 (2.6%)	286 (7.9%)	379 (10.5%)
Undetermined & ill-defined	56 (1.6%)	77 (2.1%)	133 (3.7%)
Total	**1,665 (46.2%)**	**1,936 (53.8%)**	**3,601**

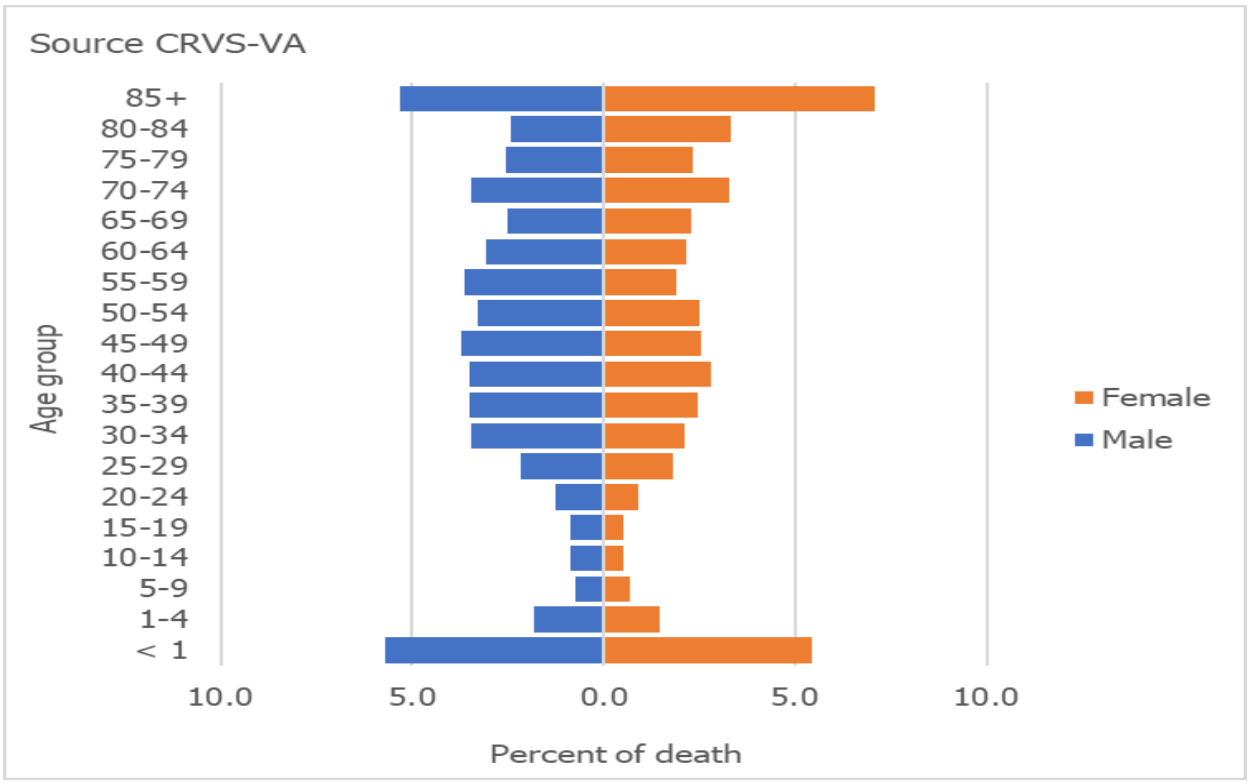

Figure 3.2a. Death pyramid from community deaths recorded by CRVS-VA

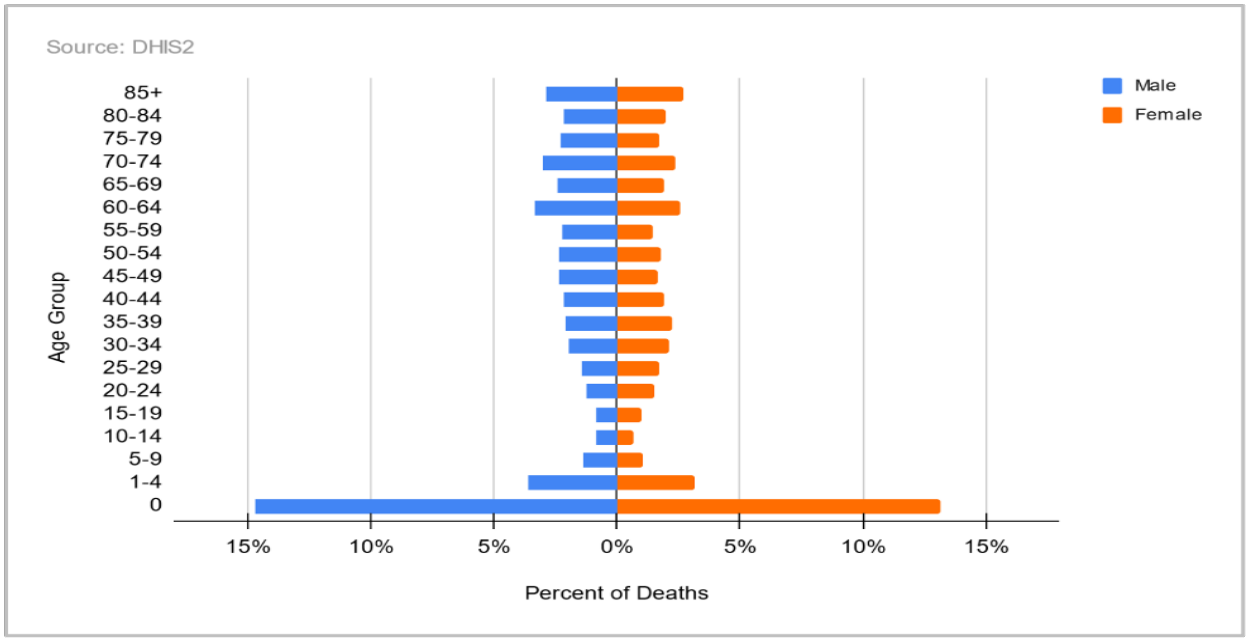

Figure 3.2b. Death pyramid from health facility deaths recorded by DHIS2-MCCD

The death pyramids above contrast the age-specific death proportions recorded by CRVS-VA in predominantly community deaths with the proportions recorded by MCCD in the DHIS2 health facility data in the same administrative jurisdictions. The differences in proportions are

predominantly visible in the youngest and oldest age groups. As expected, more child deaths are seen in health facilities while more elderly deaths are seen in the community. However, the specific causes of these deaths may differ across all ages as will be seen later in this report.

Table 3.2 Causes of death by broad cause disaggregated by age groups

Broad group	Neonate (% total)	Post neonate (% total)	1-4yrs (% total)	5-15yrs (% total)	16-24yrs (% total)	25-59yrs (% total)	60+ yrs (% total)	Unknown (% total)	Total (% total)
Group 1 Com	139 (3.9%)	100 (2.8%)	74 (2.1%)	46 (1.3%)	52 (1.4%)	764 (21.2%)	467 (13.0%)	1 (0.0%)	**1643 (45.6%)**
Group 2 NCDs	6 (0.2%)	15 (0.4%)	20 (0.6%)	25 (0.7%)	32 (0.9%)	473 (13.1%)	875 (24.3%)	0 (0.0%)	**1446 (40.2%)**
Group 3 Injuries	0 (0.0%)	8 (0.2%)	25 (0.7%)	38 (1.1%)	33 (0.9%)	198 (5.5%)	77 (2.1%)	0 (0.0%)	**379 (10.5%)**
Undetermined & ill defined	9 (0.2%)	14 (0.4%)	4 (0.1%)	4 (0.1%)	7 (0.2%)	34 (0.9%)	61 (1.7%)	0 (0.0%)	**133 (3.7%)**
Total	**154 (4.3%)**	**137 (3.8%)**	**123 (3.4%)**	**113 (3.1%)**	**124 (3.4%)**	**1469 (40.8%)**	**1480 (41.1%)**	**1 (0.0%)**	**3601**

The distribution of deaths by broad cause group, disaggregated by age group is in Table 3.2. The table shows that 40.8% and 41.1%, are coming from the adult age groups 25-59 years and 60+ years respectively and account for 82% of all deaths.

Table 3.3 Causes of death by major causes disaggregated by residency.

Cause of death	Residency: N (%)		Total (N=3,601)
	Rural (N=3303)	Urban (N=298)	Total
Communicable	1,327 (40.2%)	106 (35.6%)	1,433 (39.8%)
Other NCD	1,123 (34.0%)	117 (39.3%)	1,240 (34.4%)
Injuries	352 (10.7%)	27 (9.1%)	379 (10.5%)
Cancers	185 (5.6%)	21 (7.0%)	206 (5.7%)
Neonatal	130 (3.9%)	13 (4.4%)	143 (4.0%)
Maternal	32 (1.0%)	3 (1.0%)	35 (1.0%)
Nutritional	30 (0.9%)	2 (0.7%)	32 (0.9%)
Ill defined & Undetermined	124 (3.8%)	9 (3.0%)	133 (3.7%)
	100%	**100%**	**100%**

The distribution of deaths by major causes, disaggregated by the residency status of the deceased (urban or rural) is shown in Table 3.3. The majority of deaths are found in rural residents. This is not surprising as the VA implementation focused largely on community deaths outside of health facilities. The burden of communicable diseases appears to be slightly higher in the rural settings (40.2%) compared to the urban settings (35.6%), whereas other NCDs appear to be slightly higher in urban settings (39.3%) compared to 34% in the rural settings.

Table 3.4 Causes of death by major causes disaggregated by broad age groups

Cause of death	Age Groups							N
	0-28 Days	29-364 Days	1-4 Years	5-15 Years	16-24 Years	25-59 Years	60+ Years	
Communicable	0.1%	6.4%	4.9%	3.1%	3.0%	51.2%	31.1%	1,433
Other NCD	0.5%	1.2%	1.5%	1.4%	2.3%	31.5%	61.5%	1,240
Injuries	0.0%	2.1%	6.6%	10.0%	8.7%	52.2%	20.3%	379
Cancers	0.0%	0.0%	0.5%	3.9%	1.5%	39.8%	54.4%	206
Neonatal	95.8%	4.2%	0.0%	0.0%	0.0%	0.0%	0.0%	143
Maternal	0.0%	0.0%	0.0%	0.0%	22.9%	77.1%	0.0%	35
Nutritional	0.0%	6.3%	12.5%	3.1%	3.1%	9.4%	65.6%	32
Ill defined & Undetermined	6.8%	10.5%	3.0%	3.0%	5.3%	25.6%	45.9%	133
Total	4.3%	3.8%	3.4%	3.1%	3.4%	40.8%	41.1%	**3,600**

* One death did not have age information, hence excluded in this table

Table 3.4 summarizes the major causes of death by broad age groups. Results are consistent with what is expected from GBD estimates.

3.3 Specific causes of death

This section expands the broad cause groups to show the major causes within each group and specific causes within each major cause.

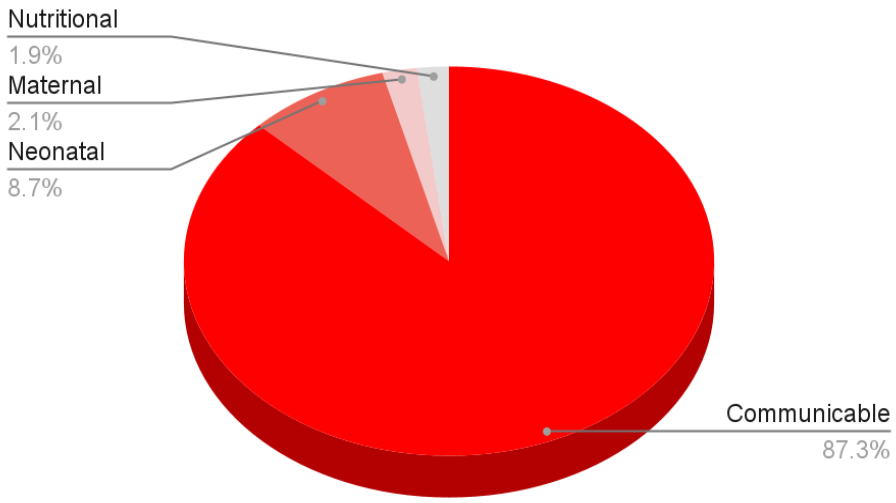

Fig. 3.2 Major causes in Group 1 Communicable, Neonatal, Maternal and Nutritional.

Fig 3.2 shows the distribution of causes of death in Group 1 which constitutes 45.6% of all deaths (n=1,643). Of these, most deaths are due to the following major causes: communicable infectious diseases (87.3%, n=1,433), followed by neonatal causes (8.7%, n=143), maternal causes (2.1%, n=35) and nutritional causes (1.9%, n=32). In subsequent graphics we show the distribution of specific causes in each of these major causes.

Communicable causes

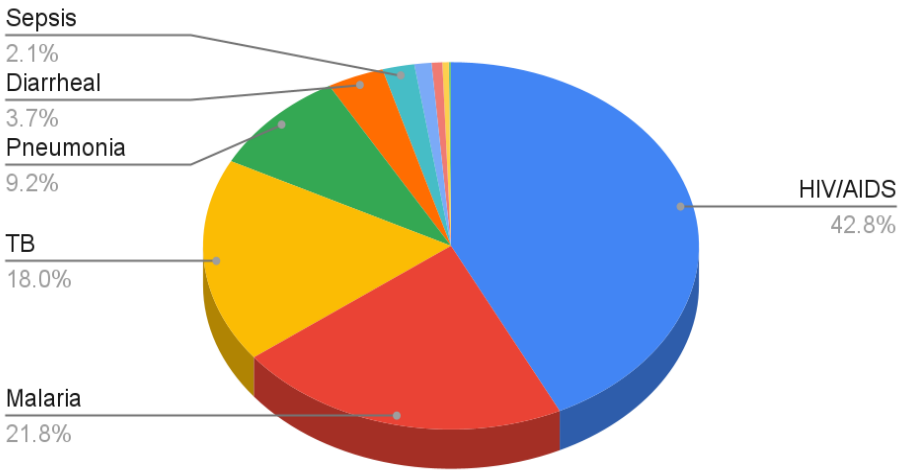

Fig. 3.3 Specific causes in Group 1 Communicable diseases

Disaggregating the communicable diseases (which account for 46.9% of all deaths; n=1,643) into the specific causes, HIV/AIDs-related deaths lead with 42.8% of Group I Communicable, followed by malaria, TB and pneumonia. See Fig. 3.3. The actual shares of these causes from among all deaths are provided in Figs. 3.9, 3.10, 3.11, and 3.12.

Neonatal causes

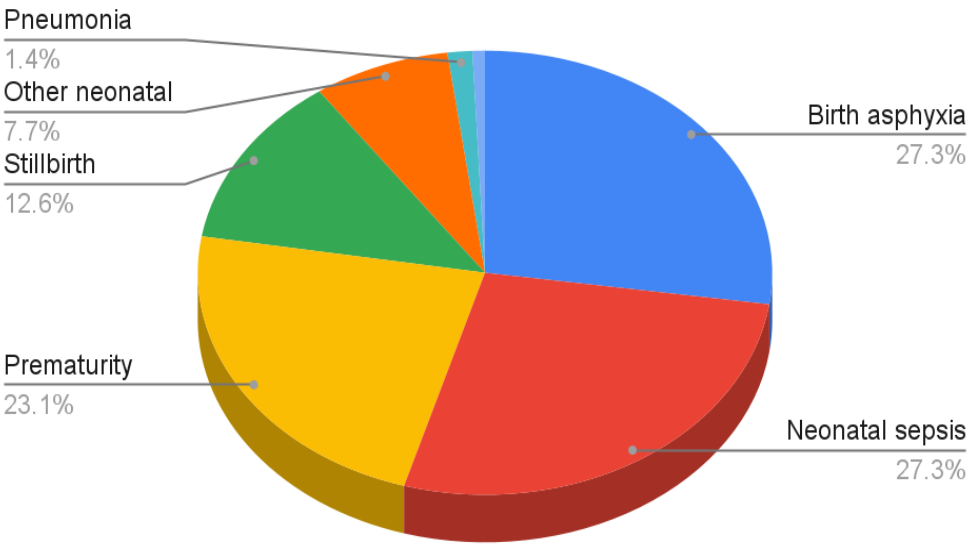

Fig. 3.4 Specific causes in Group 1 Neonatal.

Neonatal causes constitute 5.1% (n=143) of total deaths. They are composed of almost equal shares due to birth asphyxia, neonatal sepsis, prematurity (low birth weight) and stillbirths. Currently stillbirths are not registered in CRVS in Tanzania, however, VA is designed to also capture stillbirths. Health system responses need to be multifaceted to respond to this and this in part is why perinatal mortality reduction progress is so slow. (See Fig. 3.4).

Maternal causes

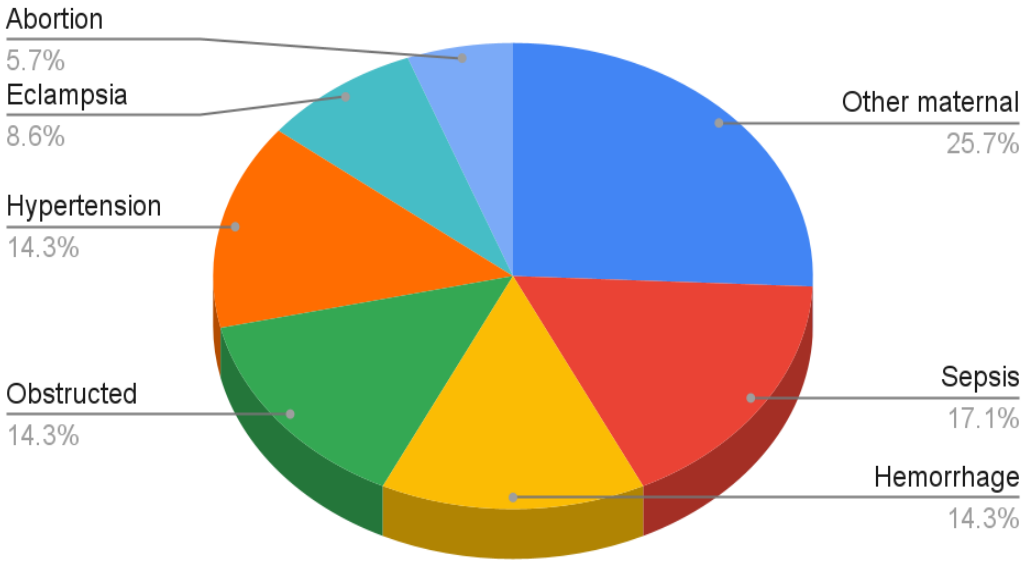

Fig. 3.5 Specific causes in Group 1 Maternal.

Although the maternal mortality ratio to 100,000 live births in Tanzania is high, the actual share of all deaths that are due to maternal causes is relatively low at 0.97% (n=3,601) of all deaths, but 2.1% (n=1,665) of all deaths in women. The specific causes of these deaths are relatively equally distributed among sepsis (n=6), hemorrhage (n=5), obstructed labor (n=5), hypertension (n=5), eclampsia (n=3) and abortion (n=2) (Fig. 3.5), again demanding a polyvalent health system response with diverse interventions.

Non-communicable diseases

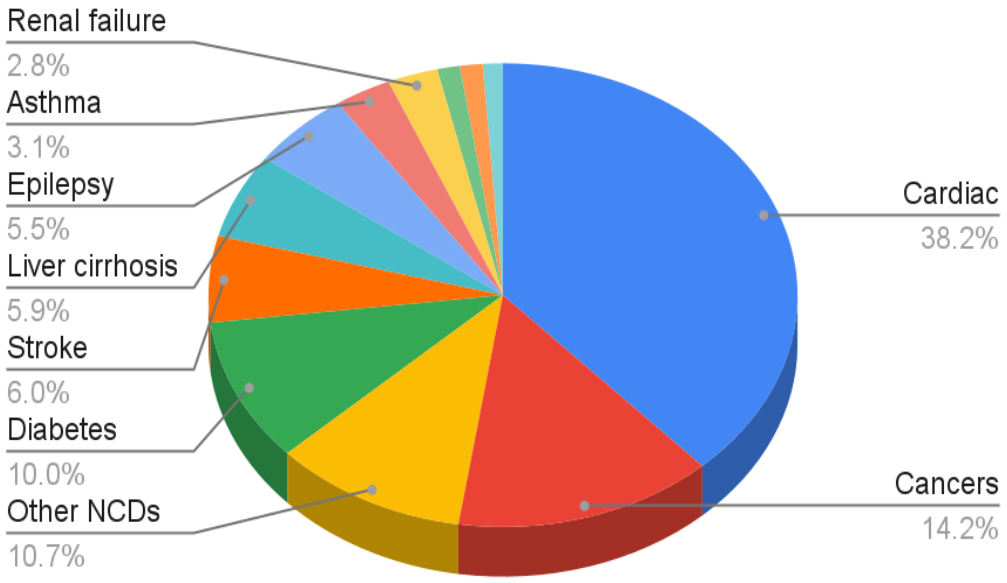

Fig. 3.6 Causes in Group 2 Non-communicable diseases.

Group 2, non-communicable disease is the second-largest broad cause of death which accounts for 42% (N=1,446) of all deaths. Most prominent among these are the various cardiac diseases, followed by, cancers, other NCDs, diabetes, stroke, liver cirrhosis, epilepsy, asthma and renal failure (Fig. 3.6).

Cancers

Cancers are a leading cause of death in Group 2. A verbal autopsy is not capable of determining the site of all cancers but can detect certain ones. The VA-detectable cancer types include oral neoplasms, digestive neoplasms, respiratory neoplasms, male reproductive (prostate) and female reproductive (uterine) neoplasms, and breast neoplasms. All others are classified as other and unspecified neoplasms.

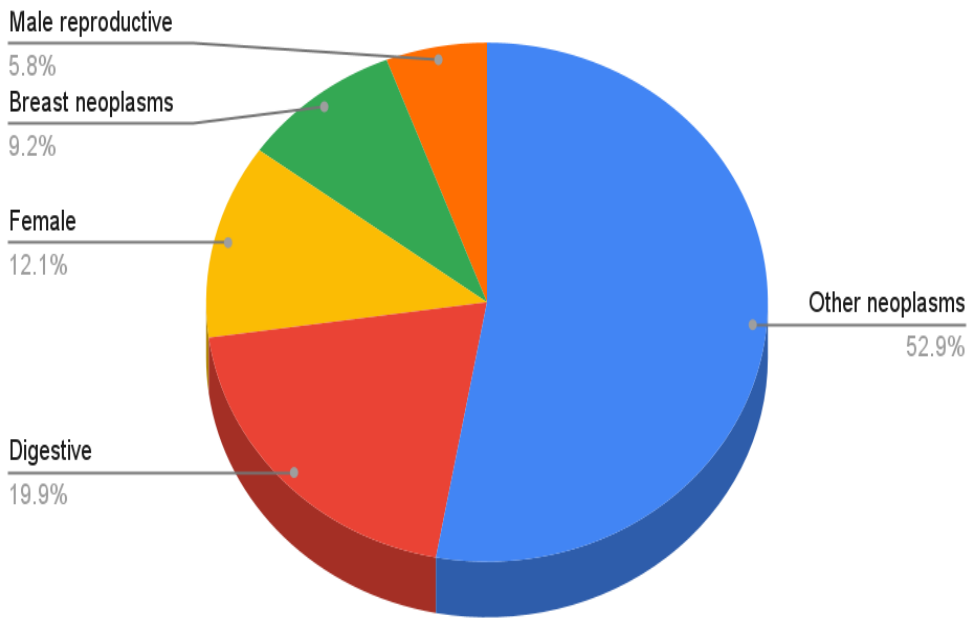

Fig. 3.7 Specific causes in Group 2 NCD cancers.

Cancers constituted 5.7% (N=206) of all deaths. The leading cancers are digestive, female cancers, breast neoplasm, and male reproductive cancers (Fig. 3.7.)

Injuries

Group 3 Injuries consist of all external causes not included in Groups 1 and 2. These constitute 10.2% (N = 379) of all deaths with the majority of deaths due to injuries (61%) were among adults aged 16-59 years. This is consistent with the proportions seen worldwide in both low-income and high-income countries.

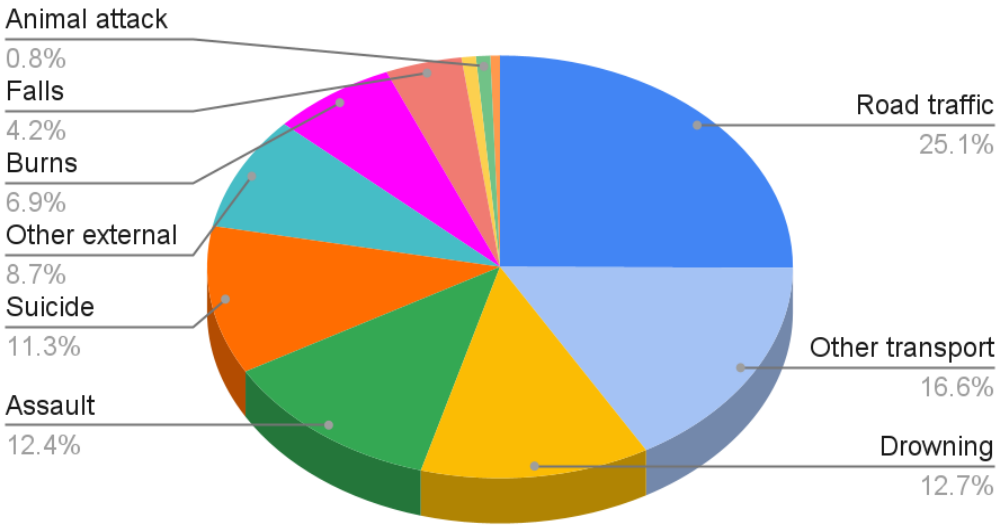

Fig. 3.8 Specific causes in Group 3 Injury.

In this VA data set, road traffic fatalities and fatalities due to other vehicular transport constitute almost half of these deaths (42%). Road traffic deaths in Tanzania are considered to be grossly underestimated in official statistics, census data, compared with Global Burden of Disease estimates [26] . The high rate of road traffic fatality could be associated with the exponential increase in ownership of motorized vehicles, particularly motorcycles, presently exceeding bicycle ownership at over 45% of all households. The next largest cause of injury death is drowning, followed by suicide, burns and falls. There are clear public service priorities (beyond the health sector) required to respond to these causes, particularly road safety and drowning (See Fig. 3.8). For example, 52.1% of drowning deaths are children under the age of 15 years.

Leading specific causes of death (top 30)

The above section has provided summary data on the aggregate causes of death by broad and major causes, and age groups. We now provide the leading individual causes of death irrespective of groups. Figs 3.9, 3.10, 3.11 and 3.12 display the top 20 leading causes contributing to the burden of disease ranked by their cause-specific mortality fractions in the PCVA data for males and females.

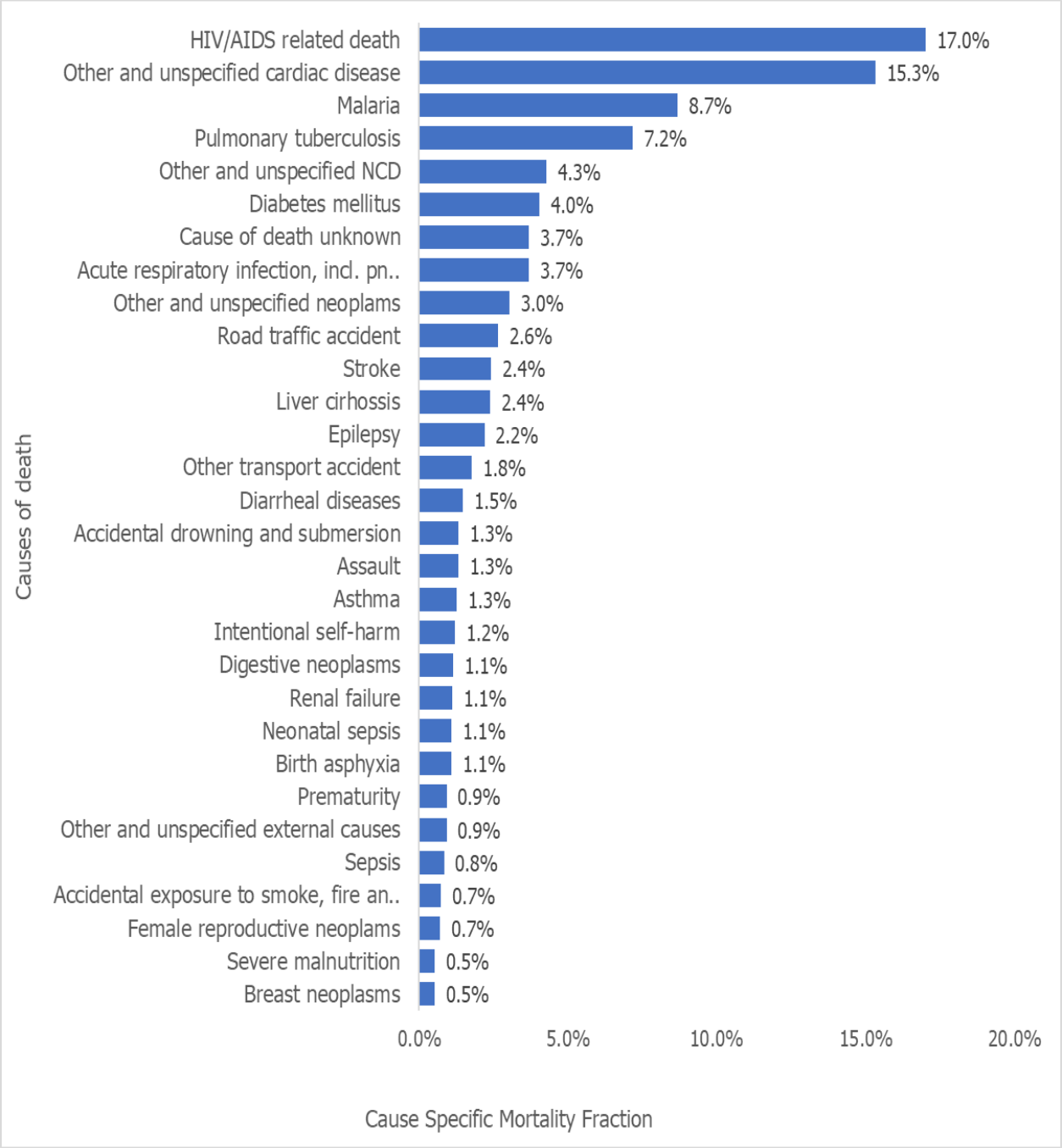

Fig. 3.9 Top 30 specific causes of death from Physician Coded Verbal Autopsy (PCVA).

Overall, HIV/AIDS, other and unspecified cardiac conditions, malaria, pulmonary tuberculosis, and other and unspecified NCDs dominate. These five causes contribute over half of all deaths, followed by a variety of non-communicable and infectious causes such as diabetes mellitus, acute respiratory infection including pneumonia, others and unspecified neoplasms, road traffic accidents, stroke and epilepsy. Aside from malaria, acute respiratory infections including

pneumonia, diarrheal diseases and birth asphyxia, many of the top causes occur in adulthood. These top 20 causes constitute 84.4% of all deaths recorded.

Leading causes of death among females

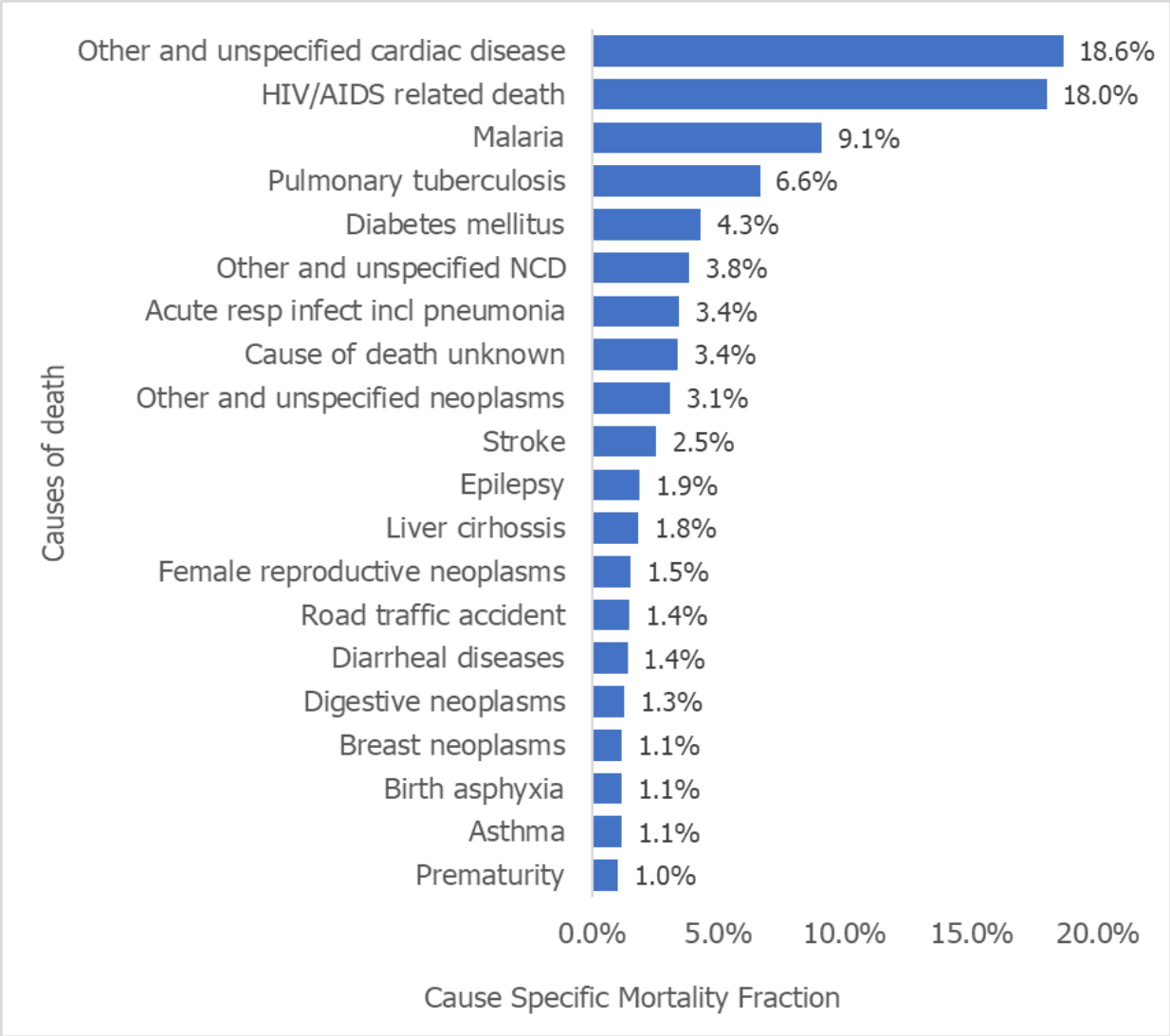

Fig. 3.10 Leading causes of death in females

The Figure above shows the 20 leading causes of death in females by rank. These leading 20 causes constitute 86.4% of all female deaths recorded. Other unspecified cardiac diseases, HIV/AIDS-related death, malaria, pulmonary tuberculosis and diabetes mellitus are very common. Maternal and cancer-related causes were also observed in the rank of top 20 causes of death in females. The remaining causes are characterized by a mixture of external causes and

degenerative and communicable diseases. This overall pattern indicates that the health transition towards non-communicable and lifestyle diseases has started to advance in Tanzania.

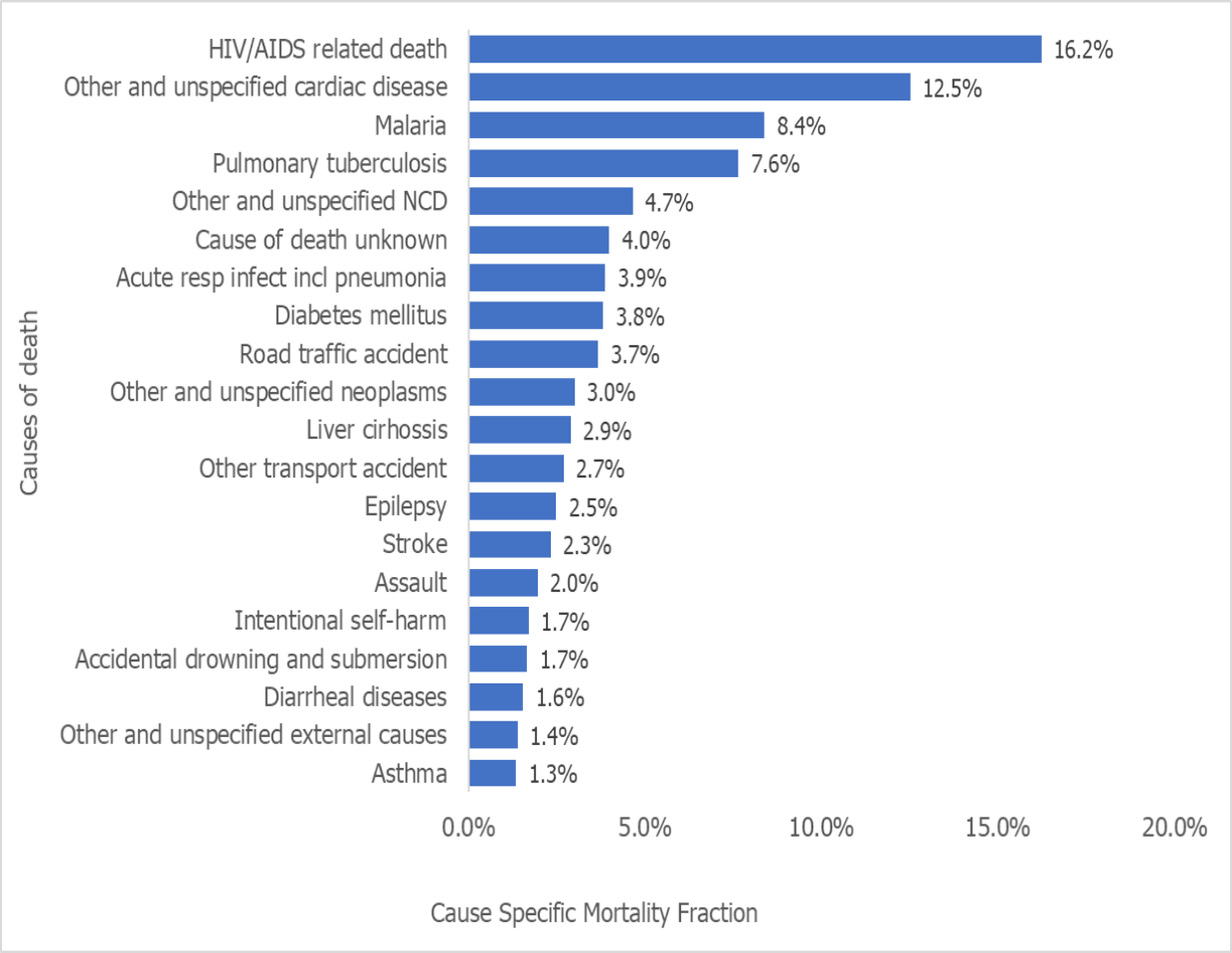

Fig. 3.11 Leading causes of death in males.

Figure 3.11 presents the 20 leading causes of death in males by rank. In this group, HIV/AIDS ranks first and is followed by other and unspecified cardiac diseases, malaria, pulmonary tuberculosis and other and unspecified NCDs. These leading 20 causes constitute 87.7% of all male deaths recorded. Males are also more affected by external factors such as road traffic accidents, other transport accidents, assault, intentional self-harm and drowning. As a majority of the top 20 causes of death in males are characterized by a mixture of external causes and degenerative diseases it indicates the gradual shift of the burden of disease in Tanzania from communicable to non-communicable conditions.

Looking at both male and females, HIV/AIDS-related deaths, other and unspecified cardiac diseases, malaria, pulmonary tuberculosis and other and unspecified NCDs are still dominating in both sexes. However, females are more affected by HIV/AIDS-related deaths and other unspecified cardiac diseases than males. On the other hand, males are more affected by

pulmonary tuberculosis, other and unspecified NCDs, road traffic accidents, renal failure, epilepsy, assault and accidental drowning than females. Female reproductive and breast neoplasms have appeared only in females.

Leading causes of death by residency urban or rural

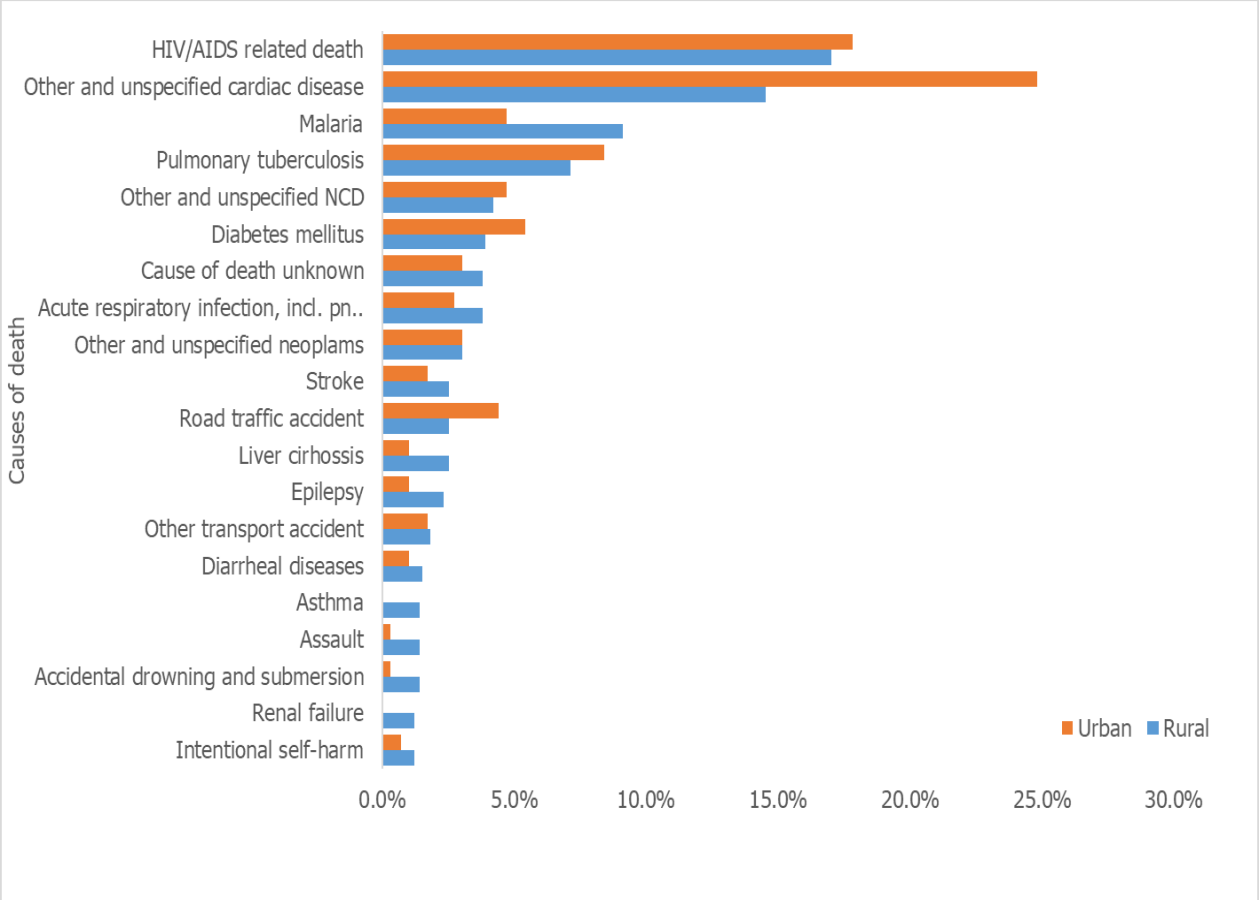

Fig. 3.12 Leading causes of death by Rural / Urban residency.

Leading causes of death by urban-rural status is shown in Fig. 3.12. Urban predominates for cardiac diseases, diabetes, and road traffic fatalities, while rural predominates for malaria, liver cirrhosis, epilepsy, drowning, assault and suicide. This further supports the observations made above regarding the epidemiological transition in Tanzania.

Chapter 4: Cause of Death Results from Computer-Coded Verbal Autopsies (CCVA)

4.1 Concordance of CCVA with PCVA

To make comparisons, it was necessary to aggregate some of the 195 causes recorded in PCVA by mapping them to the 57 possible target VA causes (See Table 2.1) for which the questionnaire was designed. There were 52 common diagnoses in this VA data set. A listing of the leading Cause Specific Mortality Fractions (CSMFs) as seen separately by PCVA and three different CCVA methods are provided in Table 4.1.

Note that these ranked lists are independent and not concordances. Concordances of CSMFs are shown in Sections 4.2 and 4.3.

Table 4.1 Leading cause-specific mortality fractions for 3,601 deaths as determined by Physician certified VA (PCVA) and by computer-coded VA (CCVA) using InterVA5, InSilico VA, and Tariff diagnostic algorithms.

No	PCVA	CSMF (%)	InterVA5	CSMF (%)	InSilicoVA	CSMF (%)	Tariff2	CSMF (%)
1	HIV/AIDS related death	17.0	HIV/AIDS related death	18.8	HIV/AIDS related death	15.3	Undetermined	16.3
2	Other and unspecified cardiac disease	15.3	Other and unspecified cardiac dis	10.0	Other and unspecified cardiac dis	12.3	AIDS	13.7
3	Malaria	8.7	Stroke	6.1	Other and unspecified infect dis	9.0	Stroke	9.1
4	Pulmonary tuberculosis	7.2	Digestive neoplasms	5.9	Acute cardiac disease	5.3	Ischemic Heart Disease	8.9
5	Other and unspecified NCD	4.3	Acute cardiac disease	5.5	Acute resp infect incl pneumonia	5.3	Malaria	8.1
6	Diabetes mellitus	4.0	Road traffic accident	5.0	Pulmonary tuberculosis	5.0	Road Traffic	4.6
7	Cause of death unknown	3.7	Pulmonary tuberculosis	5.0	Road traffic accident	4.4	Diabetes	4.5
8	Acute respiratory infection, incl. pneumonia	3.7	Acute resp infect incl pneumonia	4.1	Stroke	4.4	Other Non-communicable Diseases	4.1
9	Other and unspecified neoplasm	3.0	Diabetes mellitus	3.8	Digestive neoplasms	4.3	TB	3.3 %
10	Road traffic accident	2.6	Undetermined	3.6	Other and unspecified NCD	4.0	Pneumonia	2.4 %
11	Stroke	2.4	Diarrhoeal diseases	2.3	Acute abdomen	2.7	Maternal	2.3
12	Liver cirrhosis	2.4	Other and unspecified infect dis	2.1	Other and unspecified neoplasms	2.3	Chronic Respiratory	2.2

13	Epilepsy	2.2	Assault	1.9	Diabetes mellitus	2.0	Diarrhea/Dysentery	1.5
14	Other transport accident	1.7	Not Processed	1.8	Not processed	1.8	Cirrhosis	1.3
15	Diarrheal diseases	1.5	Liver cirrhosis	1.8	Assault	1.6	Breast Cancer	1.2
16	Accidental drowning and submersion	1.3	Other and unspecified neoplasms	1.7	Liver cirrhosis	1.5	Chronic Kidney Disease	1.1
17	Assault	1.3	Malaria	1.6	Malaria	1.4	Falls	1.1
18	Asthma	1.2	Birth asphyxia	1.4	Accidental fall	1.4	Drowning	1.0
19	Intentional self-harm	1.2	Renal failure	1.3	Diarrhoeal diseases	1.4	Other Injuries	0.9
20	Digestive neoplasms	1.1	Epilepsy	1.2	Renal failure	1.1	Suicide	0.9
21	Renal failure	1.1	Reproductive neoplasms MF	1.2	Pregnancy-related sepsis	1.1	Digestive Diseases	0.8
22	Birth asphyxia	1.1	Accidental fall	1.1	Accidental drowning and submersion	1.0	Fires	0.8
23	Neonatal sepsis	1.1	Prematurity	1.1	Birth asphyxia	0.9	Neonatal Pneumonia	0.8
24	Other and unspecified external causes	0.9	Respiratory neoplasms	1.0	Epilepsy	0.9	Other Infectious Diseases	0.8
25	Prematurity	0.9	Meningitis and encephalitis	1.0	Other transport accident	0.9	Leukemia/Lymphomas	0.7
26	Sepsis	0.8	Acute abdomen	0.9	Intentional self-harm	0.7	Homicide	0.7
27	Accidental exposure to smoke, fire an..	0.7	Accidental drowning and submersion	0.8	Prematurity	0.7	Stillbirth	0.7 %
28	Female reproductive neoplasm	0.7	Accidental expos to smoke fire & flame	0.8	Respiratory neoplasms	0.6	Esophageal Cancer	0.6
29	Breast neoplasms	0.5	Other and unspecified NCD	0.7	Severe malnutrition	0.6	Cervical Cancer	0.6
30	Severe malnutrition	0.5	Sepsis (non-obstetric)	0.7	Reproductive neoplasms MF	0.6	Birth asphyxia	0.5
31	Congenital malformation	0.5	Intentional self-harm	0.6	Neonatal sepsis	0.6	Childhood Cancer	0.5
32	Sickle cell with crisis	0.5	Obstetric hemorrhage	0.6	Neonatal pneumonia	0.5	Preterm Delivery	0.4
33	Stillbirth	0.5	Pregnancy-related sepsis	0.6	Obstetric hemorrhage	0.4	Prostate Cancer	0.4
34	Accidental fall	0.4	Breast neoplasms	0.4	Exposure to force of nature	0.4	Meningitis	0.4
35	Chronic obstructive pulmonary diseases	0.4	Other and unspecified external CoD	0.4	Breast neoplasms	0.3	Lung Cancer	0.4
36	Meningitis and encephalitis	0.4	Severe malnutrition	0.4	Macerated stillbirth	0.3	Neonatal Meningitis/Sepsis	0.4
37	Severe anemia	0.4	Sickle cell with crisis	0.4	Meningitis and encephalitis	0.3	Bite of Venomous Animal	0.3
38	Male reproductive neoplasms	0.3	Oral neoplasms	0.3	Sepsis (non-obstetric)	0.3	Childhood Cardiovascular Diseases	0.3

39		Other and unspecified perinatal causes	0.3		Macerated stillbirth	0.3		Congenital malformation	0.3		Sepsis	0.3
40		Haemorrhagic fever	0.3		Chronic obstructive pulmonary dis	0.3		Accidental expos to smoke fire & flame	0.3		Colorectal Cancer	0.2
41		Other and unspecified maternal causes	0.2		Fresh stillbirth	0.3		Fresh stillbirth	0.3		Congenital malformation	0.2
42		Pregnancy-related sepsis	0.2		Congenital malformation	0.3		Oral neoplasms	0.3		Stomach Cancer	0.2
43		Unspecified infectious disease	0.2		Other transport accident	0.2		Haemorrhagic fever (non-dengue)	0.2		Other Defined Causes of Child Deaths	0.2
44		Obstetric hemorrhage	0.1		Accidental poisoning & noxious subs	0.2		Accidental poisoning & noxious subs	0.2		Hemorrhagic fever	0.1
45		Obstructed labor	0.1		Neonatal sepsis	0.2		Other and unspecified neonatal CoD	0.1		Other Cancers	0.1
46		Pregnancy-related hypertension	0.1		Pregnancy-induced hypertension	0.1		Sickle cell with crisis	0.1		Poisonings	0.1
47		Accidental poisoning and exposure to noxious substances	0.1		Asthma	0.1		Abortion-related death	0.1		Encephalitis	0.1
48		Contact with venomous animals and plant	0.1		Neonatal pneumonia	0.1		Chronic obstructive pulmonary dis	0.1		Other Cardiovascular Diseases	0.0
49		Eclampsia	0.1		Other and unspecified maternal CoD	0.1		Ruptured uterus	0.1			
50		Abortion-related death	0.1		Abortion-related death	0.1		Dengue fever	0.1			
51		Exposure to force of nature	0.1		Dengue fever	0.1		Other and unspecified external CoD	0.1			
52		Measles	0.1		Exposure to force of nature	0.1		Severe anemia	0.1			
53		Neonatal pneumonia	0.1		Anemia of pregnancy	0.0		Anemia of pregnancy	0.0			
54		Neonatal tetanus	0.0		Contact with venomous plant/animal	0.0		Contact with venomous plant/animal	0.0			
55					Ectopic pregnancy	0.0		Ectopic pregnancy	0.0			
56					Haemorrhagic fever (non-dengue)	0.0		Pertussis	0.0			
57					Pertussis	0.0		Pregnancy-induced hypertension	0.0			
58					Severe anemia	0.0						

* Note, 0.0 is a rounding down of small numbers of the observed deaths.

4.2 Concordance of cause specific mortality fractions by scatter plot regression

A way to appreciate the statistical concordance among the different methods is through log-log scatter plots of the CSMFs. Since the distribution of causes of death is always exponential, i.e. skewed to a few dominant causes but with many less frequent causes, we plot the logs of the CSMFs as shown in Fig. 4.1.

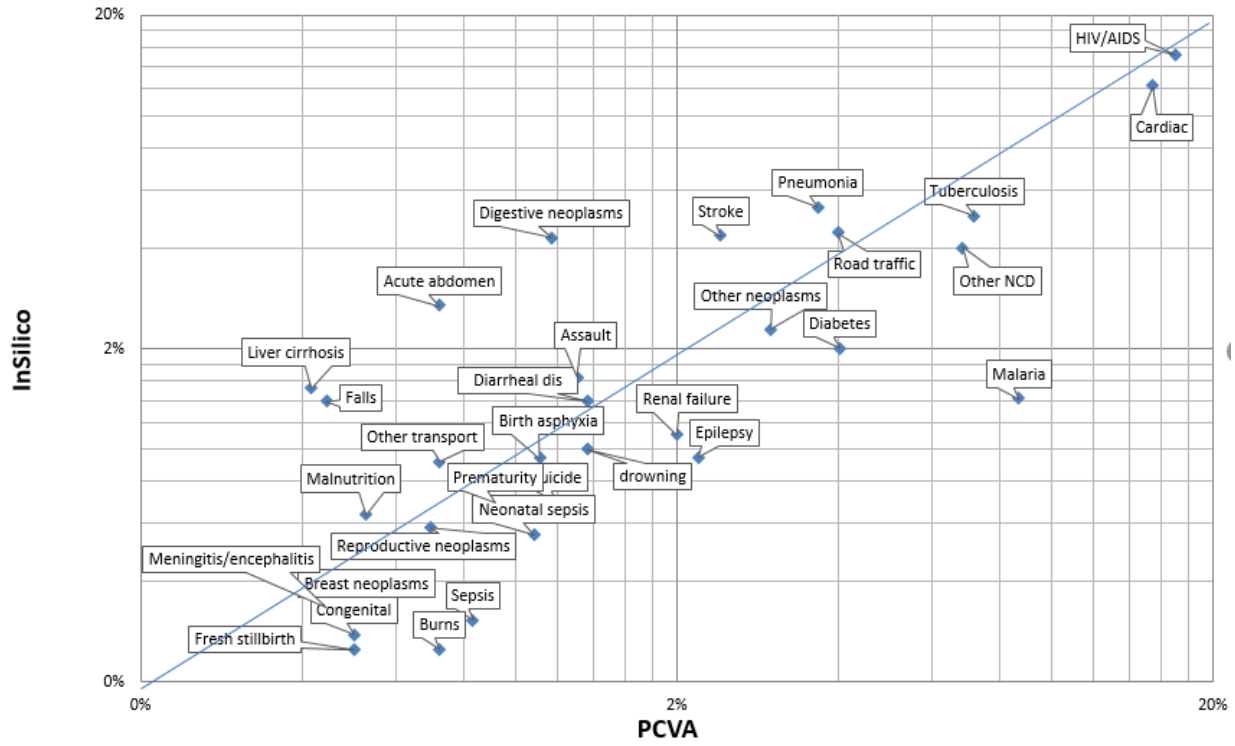

Fig. 4.1 Scatter plot showing the PCVA to CCVA InSilicoVA concordance for cause-specific mortality fractions for the leading 52 PCVA target causes from 3,601 verbal autopsies.

Figure 4.1 shows the cause fractions plotted close to the diagonal have the highest concordance. The zero intercept is a CSMF of 0.2% of deaths. The concordance of PCVA with InSilicoVA has a linear regression R-square coefficient of 0.83 on a scale of 0 to 1.0 where 1.0 is perfect agreement and 0 is no agreement. InterVA5 also has a good concordance R-square coefficient of 0.70. Tariff2 performs less well with an R-square coefficient of 0.47 (Table 4.2). This suggests that InSilicoVA and InterVA5 have good concordance with PCVA. This is especially so for the leading 10 causes of death.

Table 4.2 Linear regression concordance of Computer Coded VA with Physician Coded VA CSMFs

	InSilicoVA	InterVA5	Tariff2
PCVA	0.83	0.70	0.47

4.3 Concordance of individual causes by confusion matrix

Concordance of CSMF is the most useful measure of comparative performance of CCVA with PCVA as shown in Fig. 4.1. However, examination of individual cause of death discordance can also provide some additional insights.

			InsilicoVA																						
			Group 1: Communicable								Group 2: Non Communicable										Group 3: Injuries				
			ARI incl. pneumonia	Diarrhoeal diseases	HIV/AIDS related death	Malaria	Pregnancy-related sepsis	Pulmonary tuberculosis	Acute abdomen	Unspecified infectious disease	Diabetes mellitus	Digestive neoplasms	Epilepsy	Liver cirrhosis	Acute cardiac disease	Other and unspecified cardiac disease	Other and unspecified NCD	Other and unspecified neoplasms	Renal failure	Stroke	Accid drowning and submersion	Accidental fall	Assault	Road traffic accident	Other transport accident	PCVA - N
PCVA	Group 1: Communicable	ARI incl. pneumonia	28%		1%	2%	8%	2%	1%	7%	1%		3%		6%	3%	1%			2%						132
		Diarrheal diseases		26%					10%	3%		3%			1%		3%			1%		2%				53
		HIV/AIDS related death	6%	4%	81%	4%	24%	16%	7%	4%	4%	8%	3%	7%	10%	1%	5%	2%	3%	5%		6%	2%	3%	6%	613
		Malaria	10%	20%	3%	75%	13%	4%	11%	27%	8%	7%	9%	5%	7%	3%	15%	7%	5%	6%					3%	313
		Pregnancy-related sepsis					8%										1%									6
		Pulmonary tuberculosis	9%	2%	2%	6%	3%	57%	3%	5%	1%	6%		5%	9%	9%	3%	7%	5%	1%		2%	3%	2%	3%	258
		Acute abdomen																								0
		Unspecified infectious disease	1%	2%										2%	1%					1%						6
	Group 2: Non Communicable	Diabetes mellitus	5%	4%	1%	2%		3%	6%	3%	40%			4%	5%	5%	6%	2%	8%	11%		6%		1%	6%	145
		Digestive neoplasms			1%			1%		1%		9%		2%			3%	7%		1%						41
		Epilepsy	2%	2%	1%		5%			1%	3%	1%	65%	2%	3%	3%	7%	1%		1%				1%		79
		Liver cirhossis		2%	1%		3%	1%	5%	4%	1%	18%	3%	33%	2%	1%	1%	2%	3%							86
		Acute cardiac disease																								0
		Other and unspecified cardiac disease	15%	8%	2%	6%	11%	3%	13%	10%	21%	14%		25%	21%	53%	13%	5%	40%	43%		10%				552
		Other and unspecified NCD	2%	10%	1%			1%	23%	10%	3%	11%		4%	4%	3%	13%	6%	20%	1%	3%			2%		154
		Other and unspecified neoplams	1%	2%	1%	2%	3%	2%	1%	4%	3%	11%		2%	1%	1%	1%	33%		1%		2%		2%	15%	109
		Renal failure	1%	4%				1%		2%		2%		2%	1%	1%	1%	4%	15%							40
		Stroke	2%		1%				4%	2%	8%	1%	3%		4%	1%	5%	7%		20%		2%			3%	87
	Group 3: Injuries	Accidental drowning and submersion													1%	1%	1%			2%	81%	2%				48
		Accidental fall																				30%				16
		Assault																			3%		73%	1%	0%	47
		Road traffic accident																			3%	8%	7%	52%	3%	95
		Other transport accident										1%										18%	3%	31%		63
		Casue of death unknown	3%	2%			5%	2%	7%	2%	3%	1%			17%	6%	10%	4%		4%				1%		133
		InSilico - N	191	49	548	51	36	177	90	318	70	152	34	55	159	415	129	79	40	150	36	50	59	159	33	3,601

Fig 4.2. Confusion matrix comparing InSilicoVA to PCVA

Figure 4.2 provides a contingency matrix of the shares of individual specific causes determined by InSilicoVA relative to PCVA. Cells are arranged by quadrants of the three broad cause groups of Communicable, Non-Communicable, and Injury causes. The total number of deaths for a particular cause is presented by column and row totals (N) for the two VA methods respectively. Percent shares along the diagonal show perfect positive agreement of PCVA with InSilicoVA at

the individual cause level while blank cells indicate perfect negative agreement. On the diagonal, the degree of agreement is displayed where the darker gray cells show the higher concordance, lighter shade indicates less concordance. Pair disagreements <1% are not shown. At the individual cause level there is 81% perfect agreement of Group 1 HIV/AIDS related deaths and 81% agreement in Group 3 for Accidental drowning and submersion. In the non-diagonal, non-blank cells, the numbers represent the percent of discordance for that cause. The highest number of disagreements came from Group 2 (NCDs) coding, where 43% of the InSilicoVA Stroke were assigned to Other and Unspecified diseases by the PCVA. Similarly, 40% of the InSilicoVA Renal Failure were assigned to Other and Unspecified diseases by the PCVA. The row totals range from a low of six deaths (Pregnancy related sepsis) to a high of 613 deaths (HIV/AIDS). Overall, there was 39.3% concordance across all causes including infrequent causes, and 86.5% agreement on negatives where both methods agree. Concordance on the leading cause (HIV/AIDS) was 77.5% with a Cohen's Kappa of 0.485 indicating chance corrected moderate agreement. For the leading three causes together (HIV/AIDS. Tuberculosis, and Cardiac conditions) there was agreement on 66.7% of cases with a Cohen's Kappa of 0.332 indicating chance corrected fair agreement.

4.4 Discordance of malaria deaths

The InSilicoVA and InterVA5 algorithms show good agreement at CSMF level with all PCVA causes with the exception of malaria (Fig 4.1). When there is discordance with physicians for a high-ranking cause it is important to unpack why that may be and assess which result is more plausible. For malaria, physician coders reported a CSMF of 8.7% of all deaths while InSilicoVA and InterVA5 recorded a much lower CSMF of 1.4% and 1.6% respectively. Almost all of the individual malaria discordances were found in the Iringa VA's. We consulted with the National Malaria Control Programme malaria risk stratification team who reported that Iringa Region has one of the lowest malaria parasitemia prevalences and transmission risks in Tanzania (2% for Iringa region and 7% for the country) [27]. They considered that malaria mortality at the level of 8.7% in Iringa was highly implausible and felt that the CCVA algorithmic result was more consistent with what is known about malaria in the Region. We also consulted the DHIS2 malaria mortality data for the Iringa Region for the same time period and found a low malaria CSMF of 2.2% in 2018 and 1.0% in 2019 corresponding well with the InSilicoVA and InterVA results. We also looked at the prevalence of the reported malaria positive laboratory diagnosis in the VAs. These observations raise the question of the degree to which a recent malaria positive laboratory diagnosis in the decedent's history may have overly influenced the physician to coding the cause of death to malaria, while the algorithm continued to explore the presence and absence of other signs and symptoms leading to an alternative underlying cause of death. Our conclusion is that physicians over-relied on the answers to the VA question on prior positive malaria test. The ambiguity of the time frame of the prior positive malaria test question needs to be better specified in the VA questionnaire.

4.5 Implications for best choice of CCVA algorithm

The experience documented in this report covering the first 3,601 verbal autopsies conducted as part of routine CRVS and DHIS2 operations provides sound evidence that the WHO standard verbal autopsy methodologies work well in Tanzania and can be taken to the next level of integration into the national health information ecosystem. Moreover, it concludes that both the InSilicoVA and the InterVA5 automated computer coded analytic procedures emulate very well the performance of physician coded VA at population level. CCVA is both considerably more rapid and cost effective than PCVA. The best performing CCVA algorithm was InSilicoVA with a CSMF physician concordance of 83%. InSilicoVA also has an advantage over InterVA5 and Tariff2 in that it does not deliver undetermined results. Moreover, the InterVA5 will likely be discontinued for further development and upgrades in favor of InSilicoVA. The implications of these results suggest that InSilicoVA should become the diagnostic method of choice for CRVS-VA in Tanzania.

Chapter 5: Health Systems Contexts of Deaths as Recorded from Verbal Autopsy Interviews

VA implementation during the demonstration phase in Iringa and the ten wards in the coast region was conducted for all deaths irrespective of place of death, not just community deaths.

5.1 Place of death for VA documented deaths

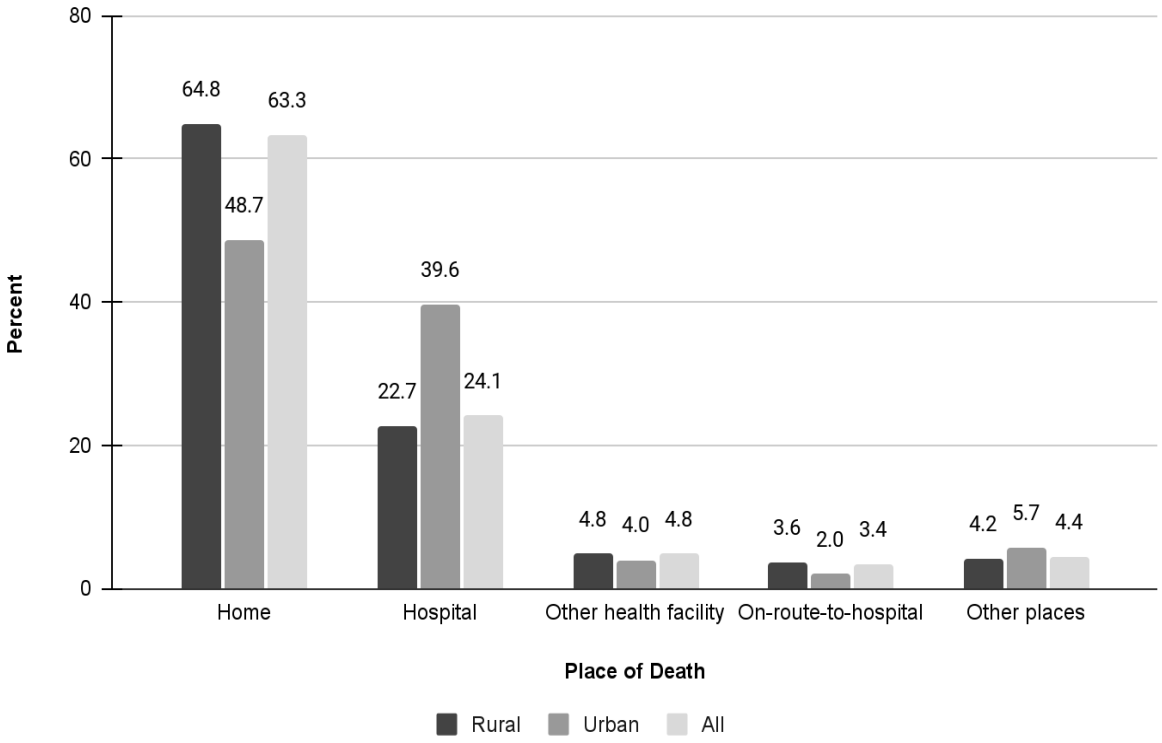

Fig. 5.1. Distribution of place of death in the population covered by VA

The place of death in the verbal autopsy study population is shown in Fig 5.1. It was observed that 71.1% of deaths occurred outside health facilities while 28.9% (27.5% rural and urban 43.6%) of deaths occurred in health facilities. There are higher chances of deaths occurring in health facilities in urban areas as compared to rural areas. This might be due to the lower level of service infrastructure and insufficiently timely referral in rural areas. This suggests the importance of strengthening the collection of community mortality data and its consideration when assessing the burden of disease and evaluating appropriate interventions to improve population health.

5.2 Civil registration status of VA documented deaths

The number of deaths registered by RITA CRVS by sex are shown in Table 5.1. The results show that a large proportion (69.4%) of deaths had been registered, and most with death certificates issued. This is a substantially higher rate than the national average of 10.3% (Table 1.1). This is likely a consequence of trying to integrate CRVS and VA.

Table 5.1 Deaths with VA according to death registration status*.

Death Registered by CRVS	Female		Male		All	
	Count	%	Count	%	Count	%
Yes	914	68.8	1,099	69.9	2,013	**69.4**
No	33	2	43	2.7	76	**2.6**
Unspecified	382	28.7	430	27.4	812	**28**
Total	**1,329**	**100**	**1,572**	**100**	**2,901**	**100**

* This table refers to deaths from Iringa Region.

76 deaths were reported as registered but did not yet have death certificates from the civil registry. And 812 had not been registered entirely, this group accounts for (28%) of the total verbal autopsies conducted. Nevertheless, this number needs to be reconciled with the number of expected deaths in the study period as presented in Table 2.2.

5.3 Civil registration death certificate status of VA documented deaths

Whether or not a death certificate for the death was issued is in Table 5.2. Results show that 63.8% of the deceased with a VA residing in urban areas had a death certificate issued compared to rural areas (47.1%). This shows that fewer people in rural areas are aware of the importance of having death certificates. The government should increase efforts advocating the importance of having death certificates for all deaths, both urban and rural.

Table 5.2 Was the death certificate issued for the death?

Death certificate Issued?	Rural		Urban		All	
	Number	%	Number	%	Number	%
Yes	1,555	47.1	190	63.8	1,745	48.5
No	1,711	51.8	102	34.2	1,813	50.3
Don't know	37	1.1	6	2	43	1.2
Total	**3,303**	**100**	**298**	**100**	**3,601**	**100**

Among those having VA who were also issued with death certificates, 23.2 percent in urban areas were not able to show the certificate for verification compared to 9.6 percent in rural areas (Table 5.3).

Table 5.3 Death certificate verification by the interviewer

Death certificate seen by the interviewer?	Rural		Urban		Total	
	Number	%	Number	%	Number	%
Yes	1,349	86.8	144	75.8	1,493	85.6
No	150	9.6	44	23.2	194	11.1
Don't know	7	0.5	2	1.1	9	0.5
Missing information	49	3.2	0	0	49	2.8
Total	**1,555**	**100**	**190**	**100**	**1,745**	**100**

5.4 Health insurance status of VA documented deaths

The number of deceased with VA who had health insurance during the terminal stage of their lives is shown in Table 5.4. The findings show that only 20.2% of the deceased report having any form of health insurance. There was a small difference in insurance ownership between men and women. However, the majority of the deceased (78.8%) did not have health insurance. This calls for the government to increase efforts to sensitize its citizens on the importance of having health insurance. This will increase the ownership coverage as well as utilization of health services during the illness.

Table 5.4 Health insurance status (Iringa Region)

Have health Insurance?	Females		Males		All	
	Number	%	Number	%	Number	%
Yes	264	19.9	323	20.5	587	20.2
No	1,051	79.1	1,236	78.6	2,287	78.8
Don't know	14	1.0	13	0.8	27	0.9
Total	**1,329**	**100**	**1,572**	**100**	**2,901**	**100**

* This table refers to deaths from Iringa Region.

The type of health insurance for those who had health insurance to cover their treatment expenses is in Table 5.5. The Improved Community Health Fund (iCHF) is most common (77.5%), followed by National Health Insurance (NHIF). Other types of health insurance are rarely used in the region.

Table 5.5 Type of Health Insurance for those who had health insurance to cover treatment expenses (Iringa)

Type of Health Insurance	Female		Male		Total	
	Number	%	Number	%	Number	%
iCHF	206	78	249	77.1	455	77.5
NHIF	54	20.4	70	21.7	124	21.1
AAR	2	0.8	1	0.3	3	0.5
Resolution	1	0.4	1	0.3	2	0.3
Other	1	0.4	2	0.6	3	0.5
All	**264**	**100**	**323**	**100**	**587**	**100**

The use of health insurance to cover treatment costs during the illness that led to death is in Table 5.6. It was observed that 71.5%of the deceased had used health insurance to cover their treatment cost during the illness that led to death. The majority of females (72.6%) and males (70.5%) have reported using health insurance at the terminal stage of their life. About 28% of the deceased could not use their health insurance to cover their treatment cost during the terminal illness.

Table 5.6 Use of health Insurance to cover treatment during illness that led to death

Used Insurance?	Female		Male		Total	
	Number	%	Number	%	Number	%
Yes	215	72.6	251	70.5	466	71.5
No	78	26.4	101	28.4	179	27.5
Don't know	3	1	4	1.1	7	1.1
Total	**296**	**100**	**356**	**100**	**652**	**100**

The reasons for not using their health insurance during a terminal illness is in Table 5.7. The top three reasons which hindered the deceased person from using their health insurance during the terminal illness were: health facility did not accept/receive the type of health insurance (43%); problem with using the insurance (26.3%); and deceased illness was not covered by the insurance (22.4%). The majority of those whose health insurance was not accepted at health facilities during the terminal illness were those who were using iCHF. This might be due to the poor knowledge on how to use this type of health insurance or its premium does not allow to receive a type of medical care required at the time of a terminal illness. The government needs to improve insurance schemes and provide more education on how to use different types of health insurance to make them useful and supportive for life-threatening conditions when required by the beneficiaries.

Table 5.7 Reasons why health Insurance was not used during the fatal illness of the deceased person?

Reasons for not using Health Insurance	Number	%
Deceased Illness was not covered by the Insurance	40	22.4
Health facility did not receive that type of Insurance	77	43
Insurance had expired	15	8.3
There was another problem with using the Insurance	47	26.3
Total	**179**	**100**

5.5 Care seeking and care getting delays in VA documented deaths.

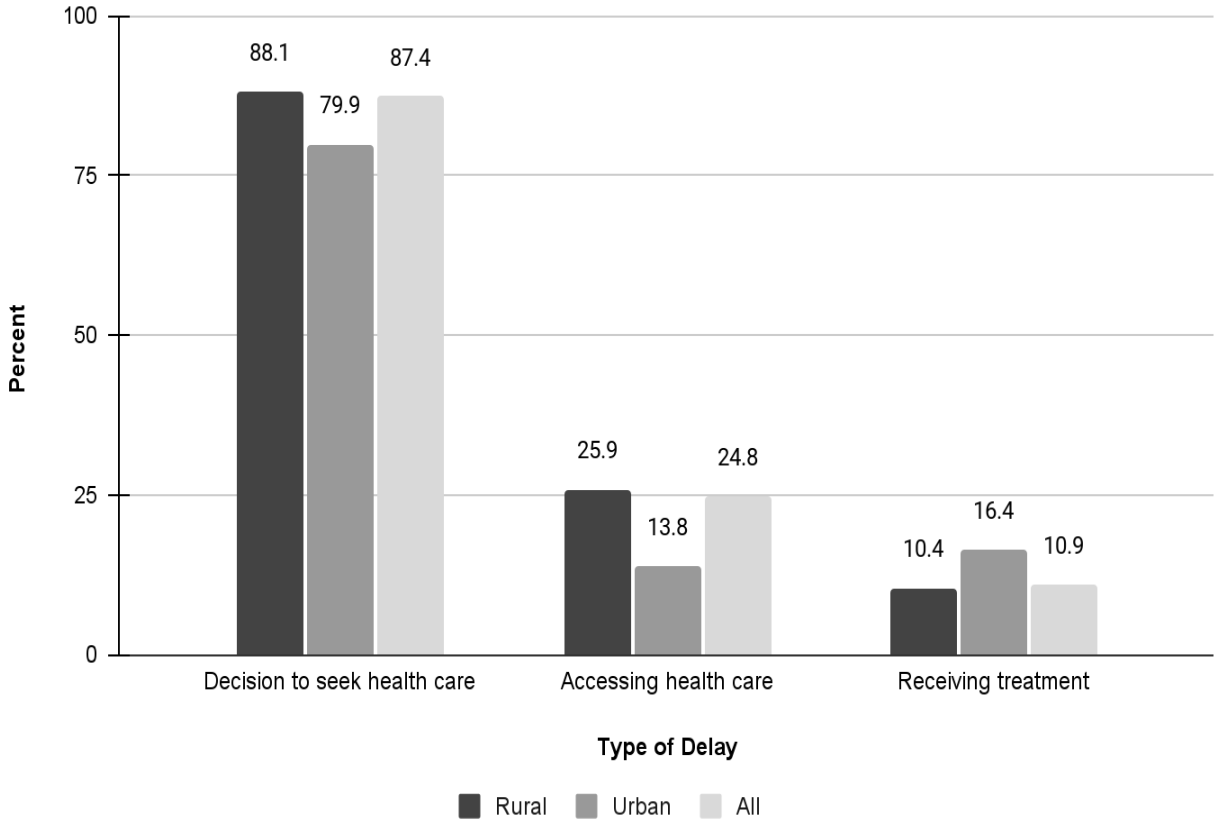

Fig. 5.2 Delays seeking and receiving health care.

The main delays in seeking medical care in Tanzania by place of residence is in Figure 5.2. Timely access and utilization of health services during the time of illness is a key factor for serving life and improving public health. The results from the verbal autopsy interviews show that most delays (87%) occurred at the household level. The delays are slightly higher in rural areas (88.1%) as compared to urban areas (79.9%). Reaching a point of care was also identified as a source of delays. 24.8% of the deceased delayed reaching a point of medical care due to accessibility reasons. The accessibility delays were more common in rural areas than in urban areas. Delays in receiving treatment at a point of health care were also reported. 10 percent of those who reached the point of care had delays in receiving treatment. The delay in receiving treatment was observed to be slightly higher in urban areas (16.4%) than in rural areas (10.4%). The reasons for the delays might be low capacity of the household members to decide, household economic status, beliefs, distance to health facilities, poor infrastructures, and insufficient human

resources for health. The government should provide education on the importance of seeking health care immediately in case of illness, household empowerment, campaigning on the importance of health insurance, construction of new health facilities, improvement of communication and referral infrastructures and addition of human resources for health.

5.6 Selected Risk Factors

The percentage of individuals who were alcohol users, by sex and place of residence is in Table 5.9. Results show that 45.2% of the deceased consumed alcohol. Among those who indicated that they consumed alcohol, 93.3% were from Rural and 6.8% Urban residency. Alcohol consumption was more frequently reported in males than females, however, there was no difference in reporting between rural and urban residency.

Table 5.9 Percent of individuals who were consuming alcohol at the time when they were alive, by sex and place of residence

	Residence		
Sex	**Rural (N= 1,316)**	**Urban (N=96)**	**All (N=1,412)**
Males	61.0%	61.5%	61.0%
Females	39.0%	38.5%	39.0%
All	**100%**	**100%**	**100%**

The number and percentages of deceased who were regularly using tobacco at the time when they were alive, disaggregated by location and sex is in Table 5.10. Out of 3,601 deaths, 343 (92%) and 27 (7.8%) reported using tobacco in rural and urban areas respectively. This is an interesting difference. As expected, the percentage of using tobacco is higher for men than for women in both areas. Most women prefer to chew tobacco while men prefer to smoke cigarettes. Women preferred to use local forms of tobacco and it is commonly used in rural areas. Tobacco use is a risk factor for non-communicable diseases (cancer, cardiovascular disease, chronic respiratory disease and diabetes). The government of Tanzania should continue to provide education particularly to its rural citizens on the side effects of using tobacco so as to avert the burden of preventable NCDs and premature deaths in the country.

Table 5.10. Types of tobacco use by sex and place of residence of those who provided the type.

	Rural			Urban		
Smoking Status	**Female**	**Male**	**Both**	**Female**	**Male**	**Both**
Cigarettes	19.0	63.7	52.5	28.6	70.0	59.3
Local form of tobacco	57.0	27.9	35.1	57.1	15.0	25.9
Chewing tobacco	19.0	5.9	9.2	14.3	0	3.7
Pipe	2.5	1.7	1.9	0	10.0	7.4
Other	2.5	0.8	1.3	0	5.0	3.7
Total (%)	**100**	**100**	**100**	**100**	**100**	**100**
N	**79**	**237**	**316**	**7**	**20**	**27**

Chapter 6: Discussion

6.1 Key findings

1. The experience documented in this report covering the first 3,601 verbal autopsies conducted as part of routine CRVS and DHIS2 operations provides sound evidence that the WHO standard verbal autopsy methodologies work well in Tanzania and can be taken to the next level of integration into the national CRVS and health information ecosystem.

2. Verbal Autopsy is practical and can be used to estimate cause specific mortality fractions of the underlying cause of death at community level in Tanzania where medical certification is not currently possible.

3. Successful integration of VA in CRVS depends on robust death notification of community deaths in CRVS. In this work there was relatively good completeness of civil death registration (69%) by RITA.

4. Summary findings of the Verbal Autopsy integrated in CRVS indicated that 46% of deaths were due to Communicable diseases, 40% due to non-communicable diseases, and 10% due to Injuries. Only 4% of deaths were undetermined as to the underlying cause. (See Section 3.2).

5. The five leading causes of death were HIV/AIDS, cardiac conditions, malaria, pulmonary tuberculosis, and diabetes. Road traffic fatalities have moved into the leading ten causes of death. (See Section 3.3).

6. Results quantify important differences between the pattern of causes of death recorded at community level by VA and the pattern of causes of death recorded at health facility level by MCCD in DHIS2. For example, there are more cancer deaths seen in the community than at health facilities. Such results when appropriately combined will change the overall ranking of some causes of death in national vital statistics. (See Sections 3.2, 4.4, and 6.5).

7. Practical experience with both the technical and operational processes of VA have been tested and optimized for scaling-up into a national verbal autopsy cluster sample system integrated in CRVS and HMIS processes.

8. Digital data capture, ICD coding and processing systems have been automated and work well.

9. The diagnostic algorithm of choice, performing best in relation to physician-coded VA is the InSilicoVA method with a Cause Specific Mortality Fraction concordance with physicians of 83%. (See Section 4.2).

10. A number of policy relevant contextual health system and public health risk factor issues were documented in VAs of the deceased (e.g. tobacco and alcohol use among the deceased, low use of health insurance for life-threatening conditions, high frequency of care-seeking delays starting at the household level, etc). (See Chapter 5).

11. A statistical stratified cluster sampling strategy to provide nationally representative estimates of the leading 20 cause specific fractions of mortality to a sufficient level of precision has been developed based on the Ward level as the sample Unit. For such a national scale VA, only 260 of the approximately 4,000 wards in mainland Tanzania are sufficient if VAs are done on 52% of all community deaths. (See Section 1.5).

6.2 Implications for best choice of CRVS VA diagnostic algorithm

The experience documented in this report covering the first 3,601 verbal autopsies conducted as part of routine CRVS and DHIS2 operations provides sound evidence that the WHO standard verbal autopsy methodologies work well in Tanzania and can be taken to the next level of integration into the national health information ecosystem. Moreover, it concludes that both the InSilicoVA and the InterVA5 automated computer coded analytic procedures emulate very well the performance of physician coded VA at population level. CCVA is both considerably more rapid and cost effective than PCVA. The best performing CCVA algorithm was InSilicoVA with a CSMF physician concordance of 83%. InSilicoVA also has an advantage over InterVA5 and Tariff2 in that it does not deliver undetermined results. Moreover, the InterVA5 will likely be discontinued for further development and upgrades in favor of InSilicoVA. The implications of these results suggest that InSilicoVA should become the diagnostic method of choice for CRVS-VA in Tanzania.

6.3 Challenges for the National Scale-up Phase

Completeness of death notification

Because VA can only be conducted on deaths that are notified in the CRVS system and provided with a unique ID by the system, completeness of death notification is a critical issue for the success of any mortality surveillance operation. We assume that even in the best circumstances completeness is rarely above 70%, especially for perinatal deaths. The sample size for the national CRVS-VA system accounts for such non-response by over sampling based on an assumed average death notification completeness level at national level of 75% and the fact that 70% of deaths will have no MCCD certification. This means a sample at national level documenting via VA a total of 9,500 notified deaths per year without MCCD is sufficient to give CSMFs with low uncertainty levels even for the most infrequent causes in the top 20. The sample is robust enough that if this number is not achieved, the CSMFs are still available however the uncertainty around infrequent causes will be increased.

Table 6.1. Status of completeness of death registration and cause of death statistics in Iringa in 2019

Indicator	Value
Iringa Population (2019)	1,122,131
Deaths expected (at CDR of 7.0 per 1,000)	7,855
Deaths Registered by CRVS	1,923 (24%)
Deaths with VA cause	1,956 (21%)
Deaths with MCCD medically certified cause	1,451 (18%)

There is a need to complete the CRVS-VA related systems integration between VA Manager and eRITA. This will help the Civil Registration office to easily know the total number of deaths notified, registered and with conducted VA interviews in the scale up wards.

Currently, all VA interviewed deaths are notified; however, the notification process relies on paper-based tools, resulting in delays in conducting VAs and complications for real-time submission of notified VAs into the system. It is crucial to digitize the process to efficiently capture notified deaths and complete registration and VA,

Governance

The Mortality and Causes of Death Task Force (MCOD-TF) was established by the Ministry of Health through the technical and financial support from the Data for Health Initiative in the year 2016. However, the MCOD-TF does not meet regularly to discuss mortality data related activities due to shortage of financial resources that are based on donors. It is crucial to plan a sustainable approach for the continuity of regular in-person or virtual meetings.

Integrating health facility-based MCCD data with community-based VA data

The mix of causes of death seen in health facilities cannot be expected to be the same as the mix of causes seen in the community. Consequently, the top 20 CSMFs provided by HMIS DHIS2 data based on MCCD certification will differ in some respects to the top 20 ranks seen in the VA data. For example, deaths due to severe acute diseases where the public routinely seek care at hospitals or health facilities will be more common in the MCCD series, while deaths at home due to chronic fatal non-communicable diseases such as cancers, or sudden deaths due to stroke or injuries may be more highly visible in the VA series. Nevertheless, planners need a single composite ranking of the aggregated leading causes of death at national level. It is statistically possible to combine the two data sets at annual national level using a new tool developed by the WHO Verbal Autopsy Reference Group that weights the value of each cause across these sources based on the

denominators that produce them and the uncertainties each has. The prototype of this tool is ready for field testing and Tanzania has the ideal data sets to explore this. Plans are underway to do this in 2024.

VA implementation in the scale-up regions is being triggered by notification of death events, whereby the relatives of the diseased are not allowed to bury the body of the diseased without completing the death notification form also called the burial permit. The serial number from the death notification form is needed in the VA questionnaire before the VA interviewer starts the interview. Soon after the mourning time or even before, the WEO will prepare the death certificate which includes information from the notification form. All of the above procedures are being implemented within the WEOs office.

The ICD-10 book/register at the health facilities has three copies of carbonated papers per each paper which is being completed by the clinician. Part of the copy is being taken by the DHIS2 focal person ready for entering the completed information into DHIS2, another copy is taken by the RITA focal person for picking COD information for inclusion into the death certificate, and the original copy is left at the health facility for archive. This way the MCCD data is being integrated across the related CRVS agencies from the point of data collection.

Machine Learning for VA

On a farther horizon, it is clear that the narrative section of the VA Interview contains valuable additional information that informs the underlying cause of death. Presently this is only visible to physician coders and is not used by the CCVA algorithms. However, the latest ODK versions of the WHO Standard VA form allow the narrative section to be recorded as an ODK Kiswahili audio file attached to the digital questionnaire. With artificial intelligence methods of machine learning and natural language processing it will soon be possible to automatically digitally mine this narrative audio file for supplemental information. Tanzanian researchers are pioneering this approach with preliminary experience shown here.

Despite wide adoption of VA methods to determine uCOD [17] such methods have been subjected to debates for years. There is now a growing interest to explore alternative methods to compute CoD to include Machine Learning (ML) algorithms and Artificial Intelligence (AI) solutions. ML and AI follow concepts whereby computer systems learn and adapt patterns in assigning CoD without following explicit instructions using computational algorithms [28]. ML and AI models come with features to learn and improve accuracy overtime. These advances make ML and AI models increasingly valuable and an effective proxy to improve accuracy.

To demonstrate the capability of ML algorithms in predicting CoD, we extracted VA data with corresponding underlying COD from PCVA (N=2509). The VA data contained narratives from the interview, as well as other parameters including signs and symptoms of the deceased in the period preceding death. We created a training dataset (N=2007)

which is equivalent to 80% of the total records in the dataset and applied the Bayesian Networks Model [29] with four clusters of COD. COD selection was based on Prevalent cases in Iringa. The four COD were malaria, HIV, Tuberculosis, and Injury cases (distributed at 6.1%, 24.5%, 8.1% and 5.0%). We performed data augmentation and reached a class size of 1,296 each. We validated the model with the remaining 20% of the data. The results show 97% accuracy, implying that the model correctly classified cases 97 times out of 100. This is a superior performance of the model as compared to the previous VA studies which reported accuracy of ML ranging from 71% to 85% in assigning adult individual CoD.

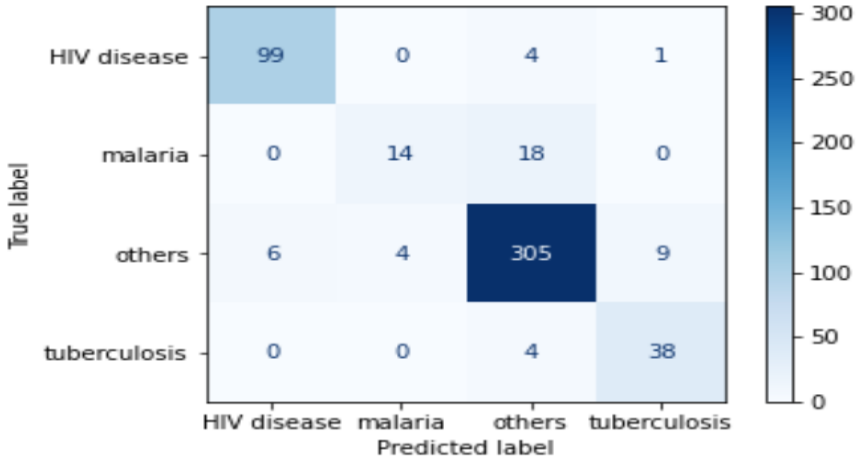

Fig. 6.1 Performance Comparison between PCVA and the developed prototype ML Model

The "0" in the confusion matrix represents no mislabeling error, and it is also termed as zero confusion. The diagonal values represent correctly labeled values (concordances). Off diagonal values represent misclassification on the respective class label. Comparing diagonal values for each class label, we observe a significant performance in computing CoD, but malaria CoD computation remains a challenge (see Section x).

Contrary to traditional CCVA methods, ML and AI present additional opportunities to use the narrative part of the VA interview to inform COD assignment. When we assessed discordant pairs from PCVA and CCV we noted the narrative section contains additional information that could not be captured by the structured VA data. Furthermore, the narrative content had a major influence in physician judgment. Our initial attempt to use the narrative part with ML and AI to inform COD assignment presented us with two main

challenges, 1) emptiness and incomplete sentences in the narrative section, and 2) limited kiswahili stop words' repository for references. For the case of the Iringa dataset, only 59.5% of interviewees filled in narrative responses. Out of the filled narrative responses, 75% had meaningful keywords for the CoD computation. Since the narrative section can significantly inform COD assignment, we propose future VA data collection to strengthen the quality of the narrative section and create a repository of stop words for VA CoD computation using swahili narratives. The ultimate goal is to include narratives in the CoD computation.

In addition, during the development of the model, 209 out of 522 features of the World Health Organization's VA questionnaire were found most relevant for the CoD prediction. The features were deduced through feature engineering, imputation, and feature selection techniques. Thus, ML algorithms open a discussion on improving questionnaire design to reduce the time for conducting VA interviews.

Work is underway in Tanzania to further expose VA data to ML and AI models. The Tanzania team is creating a community of practice where the anonymized VA data is exposed to innovators and data scientists who can further explore different techniques to improve quality and usage. Alongside this, efforts are in progress to populate the swahili corpus for AI and ML algorithms to sufficiently learn from a rich variant of swahili terminologies. In Natural Language Processing (NLP), a corpus contains text and speech data that can be used to train AI and ML systems. A rich swahili corpus will create an enabling environment to create stable swahili VA stop words database that will improve accuracy of CoD computation using VA narratives.

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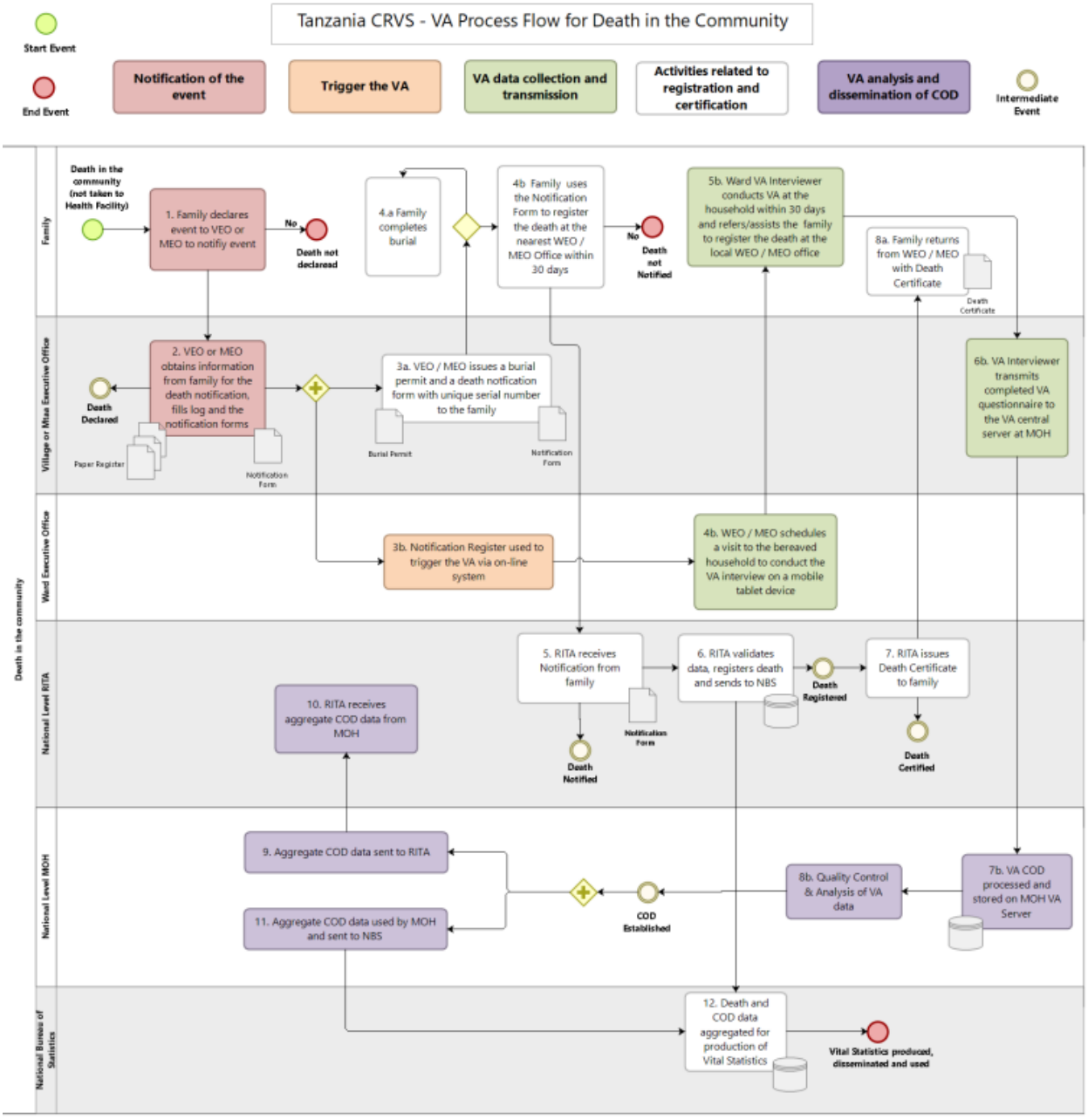
Annexes

Annex 1. CRVS-VA Process Map



Annex 2. CRVS Death Notification Form for community (D3)

FOMU YA USAJILI WA VIFO

NAMBA YA USAJILI		**FOMU D3**

TAFADHALI TOA MAELEZO YAFUATAYO:-

A: TAARIFA ZA MAREHEMU

NAMBA YA UTAMBULISHO			
JINA LA KWANZA		**JINA LA PILI**	
JINA LA MWISHO		**JINA LINGINE**	
JINSIA **KIUME** ☐ **KIKE** ☐ **UMRI** ☐	**TAREHE YA KIFO**	**TAREHE YA KUZALIWA**	
KAZI YA MAREHEMU		**NCHI ALIYOZALIWA**	
MAHALI ALIPOFIA: KITUO CHA TIBA (TICK) ☐		**NYUMBANI** ☐	**MAHALI PENGINE** ☐
KIJIJI/MTAA ALOFIA		**MKOA ALIOISHI**	
KATA ALIYOFIA		**WILAYA ALIYOISHI**	
WILAYA ALIYOFIA		**KATA ALIPOISHI**	
MKOA ALIOFIA		**KIJIJI/MTAA ALIPOISHI**	
AINA YA KIFO: **ASILI** ☐		**ISIYO ASILI** ☐	

B: SABABU ZA KIFO (HOSPITALI)

IMMEDIATE CAUSE: Disease or Condition directly leading to death (a) .....

DUE TO

ANTECEDENT CAUSES: Morbid condition if any, which gave rise to the immediate cause (a)..... (b).....

DUE TO

..... stating the underlaying condition last (c).....

OTHER SIGNIFICANT CONDITIONS: Contributing to the death but not related to (a).....

CERTIFICATION: To the best of my knowledge, the information given above is correct

NAME: ..... **DATE:** .....

SIGNATURE: ..... **TITLE:** .....

C: SABABU ZA KIFO NYUMBANI

Maumivu ya tumbo na kuharisha ☐ Shida ya kupumua pamoja na kuvimba miguu ☐ Homa kuumwa kichwa shingo kukaza, kupoteza fahamu ☐ Sababu zingine Zitaje.....

.....

.....

Maumivu ya tumbo bila kuharisha ☐ Kifo cha ghafla ☐ Homa kuumwa viungo na kutetemeka ☐

.....

.....

.....

Kukohoa kwa muda mfupi ☐ Maumivu au shida ya kupata mkojo ☐ Homa nyingine ☐

Kukohoa kwa muda mrefu (zaidi ya mwezi 1) ☐ Ngozi na macho kugeuka njano ☐ Pepopunda ☐ Surua ☐ Mama kufariki wakati wa kuzaa ☐

D: MTOA TAARIFA

ONYO: UNAKUMBUSHWA KWAMBA FUNGU LA 29(3)LA SHERIA YA KUANDIKISHA VIZAZI NA VIFO LIMEWEKA ADHABU KWA MAKOSA YA KUTOA TAARIFA ZA UONGO

JINA KAMILI: .....

UHUSIANO: .....

NAMBA YA SIMU YA MKONONI: ..... **BARUA PEPE:** .....

SAINI YA MTOA TAARIFA: ..... **TAREHE:** .....

KIAPO: NATHIBITISHA KUWA MAELEZO NILIYOTOA HAPO JUU NI SAHIHI KWA KADRI YA UFAHAMU WANGU NA NINAVYOAMINI

E: TAARIFA ZA MSAJILI

NIMEPOKEA MAELEZO YA MWOMBAJI CHINI YA KIAPO KWA MAMLAKA NILIYOPEWA CHINI YA KIFUNGU CHA 20 (2) LEO HII

JINA LA MSAJILI: .....

KITUO CHA USAJILI: .....

WILAYA YA USAJILI: .....

SAINI YA MSAJILI: ..... **TAREHE YA USAJILI:** .....

Annex 3. Table of Councils and Wards in the Pre-Test Phase

Region	District type	District name	Ward name	Population
Pwani	Rural District	Mkuranga DC	Kimanzichana	15,177.00
			Mwandege	23,166.00
		Kisarawe DC	Manerumango	4,673.00
			Masaki	8,032.00
		Chalinze DC	Bwilingu	39,922.00
			Mbwewe	16,385.00
Tanga	Urban District	Tanga CC	Mwanzange	8,681.00
			Kirare	5,342.00
Morogoro	Urban District	Morogoro MC	Boma	8,706.00

Annex 4. Table of Councils and Wards in the Demonstration Phase

No.	Council	Wards	Population		No.	Council	Wards	Population
1	Iringa DC	Idodi	12,134		54	Kilolo DC	Mtitu	13,330
2	Iringa DC	Ifunda	14,571		55	Kilolo DC	Dabaga	9,192
3	Iringa DC	Ilolo Mpya	7,483		56	Kilolo DC	Ukumbi	15,116
4	Iringa DC	Itunundu	11,110		57	Kilolo DC	Ukwega	7,737
5	Iringa DC	Izazi	6,194		58	Kilolo DC	Boma la Ng'ombe	13,097
6	Iringa DC	Kalenga	8,595		59	Kilolo DC	Idete	9,314
7	Iringa DC	Kihanga	5,035		60	Kilolo DC	Masisiwe	11,345
8	Iringa DC	Kihorogota	9,139		61	Kilolo DC	Ng'uruhe	13,125
9	Iringa DC	Kisinga	7,472		62	Kilolo DC	Ng'ang'ange	4,742
10	Iringa DC	Kiwere	11,545		63	Kilolo DC	Ihimbo	11,939
11	Iringa DC	Luhota	16,452		64	Kilolo DC	Lugalo	14,556
12	Iringa DC	Lumuli	9,326		65	Kilolo DC	Nyalumbu	18,381
13	Iringa DC	Lyamgungwe	11,487		66	Kilolo DC	Mlafu	7,520
14	Iringa DC	Maboga	9,933		67	Kilolo DC	Ibumu	7,828
15	Iringa DC	Magulilwa	15,944		68	Kilolo DC	Ruaha Mbuyuni	14,246
16	Iringa DC	Mahuninga	5,151		69	Kilolo DC	Kimala	8,839
17	Iringa DC	Nduli	2,048		70	Kilolo DC	Kising'a	6,427
18	Iringa DC	Malenga Makali	9,287		71	Kilolo DC	Nyazwa	6,531
19	Iringa DC	Masaka	4,056		72	Mafinga TC	Boma	26,846
20	Iringa DC	Mboliboli	5,742		73	Mafinga TC	Bumilayinga	7,359
21	Iringa DC	Mgama	14,771		74	Mafinga TC	Changarawe	6,140
22	Iringa DC	Migoli	13,099		75	Mafinga TC	Isalavanu	8,970
23	Iringa DC	Mlenge	11,109		76	Mafinga TC	Upendo	14,078
24	Iringa DC	Mlowa	11,081		77	Mafinga TC	Kinyanambo	7,275
25	Iringa DC	Mseke	14,797		78	Mafinga TC	Rungemba	7,132
26	Iringa DC	Nyang'olo	11,516		79	Mafinga TC	Saohil	4,915
27	Iringa DC	Ulanda	17,679		80	Mufindi DC	Idete	4,654

28	Iringa DC	Nzihi	11,094		81	Mufindi DC	Idunda	7,000
29	Iringa DC	Wasa	12,687		82	Mufindi DC	Ifwagi	14,114
30	Iringa MC	Gangilonga	12,157		83	Mufindi DC	Igombavanu	8,571
31	Iringa MC	Igumbilo	5,106		84	Mufindi DC	Igowole	16,125
32	Iringa MC	Ilala	5,493		85	Mufindi DC	Ihalimba	13,005
33	Iringa MC	Isakalilo	11,189		86	Mufindi DC	Ihanu	10,049
34	Iringa MC	Kihesa	22,393		87	Mufindi DC	Ihowanza	12,437
35	Iringa MC	Kitanzini	4,522		88	Mufindi DC	Ikongosi	5,947
36	Iringa MC	Kitwiru	14,048		89	Mufindi DC	Ikweha	9,935
37	Iringa MC	Kwakilosa	9,869		90	Mufindi DC	Itandula	14,018
38	Iringa MC	Makorongoni	9,663		91	Mufindi DC	Kasanga	9,469
39	Iringa MC	Mivinjeni	5,982		92	Mufindi DC	Kibengu	18,343
40	Iringa MC	Mkimbizi	12,804		93	Mufindi DC	Kiyowela	4,180
41	Iringa MC	Mkwawa	11,763		94	Mufindi DC	Luhunga	11,267
42	Iringa MC	Mlandege	5,786		95	Mufindi DC	Maduma	5,226
43	Iringa MC	Mshindo	2,289		96	Mufindi DC	Makungu	15,540
44	Iringa MC	Mtwivila	13,194		97	Mufindi DC	Malangali	7,053
45	Iringa MC	Mwangata	16,504		98	Mufindi DC	Mapanda	13,466
46	Iringa MC	Nduli	7,715		99	Mufindi DC	Mbalamaziwa	9,502
47	Iringa MC	Ruaha Mbuyuni	15,639		100	Mufindi DC	Mdabulo	11,097
48	Kilolo DC	Image	10,818		101	Mufindi DC	Mninga	17,737
49	Kilolo DC	Irole	14,317		102	Mufindi DC	Mpanga tazara	885
50	Kilolo DC	Ilula	13,308		103	Mufindi DC	Mtambula	12,253
51	Kilolo DC	Uhambingeto	12,046		104	Mufindi DC	Mtwango	20,572
52	Kilolo DC	Udekwa	6,802		105	Mufindi DC	Nyololo	8,976
53	Kilolo DC	Mahenge	5,210		106	Mufindi DC	Sadani	10,431

Annex 5. Table of Councils and Wards in the proposed National CRVS-VA System

No.	Zone	Region	Council	Ward	Population (2021)	Status
1	Central	Dodoma	Kongwa District Council	Sejeli Ward	24,984	Rural
2	Central	Dodoma	Kongwa District Council	Zoissa Ward	7,955	Rural
3	Central	Dodoma	Kongwa District Council	Mtanana Ward	16,778	Rural
4	Central	Dodoma	Kongwa District Council	Mlali Ward	26,008	Rural
5	Central	Dodoma	Kongwa District Council	Sagara Ward	28,728	Rural
6	Central	Dodoma	Kongwa District Council	Kibaigwa Ward	33,139	Rural
7	Central	Dodoma	Kongwa District Council	Chamkoroma Ward	19,780	Rural
8	Central	Dodoma	Kongwa District Council	Ngomai Ward	13,933	Rural
9	Central	Dodoma	Kongwa District Council	Chiwe Ward	25,390	Rural
10	Central	Dodoma	Kongwa District Council	Nghumbi Ward	15,333	Rural
11	Central	Singida	Itigi District Council	Idodyandole Ward	14,236	Rural
12	Central	Singida	Itigi District Council	Mgandu Ward	17,535	Rural
13	Central	Singida	Itigi District Council	Itigi Ward	7,206	Rural
14	Central	Singida	Itigi District Council	Ipande Ward	12,838	Rural
15	Central	Singida	Itigi District Council	Sanjaranda Ward	11,415	Rural
16	Central	Singida	Itigi District Council	Mwamagembe Ward	8,276	Rural
17	Central	Singida	Itigi District Council	Mitundu Ward	23,470	Rural
18	Central	Singida	Itigi District Council	Kitaraka Ward	12,238	Rural
19	Central	Singida	Itigi District Council	Itigi Majengo Ward	14,878	Rural
20	Central	Singida	Itigi District Council	Kilangali Ward	6,016	Rural
21	Central	Manyara	Babati Town Council	Babati Ward	23,626	Urban
22	Central	Manyara	Babati Town Council	Mutuka Ward	6,669	Urban
23	Central	Manyara	Babati Town Council	Nangara Ward	10,349	Urban
24	Central	Manyara	Babati Town Council	Singe Ward	9,289	Urban
25	Central	Manyara	Babati Town Council	Bonga Ward	13,265	Urban
26	Central	Manyara	Babati Town Council	Bagara Ward	40,581	Urban
27	Central	Manyara	Babati Town Council	Sigino Ward	13,764	Urban

No.	Zone	Region	Council	Ward	Population (2021)	Status
28	Central	Manyara	Babati Town Council	Maisaka Ward	11,906	Urban
29	Dar es Salaam	Dar es Salaam	Kinondoni Municipal Council	Magomeni Ward	30,385	Urban
30	Dar es Salaam	Dar es Salaam	Kinondoni Municipal Council	Kunduchi Ward	94,305	Urban
31	Dar es Salaam	Dar es Salaam	Kinondoni Municipal Council	Wazo Ward	114,721	Urban
32	Dar es Salaam	Dar es Salaam	Ilala Municipal Council	Kipawa Ward	93,247	Urban
33	Dar es Salaam	Dar es Salaam	Ilala Municipal Council	Gongo la Mboto Ward	72,623	Urban
34	Dar es Salaam	Dar es Salaam	Temeke Municipal Council	Mbagala Ward	66,309	Urban
35	Dar es Salaam	Dar es Salaam	Temeke Municipal Council	Kurasini Ward	32,711	Urban
36	Dar es Salaam	Dar es Salaam	Temeke Municipal Council	Mianzini Ward	88,563	Urban
37	Dar es Salaam	Dar es Salaam	Kigamboni Municipal Council	Tungi Ward	29,486	Urban
38	Dar es Salaam	Dar es Salaam	Ubungo Municipal Council	Mburahati Ward	43,350	Urban
39	Eastern	Morogoro	Morogoro District Council	Mvuha Ward	17,591	Rural
40	Eastern	Morogoro	Morogoro District Council	Bwakila chini Ward	16,726	Rural
41	Eastern	Morogoro	Morogoro District Council	Mngazi Ward	11,540	Rural
42	Eastern	Morogoro	Morogoro District Council	Mkambarani Ward	14,520	Rural
43	Eastern	Morogoro	Morogoro District Council	Mkulazi Ward	6,149	Rural
44	Eastern	Morogoro	Morogoro District Council	Kinole Ward	14,344	Rural
45	Eastern	Morogoro	Morogoro District Council	Mkuyuni Ward	15,120	Rural
46	Eastern	Morogoro	Morogoro District Council	Kisemu Ward	11,311	Rural
47	Eastern	Morogoro	Morogoro District Council	Tawa Ward	13,508	Rural
48	Eastern	Morogoro	Morogoro District Council	Kibuko Ward	6,425	Rural
49	Eastern	Pwani	Kibaha Town Council	Pangani Ward	8,956	Urban
50	Eastern	Pwani	Kibaha Town Council	Maili Moja Ward	16,725	Urban
51	Eastern	Pwani	Kibaha Town Council	Tumbi Ward	15,627	Urban
52	Eastern	Pwani	Kibaha Town Council	Picha ya Ndege	13,176	Urban

No.	Zone	Region	Council	Ward	Population (2021)	Status
53	Eastern	Pwani	Kibaha Town Council	Mkuza Ward	19,935	Urban
54	Eastern	Pwani	Kibaha Town Council	Kibaha Ward	15,184	Urban
55	Eastern	Pwani	Kibaha Town Council	Kongowe Ward	21,025	Urban
56	Eastern	Pwani	Kibaha Town Council	Misugusugu	8,044	Urban
57	Eastern	Pwani	Kibaha Town Council	Visiga Ward	11,365	Urban
58	Eastern	Pwani	Kibaha Town Council	Tangini Ward	11,862	Urban
59	Lake	Simiyu	Busega District Council	Shigala Ward	20,092	Rural
60	Lake	Simiyu	Busega District Council	Badugu Ward	20,652	Rural
61	Lake	Simiyu	Busega District Council	Kiloleli Ward	29,492	Rural
62	Lake	Simiyu	Busega District Council	Kabita Ward	34,709	Rural
63	Lake	Simiyu	Busega District Council	Kalemela Ward	16,652	Rural
64	Lake	Simiyu	Busega District Council	Lamadi Ward	33,942	Rural
65	Lake	Simiyu	Busega District Council	Lutubiga Ward	17,959	Rural
66	Lake	Simiyu	Busega District Council	Mkula Ward	25,650	Rural
67	Lake	Simiyu	Busega District Council	Malili Ward	26,126	Rural
68	Lake	Simiyu	Busega District Council	Imalamate	17,131	Rural
69	Lake	Geita	Nyang'hwale District Council	Shabaka Ward	20,967	Rural
70	Lake	Geita	Nyang'hwale District Council	Busolwa Ward	15,497	Rural
71	Lake	Geita	Nyang'hwale District Council	Kakora Ward	15,585	Rural
72	Lake	Geita	Nyang'hwale District Council	Bukwimba	19,619	Rural
73	Lake	Geita	Nyang'hwale District Council	Kafita Ward	17,198	Rural
74	Lake	Geita	Nyang'hwale District Council	Kharumwa	19,652	Rural
75	Lake	Geita	Nyang'hwale District Council	Mwingiro Ward	12,186	Rural
76	Lake	Geita	Nyang'hwale District Council	Nyabulanda	13,326	Rural
77	Lake	Geita	Nyang'hwale District Council	Nyijundu Ward	17,465	Rural
78	Lake	Geita	Nyang'hwale District Council	Nundu Ward	5,574	Rural
79	Lake	Mwanza	Magu District Council	Bujashi Ward	18,114	Rural
80	Lake	Mwanza	Magu District Council	Nyanguge	20,705	Rural
81	Lake	Mwanza	Magu District Council	Mwamanga	18,239	Rural

No.	Zone	Region	Council	Ward	Population (2021)	Status
82	Lake	Mwanza	Magu District Council	Nyigogo Ward	19,604	Rural
83	Lake	Mwanza	Magu District Council	Lubugu Ward	21,028	Rural
84	Lake	Mwanza	Magu District Council	Ng'haya Ward	28,707	Rural
85	Lake	Mwanza	Magu District Council	Shishani Ward	21,685	Rural
86	Lake	Mwanza	Magu District Council	Buhumbi Ward	11,969	Rural
87	Lake	Mwanza	Magu District Council	Chambula Ward	12,326	Rural
88	Lake	Mwanza	Magu District Council	Kabila Ward	20,415	Rural
89	Lake	Kagera	Ngara District Council	Kasulo Ward	24,809	Rural
90	Lake	Kagera	Ngara District Council	Mbuba Ward	14,826	Rural
91	Lake	Kagera	Ngara District Council	Ngara Mjini	28,932	Rural
92	Lake	Kagera	Ngara District Council	Kirushya Ward	14,075	Rural
93	Lake	Kagera	Ngara District Council	Kanazi Ward	24,038	Rural
94	Lake	Kagera	Ngara District Council	Kabanga Ward	29,319	Rural
95	Lake	Kagera	Ngara District Council	Bugarama	19,989	Rural
96	Lake	Kagera	Ngara District Council	Murusagamba	15,790	Rural
97	Lake	Kagera	Ngara District Council	Rulenge Ward	23,653	Rural
98	Lake	Kagera	Ngara District Council	Rusumo Ward	17,462	Rural
99	Lake	Shinyanga	Kahama Town Council	Nyandekwa	15,321	Urban
100	Lake	Shinyanga	Kahama Town Council	Kilago Ward	14,841	Urban
101	Lake	Shinyanga	Kahama Town Council	Wendele Ward	9,955	Urban
102	Lake	Shinyanga	Kahama Town Council	Nyasubi Ward	28,106	Urban
103	Lake	Shinyanga	Kahama Town Council	Mhungula	14,253	Urban
104	Lake	Shinyanga	Kahama Town Council	Mwendakulima	18,453	Urban
105	Lake	Shinyanga	Kahama Town Council	Malunga	14,037	Urban
106	Lake	Shinyanga	Kahama Town Council	Kagongwa	29,028	Urban
107	Lake	Shinyanga	Kahama Town Council	Isagehe Ward	14,498	Urban
108	Lake	Shinyanga	Kahama Town Council	Kinaga Ward	19,392	Urban
109	Lake	Mara	Rorya District Council	Kigunga Ward	19,612	Rural
110	Lake	Mara	Rorya District Council	Nyamtinga	16,021	Rural

No.	Zone	Region	Council	Ward	Population (2021)	Status
111	Lake	Mara	Rorya District Council	Mkoma Ward	18,353	Rural
112	Lake	Mara	Rorya District Council	Bukura Ward	21,727	Rural
113	Lake	Mara	Rorya District Council	Kitembe Ward	13,980	Rural
114	Lake	Mara	Rorya District Council	Ikoma Ward	14,859	Rural
115	Lake	Mara	Rorya District Council	Bukwe Ward	13,788	Rural
116	Lake	Mara	Rorya District Council	Kisumwa	17,733	Rural
117	Lake	Mara	Rorya District Council	Nyamunga	18,815	Rural
118	Lake	Mara	Rorya District Council	Baraki Ward	12,008	Rural
119	Northern	Tanga	Handeni Town Council	Malezi Ward	8,932	Urban
120	Northern	Tanga	Handeni Town Council	Kwenjugo	8,403	Urban
121	Northern	Tanga	Handeni Town Council	Mabanda	6,833	Urban
122	Northern	Tanga	Handeni Town Council	Mlimani Ward	6,293	Urban
123	Northern	Tanga	Handeni Town Council	Kideleko Ward	6,875	Urban
124	Northern	Tanga	Handeni Town Council	Kwamagome	11,078	Urban
125	Northern	Tanga	Handeni Town Council	Vibaoni Ward	7,923	Urban
126	Northern	Tanga	Handeni Town Council	Chanika Ward	14,258	Urban
127	Northern	Tanga	Handeni Town Council	Mdoe Ward	12,538	Urban
128	Northern	Tanga	Handeni Town Council	Kwediyamba Ward	5,064	Urban
129	Northern	Arusha	Longido District Council	Ketumbeine Ward	8,509	Rural
130	Northern	Arusha	Longido District Council	Eleng'ata Dapash	6,674	Rural
131	Northern	Arusha	Longido District Council	Gelai Meirugoi	11,134	Rural
132	Northern	Arusha	Longido District Council	Matale Ward	5,383	Rural
133	Northern	Arusha	Longido District Council	Engarenaibor	13,863	Rural
134	Northern	Arusha	Longido District Council	Kimokouwa	9,102	Rural
135	Northern	Arusha	Longido District Council	Namanga	11,814	Rural
136	Northern	Arusha	Longido District Council	Longido Ward	3,033	Rural
137	Northern	Arusha	Longido District Council	Olmolog Ward	10,737	Rural
138	Northern	Arusha	Longido District Council	Kamwanga	12,810	Rural
139	Northern	Kilimanjaro	Moshi Municipal Council	Njoro Ward	18,205	Urban

No.	Zone	Region	Council	Ward	Population (2021)	Status
140	Northern	Kilimanjaro	Moshi Municipal Council	Mji mpya Ward	19,703	Urban
141	Northern	Kilimanjaro	Moshi Municipal Council	Mawenzi Ward	2,321	Urban
142	Northern	Kilimanjaro	Moshi Municipal Council	Kiusa Ward	7,872	Urban
143	Northern	Kilimanjaro	Moshi Municipal Council	Pasua Ward	17,123	Urban
144	Northern	Kilimanjaro	Moshi Municipal Council	Msaranga	9,876	Urban
145	Northern	Kilimanjaro	Moshi Municipal Council	Longuo B	8,610	Urban
146	Northern	Kilimanjaro	Moshi Municipal Council	Mfumuni Ward	6,406	Urban
147	Northern	Kilimanjaro	Moshi Municipal Council	Soweto Ward	19,429	Urban
148	Northern	Kilimanjaro	Moshi Municipal Council	Ng'ambo Ward	10,150	Urban
149	Southwest Highlands	Mbeya	Rungwe District Council	Swaya Ward	9,879	Rural
150	Southwest Highlands	Mbeya	Rungwe District Council	Kisiba Ward	8,874	Rural
151	Southwest Highlands	Mbeya	Rungwe District Council	Kisondela	14,492	Rural
152	Southwest Highlands	Mbeya	Rungwe District Council	Malindo Ward	7,841	Rural
153	Southwest Highlands	Mbeya	Rungwe District Council	Lufingo Ward	14,815	Rural
154	Southwest Highlands	Mbeya	Rungwe District Council	Kyimo Ward	18,676	Rural
155	Southwest Highlands	Mbeya	Rungwe District Council	Kiwira Ward	33,644	Rural
156	Southwest Highlands	Mbeya	Rungwe District Council	Ibighi Ward	11,944	Rural
157	Southwest Highlands	Mbeya	Rungwe District Council	Msasani Ward	8,398	Rural
158	Southwest Highlands	Mbeya	Rungwe District Council	Lupepo Ward	9,173	Rural
159	Southwest Highlands	Katavi	Nsimbo District Council	Ugala Ward	12,704	Rural
160	Southwest Highlands	Katavi	Nsimbo District Council	Litapunga	46,354	Rural
161	Southwest Highlands	Katavi	Nsimbo District Council	Mtapenda	7,256	Rural
162	Southwest Highlands	Katavi	Nsimbo District Council	Urwila Ward	9,203	Rural
163	Southwest Highlands	Katavi	Nsimbo District Council	Nsimbo Ward	10,689	Rural
164	Southwest Highlands	Katavi	Nsimbo District Council	Machimboni	6,016	Rural
165	Southwest Highlands	Katavi	Nsimbo District Council	Itenka Ward	23,845	Rural

No.	Zone	Region	Council	Ward	Population (2021)	Status
166	Southwest Highlands	Katavi	Nsimbo District Council	Ibindi Ward	7,972	Rural
167	Southwest Highlands	Katavi	Nsimbo District Council	Kanoge Ward	23,472	Rural
168	Southwest Highlands	Katavi	Nsimbo District Council	Katumba Ward	35,656	Rural
169	Southwest Highlands	Rukwa	Nkasi District Council	Paramawe	13,796	Rural
170	Southwest Highlands	Rukwa	Nkasi District Council	Nkomolo Ward	25,742	Rural
171	Southwest Highlands	Rukwa	Nkasi District Council	Namanyere	18,695	Rural
172	Southwest Highlands	Rukwa	Nkasi District Council	Kabwe Ward	17,087	Rural
173	Southwest Highlands	Rukwa	Nkasi District Council	Kirando Ward	21,964	Rural
174	Southwest Highlands	Rukwa	Nkasi District Council	Kala Ward	17,388	Rural
175	Southwest Highlands	Rukwa	Nkasi District Council	Kate Ward	19,911	Rural
176	Southwest Highlands	Rukwa	Nkasi District Council	Kipande Ward	22,436	Rural
177	Southwest Highlands	Rukwa	Nkasi District Council	Mkwamba	14,971	Rural
178	Southwest Highlands	Rukwa	Nkasi District Council	Korongwe	23,163	Rural
179	Southwest Highlands	Songwe	Tunduma Town Council	Majengo Ward	16,913	Urban
180	Southwest Highlands	Songwe	Tunduma Town Council	Chapwa Ward	5,918	Urban
181	Southwest Highlands	Songwe	Tunduma Town Council	Kaloleni Ward	15,238	Urban
182	Southwest Highlands	Songwe	Tunduma Town Council	Sogea Ward	24,683	Urban
183	Southwest Highlands	Songwe	Tunduma Town Council	Muungano	13,566	Urban
184	Southwest Highlands	Songwe	Tunduma Town Council	Tunduma Ward	3,937	Urban
185	Southwest Highlands	Songwe	Tunduma Town Council	Katete Ward	12,929	Urban
186	Southwest Highlands	Songwe	Tunduma Town Council	Uwanjani Ward	14,926	Urban
187	Southwest Highlands	Songwe	Tunduma Town Council	Makambini	5,264	Urban
188	Southwest Highlands	Songwe	Tunduma Town Council	Mpemba Ward	14,792	Urban
189	Southern	Mtwara	Newala District Council	Chitekete Ward	4,624	Rural
190	Southern	Mtwara	Newala District Council	Mnyambe	9,043	Rural

No.	Zone	Region	Council	Ward	Population (2021)	Status
191	Southern	Mtwara	Newala District Council	Kitangari Ward	9,147	Rural
192	Southern	Mtwara	Newala District Council	Mchemo Ward	6,091	Rural
193	Southern	Mtwara	Newala District Council	Chiwonga	6,156	Rural
194	Southern	Mtwara	Newala District Council	Makukwe	7,278	Rural
195	Southern	Mtwara	Newala District Council	Nakahako	5,308	Rural
196	Southern	Mtwara	Newala District Council	Nambali Ward	7,503	Rural
197	Southern	Mtwara	Newala District Council	Mtunguru	7,018	Rural
198	Southern	Mtwara	Newala District Council	Mikumbi Ward	4,665	Rural
199	Southern	Lindi	Kilwa District Council	Tingi Ward	7,777	Rural
200	Southern	Lindi	Kilwa District Council	Kinjumbi Ward	8,601	Rural
201	Southern	Lindi	Kilwa District Council	Kipatimu Ward	17,212	Rural
202	Southern	Lindi	Kilwa District Council	Njinjo Ward	9,505	Rural
203	Southern	Lindi	Kilwa District Council	Nanjirinji Ward	8,749	Rural
204	Southern	Lindi	Kilwa District Council	Mandawa	15,293	Rural
205	Southern	Lindi	Kilwa District Council	Pande Mikoma	13,114	Rural
206	Southern	Lindi	Kilwa District Council	Kivinjesingino	22,741	Rural
207	Southern	Lindi	Kilwa District Council	Masoko Ward	16,481	Rural
208	Southern	Lindi	Kilwa District Council	Kibata Ward	10,098	Rural
209	Southern Highlands	Iringa	Mufindi District Council	Makungu	16,468	Rural
210	Southern Highlands	Iringa	Mufindi District Council	Kasanga	9,916	Rural
211	Southern Highlands	Iringa	Mufindi District Council	Mtambula	12,879	Rural
212	Southern Highlands	Iringa	Mufindi District Council	Idunda Ward	7,286	Rural
213	Southern Highlands	Iringa	Mufindi District Council	Ihowanza	12,923	Rural
214	Southern Highlands	Iringa	Mufindi District Council	Igombavu	8,976	Rural
215	Southern Highlands	Iringa	Mufindi District Council	Ifwagi Ward	14,901	Rural
216	Southern Highlands	Iringa	Mufindi District Council	Ihalimba	13,557	Rural
217	Southern Highlands	Iringa	Mufindi District Council	Mapanda	13,982	Rural

No.	Zone	Region	Council	Ward	Population (2021)	Status
218	Southern Highlands	Iringa	Mufindi District Council	Ikongisi Ward	6,239	Rural
219	Southern Highlands	Njombe	Makambako Town Council	Mjimwema	35,819	Urban
220	Southern Highlands	Njombe	Makambako Town Council	Mlowa Ward	6,760	Urban
221	Southern Highlands	Njombe	Makambako Town Council	Lyamkena	11,332	Urban
222	Southern Highlands	Njombe	Makambako Town Council	Mwembetogwa	6,206	Urban
223	Southern Highlands	Njombe	Makambako Town Council	Mahongole	11,194	Urban
224	Southern Highlands	Njombe	Makambako Town Council	Kitandililo Ward	8,107	Urban
225	Southern Highlands	Njombe	Makambako Town Council	Utengule Ward	10,442	Urban
226	Southern Highlands	Njombe	Makambako Town Council	Kitisi Ward	4,622	Urban
227	Southern Highlands	Njombe	Makambako Town Council	Maguvani Ward	12,072	Urban
228	Southern Highlands	Njombe	Makambako Town Council	Majengo Ward	3,140	Urban
229	Southern Highlands	Ruvuma	Songea Municipal Council	Misufini Ward	5,726	Urban
230	Southern Highlands	Ruvuma	Songea Municipal Council	Lizaboni Ward	18,473	Urban
231	Southern Highlands	Ruvuma	Songea Municipal Council	Bombambili Ward	35,009	Urban
232	Southern Highlands	Ruvuma	Songea Municipal Council	Matogoro Ward	6,250	Urban
233	Southern Highlands	Ruvuma	Songea Municipal Council	Subira Ward	9,481	Urban
234	Southern Highlands	Ruvuma	Songea Municipal Council	Mshangano Ward	10,199	Urban
235	Southern Highlands	Ruvuma	Songea Municipal Council	Tanga Ward	10,791	Urban
236	Southern Highlands	Ruvuma	Songea Municipal Council	Msamala Ward	23,701	Urban
237	Southern Highlands	Ruvuma	Songea Municipal Council	Mjimwema Ward	15,296	Urban
238	Southern Highlands	Ruvuma	Songea Municipal Council	Mateka Ward	17,309	Urban
239	Western	Tabora	Urambo District Council	Urambo Ward	29,760	Rural
240	Western	Tabora	Urambo District Council	Vumilia Ward	14,308	Rural
241	Western	Tabora	Urambo District Council	Songambele	18,218	Rural
242	Western	Tabora	Urambo District Council	Uyogo Ward	26,157	Rural
243	Western	Tabora	Urambo District Council	Ussoke Ward	12,222	Rural

No.	Zone	Region	Council	Ward	Population (2021)	Status
244	Western	Tabora	Urambo District Council	Ugalla Ward	11,886	Rural
245	Western	Tabora	Urambo District Council	Itundu Ward	9,577	Rural
246	Western	Tabora	Urambo District Council	Imalamakoye	4,254	Rural
247	Western	Tabora	Urambo District Council	Ukondamoyo	18,519	Rural
248	Western	Tabora	Urambo District Council	Mchikichini Ward	9,165	Rural
249	Western	Kigoma	Buhigwe District Council	Muyama Ward	13,980	Rural
250	Western	Kigoma	Buhigwe District Council	Mugera Ward	21,334	Rural
251	Western	Kigoma	Buhigwe District Council	Kilelema Ward	20,798	Rural
252	Western	Kigoma	Buhigwe District Council	Buhigwe Ward	20,523	Rural
253	Western	Kigoma	Buhigwe District Council	Janda Ward	22,295	Rural
254	Western	Kigoma	Buhigwe District Council	Munzeze Ward	25,124	Rural
255	Western	Kigoma	Buhigwe District Council	Munanila Ward	22,921	Rural
256	Western	Kigoma	Buhigwe District Council	Mwayaya Ward	14,765	Rural
257	Western	Kigoma	Buhigwe District Council	Kinazi Ward	12,446	Rural
258	Western	Kigoma	Buhigwe District Council	Mubanga Ward	9,104	Rural

Annex 6: Contributors to this report

Participants: July 2022 VA Workshop

S/N	Name	Affiliation		S/N	Name	Affiliation
1	Claud Kumalija	Head HMIS		10	Joyce Mugasa	Senior Medical Specialist
2	Trust Nyondo	Statistician		11	Geofrey Semu	Senior Health Information Officer
3	Gisbert Msigwa	Statistician		12	Richard Ndeka	Registration Officer
4	Don De Savigny	Senior Health Systems Technical Advisor		13	Walter Ndesanjo	Senior ICTO
5	Robert Mswia	VA Technical Advisor		14	Emmanuel Massawe	IT Officer
6	Isaac Lyatuu	Research Scientist		15	James Mwanza	Senior CRVS Advisor (Vital Strategies)
7	Sigilbert Mrema	Research Scientist		16	Martin Bratchi	Technical Director CRVS (Vital Strategies)
8	Imani Irema	IT Officer		17	Fabrizio Molteni	NMCP
9	Mahadia Tunga	Data Scientist		18	Emilian Karugendo	NBS
				19	Sumaiyya Thawer	NMCP

PCVA Coders

S/N	Name	Afficialtion		S/N	Name	Afficialtion
1	Dr. Joyce Mugasa	Senior Medical Specialist		3	Dr.Olivia Shirima	Senior Medical Specialist
2	Dr Robert Moshiro	Senior Medical Specialist		4	Dr. Patrick Kabangutse	Senior Medical Specialist

VA Interviewers in 10 Wards

S/N	Name	Affiliation		S/N	Name	Affiliation
1	Hamida Ramadhani	VAI		11	Japhet Isaack	VAI
2	Mohamed Rupia	VAI		12	Warialanga Nnko	VAI
3	Salma Ukwama	VAI		13	Charles Madola	VAI
4	Hamis Bofu	VAI		14	Asha Mbwana	VAI
5	Kuruthumu Dibwine	VAI		15	Habiba Mchanka	VAI
6	Zainabu Abdul	VAI		16	Mbaraka Mpenda	VAI
7	Iddy Issa	VAI		17	Moses Mkinga	VAI
9	David Mshingo	VAI		18	Love Mwambalaswa	VAI
10	Ally Mbwana	VAI		19	Hussein Halid	VAI
				20	Ezekiel Godfrey	VAI

VA Interviewers in 106 Iringa Wards

S/N	Name	Affiliation		S/N	Name	Affiliation
1	Fabian Masele	VAI		54	Suzana Mgongolwa	VAI
2	Magdalena Mkwawi	VAI		55	Nikanileka Chaula	VAI
3	Emmanuel Fungo	VAI		56	Richard Ngungulu	VAI
4	Jema Longo	VAI		57	Mkombozi Mella	VAI
5	Asha Feruzi	VAI		58	Burhani Mfinanga	VAI
6	Magie Nambela	VAI		59	Joseph Madodi	VAI
7	Rose Mbilinyi	VAI		60	Sophia Langa	VAI
8	Elice Munice	VAI		61	Rodrick Ndondole	VAI
9	Violeth Mtelekeswa	VAI		62	Grace Mazengo	VAI
10	Edgar Madembwe	VAI		63	Spia Kinyowa	VAI
11	Daudi Mohamedi	VAI		64	Elizabeth Njavike	VAI
12	Imelda Mgimwa	VAI		65	Perus Kigwa	VAI

13	Amina Mwenda	VAI		66	Simon Mbugangali	VAI
14	Erhard Willa	VAI		67	Aprow Msungile	VAI
15	Anna Chaula	VAI		68	Mathius Mkakanzi	VAI
16	Michael Kunzi	VAI		69	Mathias Mkakanzi	VAI
17	Stanley Kumbakumba	VAI		70	Marcus Makweta	VAI
18	Peter Mbunga	VAI		71	Priscus Chalamila	VAI
19	Irene Myonga	VAI		72	Richard Chelesi	VAI
20	Nansia Mwachuma	VAI		73	Rogath Mtavangu	VAI
21	Amon Msamba	VAI		74	Amani Kihwelo	VAI
22	Jackson Mhagama	VAI		75	Romanus Sanga	VAI
23	Emmason Aligawesa	VAI		76	Alfayo Kyando	VAI
24	Estye Ngombe	VAI		77	Otavyo Kalinga	VAI
25	Faustine Ngoda	VAI		78	Thomas Nyamwangi	VAI
26	David Kanyelele	VAI		79	Argentina Myovela	VAI
27	Shaibu Mpinga	VAI		80	Dafroza Mwakyusa	VAI
28	Khadija Shaha	VAI		81	Abdul Diuchile	VAI
29	Matrida Kasanga	VAI		82	Grace Kalomesi	VAI
30	Bwire Ngilla	VAI		83	Blantina Mtasiwa	VAI
31	Juma Juma	VAI		84	Zakaria Kilatu	VAI
32	Victor Katunzi	VAI		85	Mica Swale	VAI
33	Elizabeth William	VAI		86	Valeria Kiduke	VAI
34	Vicent Madelemo	VAI		87	Getrude Malangalila	VAI
35	Catherine Massao	VAI		88	Leah Kapungu	VAI
36	Jesca Ndalo	VAI		89	Gesela Shinyambala	VAI
37	Regina Mushi	VAI		90	Rehema Mbalwa	VAI
38	Yusta Siriwa	VAI		91	Leonard Irira	VAI
39	Theopist Q. Peter	VAI		92	Paschazia Rwoto	VAI
40	Fatuma Mpwapwa	VAI		93	Janeth Kinyanambo	VAI
41	Lilian Chikola	VAI		94	Kheri Chalamila	VAI

42	Johari Sengu	VAI		95	Rehema Mnyinga	VAI
43	Lazaro Lukosi	VAI		96	Donald Mgaya	VAI
44	Issa S. Abubakar	VAI		97	Faraja Mkonyola	VAI
45	Debora Kivamba	VAI		98	Basanwa Mtafya	VAI
46	Orio Chavala	VAI		99	Wilson Ntagondwa	VAI
47	Stanley Chuhila	VAI		100	Marco Charles	VAI
48	Thito K. Haule	VAI		101	Issa John	VAI
49	Sylvester Kitule	VAI		102	Fanuel Katenga	VAI
50	Zabron Mhadisa	VAI		103	Merad Mpulule	VAI
51	Simon Njiku	VAI		104	Catherine Wampembe	VAI
52	Jailosi M. Kikoti	VAI		105	Cleopatra Kang'wezi	VAI
53	Kuruthumu Mbaga	VAI		106	Rozaria Mpwiniza	VAI

Annex 7: List of 531 ICD-10 Codes used for PCVA in Tanzania

No	ICD Code	ICD Name		No	ICD Code	ICD Name
1	A00	Cholera		266	J93	Pneumothorax
2	A01	Typhoid		267	K02	Dental caries
3	A20	Plague		268	K04	Disease of pulp and periapical tissues [dental abscess]
4	A33	Tetanus, Neonatal		269	K20	Oesophagitis
5	A41	Septicaemia		270	K26	Duodenal ulcer
6	A75	Relapsing Fever (Louse borne Typhus)		271	K27	Peptic ulcer, site unspecified
7	B05	Measles		272	K35	Acute appendicitis
8	B45	Meningitis Cryptococal		273	K36	Other appendicitis
9	B53	Malaria confirmed		274	K40	Inguinal hernia
10	B54	Malaria presumptive		275	K41	Femoral hernia
11	C80	Neoplasm		276	K42	Umbilical hernia
12	G03	Meningitis		277	K70	Alcoholic liver disease
13	G04	Encephalitis		278	K71	Toxic liver disease
14	G83	Acute Flaccid Paralysis		279	K72	Hepatic failure [encephalopathy]
15	I50	Heart failure		280	K85	Acute pancreatitis
16	J06	Respiratory Infection Acute (ARI)		281	L88	Pyoderma gangrenosum
17	J18	Pneumonia		282	L89	Decubitus ulcer and pressure area
18	J45	Asthma		283	L98	Other disorders of skin and subcutaneous tissues
19	J81	Pulmonary oedema		284	M60	Myositis [pyomyositis]
20	J98	Pneumopathies		285	N17	Acute renal failure
21	L08	Skin infections		286	N18	Chronic kidney disease [chronic renal failure]
22	R09	Pleurisy (non-Tuberculosis)		287	N28	Other disorders of kidney and ureters
23	R50	Fever Chronic (> 1 month)		288	N40	Hyperplasia of prostate [BPH]

24	S09	Head injury		289	O00	Ectopic pregnancy
25	S36	Ruptured spleen		290	O03	Spontaneous abortion
26	T14	Fractures		291	O04	Medical abortion
27	T14.9	Trauma Other		292	O07	Failed attempted abortion [criminal]
28	T30	Burns		293	O10	Pre-existing hypertension complicating pregnancy, child birth and the puerperium
29	C46	Kaposi's sarcoma		294	O13	Gestation [pregnancy-induced] hypertension
30	C80	Tumours Other malignant		295	O15	Eclampsia
31	D48	Tumours Other non-malignant		296	O16	Unspecified maternal hypertension
32	E14	Diabetes		297	O24	Diabetes mellitus in pregnancy
33	I42	Cardiomyopathy		298	O29	Complication of anaesthesia during pregnancy
34	A80	Acute Flacid Paralysis (polio)		299	O44	Placenta praevia
35	K25	Ulcer, gastro-duodenal		300	O45	Abruptio placenta
36	K46	Hernia		301	O64	Obstructed labour due to malposition and malpresentation of fetus
37	K65	Peritonitis (non-Tuberculosis)		302	O65	Obstructed labour due to maternal pelvic abnormality
38	K74	Cirrhosis of the liver		303	O73	Retained placenta and membrane without haemorrhage
39	K75	Hepatitis		304	O88	Obstetric embolism
40	K92	Digestive tract Haemorrhages		305	O95	Obstetric death of unspecified cause
41	M86	Bone infections (including osteomyelitis)		306	O96	Death from any obstetric cause occurring more than 42 days but less than 1 year after delivery

42	M89	Bone and joint disease other		307	O97	Death from sequelae of obstetric causes
43	N04	Nephrotic syndrome		308	P00	Fetus and newborn affected by maternal conditions that may be unrelated to present pregnancy
44	N05	Glomerulonephritis		309	P02	Fetus and newborn affected by complications of placenta, cord and membranes
45	N15	Kidney infections		310	P03	Fetus and newborn affected by other complications of labour and delivery
46	N39	Urinary tract infections		311	P07	Disorders relating to short gestation and low birth weight [prematurity]
47	N94	Gynecological problems		312	P08	Disorders relating to long gestation and high birth weight [post-maturity]
48	B24	Paediatric AIDS		313	P10	Intracranial laceration and haemorrhage due to birth injury
49	P15	Birth trauma		314	P24	Neonatal aspiration syndromes
50	P21	Neonatal Asphyxia		315	P38	Omphalitis of newborn with or without mild haemorrhage
51	P54	Haemorrhage		316	P51	Umbilical haemorrhage of newborn
52	P74	Dehydration		317	P53	Haemorrhagic disease of fetus and newborn [Vitamin K deficiency]
53	P95	Stillbirth (macerated)		318	P55	Haemolytic disease of fetus and newborn
54	P95	Stillbirth		319	P57	Kernicterus
55	Q05	Congenital hydrocephalus and spinal bifida		320	P59	Neonatal jaundice from other and unspecified causes

56	Q24	Congenital malformation of the heart		321	P60	Disseminated intravascular coagulation of fetus and newborn
57	Q89	Other congenital malformation		322	P80	Hypothermia of newborn
58	R95	Sudden infant death syndrome		323	P96	Other conditions originating in the perinatal period
59	X49	Accidental poisoning by and exposure to noxious substances		324	Q00	Anencephaly and similar malformation
60	Y09	Assault		325	Q01	Encephalocele
61	O06	Abortion		326	Q02	Microcephaly
62	O46	Antepartum Haemorrhage		327	Q03	Congenital hydrocephalus
63	O66	Obstructed Labour		328	Q20	Congenital malformation of cardiac chambers and connections
64	O71	Rupture uterus		329	Q21	Congenital malformation of cardiac septa
65	O72	Post-partum haemorrhage		330	Q22	Congenital malformation of pulmonary and tricuspid valves
66	O75	Local herbs		331	Q23	Congenital malformation of aortic and mitral valves
67	O85	Puerperal Sepsis /Septicaemia		332	Q25	Congenital malformation of great arteries
68	O99	Pneumonia		333	Q39	Congenital malformation of oesophagus
69	Z21	Asymptomatic HIV		334	Q42	Congenital absence, atresia and stenosis of large intestine
70	T29	Burns and corrosions of multiple body regions		335	Q90	Down syndrome
71	T30	Burn and corrosion, body region unspecified		336	R54	Senility

72	T31	Burns classified according to extent of body surface involved		337	R57	Shock [cardiogenic, hypovolemic and septic]
73	T32	Corrosions classified according to extent of body surface involved		338	R65	Systemic inflammatory response syndrome [SIRS]
74	T50	Poisoning by diuretics and other unspecified drugs, medicaments and biological substances		339	R96	Sudden death (cause unknown)
75	T51	Toxic effect of alcohol		340	R98	Unattended death (found dead and no cause could be discovered)
76	T54	Toxic effect of corrosive substances		341	V01	Pedestrian injured in collision with pedal cycle
77	T56	Toxic effect of metals		342	V02	Pedestrian injured in collision with two or three wheeled motor vehicle
78	T58	Toxic effect of carbon monoxide		343	V03	Pedestrian injured in collision with car, pick-up truck or van
79	T59	Toxic effect of other gases, fumes and vapours		344	V04	Pedestrian injured in collision with heavy transport vehicle or bus
80	T60	Toxic effect of pesticides		345	V05	Pedestrian injured in collision with railway train or railway vehicle
81	T65	Toxic effect of other and unspecified substances		346	V06	Pedestrian injured in collision with other non-motor vehicle
82	T67	Effects of heat and light		347	V08	Pedestrian injured in other and unspecified traffic accidents
83	T70	Effects of air pressure and water pressure		348	V10	Pedal cyclist injured in collision with pedestrian or animal
84	T71	Asphyxiation		349	V11	Pedal cyclist injured in collision with other pedal cycle
85	T80	Complications following infusion, transfusion and therapeutic injection		350	V12	Pedal cyclist injured in collision with two or

						three wheeled motor vehicle
86	T81	Complications of procedures, not elsewhere classified		351	V13	Pedal cyclist injured in collision with car, pick-up truck or van
87	T83	Complications of genitourinary devices, implants and grafts		352	V14	Pedal cyclist injured in collision with heavy transport vehicle or bus
88	Y08	Assault by other specified means		353	V15	Pedal cyclist injured in collision with railway train or railway vehicle
89	Y09	Assault by other unspecified means		354	V16	Pedal cyclist injured in collision with other non-motor vehicle
90	V98	Other Specified transport accidents		355	V17	Pedal cyclist injured in collision with fixed or stationary object
91	V99	Unspecified transport accidents		356	V18	Pedal cyclist injured in non-collision transport accident
92	P78	Diarrhoea - Perinatal digestive system disorders		357	V19	Pedal cyclist injured in other and unspecified transport accidents
93	N19	Unspecified kidney failure		358	V20	Motorcycle rider injured in collision with pedestrian or animal
94	D64	Other anemias		359	V21	Motorcycle rider injured in collision with pedal cycle
95	E46	Unspecified protein-calorie malnutrition		360	V22	Motorcycle rider injured in collision with two or three wheeled motor vehicle
96	I51	Complications and ill-defined descriptions of heart disease		361	V23	Motorcycle rider injured in collision with car, pick-up truck or van
97	B24	Other and unspecified HIV disease		362	V24	Motorcycle rider injured in collision with heavy transport vehicle or bus
98	A06	Amoebiasis		363	V25	Motorcycle rider injured in collision with railway train or railway vehicle

99	A16	Respiratory tuberculosis, not confirmed bacteriologically or histologically		364	V26	Motorcycle rider injured in collision with other non-motor vehicle
100	C50	Malignant neoplasm of breast		365	V27	Motorcycle rider injured in collision with fixed or stationary object
101	K37	Appendicitis		366	V28	Motorcycle rider injured in non-collision transport accident
102	C55	Malignant neoplasm of uterus, part unspecified		367	V29	Motorcycle rider injured in other and unspecified transport accidents
103	C61	Malignant neoplasm of prostate		368	V30	Occupant of three wheeled motor vehicle injured in collision with pedestrian or animal
104	I64	Stroke, not specified as haemorrhage or infarction		369	V31	Occupant of three wheeled motor vehicle injured in collision with pedal cycle
105	K29	Gastritis and duodenitis		370	V32	Occupant of three wheeled motor vehicle injured in collision with two or three wheeled motor vehicle
106	O75	Other complication of labour and delivery not else classified		371	V33	Occupant of three wheeled motor vehicle injured in collision with car, pick-up truck or van
107	O16	Unspecified maternal hypertension		372	V34	Occupant of three wheeled motor vehicle injured in collision with heavy transport vehicle or bus
108	O99	Other maternal diseases complicating pregnancy, child birth and puerperium		373	V35	Occupant of three wheeled motor vehicle injured in collision with railway train or railway vehicle
109	P05	Low birth weight		374	V36	Occupant of three wheeled motor vehicle injured in collision with

						other non-motor vehicle
110	P22	Respiratory distress of newborn		375	V37	Occupant of three wheeled motor vehicle injured in collision with fixed or stationary object
111	P36	Bacterial diseases of newborn [neonatal sepsis]		376	V38	Occupant of three wheeled motor vehicle injured in non-collision transport accidents
112	P37	Congenital malaria		377	V39	Occupant of three wheeled motor vehicle injured in other and unspecified transport accidents
113	I11	Hypertensive heart disease		378	V40	Car occupant injured in collision with pedestrian or animal
114	R99	Ill-defined and unknown cause of mortality		379	V41	Car occupant injured in collision with pedal cycle
115	E40	Kwashiorkor		380	V42	Car occupant injured in collision with two or three wheeled motor vehicle
116	W01	Fall on same level from slipping, tripping and stumbling		381	V43	Car occupant injured in collision with car, pick-up truck or van
117	W17	Other fall from one level to another		382	V44	Car occupant injured in collision with heavy transport vehicle or bus
118	W74	Unspecified cause of accidental drowning and submersion		383	V45	Car occupant injured in collision with railway train or railway vehicle
119	D57	Sickle-cell disorders		384	V46	Car occupant injured in collision with other non-motor vehicle
120	O99.4	Diseases of the circulatory system complicating pregnancy, childbirth and the puerperium		385	V47	Car occupant injured in collision with fixed or stationary object

121	P23	Congenital pneumonia		386	V48	Car occupant injured in non-collision transport accidents
122	G40	Epilepsy		387	V49	Car occupant injured in collision in other and unspecified transport accidents
123	W14	Fall from a tree		388	V50	Occupant of pick-up truck or van injured in collision with pedestrian or animal
124	W20	Struck by thrown, projected or falling object		389	V51	Occupant of pick-up truck or van injured in collision with pedal cycle
125	K86	Disease of pancreas, unspecified		390	V52	Occupant of pick-up truck or van injured in collision with two or three wheeled motor vehicle
126	F32	Depression		391	V53	Occupant of pick-up truck or van injured in collision with car, pick-up truck or van
127	W19	Unspecified fall		392	V54	Occupant of pick-up truck or van injured in collision with heavy transport vehicle or bus
128	X83	Intentional Self-harm by other specified means		393	V55	Occupant of pick-up truck or van injured in collision with railway train or railway vehicle
129	X84	Intentional Self-harm by unspecified means		394	V56	Occupant of pick-up truck or van injured in collision with other non-motor vehicle
130	X33	Victim of Lightning		395	V57	Occupant of pick-up truck or van injured in collision with fixed or stationary object
131	A97	Dengue		396	V58	Occupant of pick-up truck or van injured in non-collision transport accidents

132	**X27**	**Contact with other specified venomous animals**		**397**	**V59**	**Occupant of pick-up truck or van injured in other and unspecified transport accidents**
133	**J44**	**Chronic Obstructive Pulmonary Disease**		**398**	**V60**	**Occupant of heavy transport vehicle injured in collision with pedestrian or animal**
134	**W55**	**Bitten or struck by other mammals**		**399**	**X65**	**Intentional self-poisoning by and exposure to alcohol**
135	**X08**	**Exposure to other specified smoke, fire and flames**		**400**	**V61**	**Occupant of heavy transport vehicle injured in collision with pedal cycle**
136	**W79**	**Inhalation and ingestion of food causing obstruction of respiratory**		**401**	**V62**	**Occupant of heavy transport vehicle injured in collision with two or three wheeled motor vehicle**
137	**A01**	**Typhoid and paratyphoid**		**402**	**V63**	**Occupant of heavy transport vehicle injured in collision with car, pick-up truck or van**
138	**A09**	**Other and unspecified diarrhoeal diseases**		**403**	**V64**	**Occupant of heavy transport vehicle injured in collision with heavy transport vehicle or bus**
139	**A15**	**Respiratory tuberculosis, confirmed bacteriologically or histologically**		**404**	**V65**	**Occupant of heavy transport vehicle injured in collision with railway train or railway vehicle**
140	**C22**	**Malignant neoplasm of liver and intrahepatic bile ducts**		**405**	**V66**	**Occupant of heavy transport vehicle injured in collision with other non-motor vehicle**
141	**C53**	**Malignant neoplasm of cervix uteri**		**406**	**V67**	**Occupant of heavy transport vehicle injured in collision with fixed or stationary object**

142	I10	Essential (primary) hypertension		407	V68	Occupant of heavy transport vehicle injured in non-collision transport accidents
143	K56	Paralytic ileus and intestinal obstruction without hernia [Intussusception & volvulus]		408	V69	Occupant of heavy transport vehicle injured in other and unspecified transport accidents
144	K76	Other unspecified liver diseases		409	V70	Bus occupant injured in collision with pedestrian or animal
145	O98	Maternal infectious and parasitic diseases complicating pregnancy, child birth and puerperium		410	V71	Bus occupant injured in collision with pedal cycle
146	P95	Fetal death of unspecified cause [stillbirth]		411	V72	Bus occupant injured in collision with two or three wheeled motor vehicle
147	A03	Shigellosis		412	V73	Bus occupant injured in collision with car, pick-up truck or van
148	A09.0	Other and unspecified diarrhoeal diseases		413	V74	Bus occupant injured in collision with heavy transport vehicle or bus
149	A17	Tuberculosis of nervous system		414	V75	Bus occupant injured in collision with railway train or railway vehicle
150	A18	Tuberculosis of other organs		415	V76	Bus occupant injured in collision with other non-motor vehicle
151	A19	Miliary tuberculosis		416	V77	Bus occupant injured in collision with fixed or stationary object
152	A22	Anthrax		417	V78	Bus occupant injured in non-collision transport accidents
153	A23	Brucellosis		418	V79	Bus occupant injured in collision in other and unspecified transport accidents
154	A30	Leprosy		419	V80	Animal-rider or occupant of animal

						ódrawn vehicle injured in transport accident
155	A34	Obstetric tetanus		420	V81	Occupant of railway train or railway vehicle injured in transport accident
156	A36	Diphtheria		421	V87	Traffic accident of specified type but victims mode of transport unknown
157	A37	Whooping cough		422	V89	Motor or non-motor vehicle accident, type of vehicle unspecified
158	A39	Meningococcal infection		423	V90	Accident to watercraft causing drowning and submersion
159	A40	Streptococcal sepsis		424	V92	Water-transport-related drowning and submersion without accident to watercraft
160	A50	Congenital syphilis		425	V93	Accident on board watercraft without accident to watercraft, not causing drowning and submersion
161	A51	Syphilis (early)		426	V94	Other and unspecified water transport accidents
162	A64	Other and unspecified infections with a predominantly sexual mode of transmission		427	V95	Accident to powered aircraft causing injury to occupant
163	A68	Relapsing fever		428	W03	Other fall on same level due to collision with, or pushing by, another person
164	A82	Rabies		429	W04	Fall while being carried or supported by other persons
165	A87	Viral meningitis		430	W08	Fall involving other furniture
166	A95	Yellow fever		431	W10	Fall on and from stairs and steps

167	A98	Other viral haemorrhagic fevers		432	W11	Fall on and from ladder
168	B00	Herpes viral [herpes simples]		433	W12	Fall on and from scaffolding
169	B01	Varicella [chicken pox]		434	W13	Fall from, out of or through building or structure
170	B02	Zoster [herpes zoster]		435	W16	Driving or jumping into water causing injury other than drowning or submersion
171	B06	Rubella (German measles]		436	W18	Other fall on same level
172	B16	Hepatitis B		437	W22	Striking against or struck by other object
173	B17	Other viral hepatitis		438	W26	Contact with sharp objects
174	B19	Unspecified viral hepatitis		439	W32	Handgun discharge [accidental]
175	B20	HIV disease with tuberculosis		440	W34	Discharge from other and unspecified firearm [accidental]
176	B21	HIV disease resulting in malignant neoplasm		441	W54	Bitten or struck by dog
177	B22	HIV disease resulting in other specified diseases		442	W58	Bitten and struck by crocodile or alligator
178	B37	Candidiasis		443	W65	Drowning and submersion while in bath-tub
179	B55	Leishmaniasis		444	W66	Drowning and submersion following fall into bath-tub
180	B56	African trypanosomiasis		445	W67	Drowning and submersion while in swimming-pool
181	B57	Chagas disease		446	W68	Drowning and submersion following fall into swimming-pool
182	B58	Toxoplasmosis		447	W69	Drowning and submersion while in natural water
183	B59	Pneumocystosis [PCP]		448	W70	Drowning and submersion following fall into natural water

184	B65	Schistosomiasis		449	W75	Accidental suffocation and strangulation in bed
185	C03	Malignant neoplasm of the gum		450	W76	Other accidental hanging and strangulation
186	C14	Malignant neoplasm of other and ill-defined sites in the lip, oral cavity and pharynx		451	W80	Inhalation and ingestion of other object causing obstruction of respiratory tract.
187	C15	Malignant neoplasm of Oesophagus		452	W81	Confined to or trapped in a low oxygen environment
188	C16	Malignant neoplasm of stomach		453	W83	Other specified threats to breathing
189	C17	Malignant neoplasm of small intestine		454	W84	Unspecified threat to breathing
190	C18	Malignant neoplasm of colon		455	W85	Exposure to electric transmission lines [accidental]
191	C20	Malignant neoplasm of rectum		456	W86	Exposure to other specified electric current [accidental]
192	C25	Malignant neoplasm of pancrease		457	W87	Exposure to unspecified electric current [accidental]
193	C30	Malignant neoplasm of nasal cavity and middle ear		458	W94	Exposure to high and low air pressure and changes in air pressure
194	C32	Malignant neoplasm of larynx		459	WO1	Fall on the same level from slipping, tripling and stumbling
195	C33	Malignant neoplasm of trachea		460	X00	Exposure to uncontrolled fire in building or structure
196	C34	Malignant neoplasm of bronchus and lung		461	X01	Exposure to uncontrolled fire, not in building or structure
197	C43	Malignant melanoma of skin		462	X09	Exposure to unspecified smoke, fire and flames
198	C52	Malignant neoplasm of vagina		463	X10	Contact with hot drinks, food, fats and cooking oils

199	C56	Malignant neoplasm of ovary		464	X12	Contact with other hot fluids, e.g. boiled water
200	C58	Malignant neoplasm of placenta [choriocarcinoma]		465	X16	Contact with hot heating appliances, radiators and pipes
201	C60	Malignant neoplasm of penis		466	X20	Contact with venomous snakes and lizards
202	C64	Malignant neoplasm of kidney		467	X23	Contact with hornets, wasps and bees
203	C67	Malignant neoplasm of bladder		468	X26	Contact with venomous marine animals and plants
204	C69	Malignant neoplasm of eye and adnexa		469	X28	Contact with other specified venomous plants
205	C70	Malignant neoplasm of meninges		470	X29	Contact with unspecified venomous animals or plants
206	C71	Malignant neoplasm of brain		471	X34	Victim of earthquake
207	C76	Malignant neoplasm of other and ill-defined sites		472	X36	Victim of landslide and other earth movements
208	C81	Hodgkin lymphoma		473	X37	Victim of cataclysmic [cyclone, hurricane] storm
209	C85	Other and unspecified types of non-Hodgkin lymphoma		474	X38	Victim of flood
210	C90	Multiple myeloma and malignant plasma cell neoplasms		475	X39	Exposure to other and unspecified forces of nature
211	C91	Lymphoid leukemia		476	X44	Accidental poisoning by and exposure to other and unspecified drugs, medicaments and biological substances
212	C92	Myeloid leukemia		477	X45	Accidental poisoning by and exposure to alcohol
213	C93	Monocytic leukemia		478	X48	Accidental poisoning by and exposure to pesticides
214	C94	Other leukemias of specified cell type		479	X64	Intentional self-poisoning by and exposure to other and unspecified drugs,

						medicaments and biological substances
215	C95	Leukemia of unspecified cell type		480	X68	Intentional self-poisoning by and exposure to pesticides
216	D50	Iron deficiency anaemia		481	X69	Intentional self-poisoning by and exposure to other and unspecified chemicals and noxious substances
217	D52	Folate deficiency anaemia		482	X70	Intentional self-harm by hanging, strangulation and suffocation
218	D65	Disseminated intravascular coagulation [defibrination syndrome]		483	X71	Intentional self-harm by drowning and submersion
219	D68	Other coagulation defects [incl. Vit. K deficiency]		484	X72	Intentional self-harm by handgun discharge
220	E05	Thyrotoxicosis [hyperthyroidism]		485	X74	Intentional self-harm by other and unspecified firearm discharge
221	E10	Type 1 diabetes mellitus		486	X75	Intentional self-harm by explosive material
222	E11	Type 2 diabetes mellitus		487	X76	Intentional self-harm by smoke, fire and flames
223	E41	Nutritional marasmus		488	X78	Intentional self-harm by sharp object
224	E42	Marasmic - kwashiorkor		489	X80	Intentional self-harm by jumping from a high place
225	E51	Thiamine deficiency		490	X81	Intentional self-harm by jumping or lying before moving object
226	E86	Volume depletion [dehydration]		491	X82	Intentional self-harm by crushing of motor vehicle
227	F01	Vascular dementia		492	X85	Assaulted by drugs, medicaments and biological substances

228	F05	Delirium, not induced by alcohol and other psychoactive substances		493	X86	Assaulted by corrosive substance
229	F10	Alcohol use disorders		494	X87	Assaulted by pesticides
230	F11	Mental and behavioural disorders due to use of opioids		495	X90	Assaulted by unspecified chemical or noxious substance
231	F13	Mental and behavioural disorders due to use of sedatives or hypnotics		496	X91	Assaulted by hanging, strangulation and suffocation
232	F14	Mental and behavioural disorders due to use of cocaine		497	X92	Assaulted by drowning and submersion
233	F19	Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances		498	X93	Assaulted by handgun discharge
234	G00	Bacterial meningitis		499	X95	Assaulted by other and unspecified firearm discharge
235	G06	Intracranial and intraspinal abscess and granuloma		500	X96	Assaulted by explosive material
236	G30	Alzheimers disease, dementias		501	X97	Assaulted by smoke, fire and flames
237	H66	Suppurative and unspecified otitis media		502	X99	Assaulted by sharp object
238	I05	Rheumatic mitral valve diseases		503	Y00	Assaulted by blunt object
239	I15	Secondary hypertension		504	Y01	Assaulted by pushing from high place
240	I20	Angina pectoris		505	Y02	Assaulted by pushing or placing victim before moving object
241	I21	Acute myocardial infarction		506	Y03	Assaulted by crashing of motor vehicle
242	I24	Other acute ischaemic heart diseases		507	Y05	Sexual assault by bodily force [rape]
243	I26	Pulmonary embolism		508	Y06	Neglect and abandonment
244	I30	Acute pericarditis		509	Y13	Poisoning by and exposure to other and unspecified chemicals and noxious

						substances, undetermined intent
245	I38	Endocarditis		510	Y14	Poisoning by and exposure to other and unspecified drugs, medicaments and biological substances, undetermined intent
246	I42	Cardiomyopathy		511	Y15	Poisoning by and exposure to alcohol, undetermined intent
247	I60	Subarachnoid haemorrhage		512	Y18	Poisoning by and exposure to pesticides, undetermined intent
248	I61	Intracerebral haemorrhage		513	Y20	Hanging, strangulation and suffocation, undetermined intent
249	I63	Cerebralinfarction		514	Y21	Drowning and submersion, undetermined intent
250	I69	Sequelae of cerebrovascular disease		515	Y22	Handgun discharge, undetermined intent
251	I70	Atherosclerosis		516	Y24	Other and unspecified firearm discharge, undetermined intent
252	I71	Aortic aneurism and dissection		517	Y25	Contact with explosive material, undetermined intent
253	I74	Arterial embolism and thrombosis		518	Y26	Exposure to smoke, fire and flames, undetermined intent
254	I85	Oesophageal varices		519	Y28	Contact with sharp object, undetermined intent
255	J03	Acute tonsillitis		520	Y29	Contact with blunt object, undetermined intent
256	J05	Acute obstructive laryngitis [croup] and epiglottitis		521	Y30	Falling, jumping or pushed from a high place, undetermined intent
257	J11	Influenza		522	Y31	Falling, lying or running before or into moving

						object, undetermined intent
258	J21	Acute bronchiolitis		523	Y32	Crushing of motor vehicle, undetermined intent
259	J36	Peritonsillar abscess [Quinsy]		524	Y33	Other specified events ó e.g. electrocution, etc., undetermined intent
260	J40	Bronchitis		525	Y34	Unspecified events, undetermined intent
261	J47	Bronchiectasis		526	Y35	Legal intervention
262	J64	Pneumoconiosis		527	Y40	Systemic antibiotics causing adverse effects in therapeutic use
263	J68	Respiratory conditions due to inhalation of chemicals, gases, fumes and vapours [chemical bronchitis]		528	Y41	Other systemic anti-infective and antiparasitics causing adverse effects in therapeutic use
264	J85	Abscess of lung and mediastinum		529	Y57	Other and unspecified drugs and medicaments causing adverse effects in therapeutic use
265	J90	Pleural effusion		530	P28	Other respiratory conditions originating in the perinatal period
				531	R58	Neonatal Haemorrhage

Annex 8. Informed consent form

United Republic of Tanzania

Ministry of Health

TAMKO LA KUPATA RIDHAA KUSHIRIKI MAHOJIANO YA KUBAINI SABABU YA KIFO

Salam! Jina langu ni _____ ni Afisa Mtendaji Kata wa Kata ya_____. Tunakusanya taarifa juu ya sababu za vifo vilivyotokea kwenye jamii. Tutashukuru sana iwapo utashirikiana nasi kwenye zoezi hili. Tungependa tukuulize kuhusu hali na matukio yaliyojiri kabla ya kifo cha marehemu. Yote utakayotueleza yatakuwa siri kabisa. Hatutatoa maelezo yoyote yatakayokutambulisha wewe au marehemu popote nje ya zoezi hili. Ushiriki wako kwenye zoezi hili ni muhimu sana kwa kuwa utaisaidia Serikali kupata taarifa zitakazo saidia kuboresha mikakati ya huduma za afya kwa wananchi.

Sasa ningependa kufahamu kama una swali lolote kuhusu dhumuni la zoezi hili au yale yatakayoulizwa kwenye mahojiano?

Je, naweza kuanza mahojiano sasa?

- Ndio, Mhojiwa amekubali kushiriki mahojiano…..Endelea na mahojiano
- Hapana, Mhojiwa amekataa kushiriki mahojiano…..Sitisha mahojiano

CONSENT TO PARTICIPATE IN AN INTERVIEW TO DETERMINE CAUSE OF DEATH

Hello! My name is _____. I am the Executive Ward Officer in _____ Ward. We are collecting information about the causes of deaths that have occurred in the community. We would greatly appreciate your cooperation in this exercise. We would like to ask you about the circumstances and events that took place before the deceased's passing. Everything you share with us will be kept completely confidential. We will not disclose any details that could identify you or the deceased outside of this exercise. Your participation in this exercise is crucial as it will assist the government in obtaining information to improve healthcare services for the citizens.

Now, I would like to know if you have any questions about the purpose of this exercise or the topics that will be discussed during the interview?

May I proceed with the interview?

- Yes, Interviewee has agreed to participate... Continue with the interview
- No, Interviewee has refused to participate... End the interview