

ISBN: 9987 634 01 X

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10. CAUSES OF DEATH IN PROJECT AREAS

10.1 Classification of diseases and cause of death

Historical note

The need for some system for coding causes of death was recognised over one hundred years ago in England by William Farr. The primary purpose of classification was to create a tool which would allow identification of major public health problems. The first international classification was published in 1899, and since that time classification systems have been reviewed and updated every 10 years. Responsibility for revision was undertaken by the World Health Organisation (WHO) in 1948.

From the perspective of developing countries and public health physicians, the original purpose of disease classification has become somewhat obscured and institutionalised. Nevertheless, the classification is an essential tool for purposes of standardisation and comparisons between and within countries. It has also allowed the development of structures to enable presentation of data that can be easily interpreted and identified.

The classification is based primarily on disease categories and therefore assumes availability of diagnostic facilities. Recognising that diagnostic facilities are often not available in developing countries the WHO, in 1973, published a classification system based on symptoms. This, however, was not widely applied and accepted and has never been revised. Nevertheless, since verbal “autopsy” does not always allow a precise diagnosis it is necessary to include in any classification based on verbal diagnosis, not only specific diagnoses, but syndromes or symptom-complexes.

10.2 Classification of causes of death in the Adult Morbidity and Mortality Project

The coders

The verbal autopsy forms for each area are coded independently by two physicians. One physician codes all forms from the three project areas. Those from Morogoro Rural District are subsequently reviewed by a second physician, and those from Dar es Salaam and Hai District by another second physician. Analysis of forms completed over the first three years of the project indicated that in 10% to 30% of forms there was a difference between physicians in assigned codes. Forms with differing codes are reviewed jointly by the coding physicians. For most forms agreement is reached, and those few for which there is no consensus referred to a third physician.

10.2.1 ‘Broad’ classification

Murray et al (Murray, Yang et al. 1992) have divided the causes of death into three groups: communicable and reproductive diseases (group I), non-communicable diseases (group II) and injuries (group III). Reproductive diseases were included in group I since the causes in group I “decline at much faster rates than overall mortality as socio-economic conditions improve”. We have followed their example in the creation of a ‘broad’ classification of causes of death. However, we have separated maternal and perinatal causes from communicable diseases, and have added one further category: deaths which cannot be clearly assigned to any category because their cause cannot be known from the verbal autopsy.

10.2.2 'Narrow' classification

The special condensed lists for mortality in the International Classification of Diseases (ICD-10) were taken as the starting point for creation of a verbal autopsy classification list for the Adult Morbidity and Mortality Project. See also the cause of death classification list in annex 20.5.

This list was developed and modified in the light of experience with verbal autopsies in the three study areas. It soon became clear that while it was often possible to assign cause of death to a specific disease or injury in many cases this was not possible, and for such it was necessary to expand the list by including syndromes e.g. heart failure and anaemia, and disease clusters or symptom-complexes e.g. febrile illness with seizures. We sought to keep the following criteria in mind in deciding which diseases, injuries, syndromes, and symptom-complexes should be included in the final list:

1. Is it specific enough or clinically meaningful?
2. Is it identifiable by verbal autopsy?
3. Is it of public health importance?
4. Is it susceptible to intervention?

Examination of the final list may cause observers to consider that a number of inclusions do not meet any of the above criteria. This could apply, for example, to certain cancers and a number of genito-urinary diseases. We found however, that confirmatory evidence of cause of death is often available and we encouraged interviewers to record this whenever possible. This is particularly true for Hai District which is well served by regional and district medical facilities.

Notes on principles of classification

Methods of assigning causes of death continue to be the subject of debate.

The form used for coding verbal autopsies has two columns for recording codes. The first column is headed *underlying* or *primary* cause and the second *contributory* or *associated* cause. In addition, other significant conditions not directly associated to the cause of death are recorded in the second column e.g. leprosy in a person who died as a result of injury.

Whenever possible we seek to attribute death to a single cause. "Each death is coded to the underlying cause that initiated the sequence of events leading to death." A person, for example, who dies from aspiration pneumonia as a result of carcinoma of the oesophagus is classified as having died from carcinoma of oesophagus. Nevertheless agreement on the underlying cause of death is not always easy. The elderly man, for example who fractures his femur, and while in hospital contracts a diarrhoeal disease which leads to dehydration and death. In this case which cause should be coded as the underlying or primary cause? Consider also the hypertensive patient who dies from stroke. Hypertension could be regarded as the underlying cause. We, however, code stroke as the primary or underlying cause, and hypertension as an associated or contributory cause.

For certain categories such as maternal deaths and transport accidents we code only O00 or V01 in the first column of the coding sheet since investigators may wish to analyse such groups of causes of death in detail by examination of the verbal autopsy forms. The codes therefore are sufficient to allow identification of broad categories of cause of death.

Coding of more than one cause of death

As indicated above the coding system allows for recording more than one cause of death. In the presentation of causes of death codes in column one are used. If, however, someone is, for example, interested in the number of patients recorded as having hypertension or diabetes a search can be made of both columns and all verbal autopsy forms identified with the appropriate codes.

Creation of disease clusters/symptom-complexes

The diagnosis by verbal autopsy of diseases which do not have a specific constellation of symptoms and signs is especially difficult. To partially resolve this problem, and to avoid guessing we arbitrarily created a number of symptom-complexes or disease clusters. These clusters share similar symptoms, and the identification of specific causes within these clusters could possibly be resolved by field research. A child, for example, dying from an acute febrile illness associated with seizures could have any one of a number of illnesses such as malaria, meningitis, and pneumonia. Likewise many children and adults die following on acute febrile illness. Cause of death in such patients is coded as *acute febrile illness*. Definitions of these symptom-complexes are given in the classification list. Malaria was not specifically coded unless these was confirmatory evidence from another source e.g. hospital records.

Comments on coding of particular causes of death

Diarrhoeal diseases

If the diarrhoea was observed to be bloody this is recorded as A09b.

Pulmonary tuberculosis

For each case a note is made if the tuberculosis was confirmed or suspected or if diagnosis was made only from verbal autopsy. There is also a category of chronic cough (CC) which is used if the history is not clearly suggestive of pulmonary tuberculosis.

For each case a note is made if tuberculosis was 'confirmed', 'probable', or 'possible'. By 'confirmed' we mean that there was a record of smear-positive sputum and/or treatment was started at a district hospital or health centre recognised as a tuberculosis treatment centre. By 'probable' we mean that there was a history of the patient having been on or having defaulted from treatment prior to death. By 'possible' we mean that the history was suggestive of pulmonary tuberculosis i.e. patient had clinical symptoms, often including haemoptysis but had never been to public or private health centre.

HIV disease and tuberculosis

In the presentation of causes of death we combine patients who died from HIV disease (B20) and those in whom pulmonary tuberculosis had also been diagnosed (A15B20).

Patients coded as tuberculosis only may also have HIV infection, but in the current analysis we have maintained separate categories.

Septicaemia

This diagnosis is usually based on evidence of the presence prior to death of an abscess, infected ulcer, pyomyositis or gangrene.

Fever with anaemia (BD50) and fever with malnutrition (BE40)

In the presentation of causes of death patients coded as BD50 are combined with those coded as having died from *acute febrile illness*, while those coded as BE40 have been combined with deaths due to malnutrition (E40). This decision may be regarded as unsound but we considered that patients dying from an *acute febrile illness* and who required blood transfusion, for example, may have been anaemic because of malaria. Patients with clinical evidence of malnutrition and who died following an acute fever may, however, have acquired the infection as a result of chronic malnutrition.

Liver disease

In the presentation of cause of death from liver disease all causes have been included, including presumed viral hepatitis.

When no conclusion can be reached on cause of death

If coders cannot reach a satisfactory conclusion about broad or narrow cause of death code 'Z' is used.

10.3 Leading causes of death in industrialised countries and China

Table 10.3.1 and Table 10.3.2 are shown to enable readers to compare the pattern of causes of death in Tanzania with that in industrialised countries and in a rapidly developing country like China. Most deaths in

industrialised countries are caused by non-infectious diseases. Table 10.3.1 illustrates how quickly the epidemiological transition from infectious to non-infectious diseases can occur in countries undergoing rapid development. 75% of all deaths in China are now caused by non-communicable diseases.

Table 10.3.1 Causes of death in China, 1990

Cause of death	Number	%
Infectious, Parasitic, Maternal	1,075,000	(15.5)
Non-communicable	5,970,000	(75.2)
Cancer	1,300,000	
Cardiovascular disease (CVD)	2,960,000	
Stroke	1,150,000	
Chronic obstructive lung disease	800,000	
Accidents & violence	890,000	(11.2)
Motor vehicle accidents	120,000	
Suicide	265,000	
Total	7,935,000	(100)

Table 10.3.2 Leading causes of death, in industrialised countries, 1990

Cause of death	Number	%
Cardiovascular Diseases	3,175,000	(44.5)
Coronary heart disease	1,320,000	(18.5)
Other heart disease	720,000	(10.1)
Stroke	780,000	(11.0)
Malignant neoplasms	1,765,000	(24.8)
Chronic Obstructive Lung Disease	280,000	(3.9)
Diabetes Mellitus	145,000	(2.0)
Cirrhosis of Liver	120,000	(1.7)
Accidents & Violence	450,000	(6.3)
Motor Vehicle Accidents	127,000	(1.8)
Suicide	110,000	(1.5)
Total	5,935,000	(83.2)
Total deaths	7,122,000	(100.0)

Source: Dr. Alan Lopez, World Health Organisation.

10.4 Causes of death by broad classification

Figure 10.5.1 shows the contributions of infectious and non-infectious diseases, injuries, maternal and perinatal mortality to the total burden of disease in different age-groups living in the three project areas. In males and females in all age-groups, apart from those 60 years and above in Dar es Salaam and Hai District, infectious disease were the major cause of death. In Morogoro Rural District infectious diseases accounted for approximately 70% of all deaths in the 0 to 4 and 5 to 14 year age-groups. Among adults 15-59 years the percentage of all deaths due to infectious diseases (approximately 65%) was comparable in Dar es Salaam and Morogoro Rural but less in Hai District (47.1% in men and 54.4% in women).

Non-infectious diseases accounted for an increasing proportion of all deaths with advancing age. In adults (15-59 years) in Hai District 28.7% and 26.7% of all deaths in men and women respectively were due to non-infectious diseases compared to 16.3% and 13.3% in men and women in Dar es Salaam. In the 'elderly' however in Dar es Salaam non-infectious diseases accounted for 45.2% and 49.7% of all deaths in men and women respectively. The percentage of deaths in Hai District due to

non-infectious diseases was comparable to Dar es Salaam. In Morogoro Rural District approximately 30% of deaths in the 'elderly' were due to non-infectious disease.

In adult men 60 years and above injuries accounted for a larger proportion of deaths than in women. The difference in sex ratio was most marked in adults. In children injuries accounted for an approximately equal proportion of deaths in males and females.

Among adult women maternal deaths accounted for 9.0%, 6.7% and 8.8% of all deaths (chapter 11)

In children 0 to 4 years perinatal deaths were the second commonest cause of death after infectious diseases accounting for 40.5% and 34.1% of deaths in male and female children respectively in Hai. In Dar es Salaam 32.6% of male under 4 deaths were perinatal and 28.1% female deaths. In Morogoro Rural the relative contribution of perinatal deaths to all under 5 deaths was less (17.3% in males and 17.7% in females).

Figure 10.5.2 shows the same data but with the causes divided into 2 age bands (15-39, 40-59) to allow a better examination of the relative importance of maternal deaths.

10.5 Causes of death by narrow classification

10.5.1 Underfives

Figure 10.5.1 shows the top 15 causes of death in underfive males and females in Dar es Salaam, Hai and Morogoro Rural Districts. Perinatal deaths is the most important cause of death in Dar es Salaam (34.6% in males and 28.5% females) and Hai (40.1% in males and 36.1% females). Perinatal causes also appear after acute febrile illness including malaria as the second commonest cause of death in Morogoro Rural District. Most of the top 15 causes of death are treatable or preventable.

10.5.2 Children, 5-14 years

Figure 10.5.4 shows the 'top 15' causes of death in school age children 5-14 years. Acute febrile illness including malaria was the commonest cause of death in all three project areas in this age group. Injuries were the second commonest cause of death in Dar es Salaam males and females as well as in Hai males. They were the third commonest cause of death in Hai females as well as for both males and females in Morogoro.

The 'top 15' causes of death in this age group were also treatable or preventable.

10.5.3 Adults, 15-59 years

Figure 10.5.5 shows the 'top 15' causes of death in adults aged 15-59 years in Dar es Salaam, Morogoro and Hai.

Males

HIV was the commonest cause of death in Dar es Salaam and Hai and second to acute febrile illness including malaria in Morogoro. Pulmonary tuberculosis was the second commonest cause in Dar es Salaam, 8th in Hai and 5th in Morogoro. The second commonest cause of death in Hai was injuries, which was also the third cause in Dar es Salaam and Morogoro Rural District.

Acute febrile illness including malaria and acute diarrhoea disease were among the top six causes of death in males in the three project areas.

Stroke was the sixth cause of death in Dar es Salaam males, 7th in Hai and 11th in males in Morogoro Rural District. The top fifteen causes of death in males included other non-infectious causes such as cancer, liver disease, epilepsy, diabetes, heart failure and asthma. Anaemia was the sixth cause of death in males in Morogoro Rural District but did not appear among the top 15 causes in Dar es Salaam and Morogoro.

Females

HIV was the commonest cause of death in females in the three project areas. The next commonest cause was maternal death in Dar es Salaam which caused 8.3% of all deaths in this age group. Maternal causes were the 6th commonest cause in Hai (6.4% of all deaths) and 4th in Morogoro (8.5% of all deaths in females in this age group). These percentages rose to 10.8, 8.9 and 12.3 when the 15-39 year old age band was examined. Cancer was the second commonest cause of death in Hai and was 6th in Dar es Salaam and 7th in Morogoro. Acute febrile illness including malaria followed by acute diarrhoea disease was the second and third cause of death in Morogoro. Tuberculosis was the third most frequent cause of death in females in Dar es Salaam, 9th in Hai and 6th in Morogoro Rural District. Hai District had injuries as the third commonest cause of death, which was 9th in Dar es Salaam and 8th in Morogoro Rural District.

It can also be seen that most of the top fifteen causes of death in the three project areas in females were treatable/preventable.

10.5.4 Adults, 60 years and above

Figure 10.5.6 shows the top 15 causes of death in males and females aged 60 years and above in Dar es Salaam, Hai and Morogoro Rural District.

Males

Stroke was the commonest cause of death in Dar es Salaam and Hai District but was only 11th in Morogoro Rural District. The commonest cause of death in Morogoro was acute febrile illness including malaria. The second commonest cause of death in Dar es Salaam was heart failure which was the 7th cause in Hai and 6th in Morogoro. Pneumonia was second in Hai, 9th in Dar es Salaam and 4th in Morogoro Rural District. Acute diarrhoeal disease was the second commonest cause of death in Morogoro, and it was 7th in Dar es Salaam and 5th in Hai District. AIDS was the fourth cause of death in Dar es Salaam males in this age group but did not appear among the top 15 for Hai and Morogoro Rural Districts.

Chronic non-infectious causes also appear among the top 15 causes of death.

Females

Stroke was also the commonest cause of death in females aged 60 years and above in Dar es Salaam and Hai District but was 10th in Morogoro Rural District. The commonest cause of death in Morogoro was acute febrile illness including malaria. Acute febrile illness including malaria was second in Dar es Salaam and fourth in Hai district. Pneumonia was the second commonest cause of death in Hai and was 10th in Dar es Salaam and 4th in Morogoro rural district. The second commonest cause of death in Morogoro was acute diarrhoea disease, which was 5th in Dar es Salaam and 6th in Hai. A number of non-infectious causes including stroke, heart failure, diabetes, asthma, and liver disease, appear among the top fifteen common causes of death in the three areas.

Comparison with results in Preliminary Report

In general, the proportion of deaths due to infectious and non-infectious diseases is comparable to that reported in the Preliminary Report. The most obvious difference is the increased proportion of deaths due to infectious diseases in men and women in Dar es Salaam (64.9% vs. 60% in men and 67.4% vs. 58.2% in women). This increase can probably be explained by a continuing increase in the number of deaths due to HIV infection.

KEY MESSAGES

➤ MEN

- ❖ In men in Dar es Salaam and Hai District HIV disease with or without tuberculosis, was the leading cause of death.
- ❖ In Morogoro Rural District HIV disease was the second commonest cause of death after acute febrile illnesses, of which malaria was likely to be the leading cause.
- ❖ Tuberculosis was the second commonest cause of death in Dar es Salaam, the 5th in Morogoro Rural District, and 8th in Hai.
- ❖ Stroke ranked 6th as a cause of death in Dar es Salaam, 7th in Hai and 11th in Morogoro.
- ❖ Injuries was the 3rd commonest cause of death in Dar es Salaam and Morogoro and the 2nd in Hai District.

➤ WOMEN

- ❖ In women, HIV disease is the leading cause of death in all 3 areas, and the percentage of deaths due to HIV disease is higher in women than in men in all areas.
- ❖ Maternal deaths are the second commonest cause of death in Dar es Salaam, the 4th in Morogoro Rural and 5th in Hai.
- ❖ Stroke ranked 7th in Dar es Salaam and in Hai as a cause of death.

➤ CHILDREN

- ❖ In children 0 to 4 years, perinatal deaths and deaths due to acute febrile illnesses, frequently associated with seizures, were the leading causes of deaths.
- ❖ In children 5-14 years acute febrile illnesses, often associated with seizures, were the leading causes of death in all areas.
- ❖ Among the school age children, injuries and diarrhoeal disease were among the top three commonest causes of death in both males and females in all three project areas except in females in Dar es Salaam where meningitis accounted for 6.3% of all deaths.

➤ ELDERLY

- ❖ In the elderly 60 years and above, stroke, cancer and chronic heart failure were important causes of death in Dar es Salaam and Hai, while in Morogoro Rural infectious diseases were dominant.
 - ❖ Cancer ranked 2nd in Hai, 6th in Dar es Salaam and 7th in Morogoro Rural District.
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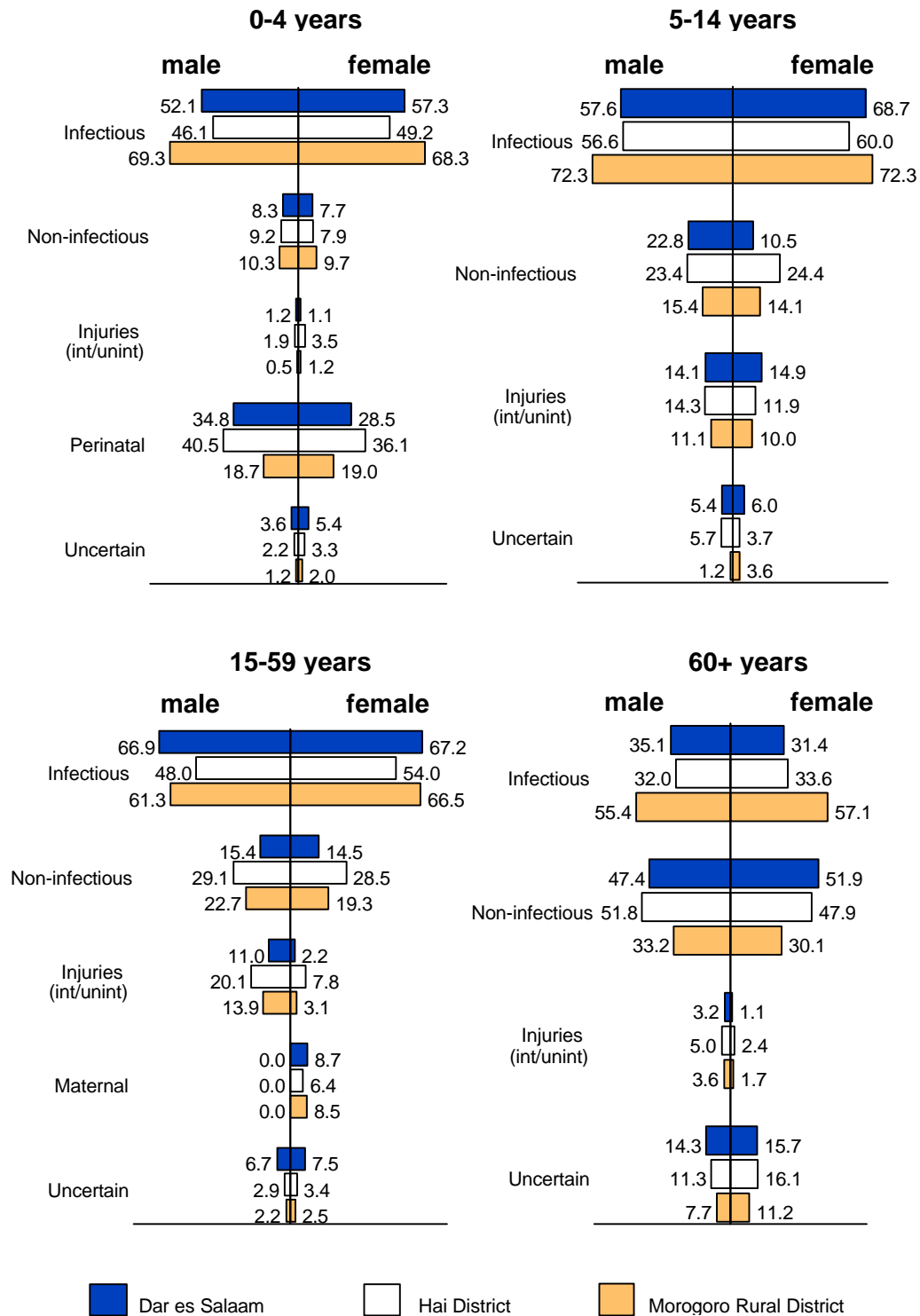


Figure 10.5.1 Percentage causes of death by broad classification in Dar es Salaam, Hai and Morogoro Rural Districts

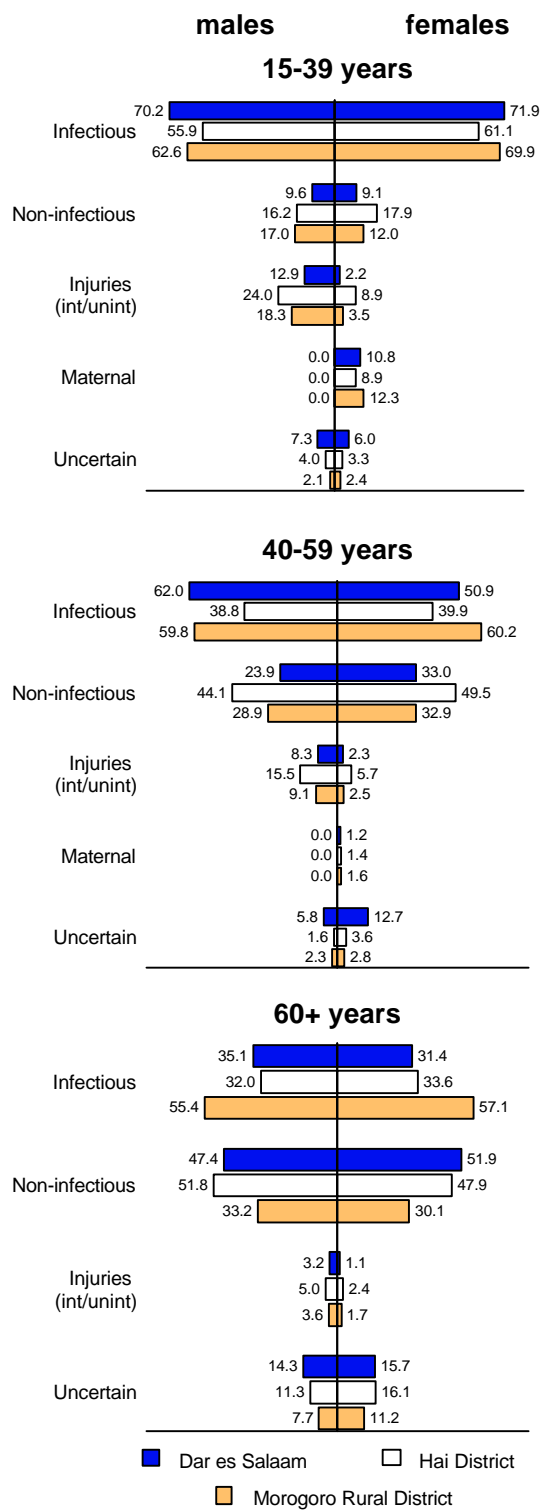


Figure 10.5.2 Percentage causes of death by broad classification in adults in Dar es Salaam, Hai and Morogoro Rural Districts

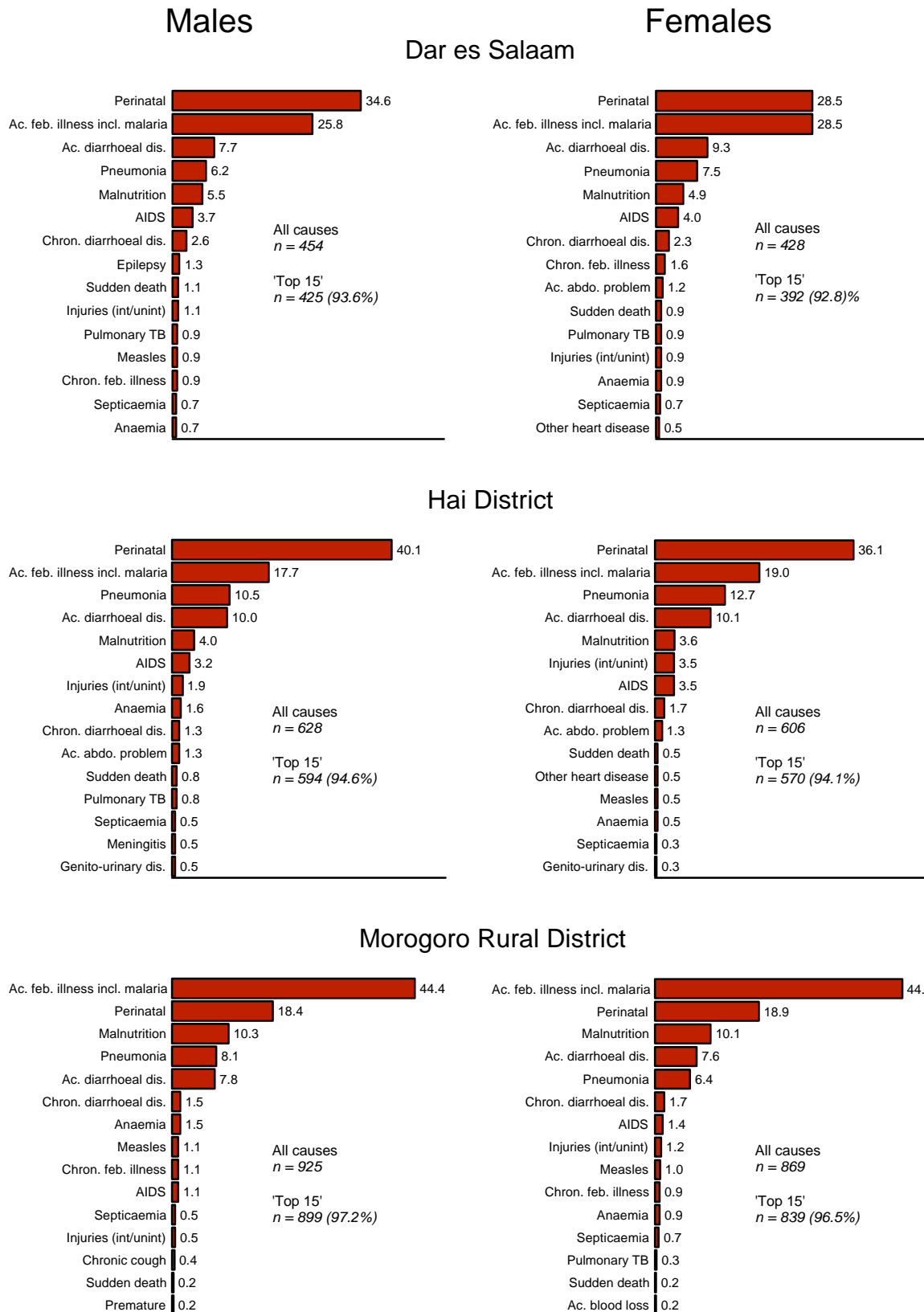


Figure 10.5.3 'Top 15' causes of death in males and females aged 0-4 years in Dar es Salaam, Hai District and Morogoro Rural District.

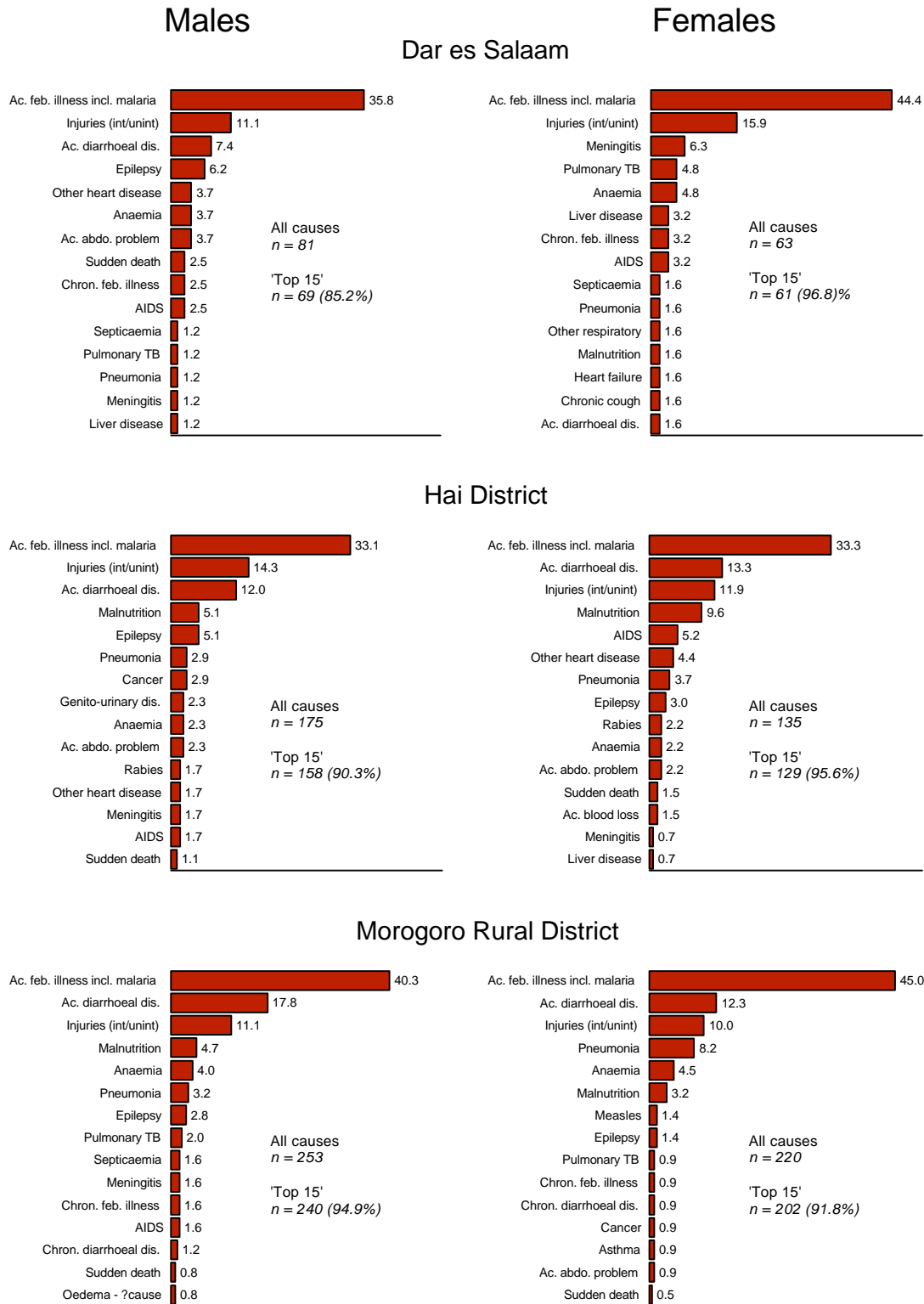


Figure 10.5.4 'Top 15' causes of death in males and females aged 5-14 years in Dar es Salaam, Hai District and Morogoro Rural District.

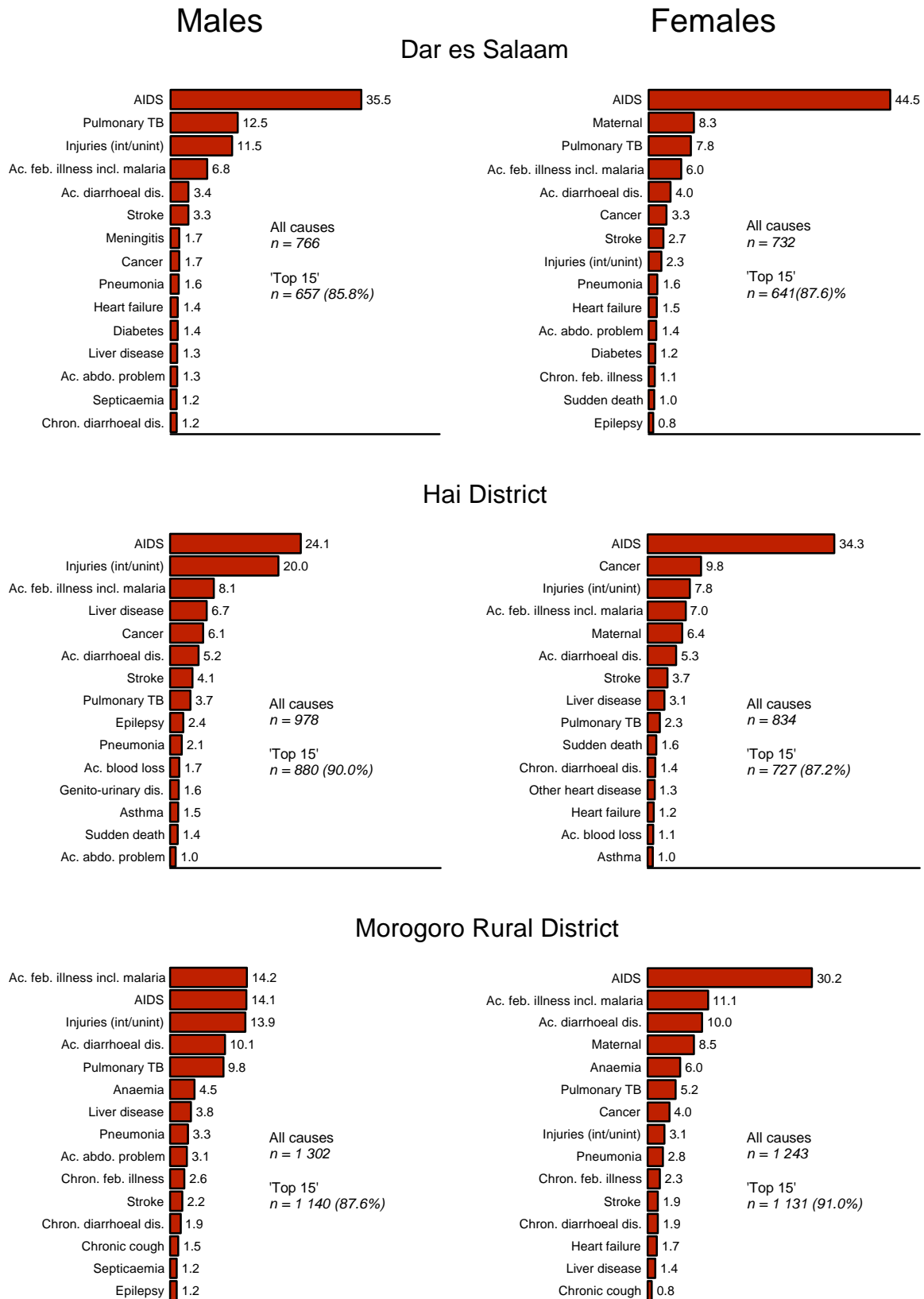


Figure 10.5.5 'Top 15' causes of death in males and females aged 15-59 years in Dar es Salaam, Hai District and Morogoro Rural District.

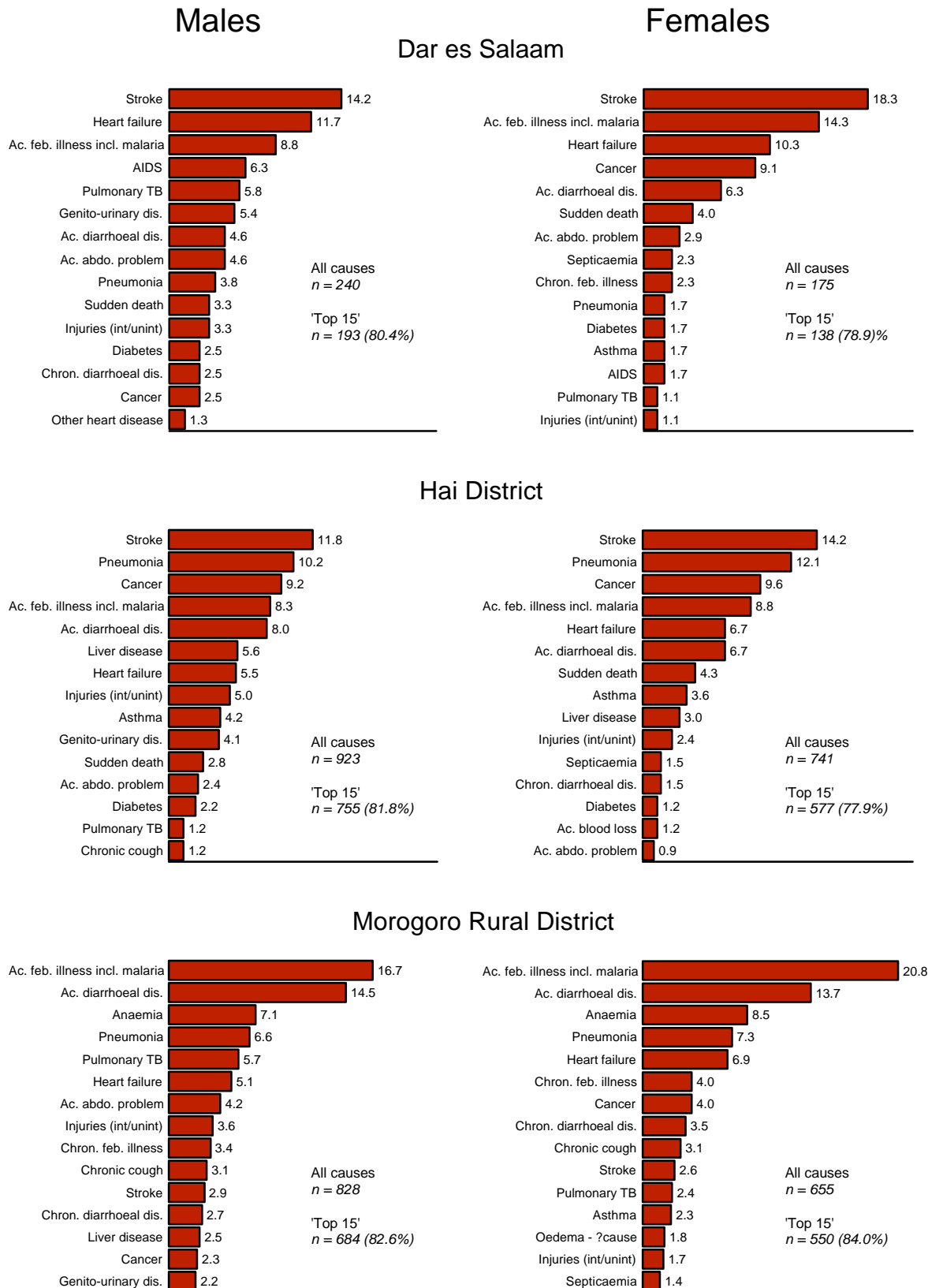


Figure 10.5.6 'Top 15' causes of death in males and females aged 60 year and above in Dar es Salaam, Hai District and Morogoro Rural District.

References

Murray, C. J. L., G. Yang, et al. (1992). Adult mortality: levels, patterns and causes. The health of adults in the developing world. R. G. A. Feachem, T. Kjellstrom, C. J. L. Murray, M. Over and M. A. Phillips. New York, Oxford University Press: 23-111.