

Cause_Limp v1.0: A Windows-based software for analysing data on multiple causes of death

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Abstract

Background

Cause_Limp v1.0 is a windows-based program for analysing data on multiple causes of death. The software comes along with South African mortality data for the period, 1997-2005. It is freely available on the Internet.

Implementation

Cause_Limp v1.0 comprises seven programs. Each program comes with a standard input selection screen. The main variables in those screens are; age, sex, years of analysis, province of residence, province of death and cause(s) of death. All the programs count the multiple mentions of selected cause(s) of death, filtered according to user's requirements and produce different outputs depending on the dimension requested.

Conclusions

The free availability of a multiple-cause program to accompany the South African data should stimulate multiple-cause analysis of South African data. This is primarily of relevance to South Africa and secondarily of relevance to research on disease associations and causation in general.

Keywords

Cause of death, multiple causes of death , software, South Africa

1. Background

Hospital information systems provide a rich source of data for studying diseases from different perspectives, from the purely medical to the epidemiological and applied medical. Data on co-morbidities are routinely collected through the statement of primary and secondary diagnoses. When these co-morbidities are present at death they are known as multiple causes of death and their recordings are officially put on the death certificate (subsequently sent to national statistics offices for processing). These multiple causes of death can be analysed using one dimension (underlying cause of death) or using its native multiple dimensions. In the latter approach, all the causes of death mentioned in the medical certificate are retained in the analysis. These include; the immediate cause of death, the contributory causes of death, the non-contributory causes of death and the underlying cause of death. The underlying cause of death, usually the last mentioned cause on the certificate, is the single cause that initiated the chain of events leading on to the other contributory causes and to the final (immediate) cause of death. In the underlying cause-of-death approach, only the underlying cause of death is retained for analysis. The underlying-cause approach is more applicable for analysing data from communities in the early stages of their epidemiologic transition when infectious diseases were leading causes of death and co-morbidities at death were relatively low.

As communities progress in their epidemiologic transition, with degenerative diseases becoming the leading causes of death, accompanied by relatively high co-morbidities at death, the multiple-cause perspective becomes more relevant.

In terms of software development, three groups of software have been developed within the underlying-cause perspective. The first group, developed within epidemiology, focuses on the automatic coding and selection of the underlying cause of death. The input data for such programs are the demographic and multiple causes-of-death information provided per unit death record. The second group, developed mostly within demography, focuses on computing rates, cause-deleted life tables and other measures derived from life tables. The input data for such programs are data that have been aggregated by age, sex and cause. The last group, initially developed within biostatistics, focuses on failure-time models, censoring and time-independent/time-varying covariates.

From the multiple-cause perspective, partly because of its late start, the software that have been developed for analysing multiple causes of death fall largely into two main categories; the automatic coding together with listing of multiple causes of death and 'tabulators'. The outputs of the

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former are used as inputs into the latter programs. Typically, tabulators are developed for a specific set of multiple-cause data (for a country or region) but work equally well with other data whose format and layout match those of the tabulator's default data. Tabulators perform multiple-cause counting and analysis and eliminate the need for writing programs to handle complicated recoding. An example of such a program is the Multiple Cause Tabulator (TCM) developed for analysing Brazilian multiple-cause data [1]. Cause_Limp v1.0 falls within the category of tabulators and the default data of the software comes from South Africa [2]. In what would suitably be described as a 'giant leap', South Africa progressed, within a decade, from a situation of delayed publication of underlying-cause data to one of being fairly up-to-date in the publication of multiple-cause data. Thanks to the data liberation policy of Statistics South Africa, unit record multiple-cause data are freely put on the Internet. These data date from 1997 and go up to latest published year (as at April 2008, the latest available year is 2005).

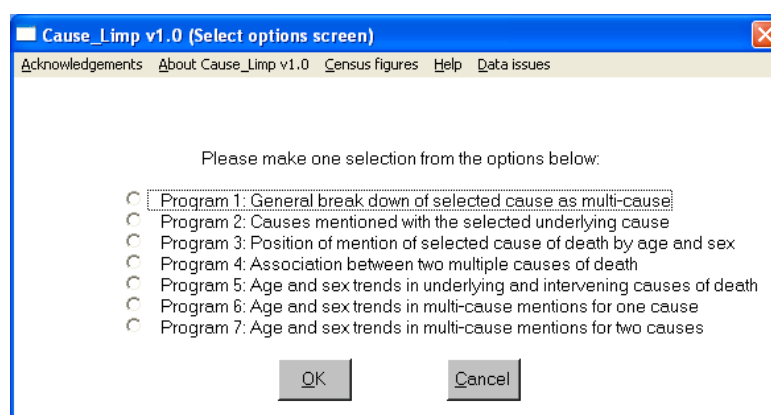
2. Implementation

Cause_Limp v1.0 is Windows-based and was written in Fortran 95 using the integrated development environment of Plato3, a product of Salford Software. Cause_Limp v1.0 comes along with the South African multiple-cause data as its default data. These data were the first set of multiple-cause data for Africa and cover the years 1996-2005 amounting to over four million records. The Cause_Limp v1.0 software together with the data is 44 Megabytes in size. The software allows for a choice of years so that trend analysis of multiple causes of death can be done. The software is freely available on the Internet since December 2007 and be accessed at: http://multi-cause.weebly.com/cause_limp-software.html[2]

Cause_Limp v1.0 comprises of seven programs as shown in screen shot 1. For all the programs, a standard set of input selection options are; years of analysis, sex, age groups, province of residence, province of death and selected cause(s) of death. A typical example of the input screen used in the different programs is shown in screen shot 2. Each

Screen shot 1

Programs available within Cause_Limp v1.0



Screen shot 2

A typical input screen for programs available within Cause_Limp v1.0

Table 1

Description of the outputs of the programs of Cause_Limp v1.0

Program	Description	Outputs
1	General breakdown of selected cause as multi-cause	- The number of times the cause is mentioned as a multiple cause - The position on the record (order) where the cause is mentioned
2	Causes mentioned with the selected underlying cause	- The position on the record (order) where the cause is mentioned - The other causes mentioned along with the selected underlying cause of death
3	Position of mention of selected cause of death by age and sex	- Age breakdown of selected causes as multiple causes - Position on the record (order of mention) in which the cause is mentioned
4	Association between two multiple causes of death	- The number of times two causes are mentioned together - The number of times none of the two causes are mentioned together - The number of times one cause is mentioned to the exclusion of the other
5	Age and sex trends in underlying and intervening causes of death	- Age breakdown of selected causes as underlying cause - Age breakdown of selected causes as intervening cause
6	Age and sex trends in multi-cause mentions for one cause	- Age breakdown of selected causes as multiple cause - Age breakdown of recorded deaths
7	Age and sex trends in multi-cause mentions for two causes	- Age breakdown of two selected causes as multiple causes - Age breakdown of recorded deaths

Table 2

Deaths due to diabetes as underlying cause, South Africa, 1997-2005

	Males	Females
Records read	1 856 043	1 695 655
Records with diabetes as underlying cause	44 673	69 666
Percentage (%)	2.41%	4.11%

program comes with its own help screen that explains what the programs does and the meanings of the abbreviations used in the program. Table 1 gives a short description of the output of each of these seven programs.

As an example, one can use Cause_Limp v1.0 to study the associations between diabetes and the co-morbidities that co-exist with it. To what extent does the multiple-cause perspective, with time series data, helps one to establish the relative importance of the different conditions associated with diabetes? After running the different programs in Cause_Limp v1.0, some of the results obtained are summarised in the sections below. Of the eligible male and female records, the recorded total deaths and those due to diabetes are given Table 2 and the breakdown of the different kinds of diabetes is given in Table 3.

The comparison of diabetes as underlying cause with diabetes as a multiple cause is given in Table 4. Among deceased males, the number of deaths with diabetes as a multiple cause was 13% higher than those with diabetes as underlying cause. For females, the corresponding increase was 10%.

Table 3

Percentage breakdown of deaths due to diabetes as underlying cause, South Africa, 1997-2005

	Males (n= 44 673)	Females (n= 69 666)
E10 (Type 1 diabetes)	2.97%	2.40%
E11 (Type 2 diabetes)	5.06%	5.69%
E11 (Malnutrition-related diabetes)	0.14%	0.15%
E12 (Other specified diabetes)	0.01%	0.01%
E14 (Unspecified diabetes)	91.82%	91.75%

Table 4

Comparison of diabetes as an underlying cause with diabetes as a multiple cause, South Africa, 1997-2005

	Males	Females
Diabetes as underlying cause (UC)	44673	69666
Diabetes as multiple cause (any mention (AM))	50453	76371
(AM/UC) Any mention to UC ratio	1.13	1.10

Further application of the software allow for the estimation of year and sex specific ratios of AM/UC. The analysis showed that for both males and females, the causes of death most frequently mentioned along with diabetes are; disease of the circulatory system, diseases of the respiratory system and diseases of the genitourinary system. Figures were also obtained for the age and sex trends of distribution of diabetes both as an underlying cause and as a multiple cause. These can then be interpreted based on the research question addressed. All the programs in Cause_Limp v1.0 typically take less than a minute to read all the four million records and do the counting and calculations.

Conclusions

While the multiple-cause perspective clearly enriches the analysis of causes of death data, research output from this perspective has lagged behind that using the traditional underlying-cause perspective. Part of the reason for this is the scarcity of readily available multiple-cause data. Another reason has been the scarcity of freely available software for analysing multiple-cause data. As with other subjects, research on multiple causes of death can be stimulated with the availability of data and free software to exploit the data. Traditionally, underlying-cause data have been more readily available than multiple-cause data. The free availability of a multiple-cause program to accompany the freely available South African data should stimulate multiple-cause analysis of South African data and contribute to the growth of research output on multiple causes of death. In addition, the over four million multiple-cause records can be used to answer epidemiologic questions on diseases causation in general. As need arises, Cause_Limp v1.0 can easily be adapted for analysing multiple-cause data from other countries.

What this paper adds

- The paper draws attention to a new software for the analysis of data on multiple causes of death, cause_limp v1.0
- The software comes with South African multiple-cause data for the period 1997-2005. The analysis of such data is greatly facilitated.
- As the data contains over four million records, it can be used to answer broader epidemiologic questions on disease causation

Policy implications

- Data liberation policies should be encouraged as they stimulate research
- Health policy should be informed by the richer multiple-cause perspective to complement what has been learnt from the underlying-cause perspective

References

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