

**INTERNATIONAL WORKSHOP ON THE MULTIPLE CAUSE-OF-DEATH
ANALYSIS**

**“Sapienza” Università di Roma, Dipartimento di Scienze Statistiche
Viale Regina Elena, 295 - Building G, 3rd floor, room 50**

12-13 June, 2014

Program

Thursday June, 12th

⌘ 9:30 – 10:00 am Welcome and Tour de table

10:00-11:00 am International comparison - Chair: Aline Désesquelles

Comparison of the standard MCODE indicators in various countries

Elena Demuru (Sapienza Università di Roma) and the French-Italian MCODE group

Can international comparison of multiple causes of death data validate choice of underlying causes?

Nehama Goldberger, Ziona Haklai (Ministry of Health, Israel)

⌘ 11:00-11:15 am Coffee Break

11:15-12:15 pm – Elaborating MCODE data - Chair: Marilena Pappagallo

Multiple causes in the Czech Republic

Marketa Pechholdova (University of Economics of Prague)

Implementation of MCODE methodology in Estonia

Gleb Denissov (Estonian Causes of Death Registry)

Luule Sakkeus (Estonian Institute for Population Studies)

🕒 12:15 - 2:00 pm Lunch break

2:00 - 3:00 pm International comparison : problems & perspectives - Chair: France Meslé

⌘ 3:00 - 3:30 pm Coffee Break

3:30 - 5:00 pm Linking health and MCODE data - Chair: Viviana Egidi

Investigating age and co-morbidity in England and Wales using multiple cause of death analysis

Emily Grundy (London School of Economics), Christopher Marshall (University College London)

Assessing the Contribution of Multiple Cause of Death Data to Late Life Health Trajectories using Biomarkers and Disability Indexes

Janet Weeks, Isaac W. Eberstein (Florida State University)

Risk factors as multiple causes of death

Magali Barbieri (INED/University of Berkeley), Irma Elo (University of Pennsylvania)

Friday June, 13rd

9:30-10:30 am Some infectious diseases – Chair : Elena Demuru

After the epidemiological transition: an evaluation of the mortality due to infectious and parasitic diseases in France and Italy using the multiple cause-of-death approach

Aline Désesquelles (INED) and the French-Italian MCODE group

The multiple causes of death in a cohort of people with AIDS in Italy, 2006-2010

Enrico Grande, Francesco Grippo, Marilena Pappagallo, Frova Luisa (Istat)

Barbara Suligoi, Vincenza Regine, Laura Camoni (Istituto Superiore di Sanità),

Diego Serraino, Antonella Zucchetto, Saverio Virdone (Centro Riferimento Oncologico, Aviano)

☞ 10:30-10:45 am Coffee Break

10:45-11:45 pm –Analysing associations of causes - Chair: Luisa Frova

Studying causes of death interrelations by the Network Analysis

Michele Antonio Salvatore (Istat), Viviana Egidi (Sapienza University of Rome) and the French-Italian MCODE group

Giulia Rivellini (Catholic University of Milan)

Multiple causes of death in order to define and estimate end-of-life suicides

Nicolas Brouard, Sylvia Pontone, Aline Désesquelles (INED), Marta Spranzi

11:45-12:15 – Final debriefing and perspectives - Chair: Aline Désesquelles

Comparison of the standard MCODE indicators in various countries

Elena Demuru (Sapienza Università di Roma) and the French-Italian MCODE group

In the occasion of our first international meeting held in Paris on November 21st and 22nd 2012, we established guidelines for computing standard multiple cause-of-death indicators. Up to the present time, six countries have already made available the results of their calculations: Czech Republic, England & Wales, France, Israel, Italy and the USA. All indicators - i.e. underlying and multiple cause mortality rates, number of multiple causes per death certificate, standardized ratios of multiple to underlying cause (SRMUs), and cause of death association indicators (CDAIs) – have been computed for the year 2009 based on two different lists of causes: one comprising 15 groups that mainly corresponds to the ICD-10 chapters, and a more detailed one comprising 72 groups. The aim of this presentation is to give an overview of the differences and similarities between the mortality profiles by sex, age and causes of death of the above-mentioned countries, as emerging from a comparative analysis performed on the available data.

CAN INTERNATIONAL COMPARISON OF MULTIPLE CAUSES OF DEATH DATA VALIDATE CHOICE OF UNDERLYING CAUSES?

Nehama Goldberger, Ziona Haklai,
Division of Health Information, Ministry of Health

Background: Rates of death from underlying cause (UC) of diabetes and kidney disease in Israel are amongst the highest of developed countries, while those from cardiovascular disease are amongst the lowest. In recent years in Israel, all causes of death mentioned on death certificates have been coded.

Study question: Can comparison between Israeli and international data published on disease prevalence in multiple causes of death (MCOd) compared to underlying cause, and on comorbidity from MCOd validate the choice of UC? In particular, can it support the high rates of diabetes and kidney disease and low rates of cardiovascular disease in Israel?

Methods: For the years 2007-2011, the number of causes mentioned on death certificates was analyzed by UC. Age-adjusted death rates were calculated for MCOd and UC and the corresponding Standardized Ratios of Multiple to underlying (SRMU's). Comorbidity was explored by calculating Cause of Death Association Indicators (CDAI's). These results were compared to published data for France and Italy in 2003, Australia in 2007, and data downloaded from the CDC for the USA in 2010.

Results: In 2007-2011, the average number of causes mentioned on death certificates in Israel was 3.7, higher than France and Italy, and similar to these countries, was highest for endocrine, nutritional and metabolic diseases (mainly diabetes), 4.7. The SRMU for this group was 3.0 compared to 3.6 in France, the USA and Australia and 3.7 in Italy and for genitourinary disease was 4.7, similar to France (4.6) and the USA (4.3) but lower than Australia (5.3) and Italy (7.6). For the circulatory system, the SRMU was 2.1, similar to France and Italy and slightly higher than Australia and the USA (1.7), while that for cancer was 1.1, the same as Australia and the USA but much lower than France and Italy.

The CDAI's for Israel showed similar patterns to those of France and Italy, although showed more strong associations. The UC cause endocrine group was strongly associated with 6 other groups compared to 2 in France and 1 in Italy, and there were strong associations between musculoskeletal, skin and other diseases with mental/behavioural and nervous system disorders.

Discussion: The difference in mean number of causes between countries makes a numerical comparison of SRMU's and CDAI's difficult, as the SRMU's would tend to be higher with more causes on the death certificate, while the CDAI's are lower, leading to lower standard deviations and more strong associations. Nevertheless, the higher SMRU for the endocrine group in other countries compared to Israel despite lower numbers of causes, and for genitourinary disease in Italy and Australia, as well as the many strong associations with other diseases for the endocrine group, may indicate that they are more likely to be chosen as UC in Israel. Maybe other causes should be chosen instead which would lower their rates as UC, particularly since they both generally have many other contributory causes. However the circulatory disease SRMU is similar to other countries, so there does not appear to be an under estimate in choosing this cause.

Conclusion: International comparison of MCOd data is potentially a valuable tool for further study of death causes, but is limited by differences between countries in number of causes recorded, and currently by the lack of available data.

Multiple causes of death as a tool to assess (and to improve)
the quality of mortality statistics.
The case of the recent coding changes in the Czech Republic.

Marketa Pechholdova,
University of Economics, Prague; INED

The Czech Republic was among the first countries to adopt ICD10 (in 1994). However, the transition was quite atypical. Against all expectations, there has initially been a very little effect of the change in the ICD10 coding rules. This can be explained by the existence of the manual coding system, which ignored the new (and much more complex) coding rules. In 2006/2007, ACME decision tables were introduced to the coding routine and the effects of ICD10 became more visible. Finally, in 2011 the Czech mortality statistics passed on to the IRIS coding system and therefore, seventeen years after implementing ICD10, we can see its final impact. At the same time however, the backward comparability worsened and the shape of the recent mortality trends is thus unclear. A positive effect of Introducing ACS is the increase of international comparability. In case of the Czech Republic, the main (and long-term) comparability issue was over-coding of cardiovascular (and other lethal) diseases, and underestimating less fatal conditions, such as nervous and mental diseases or obesity. The first results of international comparisons of MCODE patterns confirm these hypotheses – even if these conditions are largely present on death certificates, they are rarely selected as underlying cause of death (in other words, the SRMUs are extremely high, based on the results for year 2009).

The MCODE data obtained from the Institute of Health Information and Statistics range from 1998 to 2011. As such, they can provide an assessment of the three separate phases of ICD10 in the Czech Republic : 1) without ACME, 2) with ACME, 3) with IRIS. Looking at total and underlying mentions of selected diseases prone to coding-related changes, we are hoping to reveal more realistic cause-specific trends in the Czech Republic for the period of ICD10. Finally, we propose a simple method for correcting the pre-IRIS ICD10 series based on the MCODE data.

Multiple-causes of death data availability in Estonia

Gleb Denissov, *Estonian Death Registry, National Institute for Health Development*

Luule Sakkeus, *Estonian Institute for Population Studies, Estonia*

Estonia is a country of 1.3 million population and annual number of deaths 15-19 thousands. Mortality data collection follows WHO guidelines, ICD-10 has been used since 1997. Quality of data improved significantly in the beginning of 2000s because of recruitment of new staff (2002) and introduction of automated coding systems ACME (2005 data) and IRIS (2010). Since 2004 more than 80% of records have more than one ICD code and are suitable for multiple cause analysis.

Figure 1. Number of Codes, except UC

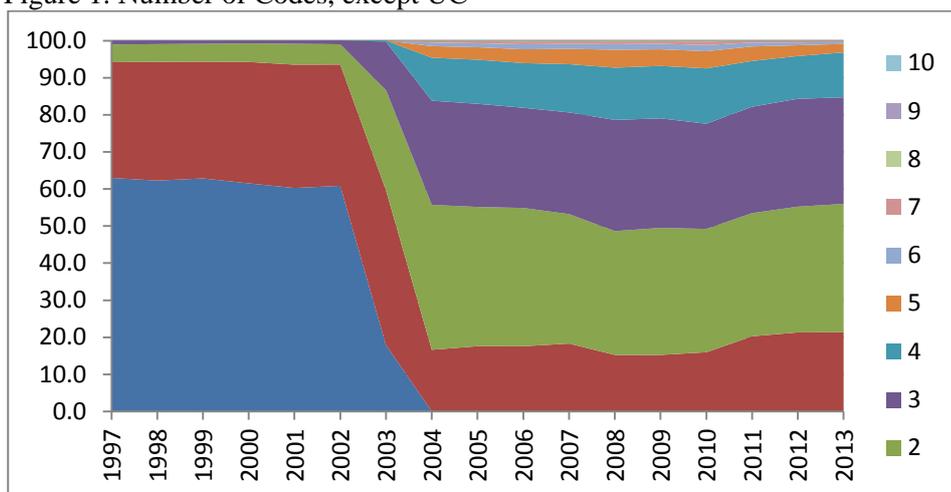
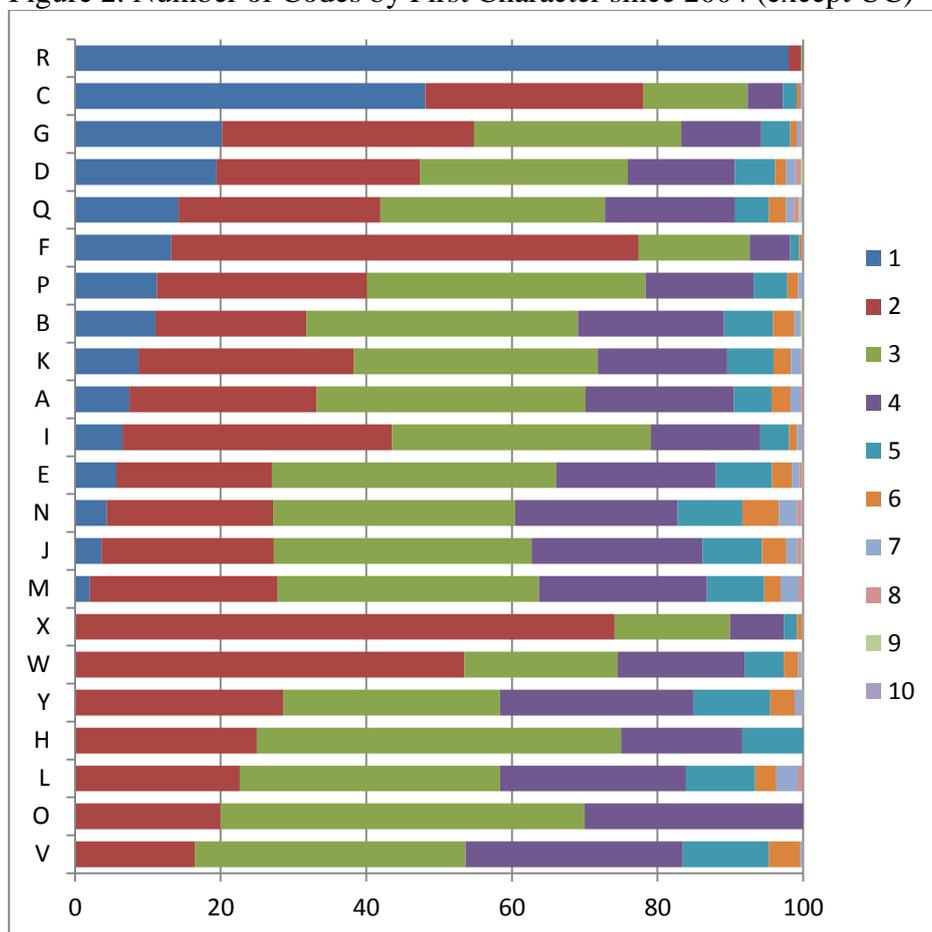


Figure 2. Number of Codes by First Character since 2004 (except UC)



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Investigating age and co-morbidity in England and Wales using multiple cause of death analysis

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Abstract

In this presentation we use data from the Office for National Statistics Longitudinal Study (ONS LS) of England and Wales to investigate whether using multiply coded cause of death data provides additional insights into associations between age at death and co-morbidity.

The ONS LS is a record linkage study initially based on approximately 1% of those enumerated in the 1971 Census of population. Sample members are defined by birth day and the study has been continuously updated by adding 1% of immigrants and births of people with the same birthday. Linked information includes data collected in subsequent censuses and registration of vital events, including death. In this paper we investigate deaths 2002-2009 of LS sample members enumerated in the 2001 Census. Deaths were coded using ICD-10 and including coding of the underlying and up to 8 contributory causes. We first compare results on number of causes reported with results previously reported for France and Italy (Salvatore, Desesquelles et al). We next investigate age variations in extent of co-morbidity as indicated by number of contributing causes and relate this to reported health in the 2001 Census.

Assessing the Contribution of Multiple Cause of Death Data to Late Life Health Trajectories using Biomarkers and Disability Indexes

Janet Weeks, M.S.
Dr. Isaac Eberstein

Florida State University

Data on multiple causes of death (MCOd) should potentially contribute to the description and analysis of patterns of late life health in ways that go beyond both studies of underlying cause of death (UCOD) mortality data and analyses of health/morbidity information from survey or direct measurement. However, much work remains to be done. Our focus is twofold: First, we examine whether multiple cause of death differentials may help to better map the process of late life health trajectories. Second, we examine disability and MCOd. We will address our first question by assessing the relationship between biomarker indicators of inflammatory, cardiovascular, and metabolic risk and mortality using underlying causes of death while considering diabetes and hypertension as associated medical conditions. Data for this portion are taken from the public use version of the National Health and Nutrition Examination Survey for 1999-2006, linked with the National Death Index through 2008. We address our second aim by using data on activities of daily living and instrumental activities of daily living (ADLs and IADLs respectively). Given that gender and socioeconomic status (SES) are often considered fundamental causes of health differentials, we then plan to assess how these relationships vary by gender and SES as a way to highlight the nuances MCOd data can add to understanding health heterogeneity. Data from this portion of the analysis from the US National Health and Interview Survey for 1997-2004, linked to the National Death Index through 2006. This work will contribute new information and extend the use of MCD mortality data to understand more about late life health.

Risk factors as multiple causes of death

Magali Barbieri¹ and Irma Elo²

EXTENDED ABSTRACT

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Meeting on Multiple Causes of Death,
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Abstract

This study investigates the relationship between the actual incidence of hypertension and diabetes before death and reports of the two conditions on the death certificate as either the underlying or as contributing causes with the overall purpose of evaluating the quality of the multiple cause of death data as they relate to major risk factors for mortality. It is based on an analysis of data from the National Health and Nutrition Examination Surveys (NHANES) for the period 1988-2004 and the linked mortality file up to the end of 2006. The circumstances in which these conditions are reported on the death certificates are also investigated, based on the decedents' social, demographic and health characteristics available in NHANES to test for differences in the likelihood that a condition be reported on the death certificate.

Background

Lifestyle patterns are well documented as major determinants of health and mortality (Mokdad et al., 2004). Changes in individual behavior are responsible for at least half of the decline in mortality from cardiovascular diseases and from cancer over the past 20 to 40 years. Statistical information on smoking, diabetes, hypertension, cholesterol and other individual risk factors is thus essential to assess the success of health interventions and to ascertain future trends in mortality.

Multiple cause-of-death statistics have been suggested as a valuable instrument to monitor change in the prevalence of chronic diseases and their risk factors. Such conditions might rarely be the initial event leading to death, and thus are unlikely to appear as the underlying cause, but they may have played an important role as aggravating factors. However, there are strong suspicions of under-recording of such conditions on the death certificate (Eberstein, Weeks and Nam, 2012) as little is known about the accuracy of risk factor reporting as contributing causes on the death certificate and of the conditions under which such reports are included. This research project proposes to fill this gap in knowledge by determining the relationship between the reported and/or measured prevalence of these risk factors in a population in specific time periods and their reporting as underlying or contributing causes in mortality statistics. The study is to be carried out in the United States using one of the multiple surveys linked to death records by the National Center for Health Statistics (NCHS), in which hypertension and diabetes are based on clinical measures in addition to self-reports.

Data

The National Death Index (NDI) is a database of death records established by the U.S. vital statistics office which has been used to link mortality information, including the multiple causes of death, to various surveys through December 31, 2006 to 2011, depending on the data file. The survival status of survey respondents is ascertained primarily through probabilistic record matching. Several nationally representative health surveys have been linked to the NDI. They include the National Health and Nutrition Examination Survey (NHANES, NHANES I, NHANES II and NHANES III), the National Health Interview Survey (NHIS), the Longitudinal Studies of Aging (LSOA II) and the Supplement on Aging (SOA). Each survey collects information about a myriad of health conditions, self-reported or clinically measured, as well as multiple measures of the respondent's economic, social and demographic background. Of these surveys, we have elected to work with the NHANES datasets because they are the only ones that use a physical examination

and a blood test to estimate the occurrence of hypertension and diabetes. The other surveys include only respondents' self-reports of these conditions.

During the first phase of our study, only the public-use data files will be analysed to investigate feasibility since access to the restricted-use file is a lengthy process. While the restricted-use data include all of the information available on the death certificate (each multiple cause of death), information from the death certificate in the public use data file is limited to the following: for each adult ages 18+ years of age we know whether the respondent is alive or dead as of December 31st, 2006³ and, if deceased, we know the date of death (quarter and year), the underlying cause of death (coded to 113 abridged cause-of-death categories), and whether diabetes, hypertension or hip fracture were present in the multiple cause-of-death codes when these conditions were reported as contributing rather than underlying causes of death. Adjusted sample weights are also provided. We should note that the public use cause of death data were subjected to perturbation techniques to reduce the risk of participant re-identification, though information on vital status was not modified. The perturbation involved substituting synthetic data for the actual date and underlying cause of death for selected decedent records. An evaluation of the resulting public use file suggests that the perturbation does not bias estimates of cause-specific mortality.

The purpose of our study is to investigate under which circumstances diabetes and hypertension are diagnosed in the NHANES and included on the death certificate either as the underlying or as a contributing cause. Because of the longitudinal follow-up of NHANES participants, several years might have elapsed between the time a respondent was interviewed and the time (s)he passed away, increasing the likelihood that either health condition appeared (or, though less likely, disappeared) in the interval, thus possibly biasing our analysis. To limit this source of bias, we will only include deaths that occurred within one year of the NHANES interview.

The NHANES is the primary data source in the United States used to assess the health and nutritional status of adults and children in the United States. The survey is unique in that it combines interviews and physical examinations. NHANES is a major program of the National Center for Health Statistics (NCHS). NCHS is part of the Centers for Disease Control and Prevention (CDC) and has the responsibility for producing vital and health statistics for the Nation. The NHANES program began in the early 1960s and has been conducted as a series of surveys focusing on different population groups or health topics. In 1999, the survey became a continuous program that has a changing focus on a variety of health and nutrition measurements to meet emerging needs. The survey examines a nationally representative sample of about 5,000 persons each year. These persons are located in counties across the country, 15 of which are visited each year. The NHANES interview includes demographic, socioeconomic, dietary, and health-related questions. The examination component consists of medical, dental, and physiological measurements, as well as laboratory tests administered by highly trained medical personnel. NHANES data are available up to 2011-2012. However, not all survey waves have been linked (yet) to mortality information from the National Death Index (NDI). The most recent NHANES linked mortality file available correspond to survey years 1999-2004 with mortality data available up to the end of 2006. Since, even among people 70 and over, mortality is a relatively rare event and the occurrence of diabetes or hypertension as an underlying or a contributing cause

³ However, the linked mortality information for the survey respondents is periodically updated.

is even rarer, we use several rounds of the NHANES, namely NHANES III collected in 1988-1994 and NHANES continuous 1999-2004. As soon as more recent data become publicly available they will be included in the analysis.

The currently publicly available datasets include a total of 6,693 deaths of which 6,607 include information on the underlying cause (as classified into the 113 NCHS COD categories) and with 758 mentions of diabetes and 754 mentions of hypertension as contributing causes (Table 1).

Table I. Description of the mortality linked files

Dataset	Total deaths	Deaths with underlying cause	Diabetes mentions as contributing cause	Hypertension mentions as contributing cause
NHANES III (1988-1994)	5,360	5,291	606	585
NHANES 1999-2000	600	590	77	79
NHANES 2001-2002	463	457	44	50
NHANES 2003-2004	270	269	31	40

Diabetes and hypertension mentions

In the NHANES

The NHANES questionnaire asks respondents whether they have ever been diagnosed with high blood pressure and/or with diabetes, and if they have, whether they are taking any prescribed medication or other preventive measures (such as reducing salt intake in the case of hypertension) to control the condition(s). A physical examination was also performed in a mobile examination center on all survey respondents, which includes direct measurement for these conditions.

More specifically, up to 3 blood pressure measurements per respondent were obtained by a trained health care practitioner under standard conditions. Hypertension is hereby defined as an average systolic blood pressure of ≥ 140 mmHg, an average diastolic blood pressure of ≥ 90 mmHg, or self-reported current use of blood pressure-lowering medication.

Diabetes mellitus was assessed through a blood test measuring fasting measures of plasma glucose (or FPG test) and glycohemoglobin (or A1C test) in all respondents 12 years and over. Following the recommendations of the American Diabetes Association, respondents affected by diabetes are identified as all of those who self-reported having told by a doctor of health professional that they had diabetes (whether or not the condition was controlled by drugs at the time of the interview) as well as all of those who, though without a history of diabetes, had a fasting plasma glucose (FPG) of 126 mg/dl or more or an A1C level at 6.5 percent or above. Pre-diabetes was assessed at FPG level between 100 mg/dl and up to 126 ml/dl, or A1C level between 5.7 and 6.5 percent.

In the linked mortality file

Though, for reasons of confidentiality, only limited information from the death certificate is available in the publicly available NHANES linked mortality file, NCHS has selected the three most commonly reported conditions found in the multiple causes of death codes (diabetes, hypertension, and hip fracture) and included a flag variable for each condition in the linked datasets. The three variables take the value of 1 if the

corresponding ICD codes were included in the multiple causes of death data corresponding to each specific record. As previously mentioned, we include only diabetes and hypertension in these analysis. The corresponding ICD codes for diabetes are ICD-9 code “250” and ICD-10 codes “E10” through “E14”, and for hypertension, ICD-9 codes “401” and “403” and ICD-10 codes “I10” and “I12”.

Method

We will first extract all subsequently-deceased survey respondents who were affected by hypertension or diabetes, whether or not under control, as determined by self-report or by physical examination in the NHANES data files and/or all respondents for whom hypertension or diabetes was mentioned as the underlying or as a contributing cause on the death certificate in the linked mortality files. These data will be used to determine the probability, for a self-reported or clinically established condition, to be mentioned on the death certificate and, vice-versa, the probability for a respondent for whom the conditions are mentioned on the death certificate who was also diagnosed at the time of the survey. We are hoping that the joint probability of a condition to be mentioned both in the survey and on the death certificate will be high, presumably higher than the probability of either one or the other. Concordance/discordance measures, such as the Kappa coefficient, will be implemented to assess the magnitude of agreement between the two sources (survey vs. death certificate).

The next step will be to determine the circumstances under which disagreement occurs (hypertension and/or diabetes as mentioned in either source – survey or death certificate – but not in both) using multivariate statistical analysis. Such "circumstances" will include respondents' characteristics (age and race in particular) as well as medical history (whether the respondents knew of the condition – when assessed through physical examination) and health insurance (as access to medical care, either to diagnose and follow-up the conditions or to provide treatment, might be an important determinant of disagreement). Additional factors will be included when warranted from a thorough review of the literature.

References

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http://www.cdc.gov/nchs/data/datalinkage/nhanes3_mort_compare_2010_final.pdf.

AFTER THE EPIDEMIOLOGIC TRANSITION: A REASSESSMENT OF MORTALITY FROM INFECTIOUS AND PARASITIC DISEASES IN FRANCE AND ITALY USING THE MULTIPLE CAUSE-OF-DEATH APPROACH

Aline Désesquelles (*INED*) and the French-Italian MCODE group

ABSTRACT

BACKGROUND: In countries that have completed the second stage of the epidemiologic transition, the majority of deaths from infectious and parasitic diseases (IPD) occur among over-65s. Old age is known to be a risk factor for IPDs, and these diseases are also more difficult to treat at advanced ages. Our premise is that published rates strongly underestimate the effective contribution of IPDs to mortality.

METHODS: We use cause-of-death data for France and Italy in 2009 to assess more accurately the contribution of IPDs to mortality. In addition to chapter I of the 10th international classification of diseases (ICD-10), we include numerous IPDs classified in other chapters, and we compute mortality rates considering all death certificate entries (underlying and contributing causes).

RESULTS: Mortality rates at age 65+ from diseases listed in chapter I are more than three times lower than those based on our more complete list of IPDs. Moreover, IPDs are frequently not selected as the underlying cause of death. In France, the share of deaths at age 65+ involving an IPD as underlying cause increases from 2.1% to 7.3% with the extended list, and to 20.8% when contributing causes are also considered. For Italy, these percentages are 1.4%, 4.2% and 18.7%, respectively.

CONCLUSIONS: IPDs are still a major cause of death in the over-65s. In terms of monitoring, we recommend that published IPD mortality rates are not be restricted to ICD-10 chapter I. Our research also shows that the underlying cause-of-death approach results in a significant underestimation of the contribution of IPDs to mortality.

INTERNATIONAL WORKSHOP ON MULTIPLE CAUSES OF DEATH ANALYSIS -- Rome, 12-13 June, 2014

Title: The multiple causes of death in a cohort of people with AIDS in Italy, 2006-2010

A collaboration among the National Institute for Statistics (**Istat**), Rome; the National Institute for Public Health (**ISS**), Rome; and the National Cancer Institute "IRCCS Centro di Riferimento Oncologico", Aviano (**CRO**).

Since 1982 Italy has a National AIDS Registry (RNAIDS), in which all AIDS cases – defined according to WHO 1993 definition – are included. With the aim of updating the vital status of the registered cases, a collaboration among RNAIDS and the national register of causes of death has been carried out.

A record linkage between the two data sources has been performed, allowing to retrieve the morbidity patterns certified at the time of death for all the deceased people included in the RNAIDS.

In fact the introduction in the mid '90s of highly active antiretroviral therapies (HAART) has substantially prolonged the survival of people with HIV/AIDS. However, people with AIDS (PWA) are still at higher risk of mortality and morbidity compared to the general population.

In our presentation we would like:

- i) To describe the multiple cause of death of people with AIDS 2006-2010
- ii) To measure the association between AIDS and other causes/conditions certified by the physicians in the death certificate by means of age-standardized relative risk compared to non-RNAIDS deaths.

Working group

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Studying causes of death interrelations by the Network Analysis

Michele Antonio Salvatore (Istat), Viviana Egidi (Sapienza University of Rome) and the French-Italian MCODE group

Giulia Rivellini (Catholic University of Milan)

Multiple causes of death can be represented as actors (nodes) of a network where the relational tie establishes a linkage between a cause-node (i) mentioned together with another cause-node (j) and the number of times two causes are mentioned in the same certificate indicates the weights of this association. A network is generally visualized by a graph where actors are nodes and relations are lines, eventually valued by some relevant aspects of the relation.

Following this idea we analyze the relations among causes of death using the Network Analysis (NA) which allows us to reconstruct the complex system of relationships linking the causes of death mentions.

Our goal is two-fold. On the one hand, we intend to explore to what extent NA is suitable for the application to the analysis of cause of death associations, on the other hand we intend to overcome the limit of the analysis made so far that makes it difficult to capture multiple relationships.

We use mortality data of Italian men aged 65 years and over in 2008 and a selection of causes of death, relevant for the analysis of mortality at older ages. Data were organized in an adjacency matrix whose cells express how many times the cause on the row (c_i) is mentioned together with the cause on the column (c_j), without distinction of role between causes (underlying or contributing). The raw matrix was standardized by the Iterative Proportional Fitting (IPF) in order to make the causes of death comparable by bringing them all to the same frequency.

Relations among causes of death describe a first high density network in which many diseases are mentioned together with nearly all other causes, although with weights generally very low. We then focused on associations whose weights are higher than the median value and we presented key network and nodes indicators, mainly related to the analysis of centrality and of sub-graphs' characteristics.

In order to focus on the strongest associations, we considered the network with weights higher than the 95th percentile. The related graph shows components describing relevant profiles (although not necessarily composed of causes mentioned in the same certificate). As an example we could consider the group composed by tumors, strongly associated with each other or the group of dementias, Parkinson's disease, Alzheimer's disease, malnutrition, diseases of the skin and subcutaneous tissue, lung diseases due to external agents, pneumonia and senility, describing the profile of deaths related to mental and nervous diseases and their complications.

The results encourage us to deepen the study by further exploring the potential of NA method for a better understanding of relationships among multiple causes of death, taking into account also gender and different age classes.

Multiple causes of death in order to define and estimate end-of-life suicides

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End of Life Decision (ELD) is an important field of research not only because it concerns two thirds of the deaths but also because the recent legislations is an attempt to react against a tendency to prolong artificially the length of the most disabled at the price of more disability and deterioration of the quality of life.

A series of surveys in Europe (EURELD), including 7 countries (Belgium, Denmark, France, Italy, Netherland, Sweden and Switzerland), based on a representative sample of death certificates (1998-2010), permits to describe the medical practice at the end of life. If end-of-life decisions concern 2/3 of deaths, almost half of them are hastening the death by “withholding or withdrawing life-prolonging treatments” (28%) and “alleviation of pain and symptoms” (19%); but among them, acts which are made with the explicit intention of hastening death could concern only 3% to 4% of deaths. Also Euthanasia which concerns death of a patient who repeatedly requested for dying, do only concern 0.6 to 1.9% of deaths. Assisted Suicides concern even less people and can't be measured with such EURELD surveys, both because of the small sample size and because of the design of the questionnaire which exclude sudden deaths.

In order to enrich the recurrent debate, we are trying to give an estimate of the number of suicides but which could result from an absence or inappropriate, end of life medical care.

Thus, the main objective was the analyze all deaths certificates in order to define and estimate the number of “end-of-life suicides” which could pretend to assistance if such new law was voted in France.

This provisional work concerns only France for the period 2000-2010, that is since the ICD10 revision has been used. Among 550 000 deaths certificates each year, about 10 500 have a mention of suicide as the underlying cause. If 40% of them are not associated with any other cause, about 60% of the certificates are mentioning at least one contributing cause with a mean of 1.4 mentions per case.

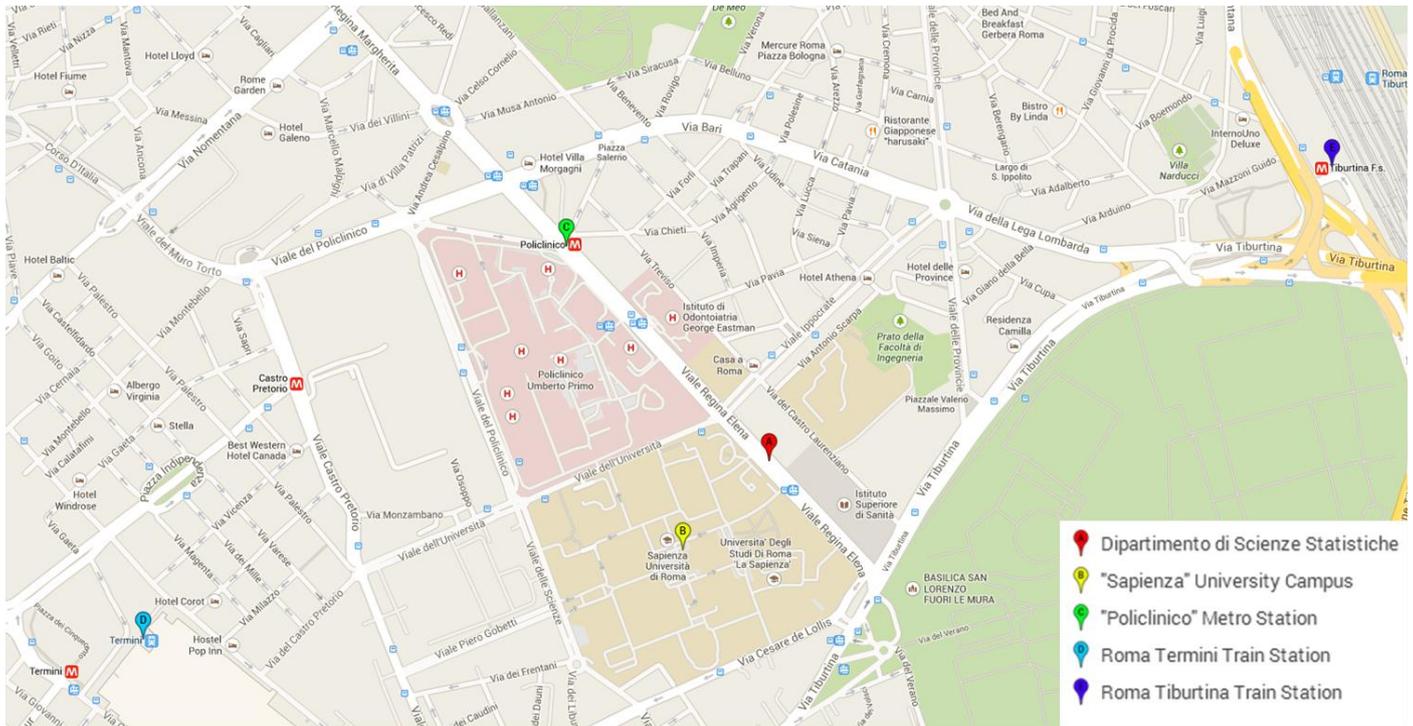
About half of these mentions concerns “mental and behavioral disorders” and a third “external causes”. Those two categories can't be included in the category EOL-suicide.

Therefore our attention focuses on the other deaths/mentions, “Disease of the circulatory system” (5.4%), “disease of the nervous system” (5.0%), “Cancers” (3.8%) and “Other causes” (8.4%). In summary, using this first count they could be around 2000 EOL suicides in comparison to 3000 illegal euthanasia in France.

In a second step we used all variables that are included in the death certificates: age, sex, marital status, profession, underlying cause of death, and contributing cause of deaths in order to describe more precisely, using correspondence factor analysis and classification, all suicides, distinguishing End of life suicides from others. Preliminary results will be presented.

THE WORKSHOP SITE

The second International Workshop on the Multiple-Cause-of-Death analysis will be held at Dipartimento di Scienze Statistiche - Università di Roma “Sapienza”, which is located right outside the university campus at the address Viale Regina Elena, 295. The closest metro station (stop “Policlinico” on the B line), is at a 10-minutes walking distance and connects to both main train stations Termini and Tiburtina.



HOW TO GET TO THE WORKSHOP SITE FROM...

TERMINI TRAIN STATION: By Metro - Line B, Train to Rebibbia, Stop: “Policlinico”

By Bus – Line 310, Stop: “Università/Regina Elena”

On foot (in about 20 minutes)

TIBURTINA TRAIN STATION: By Metro – Line B, Train to Laurentina, Stop “Policlinico”

By Bus – Lines 163, 443, 448, 545, Stop “Piazzale del Verano”

On foot (in about 20 minutes)