Multiple causes-of-death analysis: a comparison between France and Italy

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In developed countries, where most deaths occur over the age of 60, death often results from a complex process that involves several conditions. It is therefore often argued that the so-called "underlying" cause of the death is not sufficient to analyze the mortality profile of ageing populations. Since multiple cause-of-death analysis relies on the complete information reported on the death certificate, it seems to be a very relevant tool for that purpose. Using this approach, several authors (Wing and Manton, 1981; Jougla et al., 1991; Steenland et al., 1992; Désesquelles et Meslé, 2004; Romon et al., 2008) have highlighted the role played by conditions like diabetes or hypertension that are not frequently reported as underlying cause of the death but often contribute to it. Others (Mackenbach at al,1995; Désesquelles et Meslé, 2004; Egidi et al., 2006; Frova et al., 2009) have examined the associations between the causes reported on the certificate in order to identify mortality patterns and to shed light on the morbid process.
In this study, we use the multiple cause-of-death approach to compare the mortality patterns of Italy and France in 2003. We first compare the cause-specific mortality profile of the two countries, and we evaluate the overall impact of taking into account all the causes reported on the death certificates (multiple causes). We then examine whether the two countries display a similar pattern of associations between a given underlying cause and every possible contributory cause.

Data and Method

Data

Data are from the Italian National Vital Statistics Death Registry on causes of death, managed by the Italian National Institute of Statistics (Istat) and from the National institute for health and medical research (Inserm) for France. Both countries use a death certificate that follows the WHO guidelines. The certifying practitioner is expected to report on this certificate the disease process from the initial diagnosis right up to the moment of death; (s)he may also indicate any other relevant disease or condition. The WHO death certificate consists of two parts. Part I is for the diseases or conditions that directly lead to death. The condition recorded on the last line of Part I is usually the underlying cause of the death but the WHO procedures include several exceptions to that rule. Part II is for any other significant condition that contributed to the death, but was not related to the disease or condition directly causing death. The French certificate strictly follows the WHO guidelines. On the Italian Part I is presented with a reversed sequencing order (ISTAT, 2004b).

France adopted the 10th revision of the International Classification of Diseases (ICD-10) in 2000. This change coincided with the introduction of an automated coding system (STYX) adapted from the American system (ACME - Automated Classification of Medical Entities) (Pavillon et al., 2005). Since then, all diseases reported on the certificate are coded. Two thirds of the certificates are coded with STYX, without any human intervention. In the remaining cases, the coding problem is often due to a faulty optical recognition. For 8% of the certificates only, the selection of the underlying cause requires the intervention of a medical expert. Even in that case, all the causes mentioned on the certificate are coded.

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Italy adopted the ICD-10 in 2003 but the use of an automated coding system (CODSAN II) started as early as 1995. CODSAN II is an adaptation to the Italian language of the American systems MICAR (Mortality Medical Coding Indexing Classification and Retrieval) and ACME (ISTAT, 2004a). About 80% of certificates are entirely coded by CODSAN II. The automated coding system assigns a "U00" code to every rejected term and returns back the rejected records. These records are then manually coded by medical experts. When possible, the expert replaces the temporary "U00" codes by true ICD-10 codes and submits again the record to the automated system in order to select the underlying cause of death (Pace and Grippo, 2007). If not, the expert selects and codes the underlying cause only and lets the rest of the information as it is. At the end of the coding process, about 4% of all deaths still have at least one "U00" code for the associated causes; among them, 87% have only one "U00" code.
In Italy, all deaths due to an external cause as well as infant deaths are manually coded for the underlying cause only, and the information on contributory causes is not available. All these cases have been excluded from the analysis as well as all deaths that occurred in the Italian provinces of Trento and Bolzano because they are coded locally and for the underlying cause only. Finally, our analysis is conducted on a total number of 507,704 deaths for France and 550,835 deaths for Italy.

List of causes of death

The list of causes used in the present analysis is very close to the European short list (Eurostat, 1998) that is recommended for European comparisons; but it is not fully comparable with it. Our list (see Appendix) encompasses 15 large groups generally corresponding to the ICD-10 chapters, and 66 sub-groups. In some cases, the EU short list has been further broken down in order to take into account causes of death that we found of particular interest. As an example, specific attention has been given to nutritional disorders because of their epidemiological and social relevance. Consequently, the group of the "Endocrine, nutritional and metabolic diseases" has been broken into several subgroups: "diabetes mellitus" - that is strictly comparable with the group # 27 of the EU short list-, "malnutrition and other nutritional deficiency", "obesity" and "disorders of the thyroid gland". As population aging leads to an increased prevalence of several neuro-degenerative disorders, we decided to create more detailed subgroups within the groups of the "mental and behavioural disorders" and the "diseases of the nervous system". "Alzheimer disease", "Dementias excluding Alzheimer" and "Parkinson disease" have thus been isolated. Several conditions (codes G31.0, G31.2, G31.8, G31.9) that are classified in the ICD-10 with the diseases of the nervous system, have been included in our subcategories of the "mental and behavioural disorders".
Several other conditions (e.g. "hypertensive disease", "renal failure") that are frequently reported on the death certificates but rarely selected as the underlying cause of the death, have been isolated too. Our list also enables to get more details on the very large group of the "symptoms, signs, abnormal findings and ill-defined causes". "Senility" has been isolated. The "Mechanisms of death" as well as the residual subgroup ("other symptoms, signs, abnormal findings and ill-defined causes") include several conditions (respectively I46, I49.0, and I95.9, I99, J96.0, J96.9, P.28.5) that are classified elsewhere in the ICD-10 classification.
Finally, two adjustments have been made in order to achieve full comparability between the French and the Italian datasets: 1) all "Z" codes ("Factors influencing health status and contact with health services") that are used in France only, have been excluded from the French database 2) all "U00" codes of the Italian dataset have been included in the group of the symptoms, signs, abnormal findings and ill-defined causes".

Indicators

We first calculated age- and sex-standardized mortality rates for 1) a given cause reported as the underlying cause of the death, 2) the same cause reported as multiple (underlying or associated) cause of the death. Standard population is the WHO 2003 European population by sex and five-year age groups.
The cause-specific mortality ratio (CSMR) is defined as the ratio between these two rates. The CMSR measures the underestimation of the burden of a given condition in the overall mortality, when using the underlying cause only instead of using the whole information reported on the death certificate.

In order to compare the frequency of the associations of causes, within a country for different underlying causes of death as well as between countries for the same underlying cause, we developed an indicator that eliminates the potential biasing effect of the age structure of the deaths. For each country separately, we first calculated the age-standardized prevalences of 1) a given associated cause among all deaths due to a specific underlying cause, 2) the same associated cause among all deaths of the country. Standard population is the average number of deaths of France and Italy by five-year age groups. The Causes-of-Death Association Indicator" (CDAI) is then defined as the ratio between these two prevalences. It is thus given by following formula:

$$CDAI_{i,a} = \frac{\sum_x \left(\frac{{}^i d_{a,x}}{{}^i d_x} \times \overline{d}_x \right) \Big/ \sum_x \overline{d}_x}{\sum_x \left(\frac{d_{a,x}}{d_x} \times \overline{d}_x \right) \Big/ \sum_x \overline{d}_x} \times 100 = \frac{\sum_x \frac{{}^i d_{a,x}}{{}^i d_x} \times \overline{d}_x}{\sum_x \frac{d_{a,x}}{d_x} \times \overline{d}_x} \times 100$$

${}^i d_{a,x}$ = observed deaths at age x with underlying cause i and associated cause a;

${}^i d_x$ = observed death at age x with cause i as underlying cause;

$d_{a,x}$ = observed death at age x with cause a as associated cause (regardless the underlying cause);

d_x = observed deaths at age x (regardless of the underlying cause);

$\overline{d}_x$ = expected deaths at age x in the standard population

Summary results

The total mortality rate is only slightly higher in Italy than in France (Table 1). Considering the underlying cause of the death only, the cause-specific standardized mortality rates of the two countries are very similar too. Mortality rates for ill-defined causes of death (45,3 vs 13,7 per 100,000) as well as, to a lesser extent, for mental and behavioral disorders (19,6 vs 8,9 per 100,000) are higher in France than in Italy. But for the diseases of the circulatory system, mortality is higher in Italy than in France (216,9 vs 151,1 per 100,000).

In both Italy and France, the average number of causes rises as the age at death grows (Figure 1), which is in line with the increased frequency of comorbidity with age. Over the age of 85 however, the number of reported causes declines, suggesting that the certifying practitioners could describe less carefully the death process when it occurs at very old ages. Figure 1 also shows that the average number of causes reported on the death certificate is higher in Italy than in France (4.0 vs 3.1). This difference holds true when controlling for the different age- and sex- structure of the deaths in the two countries[1]. Part of the reported associated causes might be ill-defined causes or mechanisms of death that do not shed light on the mortality process. For that reason, all the results presented hereafter in this paper are computed after excluding these ill-defined associated causes of death. By doing so, the difference between Italy and France in terms of number of causes per certificate is slightly reduced (3.0 vs 2.4), suggesting that ill-defined causes of death are more frequently reported as associated cause in Italy than in France.

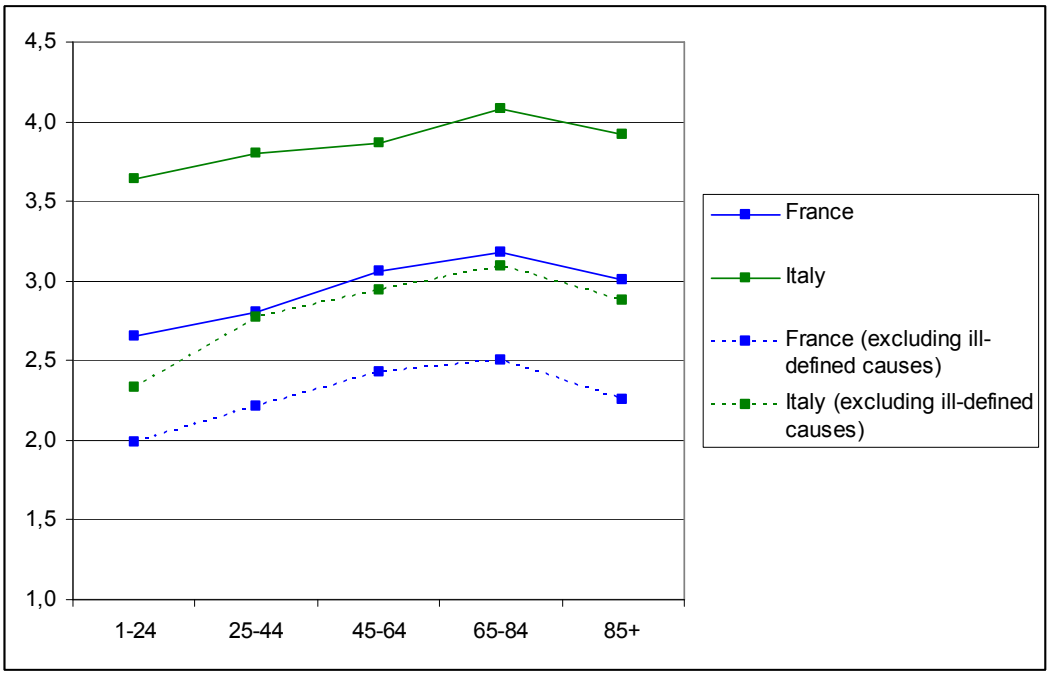
[1] The age structure of the deaths is older in Italy. The Italian population is indeed older than the French population. In addition to that, mortality risks over the age of 65 are higher in Italy

Table 1 – Standardized mortality rates (per 100,000) for each cause reported as underlying cause (1) or multiple cause (2) and cause-specific standardized mortality ratio (2/1). France and Italy, 2003.[2]

CAUSE OF DEATH	ITALY			FRANCE		
	Underlying cause (1)	Multiple cause (2)	CSMR (2/1)	Underlying cause (1)	Multiple cause (2)	CSMR (2/1)
Infectious and parasitic diseases	8,5	34,2	4,0	12,1	48,3	4,0
Neoplasms	191,8	334,8	1,7	195,8	316,4	1,6
Diseases of the blood(-forming organs), immunol.disorders	2,3	23,0	9,9	2,3	14,1	6,1
Endocrine,nutritional and metabolic diseases	23,0	85,6	3,7	21,9	78,4	3,6
Mental and behavioral disorders	8,9	29,5	3,3	19,6	57,8	3,0
Diseases of the nervous system	17,8	49,6	2,8	24,1	52,0	2,2
Diseases of the circulatory system	216,9	476,0	2,2	151,1	308,1	2,0
Diseases of the respiratory system	39,3	156,5	4,0	34,8	105,3	3,0
Diseases of the digestive system	25,4	89,1	3,5	29,4	77,2	2,6
Diseases of the skin and subcutaneous tissue	0,7	8,3	11,4	1,7	10,2	5,9
Diseases of the musculoskeletal system/connective tissue	2,8	10,7	3,8	3,5	9,1	2,6
Diseases of the genitourinary system	8,9	67,7	7,6	8,2	37,8	4,6
Other diseases	1,9	4,8	2,5	1,6	3,9	2,5
Symptoms, signs, abnormal findings,ill-defined causes and Mechanisms of death	13,7	393,8	28,8	45,3	336,4	7,4
Total	562,0	-	-	551,4	-	-

Data: France: Inserm mortality database / Italy: ISTAT mortality database

Figure 1 - Average number of causes on the death certificate by age. France and Italy, 2003.



Data: France: Inserm mortality database / Italy: ISTAT mortality database

The average number of causes per certificate varies significantly according to the underlying cause (Table 2). In both Italy and France, the certifying practitioners tend to report less conditions when the underlying causes is known to be highly lethal (e.g. neoplasms, circulatory diseases). When controlling for the different distribution of the underlying causes of death in the two countries, there still are more causes reported in Italy than in France (2.9 vs 2.5).

[2] The same table for the detailed list of causes is provided in the appendix (table A1).

Table 2 – Average number of causes mentioned on the death certificate by underlying cause of death (ill-defined causes as associated causes of death are excluded). France and Italy, 2003.

UNDERLYING CAUSE OF DEATH	ITALY	FRANCE
Infectious and parasitic diseases	3,5	2,7
Neoplasms	3,1	2,5
Diseases of the blood(-forming organs), immunol.disorders	3,0	2,8
Endocrine,nutritional and metabolic diseases	3,5	2,9
Mental and behavioral disorders	2,5	2,3
Diseases of the nervous system	2,6	2,3
Diseases of the circulatory system	3,0	2,5
Diseases of the respiratory system	2,9	2,4
Diseases of the digestive system	3,3	2,9
Diseases of the skin and subcutaneous tissue	2,8	2,5
Diseases of the musculoskeletal system/connective tissue	3,3	3,1
Diseases of the genitourinary system	3,0	2,8
Other diseases	3,1	2,9
Symptoms, signs, abnormal findings,ill-defined causes and Mechanisms of death	1,0	1,0
TOTAL	**3,0**	**2,4**
Average number controlling for the structure by underlying cause of death	2,9	2,5

Data: France: Inserm mortality database / Italy: ISTAT mortality database

Table 1 also displays the cause-specific mortality ratios (CSMR) for the two countries. The CSMR is generally higher in Italy than in France. The smallest value is for neoplasms: in Italy (resp. in France) the number of deaths due to a neoplasm has to be multiplied by 1.7 (resp. 1.6) to get the total number of mentions of a neoplasm, be as an underlying or a contributory cause to the death. For all other groups of causes, omitting the causes others than the underlying cause results in an important underestimation of the role played by the corresponding conditions in the mortality process. The highest values of the CSMR correspond to the diseases of the skin for Italy (11.4) and to the diseases of the blood for France (6.1). On a general basis, higher values are found for those causes that, though frequently reported on the death certificates, are less frequently selected as the underlying cause because of their low lethality. It is e.g. the case of diabetes (CSMR equal to 3.4, in both France and Italy –See table A.1) and hypertension (CSMR equal to 5.5 in France and 4,2 in Italy). But the multiple causes-of-death approach also reinforce the role played by several causes frequently reported as the underlying cause of the death, such as the diseases of the circulatory system (CSMR equal to 2.0 in France and 2.2 in Italy) or the diseases of the respiratory system (CSMR equal to 3.0 in France and 4.0 in Italy).

Figures 2 to 4 display graphically the Causes-of-death Association Indicator (CDAI) for two age groups (below and over 80 years of age) and for France and Italy. After computing the standard deviation (σ) of this indicator[3], we created the five following classes: $[0;100[$, $[100;100+\sigma/4[$, $[100+\sigma/4;100+\sigma/2[$, $[100+\sigma/2;100+3\sigma/4[$ and $[100+3\sigma/4;\infty[$. The grey color (weak association) has been attributed to the first class while all other classes have been attributed a progressively darkening nuance of pink. The cells of the table that result from the crossing of every underlying and every contributory cause of death, have been colored according to the intensity of the corresponding CDAI.
The detailed analysis of the strength of the associations suggests that the two countries and the two age groups under consideration have a very similar profile in terms of multiple causes of death. There of course are differences but they are the exception rather than the rule. Our main findings can be summarized as follows:

[3] The standard deviation has been calculated taking into account all the values of the CDAI in the two countries.

- most cells on the diagonals are colored in dark pink. This suggests that a disease belonging to the same ICD-10 chapter as the underlying cause of death frequently contributes to the death.
- all cells on the last horizontal lines are colored in grey. As expected, ill-defined underlying causes of death are less likely to be associated with any other cause of death.
- The contribution of infectious diseases is above the average for a number of underlying causes of death. When reported as the underlying cause of the death, infectious diseases are also strongly associated with several groups of causes.
- Tumors display a completely different pattern: they are less frequently reported as contributory cause (except when the underlying cause is a neoplasm, too), and most associations with the other causes of deaths are weak. From that perspective, tumors and circulatory diseases share the same pattern.
- When reported as the underlying cause of death, blood diseases are strongly associated with several other causes but the picture is not alike in the two countries and in the two age groups.
- The endocrine, nutritional and metabolic diseases regroup a variety of diseases but the specific pattern of diabetes probably influence greatly the overall pattern of the group. And indeed, among the associations that emerge from the analysis, we are able to identify several complications of diabetes. Endocrine diseases do not emerge as a cause frequently contributing to death. This result is in line with the WHO recommendation that diabetes should be reported as the underlying cause of the death.
- Like the circulatory diseases, respiratory diseases are characterized by weak associations. In Italy, this result is independent of the "role" (underlying or contributory cause) played by the respiratory diseases in the process leading to death. In France, several associations (in particular, associations with mental and nervous diseases as underlying cause) involve respiratory diseases as contributory cause of the death.
- Mental diseases and nervous diseases can be examined jointly since their patterns have a number of similarities. In particular, we find a strong association with the diseases of the skin as contributory cause. Over the age of 80, the same association is found in the reverse order (mental and nervous diseases as contributory causes of a disease of the skin) in France and for mental diseases only in Italy. Under the age of 80, diseases of the skin are strongly associated with mental diseases in Italy and with nervous diseases in France. Diseases of the skin might be a consequence of confinement (bedsore). More generally, they may contribute to the process leading to death in so far as they participate to – or they give the signal for - the global weakening of the body.
- Specifically to France, we find that an external cause is frequently mentioned in case the death is due to a mental or a nervous disease. This situation might for instance correspond to the death of a person who was paralyzed, and the certifying practitioner has provided information on the accidental origin of the spinal injury. A careful look at the external causes shows that the S and T codes ("injury, poisoning and certain other consequences of external causes") represent 75 % of the coded mentions in France, while they represent only 37% of the mentions in Italy. This is likely to be due to the fact that in Italy, when the automatic procedure fails to code external causes, the underlying cause often is the only coded cause.

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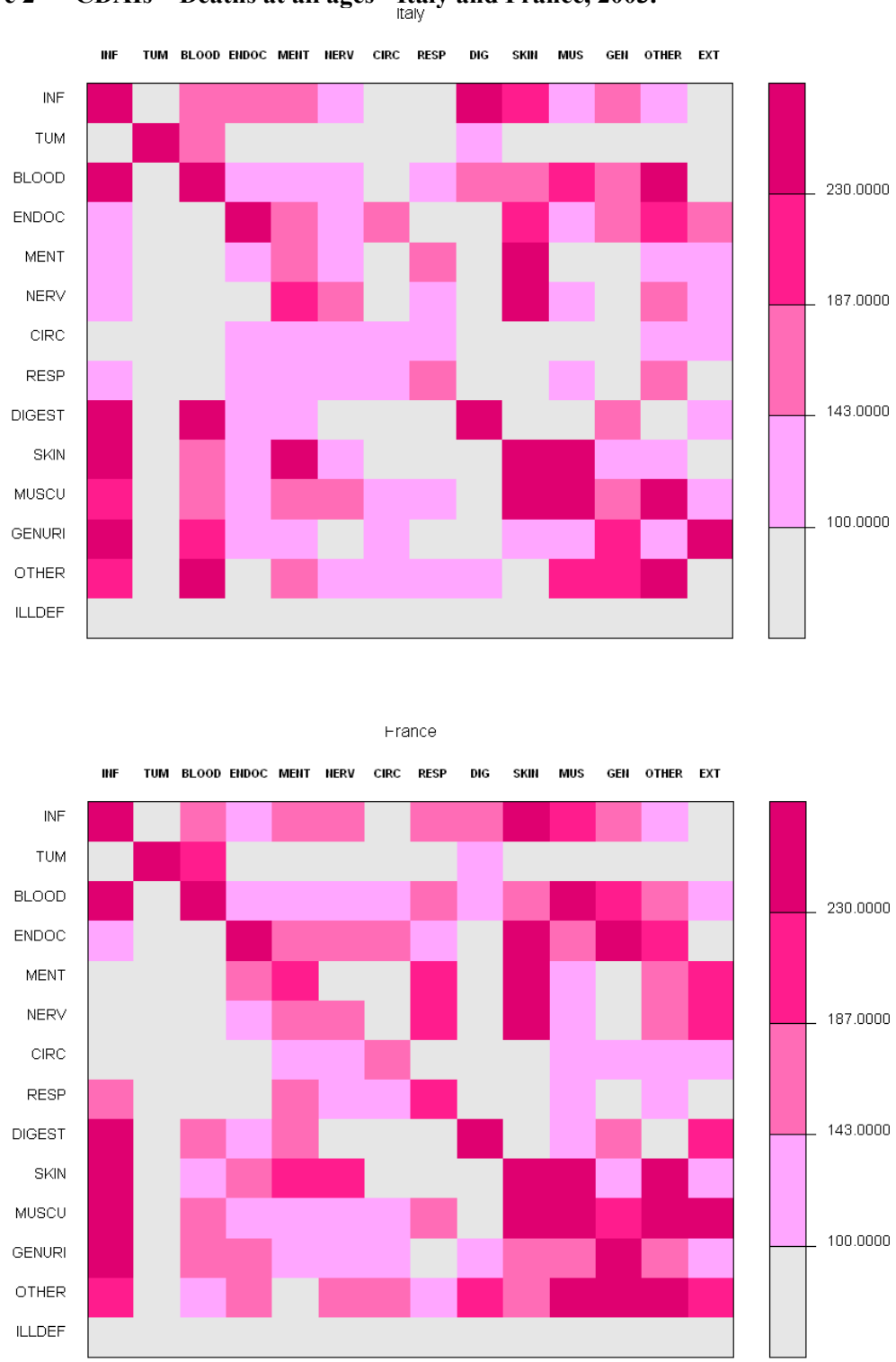
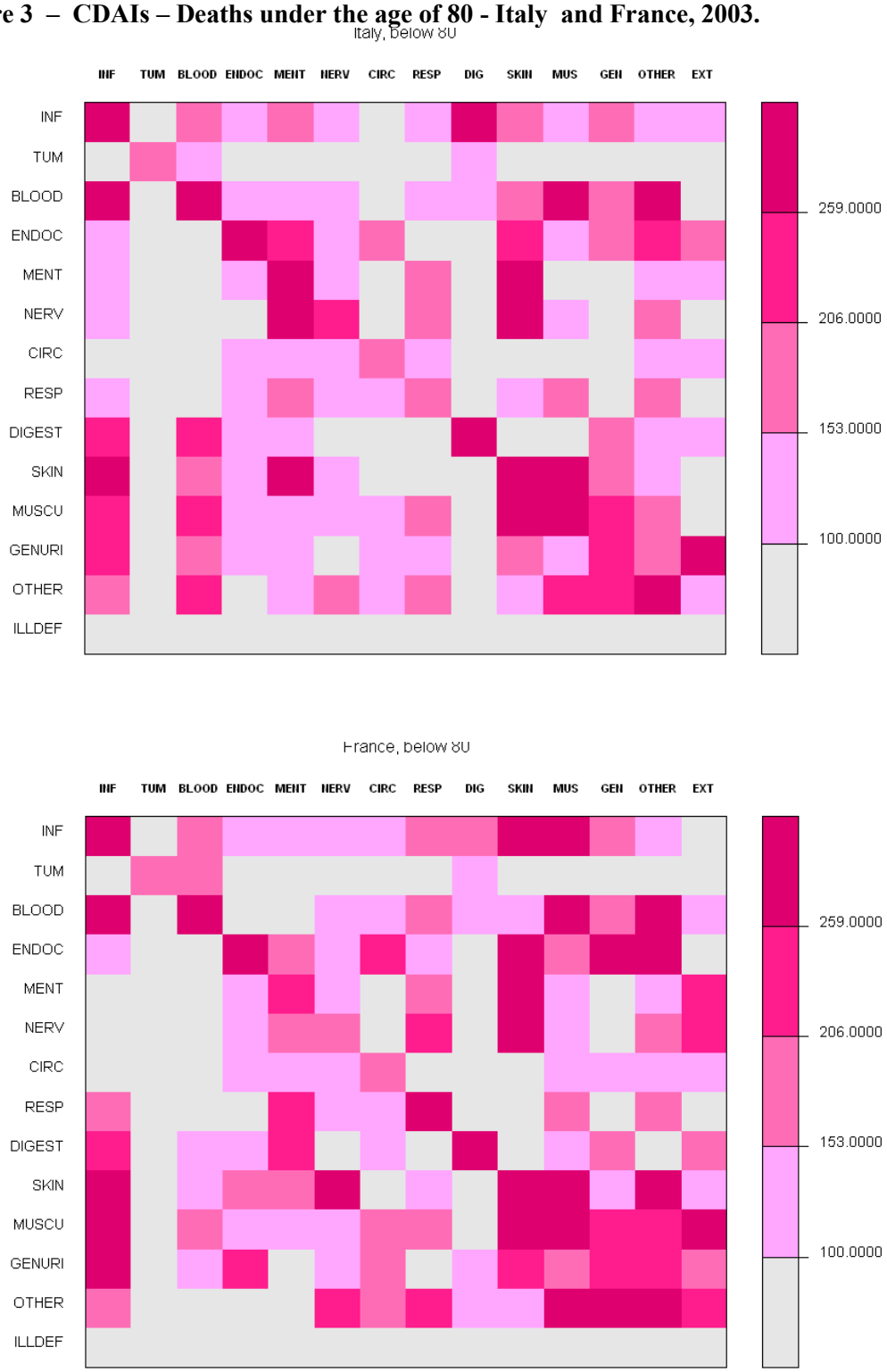
Figure 2 – CDAIs – Deaths at all ages - Italy and France, 2003.



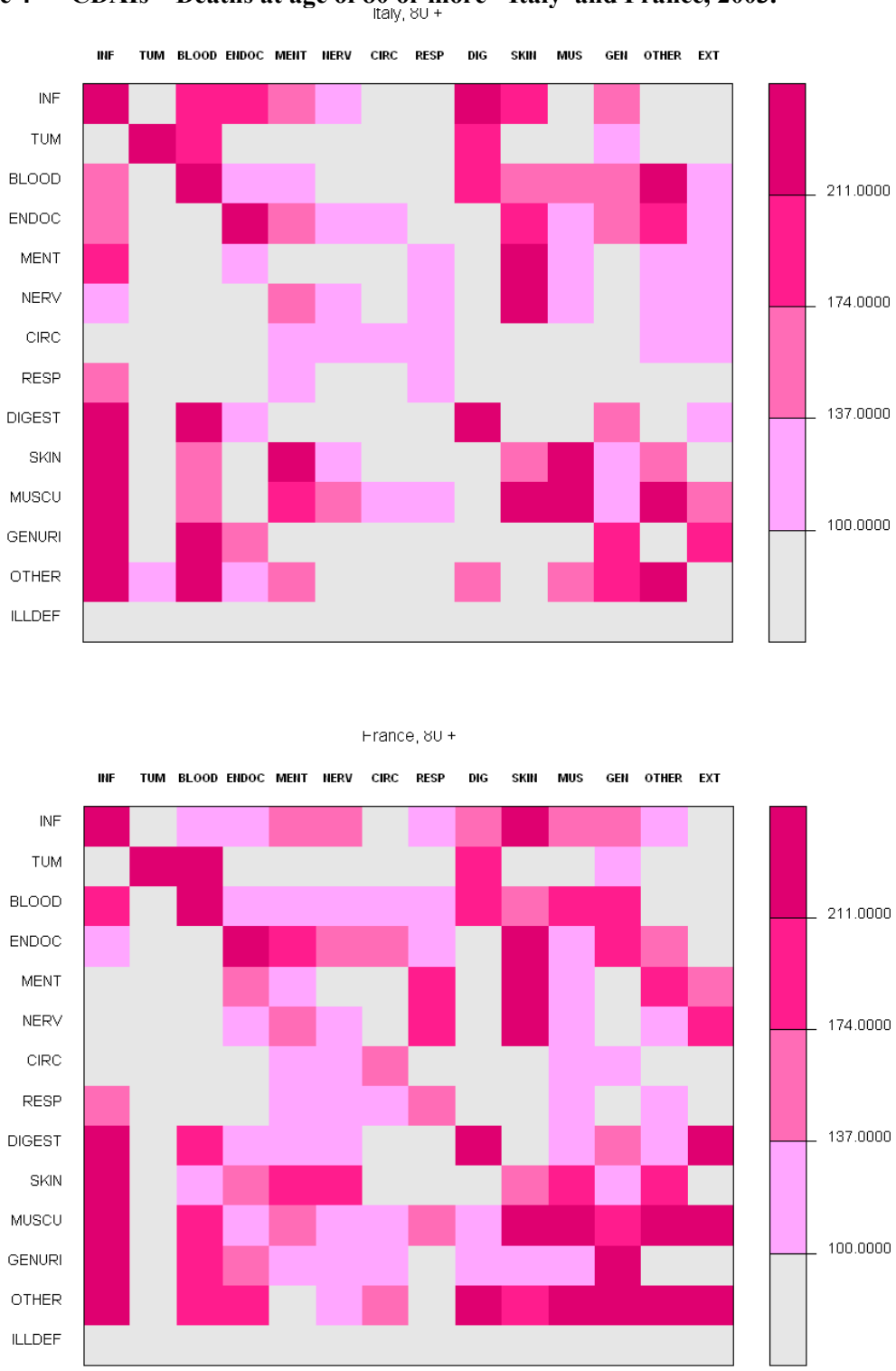
Horizontal axis : associated cause. Vertical axis : underlying cause.
Data: France: Inserm mortality database / Italy: ISTAT mortality database

Figure 3 – CDAIs – Deaths under the age of 80 - Italy and France, 2003.



Horizontal axis : associated cause. Vertical axis : underlying cause.
Data: France: Inserm mortality database / Italy: ISTAT mortality database

Figure 4 – CDAIs – Deaths at age of 80 or more - Italy and France, 2003.



Horizontal axis : associated cause. Vertical axis : underlying cause.
Data: France: Inserm mortality database / Italy: ISTAT mortality database

APPENDIX

List of causes

Nr Multiple cause group	Nr Eurostat Short List	Disease or external cause	ICD-10 code
		All causes of death	**A00-Y89**
1	01	**Infectious and parasitic diseases**	
1	02	Tuberculosis	A15-A19, B90
2	04	AIDS (HIV-disease)	B20-B24
3	05	Viral hepatitis	B15-B19, B94.2
4	-	Septicaemia	A40-A41
5	-	Intestinal infectious diseases	A00-A09
6	-	Other Infectious and parasitic diseases	(A00-B99) - Supra
2	**06**	**Neoplasms**	
7	08	Malignant neoplasm of lip, oral cavity, pharynx	C00-C14
8	09	Malignant neoplasm of oesophagus	C15
9	10	Malignant neoplasm of stomach	C16
10	11-12	Malignant neoplasm of colon, rectum and anus	C18,C19, C20, C21
11	13	Malignant neoplasm liver and the intrahepatic bile ducts	C22
12	14	Malignant neoplasm of pancreas	C25
13	15	Malignant neoplasm of larynx and trachea/bronchus/lung	C32-C34
14	16	Malignant melanoma of skin	C43

15	-	Malignant neoplasm of skin	C44
16	17	Malignant neoplasm of breast	C50
17	18-19	Malignant neoplasm of cervix uteri and other parts of uterus	C53, C54, C55
18	20	Malignant neoplasm of ovary	C56
19	21	Malignant neoplasm of prostate	C61
20	22	Malignant neoplasm of kidney	C64
21	23	Malignant neoplasm of bladder	C67
22	24	Malignant neoplasm of lymph./haematopoietic tissue	C81-C96
23	-	Other malignant neoplasms	(C00-C99) – Supra C
24	-	Benign neoplasms, In situ neoplasms and neoplasms of uncertain or unknown behaviour	D00-D09, D10-D36, D37-D48
3	**25**	**Diseases of the blood(-forming organs), immunol.disorders**	D50-D89
25	25	Diseases of the blood(-forming organs), immunol.disorders	D50-D89
4	**26**	**Endocrine, nutritional and metabolic diseases**	
26	27	Diabetes mellitus	E10-E14
27	-	Malnutrition and other nutritional deficiencies	E40-E64
28	-	Obesity	E65-E68
29	-	Disorders of thyroid gland	E00-E07
30	-	Other Endocrine, nutritional and metabolic diseases	(E00-E90) - Supra
5		**Mental and behavioural disorders**	
31	29	Alcoholic psychosis/chronic alcohol abuse	F10, G31.2
32	30	Drug dependence, toxicomania	F11-F16, F18-F19

33	-	Dementias (excluding Alzheimer)	F01, F03, G31.0, G31.8, G31.9
34	-	Other Mental and behavioural disorders	(F00-F99) - Supra ' F' codes
6		**Diseases of the nervous system**	
35	-	Epilepsy	G40-G41
36	-	Alzheimer disease	G30
37	-	Parkinson disease	G20, G21
38	-	Other Diseases of the nervous system	(G00-G98) - (G31.0, G31.2, G31.8, G31.9) and – Supra
7		**Diseases of the circulatory system**	
40	34	Ischaemic heart diseases	I20-I25
41	35	Other heart diseases	I30-I33', I39-I45, I47-I48, I49.1-I52, I00-I09
42	36	Cerebrovascular diseases	I60-I69
43	-	Hypertensive diseases	I10-I15
44	-	Other Diseases of the circulatory system	(I00-I99) – (I46, I49.0, I95.9, I99) and - Supra
8		**Diseases of the respiratory system**	
45	38	Influenza	J10-J11
46	39	Pneumonia	J12-J18
47	-	Other acute lower respiratory diseases	J00-J09, J19-J22
48	41	Asthma	J45-J46
49	40	Other Chronic lower respiratory diseases	J40-J44

50	-	Lung diseases due to external agents	J60-J70
51	-	Other Diseases of the respiratory system	(J00-J99) – (J96.0, J96.9) - Supra
9	**42**	**Diseases of the digestive system**	
52	43	Ulcer of stomach, duodenum and jejunum	K25-K28
53	44	Chronic liver disease	K70, K73-K74
54	-	Other Diseases of the digestive system	(K00-K93) – Supra
10	**45**	**Diseases of the skin and subcutaneous tissue**	
55	45	Diseases of the skin and subcutaneous tissue	L00-L99
11	**46**	**Diseases of the musculoskeletal system/connective tissue**	
56	47	Rheumatoid arthritis and osteoarthrosis	M05-M06, M15-M19
57	-	Other Diseases of the musculoskeletal system/connective tissue	(M00-M99) – Supra
12	**48**	**Diseases of the genitourinary system**	
58	In 49	Renal Failure	N17-N19
59	In 49	Other Diseases of kidney and ureter	N00-N16
60	-	Hyperplasia of prostate	N40
61	-	Other Diseases of the genitourinary system	(N00-N99) – Supra
13	**-**	**Other diseases**	
	50 51	Complications of pregnancy, childbirth and puerperium Certain conditions originating in	O00-O99 (P00-P96)-

		the perinatal period	P28.5
	52	Congenital malformations and chromosomal abnormalities	Q00-Q99
	In 31	Diseases of the eye and adnexia	H00- H59
	In 31	Diseases of the ear and mastoid process	H60- H95
62	56	SIDS	R95
14		**Symptoms, signs, abnormal findings, ill-defined causes**	
63	In 55	Senility	R54
64	In 33 and 55	Mechanisms of the death °	I46, I49.0, R09.2, R40.2, R57
65	In 55	Other Symptoms, signs, abnormal findings, ill-defined causes °°	(R00-R94), (R96-R99), I95.9, I99, J96.0, J96.9, P.28.5, U00 - Supra "R" codes,
15		**External cause**	
66	58	External cause	S, T, V, W, X Y

°) Mechanisms of death: Cardiac arrest (I46.0), Ventricular fibrillation (I49.0), Respiratory arrest (R09.2), Coma (R40.2), Shock (R57)

°°) Hypotension (I95.9), Other unspecified disorders of circulatory system (I99), Acute respiratory failure (J96.0), Respiratory failure unspecified (J96.9), Respiratory failure of newborn P(.28.5)

Abbreviations used for figures 2 to 4

Nr	Multiple cause group	Abbreviation
1	Infectious and parasitic diseases	INF
2	Neoplasms	TUM
3	Diseases of the blood(-forming organs), immunol.disorders	BLOOD
4	Endocrine, nutritional and metabolic diseases	ENDOC
5	Mental and behavioural disorders	MENT
6	Diseases of the nervous system	NERV
7	Diseases of the circulatory system	CIRC
8	Diseases of the respiratory system	RESP
9	Diseases of the digestive system	DIG
10	Diseases of the skin and subcutaneous tissue	SKIN
11	Diseases of the musculoskeletal system/connective tissue	MUS
12	Diseases of the genitourinary system	GEN
13	Other diseases	OTHER
14	Symptoms, signs, abnormal findings, ill-defined causes	ILLDEF
15	External cause	EXT

Table A.1 - Standardized mortality rates (per 100,000) for each cause reported as underlying cause (UC) or multiple cause (MC) and cause-specific standardized mortality ratio (CSMR). France and Italy, 2003.

Cause of death	France			Italy		
	UC	MC	CSMR	UC	MC	CSMR
Tuberculosis	1,0	2,1	2,1	0,5	1,4	2,5
AIDS(HIV-disease)	1,6	3,3	2,1	2,0	4,1	2,0
Viral hepatitis	0,9	3,5	3,7	2,6	7,8	3,0
Septicaemia	4,6	28,8	6,2	2,4	19,4	7,9
Intestinal infectious diseases	0,8	1,1	1,4	0,1	0,2	1,8
Other infectious and parasistic diseases	3,1	12,0	3,9	0,7	3,2	4,3
Malignant neoplasmof lip, oral cavity, pharynx	6,5	7,9	1,2	3,6	4,2	1,2
Malignant neoplasm of oesophagus	5,8	6,8	1,2	2,3	2,5	1,1
Malignant neoplasm of stomach	6,0	6,6	1,1	12,2	13,4	1,1
Malignant neoplasm of colon, rectum and anus	18,9	21,7	1,1	19,0	21,7	1,1
Malignant neoplasm liver and the intrahepatic bileducts	9,5	10,8	1,1	11,3	12,4	1,1
Malignant neoplasm of pancreas	9,1	9,5	1,0	9,6	10,1	1,1
Malignant neoplasm of larynx and trachea/brochus/lung	40,3	44,4	1,1	42,5	46,0	1,1
Malignant melanoma of skin	1,9	2,1	1,1	1,9	2,1	1,1
Malignant neoplasm of skin	0,6	0,8	1,5	0,5	0,7	1,5
Malignant neoplasm of breast	13,1	15,2	1,2	12,5	14,5	1,2
Malignant neoplasm of cervix uteri and other parts of uterus	3,3	3,8	1,2	2,7	3,2	1,2
Malignant neoplasm of ovary	3,7	4,0	1,1	3,3	3,6	1,1
Malignant neoplasm of prostate	12,2	16,6	1,4	9,4	12,9	1,4
Malignant neoplasm of kidney	4,0	4,7	1,2	3,5	4,1	1,2
Malignant neoplasm of bladder	5,6	7,0	1,2	5,8	7,5	1,3
Malignant neoplasm of lymph./haematopoietic tissue	15,0	18,5	1,2	15,3	19,1	1,2
Other malignant neoplasms	33,1	135,1	4,1	27,8	150,8	5,4
Benign neoplasms and Tumori in situ e di comportamento incerto	7,1	11,8	1,7	8,7	15,5	1,8
Diseases of the blood(-forming organs), immunol.disorders	2,3	14,1	6,1	2,3	23,0	9,9
Diabetes mellitus	12,3	41,3	3,4	18,6	63,9	3,4
Malnutritionand other nutritional deficiencies	2,1	10,6	5,0	0,4	2,8	7,7
Obesity	1,1	4,9	4,5	0,8	3,6	4,5
Disorders of thyroid gland	0,7	2,9	4,5	0,4	3,4	8,3
Other endocrine,nutritional and metabolic diseases	5,8	24,6	4,2	2,8	16,2	5,7
Alcoholic psychosis/chronic alcohol abuse	5,1	17,7	3,5	0,4	1,8	4,7
Drug dependence,toxicomania	0,2	0,5	2,1	0,7	0,8	1,2
Dementia(excluding Alzheimer)	10,8	20,8	1,9	6,9	21,0	3,1
Other mental and behavioral disorders	3,5	23,5	6,7	1,0	6,4	6,5
Epilepsia	2,0	5,5	2,7	0,8	3,4	4,5
Alzheimer disease	10,2	15,6	1,5	5,9	9,5	1,6
Parkinson disease	4,4	8,2	1,9	3,2	8,5	2,6
Other diseases of the nerous system	7,5	23,5	3,1	7,9	29,0	3,7
Ischaemic hearth diseases	46,0	74,0	1,6	79,4	134,9	1,7
Other hearth diseases	39,3	116,6	3,0	7,6	18,9	2,5
Cerebrovascular diseases	35,5	63,6	1,8	61,0	119,8	2,0
Hypertensive diseases	7,5	41,5	5,5	19,1	81,3	4,2
Other diseases of the circulatory system	22,8	61,3	2,7	49,7	205,8	4,1
Influenza	0,4	0,6	1,4	0,8	1,3	1,5
Pneumonia	11,1	38,2	3,4	7,2	37,6	5,2
Other acute lower respiratorydiseases	3,1	8,9	2,9	0,7	3,0	4,3
Asthma	1,4	3,3	2,3	0,8	2,2	2,9
Other chronic lower respiratory diseases	8,9	19,5	2,2	22,7	56,9	2,5
Lung diseases due to external agents	2,8	10,2	3,7	1,2	4,6	3,8
Other diseases of the respiratory system	7,1	32,4	4,6	6,0	62,8	10,5
Ulcer of stomach, duodenum and jejunum	1,0	2,7	2,7	1,2	4,1	3,5
Chronicliver disease	13,0	23,1	1,8	11,7	25,2	2,2
Other diseases of the digestive system	15,3	56,5	3,7	12,5	66,8	5,4
Diseases of the skin and subcutaneous tissue	1,7	10,2	5,9	0,7	8,3	11,4
Rheumatoid arthritis and osteoarthritis	0,6	1,9	3,1	0,8	4,1	5,2
Other diseases of the musculoskeletal system/connective tissue	2,9	7,3	2,5	2,0	6,9	3,4
Renal Failure	5,4	30,5	5,6	7,3	59,3	8,1
Other diseases of kidney and ureter	0,7	2,1	3,0	0,4	1,8	4,9
Hyperplasia of prostate	0,2	0,8	3,2	0,3	2,2	8,7
Other diseases ofthe genitourinary system	1,9	5,6	3,0	1,0	6,7	6,7
Other Diseases	1,6	3,9	2,5	1,9	4,8	2,5
Senility	4,3	19,1	4,4	4,2	24,7	5,9
Mechanisms of the death	18,8	217,5	11,6	6,8	300,1	44,1
Other Symptoms, signs, abnormal findings,ill-defined causes	22,2	142,5	6,4	2,7	170,5	63,1