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Analysis of the Underlying and Multiple Causes of Death for the Kuwaiti Population 40 years or over; Part II: Causes

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ABSTRACT: Background: Death rarely results from a single cause; it can be caused by a variety of factors. Multiple causes of death (MCD) can provide information about the associations between causes of death revealing common combinations of conditions. Moreover, they can rectify inconsistencies in the death certificates (DC). **Objective:** This paper is meant to highlight the importance of multiple causes of death and point out the contributing and associated disease conditions to the underlying cause of death (UCD). **Methods:** The study was based on analysis of multiple causes of death for the Kuwaiti population 40 years or over in the period 1993-2001. All multiple causes up to 5 in the death certificate notification (DCN) were coded and analyzed. The data were coded according to ICD9 following the WHO rules. The ratios for the MCD/UCD were computed for the groups of diseases and for individual causes exceeding 50 entries. The relative ratios (Observed/Expected) were computed to show the associations between the groups of causes. **Results:** A total of 13960 DCNs were analyzed, the ratios were low for neoplasms (1.51), followed by respiratory (2.50), nervous (2.97), and digestive conditions (3.01), Ill-defined conditions had the highest ratio (13.40). Infections and genitourinary diseases had ratios of 4.19 and 4.56. Ranking changed when using MCD; circulatory, endocrinal, nervous and digestive conditions kept their position, with circulatory diseases on the top and nervous conditions occupying position 10. Relative risk (RR) was computed for the different groups; positive RR was found between infections and respiratory, digestive, genitourinary and ill-defined disease conditions. Neoplasms showed positive association was other neoplasms, and endocrine conditions were positively associated with circulatory, respiratory, and genitourinary conditions. A positive association was found between ill-defined conditions with circulatory and other Ill-defined conditions. **Conclusions:** UCD is still essential to analyze historical trends, compare countries, and guide prevention of death; MCD offer a new sight into the study of mortality. The combination of the 2 methodologies is more useful than the isolated use of either approach. **Conclusion and Recommendations:** The Collection of MCD is essential, there has been major development in the area and soft ware was developed to analyze MCD data. MOH should start the development of data bases for MCD, make them available, and include the highlights in the MOH annual reports. Special reports discussing individual disease conditions particularly neoplasms and circulatory and respiratory conditions should be organized.

Key words: Kuwait, UCD, MCD, causes of death.

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INTRODUCTION:

Mortality statistics are used in epidemiology and public health as an indicator of health status, to evaluate health programs, and in population studies to compare trends and spatial differences.[1] Mortality statistics can be compiled using the underlying cause (UCD) or multiple causes (MCD). Deaths rarely have only one cause and using the UCD will not allow researchers to assess the role of conditions that are important contributors to death but were not reported as the UCD.[2] Analyses that use only the UCD ignore a lot of information that is readily available and underestimate the importance of several leading causes of death.[3] Wall et al.[4] stressed the analytical potential of MCD and pointed its use of looking for inaccuracy in reporting the cause of death. The last century was characterized by a persistent increase in survival, resulting from improved quality of nutrition and living conditions, and progress in medical technology and health care.[5] The pattern is however complicated, the mortality rates from CVD substantially declined during the second half of the last century; mortality from cancer however increased until that time and slightly decreased thereafter. [6]

The selection of a single UCD is frequently problematic in the elderly people who often have several chronic diseases that concurrently lead to death.[7] Historically reliable, representative routine low cost and long term mortality measurements have been the key to monitoring trends in health conditions of the population, detecting new epidemics , spurring research into avoidable causes of death, evaluating the success of control programs and improving accountability of expenditure on disease control.[8] Routinely collected data have helped to spur further research and public health action and contributed to the enormous increase in life expectancy in the last century.[9]

The relative frequency with which a cause is selected as the underlying cause of death will influence the position of this disease in order of importance in the official statistics of mortality in any country. However, knowing how many times any disease is registered on the death certificate would serve health services as an indirect indicator of their prevalence and impact on the population.[10] The causal pathway generally reflects the attending physician's best judgment about the causal train of events and will be influenced by his reasoning; the association between causes of death can be pointed by examining the frequency with which the conditions are reported together.[3] The biological plausibility of a connection between 2 conditions; and the opinion of the person filling the death certificate is critical. [3]

While examining the absolute numbers and ratios of MCD provide valuable information about the relative magnitude of the different disease conditions, there are other important analytical uses; MCD can be used to examine the links between the different causes listed on the death certificate (DC), ultimately this potential is of great value to health authorities.[2] A simple way to investigate the association between the causes of death is to compute the percentage of deaths involving a particular disease condition which also involves another specified cause,[11,3] The biological plausibility of a connection between the 2 conditions may determine the decision of the physician in charge. The strength of the association can be measured by comparing the ratio in which the 2 causes are mentioned together and the number of cases that might be expected under the assumption of the 2 conditions being independent;[3] the method was adopted and applied by the Australians.[11] An observed ratio higher than 1 indicates that the 2 conditions may have a positive association.[12]

The Ministry of Health in Kuwait (MOH)

publishes the age, sex and nationality distribution of the first hundred causes in the annual reports;[13] only one cause, the UCD, is provided in its publications. This study is designed to fill a gap in the mortality data published in the MOH annual reports, based on the UCD alone.

AIM OF THE STUDY: This paper is meant to highlight the importance of multiple cause of death and point out the contributing and associated disease conditions to the UCD.

MATERIAL AND METHODS:

Mortality data are collected by the Vital and Health Statistics Department, MOH Kuwait; notification is mandatory and data cover nearly 100% of cases. Causes of death are reported in the annual reports, as a rule the UCD is provided. To provide better insight into the magnitude of the causes and their contribution to the mortality pattern in a holistic manner, all the death certificates notification (DCN) for the Kuwaiti population 40 years and over were reviewed for this study, and all the causes up to six additional causes were coded. A total of 13960 cases (7966 male and 5994 female), the total reported in the period 1993-2001, were analyzed. The causes of death were provided according to the ICD9. The Ministry of Health in Kuwait publishes the age and sex distribution of the first hundred causes in the annual reports. The majority of the patients (78%) die in the hospital and the DCNs are filled up by a senior physician at the hospital. The cases that are referred for treatment abroad are generally fully investigated before they leave. A physician at the Vital and Health Vital Statistics Department is in charge of verifying the DCNs and their UCD coding.

The causation matrix was done by cross tabulation of the disease conditions, the relative ratios (RR) were computed along the method applied and elaborated by the Australians (ABS 2003), [11] originally reported by Stallard.[12] The RR is

computed by dividing the actual ratio by the expected, assuming independence of the 2 conditions. Values higher than unity denote association. The expected frequency is computed by multiplying the number of deaths in which cause one is present by the number of deaths in which cause 2 is mentioned and dividing the product by total number of deaths for the time. The RR was computed at the ICD chapter level and not for the individual disease condition to give a holistic approach. The data were tabulated and cleaned using Excel program. Statistical manipulations were done by SPSS for Windows version 14.

RESULTS:

The relative distribution of the multiple causes of death at the chapter level for the males is shown in Table 1. The causes entered as the UCD, as second, third, fourth or higher cause and their relative contribution is shown in the table; here the % is computed for the valid cases. The row assigned missing in the table denotes the number for which a lower number of causes were entered. With the UCD the total is 7966, since every case had an UCD; with the column 2nd cause the number dropped to 7430, since in 536 cases only the underlying cause was mentioned on the DC; and with the group in which a 3rd cause was found the total came to 6294. The total number of entries amounted to 28982. The circulatory system diseases were reported in 51.0% of the UCD, and were more prominent as a second cause of death accounting for 78.8%. The proportion dropped to 20.7% as a third cause. The total entries for circulatory system amounted to 13799; this is the number of times they were noted on the death certificates including the UCD. Neoplasms were mainly a first cause (14.3%); were not mentioned as frequently as a 2nd (1.9%), or a 3rd cause (1.8%). The contribution to the total entries amounted to 5.8%. The group of

endocrine, nutritional and metabolic diseases was contributing appreciably higher proportions to the group of the 5th causes (18.9%) and increased to 22.2% with the valid 6 causes. The proportions attributed to infectious and parasitic diseases were small, amounting to 2.8% with UCD and 3.3% with the MCD; but the proportion was relatively constant all through the spectrum of the causation. Symptoms, signs and ill-defined causes of death (ICD9 780-789) was not a major component of the UCD (5.0%), but showed up as the major contributor to the group with 3 causes accounting for 60.4% of that group. Genitourinary and digestive system diseases were mentioned in 1190 and 656 DCs, amounting to 4.1 and 2.3% of the MCD, respectively. Their contribution was slightly higher as a 4th cause and higher. Injury and poisoning accounted for a small proportion of this group and were fairly constant. Mental disorders and congenital anomalies were very uncommon, and no cases were attributed to the group of pre-natal conditions.

The relative contributions of the different groups of causes for females are shown in Table 2. A total of 22801 enteries were reported on the 5994 valid cases. The similarity between the males and females is striking, circulatory system diseases were reported in 10924 enteries or 47.9% of the total MCDs. The relative cotribution as a UCD was 50.1%. Their relative contribution to the group of 2 causes was appreciably higher (81.4%). Neoplasms cotributed relativly more than that for males as UCD (16.2%). Endocrinal disorders were the third on the list of the UCD (8.8%), followed by the respiratory (6.0%) and ill-defined conditions (6.2%). Similar to the males, ill-defined conditions were quite common as a third cause (61.3%). Infections were contributing a total of 3.7% of the MCDs, the relative contribution was slightly higher with the cause number 4

(8.1%). Injury contributed slightly less than that for the males, accounting for 2.1% of the total and was 2.3 % of the UCD. Respiratory, digestive and genitourinary diseases accounted collectively for 10.1% of the total entries. The rising trend seen with the endocrinal diseases was more obvious in case of females.

The change in the mortality pattern using the multiple cause of death in place of the underlying cause at the chapter level for the males and females is summarized in Table 3. Ratios were computed by dividing the MCD by the number of the UCD. The overall ratios for males (3.64) and females (3.80) were quite close. With males the ratio was higher than the group mean for infections (4.27), genitourinary diseases (4.41), and ill-defined conditions (14.42). Lower ratios were found for neoplasms (1.46), respiratory diseases (2.61), and injuries (3.14). With females the ratio was somewhat lower than that for the males with ill-defined (12.34), and respiratory conditions (2.36), and was slightly higher for the endocrine (3.64), neoplasms (1.57) and the genitourinary group (4.75). Generally the ratios for neoplasms (1.43 for males and 1.53 females) were appreciably lower than any other disease conditions. The ratios for mental disorders and congenital anomalies were based on very small numbers.

Ranking of the different groups at the chapter level is shown in Table 4. The two groups that contributed minimally to mortality, namely, the congenital anomalies and mental disorders were excluded from the analysis; mental disorders were added to the group of diseases of nervous system, and the congenital anomalies (6 cases) were deleted. With males circulatory system diseases were on top of the list of UCD and kept that position. Neoplasms were the second on the list of the UCD and moved to the 4th position among the multiple causes, and this was common to the 2 gender groups.

Endocrinal and metabolic conditions ranked third in the 2 causation categories. Nervous system diseases were at the bottom of the list using the UCD or the total causes. Infections were the 9th on the UCD and moved to the 8th position on the MCD list; genitourinary conditions were the 7th and kept that rank with the 2 lists. The group of ill-defined conditions, which occupied the 6th position moved to occupy the 2nd on the MCD. With females the order of neoplasms, and circulatory, endocrine, nervous and digestive system diseases were the same as that for the males. Infections which moved up with the males moved down with the females, from the 7th to the 8th position.

The association of the different causes using the MCD is summarized in Table 5, the magnitude of the association is denoted by the relative ratios (RR observed/expected), a value above unity would denote a positive association, With infections as an UCD, a positive RR was seen with the nervous (1.08), respiratory (2.32), digestive (2.41), genitourinary (1.56) and ill-defined conditions (1.09). Neoplasms as an UDC was positively associated with other neoplasms (6.56), respiratory (1.15) digestive (2.19), and genitourinary conditions (1.06). Endocrine conditions as an UDC showed positive association with infections (1.52), circulatory (1.17) respiratory (1.15) and genitourinary conditions. Circulatory diseases were positively associated with endocrine (1.39), nervous (1.3), other circulatory (1.11) and ill-defined conditions (1.05). Respiratory conditions were positively associated with infections (2.36), nervous (1.24), other respiratory (1.35) and ill-defined conditions (1.2). Genitourinary conditions showed a positive association with infections (2.92), endocrine and ill-defined conditions. Ill-defined conditions were positively associated with circulatory (1.19) and other ill-defined conditions (1.39). Injuries were associated only with other

injuries (21.27).

DISCUSSION:

This is the 2nd of a series of papers that discuss the MCD in the Kuwaiti population 40 years or over. This paper is meant to highlight the medical aspects and point out the contributing and associated disease conditions to the UCD in this group. It is designed to fill a gap in the mortality data published in the MOH annual reports, [13] based on the UCD alone. The findings are not directly comparable to those published by the MOH since the present study was limited to the Kuwaiti population 40 years or over. This age selection will practically exclude almost all congenital anomalies, prenatal and childhood diseases and a major portion of traumatic injuries seen in children and young adults. Selection of those 40 years or over will highlight the chronic and degenerative diseases seen more frequently now in Kuwait, particularly among the nationals.

To highlight the differences the findings (table 1) were compared with the MOH figures for 1998,[13] the mid year for the present study (1993-2001). The major difference was however in the relatively higher proportion attributable to circulatory system diseases (51.0%) compared to what is reported by MOH annual reports (40.2%). The group of neoplasms was a primary cause in 14.3% of the cases; the corresponding MOH figure was 12.0%. Endocrinal conditions came the third on the list accounting for 7.6% of the valid cases in this study, compared to 7.0% for MOH. Respiratory diseases were generally contributing similar proportions in this study (5.8%) and that from MOH (5.5%). The proportion of injuries (5.9%) was appreciably lower than that for MOH (11.9%). Ill-defined causes were the primary cause in 4.6% of the cases, the proportion for MOH was very close (4.3%). As expected the proportion of prenatal (4.4%) and congenital anomalies (6.1%)

were appreciably higher with the MOH. It should be noted that the comparison is done for the UDC and not the MCD. The differences are mostly attributed to the difference in age.

The disease conditions analyzed in the present study are all those mentioned in the DCN; it should be noted that these would include both the contributing and associated disease conditions, a point that was discussed by Deshpande,[14] who presented the 2 conditions individually. Bah[15] presented results for South Africa as the UCD, the number of contributing disease conditions, beside the total. In the present study, the disease conditions that showed-up by using the MCD analysis included ill-defined conditions (11.4 times the original UCD) followed by genitourinary diseases (4.5 times), infections (4.19 times), endocrine and metabolic conditions (3.50 times), and circulatory diseases (3.5 times the original UCD figures).

Within the limitations mentioned for this study; data from Australia for 2004 [16] were comparable to Kuwait, the ratio for infections (5.5) was higher than Kuwait, but the ratio for neoplasms was very close to that for Australia (1.4), the ratio for endocrine and metabolic diseases (3.9) was slightly higher than Kuwait. The ratios for mental and nervous disease in Australia (5.3 and 4.1) were higher than the corresponding ratios for Kuwait, the ratio for the circulatory diseases in Kuwait was higher than that for Australia as a whole (3.0). It is worth noting that the overall ratio for Kuwait (3.71) was higher than that for Australia (2.9); moreover the data for Australia covered all the age groups which is different from the present study.

The ratio for the ill-defined conditions (13.4 for Kuwait and 16.8 for Australia)

were close, also both had the highest ratio compared to any disease group, both were much higher than that for Minnesota in the period 1990-1998 (2.96), however the ratio for Canada (19.98) was higher than that for Kuwait. It is interesting to note that many workers thought that using the ill-defined ICD9 codes is a sign of poor quality of the data. [7] In Kuwait, the major use of these conditions was as a third cause; the physicians were in no obligation to mention any other cause and they already had two definite valid causes on the DCN and would have been satisfied with that. However, it seems they were aware of the need to use these codes. This point needs to be elaborated further.

Ranking of the 10 leading causes of deaths was computed in a manner similar to that reported for the US 2000-2001;[17] several disease conditions kept their position, but some others moved to a higher or a lower position. The order of the disease conditions was somewhat different from that reported for Australia; where neoplasms were on the top of the list. This is expected since they ranked IHD, CVS conditions, and HF separately; combining the 3 disease conditions would put the circulatory diseases before neoplasms or any other group. Injuries were also split between injury, poisoning and other consequences and general accidents. The order of diabetes in Australia had position 9 and 6 but it was the 3rd in Kuwait as UCD, and moved to position 5 with MCD.

Data from Canada[18] showed a pattern different from Kuwait, the ill-defined conditions were on the top of the list as an UCD but moved to position 8 with MCD; mental disorders were ranked 4th and 5th in Canada, diabetes occupied the 2nd position as UCD and moved to the top with the MCD data. Suicide and

homicides were reported separately. The data from Canada included the congenital and prenatal conditions which are not expected for the age structure of the data from Kuwait.

The causation matrix developed for the MCD in this study was designed in line with the one used by Australia[11] where the individual MCD was cross tabulated with the other MCD cited on the DC. The one for Kuwait is for the total chapter data, and that for Australia was done for selected disease or groups of disease conditions. This is an important dimension to the MCD analysis, providing the capability to point out the possible association between different disease conditions and quantify the magnitude of the associations considering the clinical logic. The causes did not include the UCD, and the computation of RR was done for the different chapters, many of them included many disease conditions.

The magnitude of the association can be interpreted by comparing the relative ratios (RR). Neoplasms showed a strong association with the other types of neoplasms, and a lower but still positive RR was seen with respiratory, digestive and genitourinary conditions; this is quite logic, the 3 system organs were among the major neoplasm sites. The high level of association with neoplasms in other sites is expected and secondries often settle in the lungs and liver. Ill-defined conditions were associated with circulatory and other ill-defined conditions; the majority of these cases were the unattended deaths as reported for Brazil.[19] The relation of the ill-defined causes and circulatory system diseases was similar to finding for the Iranian Islamic republic. [20].

CONCLUSIONS:

Analysis of causes of death must focus on multiple causes and not aim only at knowing the underlying cause, especially at the country level. The multiple-cause analysis has also brought out the importance of certain diseases as contributing causes of death and deemphasized the importance of ill-defined causes of death, genitourinary conditions, infections, endocrine and circulatory conditions. Although underlying causes of death are still essential to analyze historical trends, compare countries, and guide the prevention of death, yet multiple cause of death data offer a new insight into the study of mortality. The combination of the two methodologies is more useful than the isolated use of either approach.

RECOMMENDATIONS:

The collection of MCD is essential, there has been a major development in the area and soft-ware was developed to analyze MCD data. MOH should start the development of data bases for MCD, make them available, and include the highlights in the MOH annual reports. Special reports discussing individual disease conditions particularly circulatory, neoplasms, ill-defined and respiratory conditions need to be organized for Kuwait.

Table 1: Distribution of the UCD & multiple causes of death for males (Kuwait 1993-2001)

ICD9 Chapter		UCD		2nd		3rd		4th		5th		6th		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
I	Infections	226	2.8	168	2.3	147	2.3	285	6.9	103	4.6	36	3.9	965	3.3
II	Neoplasms	1143	14.3	142	1.9	111	1.8	183	4.4	72	3.2	20	2.2	1671	5.8
III	Endocrine	609	7.6	82	1.1	239	3.8	496	12.0	422	18.9	205	22.2	2053	7.1
V	Mental	4	0.1	2	0.0	2	0.0	1	0.0	2	0.1	0	0.0	11	0.0
VI	Nervous	90	1.1	11	0.1	26	0.4	53	1.3	50	2.2	25	2.7	255	0.9
VII	Circulatory	4066	51.0	5858	78.8	1304	20.7	1571	38.0	741	33.2	259	28.1	13799	47.6
VIII	Respiratory	462	5.8	103	1.4	147	2.3	281	6.8	153	6.9	62	6.7	1208	4.2
IX	Digestive	229	2.9	74	1.0	94	1.5	142	3.4	86	3.9	31	3.4	656	2.3
X	Genitourinary	270	3.4	76	1.0	162	2.6	347	8.4	235	10.5	100	10.8	1190	4.1
XIV	Congenital	3	0.0	0	0.0	3	0.0	0	0.0	0	0.0	0	0.0	6	0.0
XVI	Ill defined	395	5.0	614	8.3	3803	60.4	545	13.2	227	10.2	110	11.9	5694	19.6
XVII	Injury	469	5.9	300	4.0	256	4.1	233	5.6	142	6.4	74	8.0	1474	5.1
Valid cases		7966	100	7430	100	6294	100	4137	100	2233	100	922	100	28982	100
Missing cases		0	0.0	536	6.7	1672	21.0	3829	48.1	5733	72.0	7044	88.4	18814	
Total		7966		7966		7966		7966		7966		7966			

Table 2: Distribution of the UCD & multiple causes of death for females (Kuwait 1993-2001)

ICD9 Chapter		UCD		2nd		3rd		4th		5th		6th		Total	
		No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
I	Infections	206	3.4	143	2.5	125	2.5	274	8.1	63	3.4	33	4.0	844	3.7
II	Neoplasms	969	16.2	141	2.5	126	2.5	187	5.5	75	4.0	25	3.0	1523	6.7
III	Endocrine	526	8.8	73	1.3	202	4.0	496	14.7	414	22.2	204	24.8	1915	8.4
V	Mental	4	0.1	1	0.0	2	0.0	5	0.1	1	0.1	1	0.1	14	0.1
VI	Nervous	66	1.1	12	0.2	38	0.8	39	1.2	41	2.2	13	1.6	209	0.9
VII	Circulatory	3001	50.1	4682	81.4	1044	20.9	1304	38.7	627	33.6	266	32.3	10924	47.9
VIII	Respiratory	357	6.0	57	1.0	99	2.0	173	5.1	109	5.8	48	5.8	843	3.7
IX	Digestive	145	2.4	68	1.2	57	1.1	103	3.1	67	3.6	29	3.5	469	2.1
X	Genitourinary	204	3.4	68	1.2	158	3.2	264	7.8	189	10.1	87	10.6	970	4.3
XIV	Congenital	4	0.1	0	0.0	0	0.0	1	0.0	1	0.1	0	0.0	6	0.0
XVI	Ill defined	374	6.2	424	7.4	3063	61.3	452	13.4	216	11.6	85	10.3	4614	20.2
XVII	Injury	138	2.3	83	1.4	80	1.6	75	2.2	61	3.3	33	4.0	470	2.1
Valid cases		5994	100	5752	100	4994	100	3373	100	1864	100	824	100	22801	100
Missing cases		0	0	242	4.0	1000	16.7	2621	43.7	4130	68.9	5170	86.3	13163	
Total		5994		5994		5994		5994		5994		5994			

Table 3: The UCD & MCD together with the ratios (Kuwait 1993-2001)

ICD9 Chapter		Males			Females			Total		
		UCD	MCd	Ratio	UCD	MCd	Ratio	UCD	MCd	Ratio
I	Infections	226	965	4.27	206	844	4.10	432	1809	4.19
II	Neoplasms	1143	1671	1.46	969	1523	1.57	2112	3194	1.51
III	Endocrine	609	2053	3.37	526	1915	3.64	1135	3968	3.50
V	Mental	4	11	2.75	4	14	3.50	8	25	3.13
VI	Nervous	90	255	2.83	66	209	3.17	156	464	2.97
VII	Circulatory	4066	13799	3.39	3001	10924	3.64	7067	24723	3.50
VIII	Respiratory	462	1208	2.61	357	843	2.36	819	2051	2.50
IX	Digestive	229	656	2.86	145	469	3.23	374	1125	3.01
X	Genitourinary	270	1190	4.41	204	970	4.75	474	2160	4.56
XIV	Congenital	3	6	2.00	4	6	1.50	7	12	1.71
XVI	Ill defined	395	5694	14.42	374	4614	12.34	769	10308	13.40
XVII	Injury	469	1474	3.14	138	470	3.41	607	1944	3.20
Valid cases		7966	28982	3.64	5994	22801	3.80	13960	51783	3.71
Missing cases		0	18814		0	13163		0	31977	
Total		7966	47796		5994	35964		13960	83760	

Table 4: Change in ranking the different disease conditions using the UCD and MCD (Kuwait 1993-2001)

ICD9	Chapter	Males				Females				Total			
		UCD	Rank	Total	Rank	UCD	Rank	Total	Rank	UCD	Rank	Total	Rank
I	Infections	226	9	965	8	206	7	844	8	432	8	1809	8
II	Neoplasms	1143	2	1671	4	969	2	1523	4	2112	2	3194	4
III	Endocrine	609	3	2053	3	526	3	1915	3	1135	3	3968	3
V & VI	Mental & Nervous	94	10	266	10	70	10	223	10	164	10	489	10
VII	Circulatory	4066	1	13799	1	3001	1	10924	1	7067	1	24723	1
VIII	Respiratory	462	4	1208	6	357	4	843	7	819	4	2051	6
IX	Digestive	229	8	656	9	145	8	469	9	374	9	1125	9
X	Genitourinary	270	7	1190	7	204	6	970	6	474	7	2160	5
XVI	Ill defined	395	6	5694	2	374	5	4614	2	769	5	10308	2
XVII	Injury	469	5	1474	5	138	9	470	5	607	6	1944	7
	Total	7963		28976		5990		22795		13953		51771	

Table 5: The computed Relative Ratios (RR) for the different disease Conditions (Kuwait 1993-2001)

ICD9 Chapter		Inf	Neopl	Endo	Nerv	Circ	Resp	Dig	Geni	Ill def	Inj	Total
I	Infections	0.91	0.08	1.00	1.08	0.87	2.32	2.41	1.56	1.09	0.09	1.00
II	Neoplasms	0.98	6.56	0.60	0.43	0.79	1.15	2.19	1.06	0.90	0.04	1.00
III	Endocrine	1.52	0.00	0.23	0.71	1.17	1.15	0.99	1.67	0.95	0.01	1.00
VI	Nervous	2.46	0.00	1.22	2.37	0.82	3.12	0.72	1.28	1.02	0.35	1.00
VII	Circulatory	0.60	0.02	1.39	1.30	1.11	0.87	0.42	0.89	1.05	0.05	1.00
VIII	Respiratory	2.36	0.04	0.93	1.24	0.92	1.35	0.62	0.92	1.20	0.00	1.00
IX	Digestive	1.71	0.07	0.73	0.54	0.92	0.54	5.67	1.86	0.90	0.05	1.00
X	Genitourinary	2.92	0.14	1.14	0.70	0.98	1.12	1.59	0.68	0.94	0.10	1.00
XVI	Ill defined	0.69	0.00	0.43	0.30	1.19	0.24	0.09	0.39	1.39	0.10	1.00
XVII	Injury	0.24	0.00	0.08	0.34	0.31	0.18	0.21	0.28	0.24	21.27	1.00
Total		1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00	1.00

REFERENCES:

1. Laurenti R, de Mello Jorge MH, Gotlieb SL. Underlying cause-of-death mortality statistics: considering the reliability of data. Panam Salud Publica. 2008;23(5):349-56.
2. Australian Bureau of Statistics. Causes of Death, Australia, 2005. ABS (2005); Release March 2007.
3. Redelings MD, Wise M, Sorvillo F. Using Multiple causes-of-death to investigate associations and causality between conditions listed on the death certificate. Am J Epidemiol. 2007; 166:104-8.
4. Wall MM, Huang J, Oswald J, McCullen D. Factors associated with reporting multiple causes of death. BMC Medical Research Methodology. 2005; 5:4 doi:10.1186/1471-2288-5-4.
5. Yashin AI, Ukraintseva SV, Akushevich IV, Arbeev KG, Kulminski A, Akushevich L. Trade-off between cancer and aging: what role do other diseases play? Evidence from experimental and human population studies. Mech Ageing Dev. 2009;130(1-2):98-104.
6. Gorina Y, Lentzer H. Multiple causes of death in old age. Aging Trends, No. 9. Hyattsville, MD. National Center for Health Statistics; 2008.
7. Mathers CD, Fat DM, Inoue M, Rao C, Lopez AD. Counting the dead and what they died from: an assessment of the global status of cause of death data. Bull World Health Organ. 2005;83(3):171-7.
8. Jha P, Gajalakshmi V, Gupta PC, Kumar R, Mony P, Dhingra N, et al. Prospective study of one million deaths in India: Rationale, design, and validation results. PLoS Med. 2006; 3 (2) e18.
9. Jha P, Slutisky AS, Brown D, Nagelkerke N, Brunham BG. Health and economic benefits of an accelerated program of research to combat global infectious diseases. CMAJ. 2004; 171(10):1203-8.
10. Tardon AG, Zaplana J, Hernandez R, Cueto A. Usefulness of the codification of multiple cause of death in mortality statistics. Int J of Epidemiol. 1995; 24, 5 :1132- 7.
11. Australian Bureau of Statistics. Australian Bureau of Statistics: Multiple Cause of Death Analysis, 1997-2001. ABS (2003); 3319.0.55.001.
12. Stallard E. Underlying and multiple cause mortality at advanced ages: United States 1980-1998. North American Actuarial J. 2002; 6(3):64-87.
13. MOH Ministry of Health Kuwait: Annual Reports. Health and Vital Statistic Division, Department of Statistics & Medical Records, Ministry of Health, State of Kuwait. 2007. http://www.q8whs.com/helthkuwaitreports/report2007.html
14. Deshpande S. Value of statistics of multiple cause of death. Regional Health Forum.1997;2(1):55-8.
15. Bah S. Using multiple cause mortality data to resolve conflicting information on trends in maternal mortality in South Africa. Scientific Letters. SAMJ. 2006 April; 96(4).
16. Australian Bureau of Statistics. Causes of Death, Australia, 2004. ABS (2004); Release March 2006. (cat no. 3303.0)
17. Redelings MD, Sorvillo F, Simon P. A comparison of underlying cause and multiple causes of death: US vital statistics, 2000-2001. Epidemiology. 2006; 17(1):100-3.

18. Wilkins K. Parsons GF. Gentleman JF. Forbes WF. Deaths due to dementia: An analysis of multiple-cause-of-death data. Chronic Diseases in Canada (CDIC). 1999;20(1):26-35.
19. Franca E, de Abreu DX, Rao C, Lopez AD. Evaluation of cause-of-death statistics for Brazil, 2002-2004. Int J Epidemiol. 2008; 37(4):891–901.
20. Khosravi A, Rao C, Naghavi M, Taylor R, Jafari N, Lopez AD. Impact of misclassification on measures of cardiovascular disease mortality in the Islamic Republic of Iran: a cross-sectional study. Bull World Health Organ. 2008; 86 (9):657-736.