Evaluation of Causes-of-Death: Which statistics should We rely on, Hospital Deaths or Vital Statistics?

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Background: *Age-specific causes of death yield important information for planning health services and medical education.*
Objective: *To compare the age-specific causes of death between in-hospital deaths and death registration statistics.*
Material and Method: *Information on in-hospital mortality in fiscal 2010 was extracted from the three health insurance schemes. Death registrations (ICD-10 coding) were from the Bureau of Registration Administration, Ministry of Interior. Statistics on the age-specific causes of death were analyzed.*
Results: *In-hospital deaths numbered 132,512 (47.5% occurring in tertiary care) vs. 411,331 recorded in vital statistics (68% died outside hospitals). Most (74%) infants died in-hospital so causes were clearly documented vs. death registration. A minority (6.2%) of in-hospital deaths and of death registrations (9.7%) were due to unnatural causes. The majority (79.5%) of unnatural deaths died before arriving at hospital. Ill-defined codes for causes of death were found in 6.1% of in-hospital records and 42.2% of death registrations. After censoring ill-defined codes, the ten leading, age-specific causes of death agreed between the two data sets.*
Conclusion: *Medical personnel should receive training to do proper death certification. Periodic validation of hospital COD certification should also be done. Use of verbal autopsy in the Thai context would help to standardize record-keeping and to reduce ill-defined codes for deaths occurred outside hospital.*

Keywords: *Cause-of-death, Age-specific causes of death, In-hospital death*

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The assessment of mortality by age, sex and cause-of-death (COD), using standard of medical criteria, provides the evidence basis needed for health education and service reforms. Ideally, vital statistics should capture all deaths that occur in a given population and information regarding COD should be based on the consideration of medically qualified personnel. Age-specific death rates are also important outputs of vital registration for estimating and mitigating risks.

Thailand has a long history of birth and death registration since 1917 and is generally accepted as having good information. According to the civil registration law of 1991, deaths must be registered within 24 hours of being witnessed. Since 1995, all data on births and deaths throughout the nation have been entered into a centralized computerized system at the Bureau of Registration Administration (BORA), Ministry of the Interior, using the 13-digit identification number assigned to each Thai citizen.

Statistics on the Causes of Deaths were analyzed using BORA, the civil registration database, after coding the underlying cause-of-death; as per ICD-10 by the Bureau of Policy and Strategy, Ministry of Public Health. Mathers et al classified Thailand's mortality statistics between 1955 and 2000 as low quality, because of 86% completeness, 89% coverage and 49% of ill-defined (ICD 10) codes[1]. With an annual average 400,000 reported deaths in Thailand, 65% took place outside and 35% in hospitals. Of these, 25% were classified as 'unnatural deaths' subject to forensic investigation, as required by law[2].

Unnatural Deaths as defined by Thai Criminal Law Article 148 included: Deaths by Intentional self-harm (ICD10-X60-X84), Assault (X85-Y09), Other

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external causes of accidental injury (W00-X59), Transport accidents (V01-V99) and Other event of undetermined (Y10-Y98). Physicians who perform forensic investigations make a diagnosis for COD which involves a legal process.

Ill-defined codes are death registrations assigned ICD codes for symptoms, signs and ill-defined conditions (R00-R09), injury with undetermined intent (Y10-Y34 and Y872), cardiovascular diseases which lack diagnostic meaning (I47.2, I49.0, I46, I50, I51.4, I51.5, I51.6, I51.9, I70.9) and unspecified sites cancer deaths (C76, C80, C97). The vital registration of any country containing more than 20% ill-defined codes is categorized as being low-quality data[1].

The completeness of death registrations is from the Survey of Population Change (SPC), conducted by the National Statistical Office (NSO) every 10 years. The degree of completeness of death registration as per the last survey in 2005-2006 was 95.2%. A study conducted in Kanchanaburi province in 2004 reported that 12.5% of deaths were unregistered, which is much higher than the national report[3]. A recent study similarly reported an overall under-registration of deaths between 2005-2006 of 8.69% with the highest rate of under-registration among 1-4 year-olds (61.11%)[4].

Despite attending physicians' using the ICD-10 to clarify causes of deaths, a study on validation of hospital death reports in Thailand in 2005 revealed that 51% of hospital death certifications contained errors and ~30% were ill-defined diagnoses[5].

Cause-specific mortality statistics by age and sex are essential for planning health services, resources allocation and medical education. Reliable information on levels of mortality and leading causes of death combined with condition-specific morbidity are essential baseline information. Several studies conducted in 2005 to assess the validity of COD statistics presented disappointing results albeit having successfully applied the verbal autopsy method for improving the validity of COD for deaths outside hospital and reduced the ill-defied codes on COD registration[6-8].

Objective

The goal of the current analysis was to consider the age-specific death rate and cause-of-death from hospital-based data of the three health care schemes in order to compare it with the mortality data from the national vital statistics registry. The data on unnatural deaths and ill-defined codes were also analyzed and compared between the two sources. This preliminary evaluation will serve as baseline data for further health research as well as health services and medical education planning.

Material and Method

The present study is part of the "Health Situation Analysis of Thai People 2010: Implications for Health Education and Health Service Reform" described elsewhere. In-hospital mortality data (including age, sex, type of hospital, region of the country and COD) for the fiscal year 2010 (October 1, 2009 and September 30, 2010) were extracted from the National Health Security Office (NHSO), the Social Security Office and the Civil Servants Benefit System which together provide coverage to 96% of the Thai population. The data analysis team checked data for accuracy for: (a) overlapping information; (b) hospital visit dates; (c) missing items; (d) incorrect coding; and, (e) correctly dated fiscal year. The basic statistical analysis of variables, including frequency and interrelationships, were calculated using the SPSS for Windows. After validating the data, the research team passed on the primary analysis to ten medical specialists in order to check the face validity of the information. Upon confirmation, the data were compared to the Ministry of Public Health's Statistics Report for 2010 for trend congruence.

Statistics on Causes of Death were analyzed from the civil registration database of the Bureau of Registration Administration, Ministry of Interior, after the coding for underlying cause of death was done under ICD-10 basis by the Bureau of Policy and Strategy, Ministry of Public Health. For causes of in-hospital death, the primary diagnosis for causes of death were used. To be able to compare the causes of hospital death due to unnatural death, secondary diagnosis or causes of morbidity were used. The age-specific death rate were calculated from the number of deaths in each age group as nominator and number of people in the same age group who registered to the three health care schemes as denominator.

Results

Types of death registration

In Thailand, deaths are classified into three types[9]

(1) In-hospital:

The attending physician specifies the cause of death and issues a "death certification form," which the relatives use as evidence for registering the death

at the district office, which then issues a "death certificate".

(2) Natural cause at home:

The deceased's relatives report the death to an "assistant local registrar' (village head) who specifies the COD and issues a "death notification form" which is used for death registration.

(3) Unnatural cause.

A person seeing a body must report to a local police officer who, accompanied by a physician, will conduct a forensic investigation, including an autopsy and specification of the COD.

Hospital deaths and Death Registration

In 2010, the three health insurance schemes recorded a combined 132,512 in-hospital deaths for a rate of 212 deaths/100,000 (56.3% males; 43.7% females). The majority of deaths (62,917 cases; 47.5%) occurred in tertiary care hospitals; partly reflecting the health referral system in Thailand. By comparison, Vital Statistics recorded 411,331 deaths (56.5% male; 43.3% females) for an overall rate of 635.6 deaths/100.000. Most of all deaths (68%) occurred outside the health facilities covered by the health insurance schemes or at home (Table 1).

Age-group specific death rates, region and ratio of hospital deaths per mortality statistics

The highest mortality rate was for 60+ year-olds followed by infants under one year. The respective descending rank of mortality registration per 100,000 by age group for 60+, 0-1, 26-59, 19-25, 13-18, 1-5 and 6-12 year-olds were 2,980.8, 704.3, 399.8, 125.5, 82.0, 52.9, and 40.1. The respective in-hospital death rate per 100,000 by age group was 591.1, 23.1, 13.9, 25.7, 37.0, 153.8 and 931.8 for patients between 0-1, 1-5, 6-12, 13-18, 19-25, 26-59 and 60+ year-olds. In-hospital deaths occurred most in the central region. Nearly three-quarters of death registrations of infants (74%) occurred in-hospital compared to between 29% and 42% for other age groups. The average in-hospital deaths in the Thai population were 32% (Table 2).

Age-specific causes-of-death

The age-group specific COD of children (0-18 year-olds), adults (19-59 year-olds) and elderly (60^{+} year-olds) using the 22 disease ICD groups are presented in Table 3. The vital statistics used codes V01 to Y98 (*i.e.*, External causes of morbidity and mortality) for all unnatural causes of death while hospital

Table 1. Number and rate per 100,000 population of hospital deaths and mortality statistics by hospital level and sex, 2010

Sex	Number of hospital Deaths/Hospital levels						Mortality Statistics	
	Primary	Secondary	Tertiary	Private	Total	Rate	Total	Rate
Male	9,875	25,000	35,514	4,223	74,612	242.9	232,791	729.8
Female	7,905	19,637	27,403	2,955	57,900	182.1	178,540	544.0
Total	17,780	44,637	62,917	7,178	132,512	212.0	411,331	635.6

Table 2. Number of hospital deaths and mortality statistics and rate per 100,000 population and their ratio by age groups and regions, 2010

Age (years)	Hospital Deaths / Regions						Mortality Statistics		Ratio
	Northern	Northeast	Central	Southern	Total	Rate	Total	Rate	
0-1	577	1,196	1,444	769	3,986	591.1	5,366	704.3	0.74
1-5	150	252	325	162	889	23.1	2,116	52.9	0.42
6-12	119	255	280	158	812	13.9	2,382	40.1	0.34
13-18	273	487	507	225	1,492	25.7	4,834	82.0	0.31
19-25	418	606	913	373	2,310	37.0	8,344	125.5	0.28
26-59	10,404	10,900	22,978	5,002	49,284	153.8	130,657	399.8	0.38
60+	16,268	14,816	34,889	7,766	73,739	931.8	257,495	2,980.8	0.29
Total	28,209	28,512	61,336	14,455	132,512	212.5	411,194	636.9	0.32

Table 3. Number of deaths and rate per 100,000 population of hospital deaths and mortality statistics by causes of death (ICD-10) and by age group, 2010

ICD-10	Age	0-18				19-59				60+			
	Causes	Hospital Deaths		Mortality statistics		Hospital Deaths		Mortality statistics		Hospital Deaths		Mortality statistics	
		N	Rate	N	Rate	N	Rate	N	Rate	N	Rate	N	Rate
A00-B99	Certain infectious and parasitic diseases	716	4.4	1,023	6.2	11,347	120.1	18,093	46.0	10,287	130.0	22,230	257.3
C00-D48	Neoplasms	409	2.5	650	3.9	9,340	98.9	25,470	64.8	11,382	143.8	31,947	369.8
D50-D89	Diseases of the blood	58	0.4	59	0.4	249	2.6	308	0.8	288	3.6	229	2.7
E00-E90	Endocrine, nutritional and metabolic	33	0.2	44	0.3	749	7.9	2,600	6.6	1,248	15.8	5,184	60.0
F00-F99	Mental and behavioural disorders	0	0.0	1	0.0	128	1.4	629	1.6	44	0.6	101	1.2
G00-G99	Diseases of the nervous	166	1.0	311	1.9	936	9.9	2,332	5.9	757	9.6	1,989	23.0
H00-H59	Diseases of the eye	1	0.0	0	0.0	9	0.1	1	0.0	18	0.2	3	0.0
H60-H95	Diseases of the ear and mastoid process	0	0.0	0	0.0	4	0.0	0	0.0	7	0.1	0	0.0
I00-I99	Diseases of the circulatory	278	1.7	454	2.7	8,763	92.7	13,506	34.3	18,313	231.4	25,488	295.1
J00-J99	Diseases of the respiratory	879	5.4	1,079	6.5	5,386	57.0	8,451	21.5	15,566	196.7	20,110	232.8
K00-K93	Diseases of the digestive	96	0.6	106	0.6	4,615	48.8	7,643	19.4	5,104	64.5	5,733	66.4
L00-L99	Diseases of the skin and subcutaneous tissue	10	0.1	3	0.0	443	4.7	378	1.0	1,434	18.1	823	9.5
M00-M99	Diseases of the musculoskeletal system	42	0.3	28	0.2	857	9.1	502	1.3	1,041	13.2	494	5.7
N00-N99	Diseases of the genitourinary system	62	0.4	101	0.6	1,906	20.2	4,706	12.0	4,412	55.7	9,895	114.5
O00-O99	Pregnancy, childbirth	7	0.0	2	0.0	106	1.1	76	0.2	0	0.0	0	0.0
P00-P96	Certain conditions originating in the perinatal	2,403	14.9	2,573	15.5	0	0.0	0	0.0	0	0.0	0	0.0
Q00-Q99	Congenital malformations, deformations and chromosom	874	5.4	1,148	6.9	43	0.5	120	0.3	1	0.0	23	0.3
R00-R99	Symptoms, signs and abnormal clinical	63	0.4	2,071	12.5	700	7.4	25,730	65.4	1,221	15.4	126,828	1,468.2
S00-T98	Injury, poisoning	67	0.4	0	0.0	507	5.4	0	0.0	657	8.3	0	0.0
V01-Y98	External causes of morbidity and mortality	993	6.1	5,045	30.4	5,385	57.0	28,456	72.4	1,799	22.7	6,418	74.3
Z00-Z99	Factors influencing health status and contact	21	0.1	0	0.0	97	1.0	0	0.0	138	1.7	0	0.0
Others		1	0.0	0	0.0	24	0.3	0	0.0	22	0.3	0	0.0

mortality records used the codes S00 to T98 (*i.e.*, Injury, poisoning) as causes of deaths for the same illness. A secondary diagnosis was used for hospital deaths so that the two data sets could be compared. Logically, the number of registered deaths in the mortality statistics should be much higher than hospital deaths, but the reverse was observed in some items probably due to misclassification errors (Table 3).

Unnatural Deaths

The age group and specific causes of unnatural deaths for both hospital deaths and vital statistics were compared. Transport accidents (V01-V99), Accident injury X00-X59), Intentional self-harm (X60-X84) and Assault (X85-Y09) were the major causes of unnatural deaths among both adolescents and adults (13-59 year-olds). A minority of both in-hospital deaths (6.2%; 8,177) and death registrations 9.7% (39,919 deaths) were due to unnatural causes. The majority of unnatural deaths (79.5%; 31,742) occurred outside health facilities, at home or before arriving at hospital (Table 4).

Ill-defined codes for COD

Ill-defined codes for COD both in-hospital and in the vital statistics were compared within age groupings. The average ill-defined codes for in-hospital deaths was 6.1% (8,019/132,512) compared to 42.2% (173,619/411,194 deaths) for death registrations. The lowest rate of ill-defined codes was for 0-5 year-olds with 2.1% for in-hospital deaths vs. 18.7% for vital statistics while the highest rate was for 60+ year-olds with 6.9% in-hospital deaths and 51.8% for death registrations (Table 5). Most of the elderly died outside healthcare facilities and with multiple, complicated health problems: it was therefore difficult to assign a single COD even by the specialists at tertiary care centers.

COD in-hospital vs. vital statistics death registrations

For 0-1 year-olds, three-quarters of deaths (74%) occurred in-hospital and mostly in tertiary care centers. Some infants died shortly after their birth was registered and in some such cases neither the birth nor the death would be registered. Hospital-based mortality statistics may provide better information on COD than the vital statistics registration system (Table 6).

Since ill-defined codes characterize more than 40% of vital statistics, it is not realistic to compare the rank of specific CODs between in-hospital deaths and death registrations; particularly since the latter has a huge number of non-specific CODs. After censoring the ill-defined entries from both data sets, a comparison of the top ten leading causes of death by sex in Thailand in 2010 was done (Table 7): the top ten leading CODs by age group in the two data sets are presented in Table 8. The top ten age group and sex specific CODs between the two data sets showed a degree of agreement but the validity of the information is moot.

Discussion

The current study aimed to identify the age-specific death rate and CODs among Thais for use in research, health service planning and medical education reform. The data sources included hospital-based data from the three universal health care schemes and the Vital Statistics death registration data**.** These data allowed an analysis on CODs according to the 22 diseases groups of the ICD-10.

One-third (32%) of all deaths occurred in-hospital; of which nearly one-half (47.5%) occurred in tertiary care hospitals and the CODs were medically certified by attending physicians. It was expected that the correct diagnosis on CODs would be highest for deaths that occurred in-hospital; however, about 6.1% of in-hospital deaths registered nonspecific diagnosis with ill-defined codes, despite using information from the medical records. Pattaraarchachai[5] conducted a study in 2005 to validate the information on in-hospital deaths and found a certification error of 51%. Two clear priorities include (1) training medical personnel to do proper death certification and (2) periodically validating hospital records.

Since the village head is required to issue a death certification form for deaths occurring outside hospital, the COD is likely in lay terms and not very specific or verifiable. This tends to result in the signs and symptoms being recorded as ill-defined causes. In the current study, 42.2% of ill-defined CODs were recorded on the death registrations of vital statistics, which strongly undermines the reliability of this data. After censoring the ill-defined codes, better agreement between the hospital-based data and vital statistics was observed; notwithstanding, the validity of the information is unknown.

In 2005, Polprasert[6] developed and tested the validity of the use of verbal autopsy (VA) in the Thai context to deal with ill-defined causes of death. Verbal autopsy is a process combining household inquiry by local health personnel with a review of medical records, where available. The information is then reviewed by a trained physician who will derive

Table 4. Number of unnatural deaths among hospital deaths and mortality statistics by age group among the Thai population, 2010

	Total		0-12		13-18		19-25		26-59		60+	
	Hospital Deaths	Mortality Statistics	Hospital Deaths	Mortality Statistics	Hospital Deaths	Mortality Statistics	Hospital Deaths	Mortality Statistics	Hospital Deaths	Mortality Statistics	Hospital Deaths	Mortality Statistics
Total	8,177	39,919	382	2,006	611	3,039	879	5,170	4,506	23,286	1,799	6,418
Others	0	1	0	0	0	0	0	0	0	1	0	0
V01-V99 Transport accidents	3,871	13,774	126	410	430	1,443	561	2,212	2,241	7,885	513	1,824
X00-X59 Other external causes of accidental injury	2,337	9,144	236	1,280	64	564	65	641	1,042	4,608	930	2,051
X60-X84 Intentional self-harm	815	3,761	0	7	34	116	92	415	566	2,608	123	615
X85-Y09 Assault	682	3,301	10	18	80	211	144	563	416	2,298	32	211
Y10-Y34 Event of undetermined intent	106	9,892	3	291	0	705	7	1,338	69	5,860	27	1,698
Y35-Y36 Legal intervention and operations of war	5	8	0	0	0	0	1	1	4	7	0	0
Y40-Y84 Complications of medical and surgical care	339	29	7	0	2	0	9	0	156	13	165	16
Y85-Y89 Sequelae of external causes of morbid. & mortality	5	9	0	0	1	0	0	0	3	6	1	3
Y90-Y98 Supplementary factors related to causes of morbid	17	0	0	0	0	0	0	0	9	0	8	0

Table 5. Number and percentage of ill-defined codes of hospital deaths and mortality statistics and age group in the Thai population, 2010

	0-5				6-12				13-18			
	Hospital Deaths Count	%	Mortality Statistics Count	%	Hospital Deaths Count	%	Mortality Statistics Count	%	Hospital Deaths Count	%	Mortality Statistics Count	%
R00-R99 ill-defined conditions	31	0.6	1,185	15.8	10	1.2	346	14.5	22	1.5	540	11.2
I47.2, I49.0, I46, I50, I51.4, I51.5, I51.6, I51.9, I70.9 cardiovascular Deaths, unspecified	67	1.4	49	0.7	23	2.8	20	0.8	39	2.6	25	0.5
C76, C80, C97 cancer Deaths, unspecified site	2	0.0	8	0.1	0	0.0	20	0.8	1	0.1	29	0.6
Y10-Y34, Y872 non-injury, unspecified	1	0.0	156	2.1	2	0.2	135	5.7	0	0.0	705	14.6
Total	103	2.1	1,398	18.7	35	4.3	521	21.9	62	4.2	1,299	26.9
All causes	4,875	100	7,482	100	812	100	2,382	100	1,492	100	4,834	100
	19-25				26-59				60+			
	Hospital Deaths Count	%	Mortality Statistics Count	%	Hospital Deaths Count	%	Mortality Statistics Count	%	Hospital Deaths Count	%	Mortality Statistics Count	%
R00-R99 ill-defined conditions	20	0.9	1,057	12.7	680	1.4	24,673	18.9	1,221	1.7	126,828	49.3
I47.2, I49.0, I46, I50, I51.4, I51.5, I51.6, I51.9, I70.9 cardiovascular Deaths, unspecified	79	3.4	31	0.4	1,782	3.6	814	0.6	3,762	5.1	1,460	0.6
C76, C80, C97 cancer Deaths, unspecified site	1	0.0	47	0.6	71	0.1	3,088	2.4	100	0.1	3,507	1.4
Y10-Y34, Y872 non-injury, unspecified	7	0.3	1,338	16.0	69	0.1	5,860	4.5	27	0.0	1,698	0.7
Total	107	4.6	2,473	29.6	2,602	5.3	34,435	26.4	5,110	6.9	133,493	51.8
All causes	2,310	100	8,344	100	49,284	100	130,657	100	73,739	100	257,495	100

Table 6. Top ten leading causes of deaths among infants (0-1 years old) and number of deaths comparing between hospital deaths and mortality statistics, 2010

	Hospital Deaths Causes	N		Mortality statistics Causes	N
P07	Disorders related to short gestation and low birth weigh	1,079	P07	Disorders related to short gestation and low birth weigh	819
P22	Respiratory distress of newborn	299	R99	Other ill-defined and unspecified causes of mortality	732
P21	Birth asphyxia	260	P36	Bacterial sepsis of newborn	710
P36	Bacterial sepsis of newborn	211	Q24	Other congenital malformations of heart	420
J18	Pneumonia organism unspecified	167	J18	Pneumonia organism unspecified	260
A41	Other septicaemia	122	P28	Other respiratory conditions originating in the perinatal	204
P29	Cardiovascular disorders originating in the perinatal	121	P20	Intrauterine hypoxia	171
P24	Neonatal aspiration syndromes	117	Q89	Other congenital malformations not elsewhere classified	157
Q24	Other congenital malformations of heart	105	P24	Neonatal aspiration syndromes	126
Q79	Congenital malformations of the musculoskeletal system	99	P23	Congenital pneumonia	94

the probable COD from the recorded information during the review.

Public awareness of the importance of death registration is another issue needing attention to further improve the reliability of vital statistics. In this vein, Tangcharoensathien[2] performed a critical assessment of Thai mortality statistics and proposed an algorithm for improving the process of Death certification and COD registration.

Conclusion

Even though vital statistics have been developed for a long time, their utilization is low, probably because: (1) The data presentation is from a national perspective and only CODs of the elderly appear in top 10 list. Policy and health service development needs a more age-specific analysis of COD. And (2) People are not aware of the validity of the information so are equally unaware of the improvements needed. For a start, then, the primary steps for improving the system should be on completeness and coverage.

In sum, continued development of mechanisms to validate COD statistics needs to remain a priority, as the utilization of unreliable data will lead to wrong decision-making and potentially unnecessary health interventions.

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Potential conflicts of interest

None.

Table 7. Top ten leading causes of death by sex and number of deaths comparing between hospital deaths and mortality statistics, 2010

Sex	Hospital Deaths			Mortality statistics		
	Causes		N	Causes		N
Male	A41	Other septicaemia	6,241	A41	Other septicaemia	14,485
	J18	Pneumonia organism unspecified	4,772	C22	Malignant neoplasm of liver and intrahepatic bile ducts	9,959
	I61	Intracerebral haemorrhage	3,671	J18	Pneumonia organism unspecified	8,579
	C22	Malignant neoplasm of liver and intrahepatic bile ducts	3,039	C34	Malignant neoplasm of bronchus and lung	6,145
	J15	Bacterial pneumonia not elsewhere classified	2,988	V89	Motor- or nonmotor-vehicle accident, type of vehicle	5,060
	I21	Acute myocardial infarction	2,617	I61	Intracerebral haemorrhage	5,007
	B20	Human immunodeficiency virus [HIV] disease resulting…	2,496	J98	Other respiratory disorders	4,476
	C34	Malignant neoplasm of bronchus and lung	2,280	K74	Fibrosis and cirrhosis of liver	3,682
	J44	Other chronic obstructive pulmonary disease	2,242	I25	Chronic ischaemic heart disease	3,442
	I63	Cerebral infarction	1,782	W74	Unspecified drowning and submersion	3,103
Female	A41	Other septicaemia	6,427	A41	Other septicaemia	14,477
	J18	Pneumonia organism unspecified	3,702	J18	Pneumonia organism unspecified	6,155
	I21	Acute myocardial infarction	2,580	C22	Malignant neoplasm of liver and intrahepatic bile ducts	4,049
	I61	Intracerebral haemorrhage	2,560	E14	Unspecified diabetes mellitus	3,958
	I63	Cerebral infarction	2,021	N19	Unspecified renal failure	3,300
	J15	Bacterial pneumonia not elsewhere classified	2,021	C34	Malignant neoplasm of bronchus and lung	3,126
	B20	Human immunodeficiency virus [HIV] disease resulting…	1,615	I61	Intracerebral haemorrhage	3,111
	N18	Chronic renal failure	1,282	J98	Other respiratory disorders	2,784
	C34	Malignant neoplasm of bronchus and lung	1,156	I25	Chronic ischaemic heart disease	2,506
	C22	Malignant neoplasm of liver and intrahepatic bile ducts	1,095	C50	Malignant neoplasm of breast	2,500

Table 8. Top ten leading causes of deaths by age group, number of deaths and rate per 100,000 population comparing between hospital deaths and mortality statistics, 2010

Age group	Hospital death				Mortality statistics			
	ICD-10	Cause	N	Rate	ICD-10	Cause	N	Rate
0-18	P07	Disorders related to short gestation and low birth weigh	1,079	6.7	W74	Unspecified drowning and submersion	1,264	7.6
	J18	Pneumonia organism unspecified	402	2.5	V89	Motor- or nonmotor-vehicle accident, type of vehicle	822	5.0
	A41	Other septicaemia	355	2.2	P07	Disorders related to short gestation and low birth weigh	819	4.9
	P22	Respiratory distress of newborn	300	1.9	P36	Bacterial sepsis of newborn	710	4.3
	P21	Birth asphyxia	260	1.6	J18	Pneumonia organism unspecified	643	3.9
	P36	Bacterial sepsis of newborn	211	1.3	A41	Other septicaemia	552	3.3
	J15	Bacterial pneumonia not elsewhere classified	190	1.2	Q24	Other congenital malformations of heart	505	3.0
	V23	Motorcycle rider injured in collision with car, pick-up	157	1.0	V29	Motorcycle rider injured in other and unspecified transp	465	2.8
	P29	Cardiovascular disorders originating in the perinatal	121	0.7	C95	Leukaemia of unspecified cell type	256	1.5
	P24	Neonatal aspiration syndromes	117	0.7	J98	Other respiratory disorders	232	1.4
19-59	A41	Other septicaemia	4,558	48.2	A41	Other septicaemia	9,952	25.3
	B20	Human immunodeficiency virus [HIV] disease resulting...	3,897	41.2	C22	Malignant neoplasm of liver and intrahepatic bile ducts	6,489	16.5
	I61	Intracerebral haemorrhage	2,709	28.7	V89	Motor- or nonmotor-vehicle accident, type of vehicle	4,783	12.2
	J18	Pneumonia organism unspecified	2,319	24.5	J18	Pneumonia organism unspecified	4,191	10.7
	C22	Malignant neoplasm of liver and intrahepatic bile ducts	1,984	21.0	I61	Intracerebral haemorrhage	3,883	9.9
	K92	Other diseases of digestive system	1,295	13.7	K74	Fibrosis and cirrhosis of liver	3,438	8.7
	C34	Malignant neoplasm of bronchus and lung	1,170	12.4	C34	Malignant neoplasm of bronchus and lung	3,079	7.8
	J15	Bacterial pneumonia not elsewhere classified	1,128	11.9	B20	Human immunodeficiency virus [HIV] disease	2,566	6.5
	I21	Acute myocardial infarction	1,045	11.1	J98	Other respiratory disorders	2,419	6.2
	N18	Chronic renal failure	886	9.4	A16	Respiratory tuberculosis not confirmed bacteriologicall	2,195	5.6
60+	A41	Other septicaemia	7,755	98.0	A41	Other septicaemia	18,443	213.5
	J18	Pneumonia organism unspecified	5,753	72.7	J18	Pneumonia organism unspecified	9,889	114.5
	I21	Acute myocardial infarction	4,151	52.5	C22	Malignant neoplasm of liver and intrahepatic bile ducts	7,505	86.9
	J15	Bacterial pneumonia not elsewhere classified	3,691	46.6	C34	Malignant neoplasm of bronchus and lung	6,180	71.5
	I61	Intracerebral haemorrhage	3,487	44.1	J98	Other respiratory disorders	4,608	53.3
	I63	Cerebral infarction	2,969	37.5	E14	Unspecified diabetes mellitus	4,545	52.6
	J44	Other chronic obstructive pulmonary disease	2,613	33.0	I25	Chronic ischaemic heart disease	4,389	50.8
	C34	Malignant neoplasm of bronchus and lung	2,261	28.6	N19	Unspecified renal failure	4,213	48.8
	C22	Malignant neoplasm of liver and intrahepatic bile ducts	2,139	27.0	I61	Intracerebral haemorrhage	4,081	47.2
	N18	Chronic renal failure	1,551	19.6	I63	Cerebral infarction	3,023	35.0

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การประเมินสาเหตุของการเสียชีวิต: จะใช้สถิติไหนระหว่างข้อมูลการเสียชีวิตในโรงพยาบาลกับสถิติชีพ

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***ภูมิหลัง**: ข้อมูลสาเหตุการเสียชีวิตตามกลุ่มอายุมีความสำคัญอย่างยิ่งต่อการวางแผนการให้บริการทางการแพทย์และการศึกษาแพทย์*

***วัตถุประสงค์**: เพื่อเปรียบเทียบสาเหตุของการเสียชีวิตตามกลุ่มอายุระหว่างข้อมูลของการเสียชีวิตในโรงพยาบาลและทะเบียนการเสียชีวิตของสถิติชีพ*

***วิธีการและวัสดุ**: วิเคราะห์ข้อมูลการเสียชีวิตตามกลุ่มอายุจากข้อมูลการเสียชีวิตในโรงพยาบาลจากโครงการประกันสุขภาพทั้งสามโครงการในปี พ.ศ. 2553 และจากข้อมูลการลงทะเบียนการเสียชีวิตซึ่งได้รับการแปลงรหัส ICD-10 จากระบบทะเบียนราษฎร สำนักบริหารการทะเบียน กระทรวงมหาดไทย*

***ผลการศึกษา** : ข้อมูลจากระบบประกันสุขภาพ รายงานการเสียชีวิตในโรงพยาบาล 132,512 คน ซึ่งร้อยละ 47.5 เสียชีวิตในโรงพยาบาลตติยภูมิ เปรียบเทียบกับรายงานการเสียชีวิต 411,331 คน จากสถิติชีพ ซึ่งร้อยละ 68 เสียชีวิตนอกโรงพยาบาล เด็กทารกที่เสียชีวิตทั้งหมดร้อยละ 71 เสียชีวิตในโรงพยาบาล ข้อมูลสาเหตุของการเสียชีวิตในโรงพยาบาลของทารกในวัยนี้น่าจะมีความถูกต้องมากกว่าสถิติชีพร้อยละ 6.2 ของการเสียชีวิตในโรงพยาบาลและร้อยละ 9.7 จากทะเบียนราษฎร์เสียชีวิตแบบผิดธรรมชาติและร้อยละ 79.5 ของการเสียชีวิตแบบผิดธรรมชาติเสียชีวิตก่อนมาถึงโรงพยาบาลร้อยละ 6.1 ของการเสียชีวิตในโรงพยาบาลและร้อยละ 42.2 ของทะเบียนราษฎร์มีการลงรหัสโรคที่ไม่ชัดเจน เมื่อนำรหัสที่ไม่ชัดเจนออกและเปรียบเทียบสิบโรคแรกจำแนกตามกลุ่มอายุของสาเหตุการเสียชีวิตในโรงพยาบาลและสถิติชีพ พบความสอดคล้องกับของฐานข้อมูลทั้งสองดีขึ้น*

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