Death certification and epidemiological research

Medical Services Study Group of the Royal College of Physicians of London

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Summary and conclusions

The cause of death shown on 191 death certificates was compared with the cause indicated by the hospital case notes, the consultants' opinions, and the necropsy findings. All 191 deaths occurred among medical hospital patients aged under 50. In 39 cases there was a major discrepancy between the two sources over the cause of death and in another 54 there was a minor but epidemiologically important difference.

Death certificates are not primarily intended for epidemiological research, but researchers often rely on them. This and other studies have shown, however, that death certificates are often inaccurate records of the cause of death—even coroner's certificates issued after a coroner's necropsy. The accuracy of death certificates might be improved if coroners consulted clinicians more closely and if senior hospital staff completed hospital death certificates.

Introduction

Much epidemiological research is based on mortality statistics, yet death certificates have long been recognised as an inaccurate record of the cause of death. Over 20 years ago James *et al*[1] in a study of necropsies in Albany, New York, found major inaccuracies in death certification in 29% of cases and complete agreement between postmortem findings and the certified cause of death in 45·8%. A similar investigation by the Registrar General[2] showed a comparable position in England and Wales in 1955, 51% of death certificates being in accord with the necropsy evidence; four years later a larger study[3] showed 45% agreement. More recently Waldron and Vickerstaff[4] in a study in the Trent and West Midlands regions found the certified cause of death unchanged after necropsy in 47·5% of patients and pointed out the preponderance of discrepancies in the older age groups and in certain diagnostic categories, particularly neoplasms and cardiovascular and respiratory diseases.

During the study of deaths in medical inpatients aged under 50 (see accompanying paper) the Medical Services Study Group examined case notes; reports of the consultants' opinions on the illness and causes of death; and, when available, the necropsy reports. At the suggestion of Dr A M Adelstein of the Office of Population Censuses and Surveys (OPCS) we decided to compare the cause of death determined from these sources with the cause of death recorded on the death certificates of the first 200 of our cases reported to the OPCS.

Methods

OPCS supplied copies of the death certificates of the 200 cases, except in nine cases where the certificates could not be traced.

In 92 (48%) of the 191 cases necropsies were performed. This rate was considerably higher than the national necropsy rate for 1972 (26%) and probably largely reflected the youth of the patients. Half the necropsies were performed at the coroner's request. In two other cases coroners issued certificates without a necropsy, and they were therefore responsible for certification in 48 patients, the remaining certificates being completed by junior hospital staff. None of the coroners who issued certificates were medically qualified.

The 191 certificates were divided into three groups: those issued by a coroner after necropsy or issued by him without a necropsy; those issued after a hospital necropsy; and those issued when no necropsy was performed. The causes of death recorded on the certificate were then compared with the cause of death, as indicated by the consultant and the case notes.

Results and comment

Table I shows the results of the comparisons in the three groups. In over half of all cases there was complete agreement over the cause of death, in a fifth there was a major discrepancy between the cause of death, and in a quarter of cases there was a discrepancy large enough to be epidemiologically misleading.

The highest proportion of major discrepancies occurred among deaths certified by the coroner (table II), while the least occurred among patients on whom no necropsy was performed. In tables II-IV, which give details of the discrepancies in each of the three groups, the words appearing on the certificate, including abbreviations and spelling errors, have been reproduced exactly. In all the tables the "actual" cause of death is that most likely on all the evidence available.

The death certificate in current use provides for the submission of supplementary evidence accruing after the initial certification. This facility was used in 14 of the 191 cases—in nine on the basis of subsequent necropsy evidence, in one on biopsy findings, in one after radiological diagnosis, and in three as a result of "second thoughts" by the certifying doctor. Of the 21 amendments made in respect of these 14 patients, four were of value, 10 were of no value, and seven were wrong.

TABLE I—*Cause of death recorded on death certificate compared with "actual" cause of death*

	Complete agreement	Major discrepancy	Minor discrepancy	Total
Coroner's necropsy and/or certificate	23	17	8	48
Hospital necropsy	21	10	15	46
No necropsy	54	12	31	97
Total	98	39	54	191

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TABLE II—*Major discrepancies between cause of death recorded on certificate and "actual" cause of death in cases where coroner issued the certificate*

Case No	Section	Death certificate	"Actual" cause of death
1	Ia	Bronchopenumonia	Cerebral anoxic damage
	b	Prolonged coma	Cardiac arrest
	c	Idiopathic cardiac arrest	Acute alcoholism
2	Ia	Bronchopneumonia	Pneumonia
	b		Cerebral palsy and mental subnormality due to intrapartum asphyxia
3	Ia	Acute pulmonary oedema due to	Acute laryngoepiglottitis
	b	Toxic myocarditis following	
	c	Acute laryngoepiglottitis	
4	Ia	Aspirin poisoning (open verdict)	Suicidal aspirin poisoning
	b		Depression
5	Ia	Liver failure	Cirrhosis of liver
	b	Mycronodular cirrhosis	Chronic alcoholism
6	Ia	Hepatic failure due to paracetamol poisoning following an overdose of paracetamol tablets, self administered—he killed himself	Suicidal paracetamol poisoning
	b		Depression
7	Ia	Acute myocarditis	Myocardial infarction
	b		Hypertension
8	Ia	Lobar pneumonia	*E coli* septicaemia
	II		Pneumonia
9	Ia	Fulminating influenzal pneumonia	Staphylococcal septicaemia
	b		Staphylococcal bronchopneumonia
10	Ia	Bilateral pneumothorax	Asthma
	b	Asthma	
11	Ia	Haemorrhagic pneumonia	Septicaemia
	b	Neutropenia	Hodgkin's disease
	c	Cytotoxic drug therapy for Hodgkin's disease	
	II		Thromboembolic disease
12	Ia	Pulmonary fibrosis	Paraquat poisoning
	b	Paraquat poisoning. Deceased took his own life	Depression
13	Ia	Cardiac arrest following ventricular fibrillation occurring as a result of myocardial damage. Anoxia due to pneumonia developing during a state of coma due to drugs phenobarbitone and alcohol. Death by misadventure	Suicidal poisoning by Mandrax, Luminal, Dalmane, and alcohol
	b		Depression
14	Ia	Bronchopneumonia and pulmonary fibrosis	Paraquat poisoning
	b	Paraquat poisoning. Deceased took his own life	Depression
15	Ia	Cerebral infarction and haemorrhage	Subarachnoid haemorrhage
	II	Ulcer polypus	Crohn's disease
16	Ia	Left ventricular failure	Myocardial infarction
	b	Myocardial infarction	Diabetes mellitus
17	Ia	Gastrointestinal haemorrhage due to	Alcoholic cirrhosis of liver
	b	Acute gastric erosion	
	II	Cirrhosis of the liver	

Other errors on the certificates were mainly in names and dates of birth. In 67 of the 191 patients the full name given at death registration was dissimilar to that recorded in the hospital notes. In 56 of the 67 this was because the hospital records office included only one christian name and in one because the registrar made the same omission. In the remaining 10 cases spellings of names differed. In 34 cases there were discrepancies between death certificates and notes over date of birth. These were due mainly to the uncertainty of the relative registering the death, but recording and transcription errors may have been responsible in a few cases.

Discussion

The fact that the highest proportion of errors occurred on certificates issued by coroners reflects the fact that these certificates usually summarise the morbid anatomical abnorm-

TABLE III—*Major discrepancies between cause of death recorded on certificate and "actual" cause in cases where hospital necropsies were performed*

Case	Section	Death certificate	"Actual" cause of death
18	Ia	Cardiac failure	Rheumatic heart disease
	b	Rheumatic valvular disease	
	II		Thromboembolic disease
19	Ia	Myocardial infarction	Myocardial infarction
	b	Coronary artery atheroma and thrombosis	Diabetes mellitus
	c		
	II	Bilateral renal infarction, diabetes mellitus	
20	Ia	Cardiac arrest	Hypertrophic obstructive cardiomyopathy
	b	Hypertension	
	c	Heart failure	
	II	Recurrent pulmonary emboli	
21	Ia	Acute heart failure	Dissecting aneurysm of aorta
	b	Haemopericardium	Carcinoma of bronchus
	c	Dissecting aortic aneurism	
	II	Carcinoma of bronchus	
22	Ia	Carcinomatosis	Carcinomatosis
	b	Carcinoma colon	Carcinoma of colon
	c		Ulcerative colitis
	II	Colitis	
23	Ia	Bronchopneumonia	Cardiorespiratory failure
	b		Chronic airways obstruction
	II	Chronic pyelonephrosis, diabetes mellitus	Diabetes mellitus
24	Ia	Hypoxic brain damage	Brain stem infarction
	II	Phagchromocytoma	
25	Ia	Acute renal failure	Cardiac failure
	b	Glomerulonephritis	Hypertension
	II	Pancreatitis, hypertensive heart disease	Pancreatitis, gall stones
26	Ia	Bronchopneumonia	Cardiac failure, hypertension
	b	Left ventricular failure	
	c	Myocardial degeneration	
	II	Peritonitis, chronic hypertension	Pneumonia
27	Ia	Heart failure	Bacterial endocarditis
	b	Mitral stenosis and incompetence	Rheumatic heart disease
	II	Bacterial endocarditis	Chronic anxiety state

TABLE IV—*Major discrepancies between cause of death recorded on certificate and "actual" cause of death in cases in which no necropsy was performed*

Case No	Section	Death certificate	"Actual" cause of death
28	Ia	Carcinomatosis	Carcinomatosis
	b	(Primary hepatoma)	Carcinoma of colon
29	Ia	Bronchopneumonia (bilateral)	Bronchopneumonia
	II	Vitamin B deficiency, peripheral neuropathy	Hysterical inanition
30	Ia	Multiple cerebral infarcts	Uncertain but not as on death certificate. ? Encephalitis ? Carcinomatosis
	b	Cerebral arteritis	
31	Ia	Cardiac failure	Coronary artery disease
	b	Supervent tachycardia	
	II	DVT and pulmonary embolus	
32	Ia	Carcinomatosis	Undiagnosed
33	Ia	Carcinomatosis	Carcinomatosis
	b	Bowel carcinoma	Unidentified primary
	II	Oesophageal varices	
34	Ia	Raised intracranial pressure	Septicaemia
	b	Hydrocephalus	Hydrocephalus (failed shunt)
	c	Meningomyelocele repair 5/1/74	
35	Ia	Cerebral haemorrhage	Subarachnoid haemorrhage
36	Ia	Intracerebral haemorrhage	Subarachnoid haemorrhage
37	Ia	Cardiac arrest	Myocardial infarction
	b	R ventricular failure	Syphilitic aortitis
	c	Myocardial infarction	
38	Ia	Cardiac failure	Cardiorespiratory failure
	b	Emphysema	Old pulmonary tuberculosis
39	Ia	Pulmonary embolism	Coronary artery disease
	II	Mitral incompetence, myocardial infarction	

alities recorded by pathologists carrying out necropsies at the coroner's command, which are not invariably the cause of death. Another important factor is the reluctance of coroners to mention abuse of or addiction to alcohol or to acknowledge suicide or the depression from which it stems.

Death certificates not given by a coroner are usually completed by the most junior and least experienced member of the hospital team responsible for the patient's care. Understandably therefore inaccurate impressions are sometimes conveyed. The smallest discrepancy between death certificates and case notes was in the group where no necropsies were performed. In cases where the cause of death is not in doubt efforts to persuade relatives to agree to permit a necropsy may be less persistent, and because no necropsy is performed a wrong clinical diagnosis may remain undisclosed.

Although there were several discrepancies between certificates and case notes in names and dates of birth, such errors are not very important except in cases where the patient's name is all that is available, when difficulties in tracing the relevant death certificate may arise.

The present certificate, in which the last diagnosis under section I is the real cause of death, might usefully be revised. Today a high proportion of entries under Ia are "cardiac arrest," which is how all of us will leave this world whatever the real cause of our death. The next most frequent entry is "bronchopneumonia"—the final curtain of so many chronic diseases.[5] Section II, "Other significant conditions contributing to the death, but not relating to the disease or condition causing it," is not always capable of completion in a manner that may not mislead the epidemiological research worker.

Death certificates are not primarily intended for epidemiological research—they are an important legal and social requirement. Nevertheless, they are often used by research workers because they form a concise[6] and convenient record. As we have shown, however, they are sometimes materially inaccurate and research based on them alone may not be secure, despite what Rose and Barker have recently said.[7]

The purpose of this paper is to try to improve the accuracy of the information which the OPCS receives. Thus coroners' certificates might be more accurate if the coroners more often consulted the clinician in charge, and other certificates would more closely reflect the cause of death if supplied by senior hospital staff.

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How to do it

Raise funds

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"Can anyone remember when the times were not hard, and money not scarce?"

Ralph Waldo Emerson

The above quotation steeled my own resolve when attempting to raise funds for a major project, and lesson one about fund raising is—if *you* are convinced that the cause is worthy and the project viable, don't let anyone put you off, and don't be disheartened because the country is bankrupt. It is never the right time to raise money, so go ahead and do it anyway.

Lesson two is that if you think fundraising is merely a matter of saying to yourself: "there are 300 000 people in this county, so if everyone gives 50p we will be home and dry"—forget it, go home, and tend your roses instead. Nobody is interested in handing over their hard-earned cash unless you can convince them that the whole scheme is sound, necessary, and appealing to *them*. After all, why should they? Fundraising is grinding hard work. You must be prepared to kiss your wife and the baby goodbye for many evenings, because you will need to address any number of lay meetings. You will spend many hours at the kitchen table with your spouse signing letters and putting them in envelopes. You will go through agonies of self-doubt and many crises of morale in your organisation. You will learn to endure the hunted look of your friends as they see you approach, hot with the news of your latest disaster/triumph. Fascinating for you; boring for them. If all this appears too much for you, with the seemingly endless hours of repetitive, slogging work, then don't go fundraising, not at any price—it is not for the faint-hearted.

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Basic organisation

If you have lasted this far, and are still convinced of the rightness of your cause and the glamour of your appeal, then the next step is to set up your basic organisation. First of all, you will need a small but select band of trusted (voluntary) and dedicated hard-working helpers. You *must* have a very good secretary/typist, because you are going to need to send out a great many letters: thousands will be needed for a major appeal. Next, you need to gather together a small committee you can trust. The members will need to be long-suffering, industrious but