

Inadequacies of death certification in Beirut: who is responsible?

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Objective To assess the completeness of data on death certificates over the past 25 years in Beirut, Lebanon, and to examine factors associated with the absence of certifiers' signatures and the non-reporting of the underlying cause of death.

Methods A systematic 20% sample comprising 2607 death certificates covering the 1974, 1984, 1994, 1997 and 1998 registration periods was retrospectively reviewed for certification practices and missing data.

Findings The information on the death certificates was almost complete in respect of all demographic characteristics of the deceased persons except for occupation and month of birth. Data relating to these variables were missing on approximately 95% and 78% of the certificates, respectively. Around half of the certificates did not carry a certifier's signature. Of those bearing such a signature, 21.6% lacked documentation of the underlying cause of death. The certifier's signature was more likely to be absent on: certificates corresponding to the younger and older age groups than on those of persons aged 15–44 years; those of females than on those of males; those of persons who had been living remotely from the registration governorate than on those of other deceased persons; and those for which there had been delays in registration exceeding six months than on certificates for which registration had been quicker. For certificates that carried the certifier's signature there was no evidence that any of the demographic characteristics of the deceased person was associated with decreased likelihood of reporting an underlying cause of death.

Conclusions The responsibility for failure to report causes of death in Beirut lies with families who lack an incentive to call for a physician and with certifying physicians who do not carry out this duty. The deficiencies in death certification are rectifiable. However, any changes should be sensitive to the constraints of the organizational and legal infrastructure governing death registration practices and the medical educational systems in the country.

Keywords Death certificates; Cause of death; Vital statistics; Data collection/methods/trends; Lebanon (*source: MeSH, NLM*).

Mots clés Certificat décès; Cause décès; Statistique démographique; Collecte données/méthodes/orientations; Liban (*source: MeSH, INSERM*).

Palabras clave Certificado de defunción; Causa de muerte; Estadísticas vitales; Recolección de datos/métodos/tendencias; Líbano (*fuentes: DeCS, BIREME*).

Bulletin of the World Health Organization 2002;80:555-561.

Voir page 560 le résumé en français. En la página 561 figura un resumen en español.

Introduction

Death certification is a public health surveillance tool and a valuable source of information at the national and local levels. Among activities that benefit from the availability of cause-of-death statistics obtained from death certificates are the monitoring of the health of populations, the setting of priorities and the targeting of interventions (1, 2). Such statistics are also the keystone of much epidemiological study, directing the focus of research and complementing mortality data in follow-up studies (3, 4).

In order to facilitate cause-of-death documentation and to standardize reporting and coding practices among various countries, the United Nations and the International Institute for Vital Registration and Statistics periodically develop protocols and guidelines for the management, operation and maintenance of civil registration (5). Moreover, WHO and other organizations produce rules and guidelines for mortality and morbidity coding (6, 7). Nevertheless, death registration is fragmented and largely inadequate in most developing

countries (8). In the Eastern Mediterranean Region, for example, only five countries reported mortality data to WHO between 1985 and 1990. This amounted to a population coverage of only 16%, whereas in Europe and the Americas the corresponding values were 94% and 80%, respectively (9). Late registration, incomplete information and inaccurate data may also be factors in inadequate death registration. While several studies, largely conducted in the West, have focused on the validity of information (10–14) and coding practices (15–18) related to specific causes of death, only a few have examined omissions in data-reporting on death certificates (19, 20) and no information is available on the timing of registration in relation to the occurrence of death. The two latter problems remain issues of concern mainly in developing countries. Little, if anything, is known of the magnitude of these deficiencies or the reasons for them.

The present study was undertaken to evaluate death certification in Lebanon, with reference to its process, mortality documentation and registration as a first step towards identifying limitations and reducing deficiencies.

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The vital system in Lebanon has never been examined and its utility as a public health tool for planning and evaluation remains questionable. Lebanon is a middle-income country with a population of about 3.5 million. Data at the national level are scarce, the only census ever conducted having been in 1932. Until very recently there were no government statistical surveys or health statistics. The conflicts that ravaged the country between 1975 and 1991 exacerbated the chaotic nature of official documentation. There is virtually no information on causes of death. Even today there are no coding procedures or computerization for the information on death certificates.

The specific aims of the study were to assess the completeness of data-reporting on death certificates and to search for trends over the past 25 years, a period of transition from prewar to postwar conditions. We also investigated whether omissions in data varied with the demographic characteristics of deceased persons and with the circumstances surrounding death events.

Methods

Study sample

Data were obtained from a systematic random sample of 20% of death certificates registered in selected years between 1974 and 1998 in Beirut. The certificates were retrieved, stratified by year of registration, from the files of the Statistics Department of the Ministry of the Interior. Initially, the years 1974, 1984 and 1994 were chosen to represent deaths registered in the prewar period, the war period and the postwar period respectively. Subsequently, the years 1997 and 1998 were added. The same sampling methodology, abstract form, coding manual and data entry file were used for all registration years. The final samples of approximately 500 for each year were considered adequate (maximum error 5%) for estimating proportions of missing data.

Death certification in Lebanon: historical background and process

Death registers in Lebanon were begun in 1924. In accordance with recommendations made by the United Nations and WHO a uniform death certificate was developed in 1951. Originally, the certificate included demographic and administrative data. Because of the fear of social stigma, information relating to mortality was recorded on a separate slip of paper without identification of the individual concerned (21). Cause-of-death information was integrated into the certificate in 1967 but was placed in a corner with very little space for recording the sequence of events leading to death.

When a death occurs, the relatives of the deceased should, *ideally but not necessarily*, ask a physician to witness the event and record the date and cause on the certificate. In the case of an unnatural death, a medical examiner (coroner) should additionally testify and sign the certificate. The certificate is then passed to the district registrar (*mokhtar*) together with the deceased person's identity card. The testimony of two witnesses, usually relatives of the deceased, i.e. their signatures and identification profiles, along with the registrar's signature and stamp, are sufficient to make the death certificate a legal document. The registrar submits the certificate to the Department of Vital Statistics in the Ministry of the Interior for filing under the civil registration system of each governorate.

Variables and measurement

The following information was abstracted from the sample of death certificates:

- (i) demographic characteristics of the deceased, e.g. sex, dates of birth and death;
- (ii) administrative details, including the date of registration and the names and testimony (signature and identification profile) of the two witnesses and the registrar;
- (iii) medical data indicating the cause of death, accompanied by the signature of the certifier, i.e. the physician or medical examiner.

Part I of the cause-of-death section on the death certificate covers the cause of death as it relates to immediate, intermediate and underlying causes. Part II covers additional associated conditions that contribute to death.

Missing data for all variables were given a separate code. Descriptive statistics showing the proportion of missing information were presented for each registration year. An underlying cause of death was assigned in accordance with the general principle of the international rules (condition entered on the lowest used line of Part I) (6). The lag period in months, defined as the time taken to register a death, was derived from available data on the dates of death and registration, and was categorized as <1, 1–2, 3–6 or >6 months. The cut-off point of 2 months is of particular interest because after this time a penalty of approximately US\$ 70 is incurred if registration has not taken place. The place of residence at the time of death was categorized according to its geographical proximity to the place of registration.

Statistical analysis

The χ^2 test was used to assess changes in the completeness of reporting across the years. Because the presence of a physician is necessary for reporting the underlying cause of death, logistic regression analysis was conducted first to examine factors associated with failure to have a certifier's signature on death certificates (Model 1) and then, for those certificates that included a certifier's signature, to investigate factors associated with failure to report the underlying cause of death (Model 2). Odds ratios and their 95% confidence intervals were determined. The following variables were included in the models: sex, age (<1, 1–14, 15–44, 45–64, >64 years), marital status (single, married, divorced/widowed), district of residence, year of registration and lag period. Analysis was conducted by means of SPSS for Windows, Version 8.0 (22).

Results

Characteristics of the sample

Of the 2607 death certificates retrieved, 56% related to males. The median age at death was 69 years (range 0–111 years) for the total sample, the values for males and females being 67 and 72 years, respectively. The highest male:female ratio of deaths (1.54:1) and the lowest mean age at death (59 years) occurred in 1984 because of the then prevalent war conditions that disproportionately affected adult males.

Delays in registration

More than two-thirds of deaths were registered within two months after the event (Table 1). The proportion of death certificates that were delayed for a period exceeding six months

Table 1. Delays in registration by geographical proximity of district of residence to registration place, Beirut, 1974–98

Lag period	District of residence at death ^a				P
	Beirut n = 2069	Mount Lebanon n = 421	Others n = 78	Total ^b n = 2568	
1 month	1054 (50.9) ^c	144 (34.2)	9 (11.5)	1207 (47.0)	<0.001
1–2 months	474 (22.9)	116 (27.6)	23 (29.5)	613 (23.9)	
3–6 months	205 (9.9)	49 (11.6)	16 (20.5)	270 (10.5)	
>6 months	336 (16.2)	112 (26.6)	30 (38.5)	478 (18.6)	
Mean ± SD	18.5 ± 66.4	20.0 ± 65.6	34.9 ± 81.35	19.3 ± 66.7	0.009
Range	0–631	0–655	0–411	0–655	

^a Mount Lebanon is closer to Beirut, the registration district, than the other districts that include the North, Bekaa, South and Nabatieh Governorates.

^b Total number of certificates, out of 2607 retrieved, with complete information on both lag period and district.

^c Figures in parentheses are percentages, calculated from the total number of the corresponding district of residence at death.

was approximately 9% in 1974 and more than twice as high in the following years (data not shown, $P < 0.001$). The mean lag period was shortest for deaths occurring in Beirut (18.5 months). It increased significantly with increasing distance of the district of residence from the governorate where registration took place.

Completeness of data-reporting

Administrative data were complete on all death certificates. The proportions of missing information in the demographic and medical sections are indicated in Table 2. Whereas the desired information on demographic variables such as sex, marital status and date of death was mostly present, that on occupation and month of birth was missing from 95% and 78% of the certificates, respectively. There was a frequent absence of mortality-related data. While a consistent and significant increase in the proportion of certificates that listed a cause of death was observed over the study period ($P < 0.001$), the most recent registration cohorts (1997–98) nevertheless included 43% of certificates that did not describe the underlying cause of death. There were similar findings in respect of the certifier's signature, for both that of the physician and that of the medical examiner.

Table 3 indicates the association between the presence of a certifier's signature and the underlying cause of death. Of the physicians who certified deaths, 21.6% did not report an underlying cause. An underlying cause was reported on 6.3% of the certificates that did not include a certifier's signature.

The reported causes of death were very general, e.g. natural death, aging and coma. Some were indicated in Arabic, others in English or French. In some cases the sequence of reporting underlying, intermediate and immediate causes of death was incorrect. Approximately 36% of certified deaths were attributed to a single cause, 38.2% to a sequence of two causes and the rest to three causes. Ill-defined single causes such as bleeding, general fatigue and multiple organ failure were given in 10% of certified deaths.

Associations with lack of certifier's signature and non-reporting of an underlying cause of death

A certifier's signature was more likely to be absent on certificates corresponding to deceased persons aged under 15 years or over 44 years than on those for the intermediate age group (Model 1, Table 4). The odds were significantly higher among females (odds ratio = 1.22, 95% confidence interval =

1.00–1.47), persons who had been living outside Beirut, particularly those who had been living farthest away (odds ratio = 3.43, 95% confidence interval = 1.96–5.98), and when delays in registration exceeded six months (odds ratio = 2.25, 95% confidence interval = 1.76–2.87). A clear trend of improvement in the proportion of certified deaths was noted over the years. For certificates bearing a certifier's signature (Model 2), there was no evidence of an association between age or sex and a decreased likelihood for reporting an underlying cause of death. However, the odds were significantly higher for those who died outside Beirut. Failure to report an underlying cause of death decreased over the years.

Discussion

On the majority of death certificates registered in Beirut there was an absence of such pertinent demographic information as occupation of the deceased. Approximately half of the death certificates were not certified by a physician and an even larger proportion lacked documentation of the underlying cause of death. Failure to request a physician to certify death was associated with the age and sex of the deceased, delays in registration and the geographical remoteness of the deceased person's place of residence from the registration district. However, where a death was certified by a physician there was no tendency for non-reporting an underlying cause in relation to any of the deceased person's demographic characteristics. Whereas a gradual improvement in reporting the cause of death was noted over the last 25 years, the information was either imprecise or inadequately completed.

Delay in registration was shown to be largely influenced by the district of residence at the time of death. Lebanese law decrees that deaths can only be registered in the administrative governorate where the deceased and his or her ancestors were counted in the 1932 census, irrespective of the current place of residence. Families living outside Beirut were undoubtedly hindered by their geographical remoteness to the registration governorate from obtaining the required documentation. Consequently, on average, registration did not occur for up to 35 months after death in some districts outside Beirut. Such delays not only adversely affect the completeness and reliability of the cause-of-death structure, but also bias mortality estimates for given years and impede public health efforts.

Only a negligible proportion of certificates lacked information for selected demographic characteristics, e.g. sex and year of birth. These data are readily available and can be

Table 2. Percentage of missing data in death certificates across registration years, Beirut, 1974–98

	Registration years					Total	
	1974 <i>n</i> = 566	1984 <i>n</i> = 529	1994 <i>n</i> = 530	1997–98 <i>n</i> = 982	<i>n</i> = 2607		
	%	%	%	%	<i>n</i>	%	
Sociodemographic data							
Sex	0.2	0.4	0.0	4.8	50	1.9	
Marital status	1.1	2.8	4.9	4.5	91	3.5	
Occupation	90.8	97.7	94.3	96.9	2483	95.2	
Religion	0.2	0.2	0.8	1.0	16	0.6	
District of residence	0.7	0.0	0.6	0.7	14	0.5	
Month of birth	86.0	86.2	78.9	68.0	2029	77.8	
Year of birth	0.4	0.4	0.0	0.0	4	0.2	
Month of death	0.0	0.0	0.0	0.4	4	0.2	
Year of death	0.0	0.0	0.0	0.0	0	0.0	
Mortality-related data^a							
Cause of death (UCD) ^b on	79.5	66.0	57.2	43.2	1526	58.5	
Line 1 of Part I	80.0	66.4	57.7	44.3	1545	59.3	
Line 2 of Part I	86.0	83.0	75.7	61.7	1933	74.1	
Line 3 of Part I	92.0	94.1	88.3	82.9	2301	88.5	
Associated cause (Part II)	96.6	95.7	93.6	96.5	2497	95.8	
Certifier's signature (missing both)	65.0	59.9	49.4	39.6	1336	51.2	
Physician	67.8	64.3	53.8	44.2	1443	55.4	
Medical examiner	67.1	67.1	56.8	58.1	1607	61.6	

^a χ^2 test: $P < 0.001$ for all items listed under mortality-related data.

^b An underlying cause of death (UCD) was assigned in accordance with the general principle (condition entered on the lowest used line of Part I) for selecting the cause of death (\emptyset).

Table 3. Cause-of-death reporting by certifier's signature, Beirut, 1974–98

Cause of death (UCD) ^a	Certifier's signature		<i>P</i>
	Present	Absent	
	<i>n</i> = 1271	<i>n</i> = 1336	
Present	997 (78.4) ^b	84 (6.3)	<0.001
Absent	274 (21.6)	1252 (93.7)	

^a Underlying cause of death.

^b Figures in parentheses are percentages.

transcribed from the identity card, which, by law, has to be presented to the registrar at time of registration. However, 95% of certificates lacked information on occupation. Difficulties may arise in assigning a single occupation if several have been engaged in either simultaneously or over a lifetime. This hinders occupational health research and the analysis of mortality data in relation to socioeconomic status, particularly as there is no requirement for educational level to be indicated on the certificate.

The responsibility for failing to report causes of death was shared between the families of the deceased, who lacked an

incentive to call for physicians (51% of all certificates), and the physicians who failed to report the causes (21.6% of certified deaths). The drawing up of death certificates is a statutory obligation of district registrars but not of physicians (21). Physicians and the population at large have no appreciation of the importance of death certification. Many administrative and social factors are responsible for these shortcomings (18, 23). The documentation of causes of death improved over time, even during the war period when there was no government action in the matter, but the quality of the data was deficient in various respects. The cause of death, when present, was poorly described and, in some cases, the documentation covered more than one line of Part I of the mortality section, making it difficult to distinguish whether it was in reference to the immediate, intermediate or underlying cause of death. Furthermore, even when death was natural, the majority of certificates wrongly included the same certifier's signature on both entry lines originally assigned for the physician or the medical examiner. Such flaws were as common in the prewar period as in the postwar period and reflect a lack of understanding of the principles used in completing death certificates.

These issues are not peculiar to developing countries. More than 50% of general practitioners in the United Kingdom and in the US reported being insufficiently instructed about the

Table 4. Associations with lack of certifier's signature on death certificates (Model 1) and, for certificates that included a certifier's signature, associations with non-reporting an underlying cause of death (UCD) (Model 2): results of multivariate regression analysis, Beirut, 1974–98

Variable	Model 1		Model 2	
	Outcome: lack of certifier's signature		Outcome: non-reporting of UCD	
	OR ^a	95% CI ^b	OR	95% CI
Sex				
Male	1.00	–	1.00	–
Female	1.22	1.00–1.47	0.96	0.69–1.33
Age at death (years)				
<1	1.33	0.73–2.41	0.96	0.37–2.52
1–14	1.95	1.21–3.15	0.66	0.27–1.59
15–44	1.00	–	1.00	–
45–64	1.44	1.01–2.04	1.10	0.63–1.91
65+	1.70	1.22–2.36	0.93	0.55–1.58
Marital status				
Married	1.00	–	1.00	–
Single	1.10	0.83–1.47	1.23	0.76–1.98
Divorced/widowed	1.10	0.88–1.47	1.38	0.94–2.04
District of residence				
Beirut	1.00	–	1.00	–
Mount Lebanon	1.48	1.17–1.86	1.95	1.33–2.88
Other governorates	3.43	1.96–5.98	4.63	1.79–12.0
Lag period				
<1 month	1.00	–	1.00	–
1–2 months	1.11	0.90–1.37	1.10	0.76–1.60
3–6 months	0.99	0.74–1.32	1.41	0.88–2.25
>6 months	2.25	1.76–2.87	1.42	0.91–2.21
Year of registration				
1974	1.00	–	1.00	–
1984	0.78	0.60–1.02	0.32	0.20–0.51
1994	0.43	0.33–0.56	0.32	0.21–0.50
1997–98	0.28	0.22–0.36	0.18	0.12–0.26

^a OR = odds ratio.

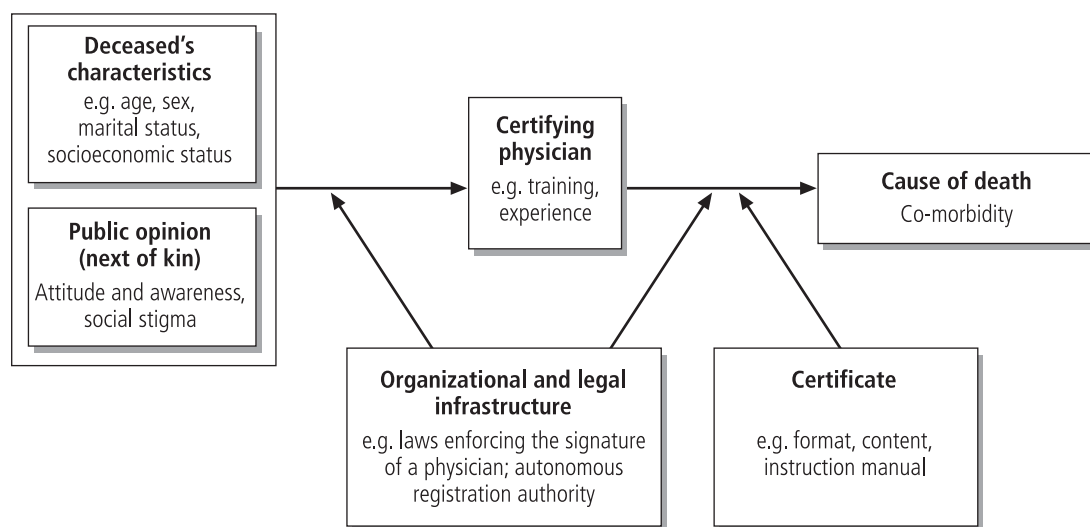
^b CI = confidence interval.

process of death certification (24, 25); many said that their first contact with a death certificate occurred when they first managed a death event (26). Consequently, there has been growing interest in the provision of training in this field for physicians with the help of formal courses, brochures and videos (1, 27, 28).

Currently, education and postgraduate training in death certification practices appear to be deficient in all medical schools and teaching hospitals in Lebanon. Instructional resources and educational material in Arabic are lacking. Confusion may arise when physicians use a foreign medical

language in clinical practice while completing death certificates in Arabic. Semantic difficulties in reporting the cause of death may be influenced by various characteristics of the certifier and the cause of death itself (19). A recent study in Taiwan showed that problems arising from translation were the most frequent source of disagreement between reviewers and original coders, because different doctors use different Chinese words for the same diagnosis in English (17). In Lebanon the situation is exacerbated because physicians have been trained in a wide diversity of medical educational systems in many different

Fig. 1. Framework for factors affecting death certification process and mortality data



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countries. Instructional material providing translations from English and French into the local language should be standardized and widely disseminated. Initially, even at the expense of some loss of information, the use of larger groupings of causes of death would tend to lessen errors, enhance quality and improve the homogeneity of data (3).

In conclusion, the following deficiencies and procedural problems appear to affect death certification in Lebanon:

- (1) delayed registration;
- (2) failure of the laws to enforce the responsibility of the certifying physician as signatory;
- (3) lack of appreciation of the importance of mortality statistics by the public and physicians;
- (4) deficiency of training in medical schools and during clinical practice and lack of educational and instructional material in the native language;
- (5) death certificate not user-friendly;
- (6) absence of an autonomous central registration authority.

Maudsley & Williams indicated four elements of particular concern in the cause-of-death certification process: the certifier, the certificate, the deceased and the cause of death (29). For countries in transition, and within a theoretical

framework that starts with characteristics of the deceased and public awareness and ends with cause of death documentation, there is also a need to consider the organizational and legal infrastructure that governs the registration process (Fig. 1).

Mortality statistics are the basic source of data for continuous monitoring of population health. We previously drew attention to the poor fit between indirect estimates based on a range of assumptions and extrapolations on the one hand and measurements driven by empirical data on the other, and called for the improvement of reporting systems for routine sources of data in the interest of evidence-based decision-making (30). The absence of reliable data on causes of death impedes the structuring of health-related activities and could result in misleading appraisals of research and wrong decisions about public health priorities. ■

Acknowledgements

This study was supported in part by the University Research Board of the American University of Beirut (grant DCU 17996075600). The authors thank Dr Raj Bhopal for his useful comments on an earlier version of the manuscript.

Conflicts of interest: none declared.

Résumé

Les lacunes des certificats de décès établis à Beyrouth: qui est responsable ?

Objectif Évaluer le degré d'exhaustivité des données figurant sur les certificats de décès établis au cours des 25 dernières années à Beyrouth (Liban) et examiner les facteurs pouvant expliquer l'absence de signature de la personne ayant établi le certificat et le fait que la cause du décès n'est pas mentionnée.

Méthodes Un échantillon systématique de 20 % des certificats de décès représentant un total de 2607 documents établis pour les années 1974, 1984, 1994, 1997 et 1998 a été examiné rétrospectivement afin d'évaluer les pratiques en matière d'établissement des certificats et de recenser les données manquantes.

Résultats Les renseignements mentionnés sur les certificats de décès étaient pratiquement complets s'agissant des caractéristi-

ques démographiques des personnes décédées, à l'exception de leur profession et de leur mois de naissance qui n'étaient pas indiqués sur environ 95 % et 78 %, respectivement, des certificats. Près de la moitié des certificats ne portaient pas la signature de la personne les ayant établis. Sur ceux qui portaient cette signature, 21,6 % ne mentionnaient pas la cause du décès. Les certificats non signés concernaient plus souvent des enfants ou des personnes âgées que des personnes appartenant à la classe d'âge des 15-44 ans; des femmes que des hommes; des personnes vivant loin des services d'état civil et des personnes pour lesquelles il y avait eu un retard de plus de 6 mois dans l'enregistrement du décès. Pour les certificats signés, il ne

semblait pas y avoir de corrélation entre les caractéristiques démographiques de la personne décédée et le fait que la cause du décès avait ou non été mentionnée.

Conclusion La non-notification de la cause du décès à Beyrouth est imputable aux familles qui ne voient pas l'intérêt d'appeler un médecin et aux praticiens établissant les certificats qui ne font pas

leur travail correctement. Les imperfections du système de certification des décès peuvent donc être corrigées. Toutefois, les modifications apportées à ce système devraient tenir compte des contraintes tant organisationnelles que juridiques qui pèsent sur les pratiques d'enregistrement des décès ainsi que des programmes de formation médicale existant dans le pays.

Resumen

Datos faltantes en los certificados de defunción en Beirut: ¿de quién es la responsabilidad?

Objetivo Evaluar la integridad de los datos de los certificados de defunción emitidos a lo largo de los últimos 25 años en Beirut (Líbano), y determinar los factores asociados a la ausencia de firma y a la omisión de la causa de defunción subyacente.

Métodos Las prácticas de certificación y los datos faltantes se analizaron retrospectivamente a partir de una muestra sistemática del 20% constituida por 2607 certificados de defunción, repartidos entre los periodos de registro de 1974, 1984, 1994, 1997 y 1998.

Resultados La información sobre los certificados de defunción estaba casi completa en lo que respecta a todas las características demográficas de las personas fallecidas, excepción hecha de la ocupación y del mes del nacimiento. En aproximadamente el 95% y el 78% de los certificados, respectivamente, no se mencionaba esa información. Alrededor de la mitad de los certificados no estaban firmados. De los que sí lo estaban, el 21,6% carecían de documentación sobre la causa de defunción subyacente. La falta de firma era más frecuente en los siguientes casos: certificados

correspondientes a los grupos de edad jóvenes o mayores, por oposición a las personas de 15-44 años; los certificados correspondientes a mujeres, en comparación con los hombres; los de las personas que vivían lejos de la prefectura de registro; y los de los casos en que el registro se había retrasado más de seis meses. En el caso de los certificados con firma, no había indicio alguno de que cualquiera de las características demográficas de los fallecidos se asociara a una menor probabilidad de notificación de la causa de defunción subyacente.

Conclusión Los responsables de que no se declaren las causas de defunción en Beirut son, por una parte, las familias, que carecen de incentivos para llamar a un médico, y por otra los facultativos que deben certificar los decesos y no lo hacen. Estos fallos son subsanables. Sin embargo, cualquier cambio que se introduzca deberá tener en cuenta las limitaciones tanto de la infraestructura organizacional y forense que rija las prácticas de registro de las defunciones como de los sistemas de enseñanza de la medicina que haya en el país.

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