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Abstract

Background: Vital civil information is recorded in only 25% of middle-income countries.

Aims: To estimate the number and causes of deaths expected in the population, using hospital mortality data and comparing them with data from the Ministry of Health and Medical Education, Tehran, Islamic Republic of Iran.

Methods: Hospital mortality data for 2011–2015 were extracted and were corrected qualitatively through reference to medical records. Using Murray's proposed method, an estimate of the expected deaths was obtained according to cause of death.

Results: During 2011–2015, 12 704 deaths were recorded in the hospital and Murray's method estimated 28 768 deaths for the entire population. The most frequent cause of death was ischemic heart disease. The results were compared with data from the Ministry of Health and Medical Education, which had a relative error of 6.9% and –13.5% respectively. The mortality rates registered by the Civil Registration Office were higher than those estimated in the present study. The mortality rates registered by the Ministry of Health and Medical Education were lower than those in the present study.

Conclusions: Considering the importance of registering deaths, alternative methods, with

efficiency and low cost, are needed to estimate the number and causes of death in a population.

Keywords: cause-specific mortality rate, estimated mortality, hospital mortality, Islamic Republic of Iran, Murray's method

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Introduction

Frequency and causes of mortality are important components in the health planning of communities (1). Timely registration of deaths and correct record keeping form the basis of demographic analysis (2). In order to monitor epidemiological changes in disease, the health sector relies heavily on the proper functioning of such vital records and statistics (3). Changes in trends of the causes of mortality over time determine the direction of a country's health policies. Mortality among different age and sex groups indicates the status of health services and the health status of different groups in society (4). Despite the importance of information about the causes of mortality, data availability and accuracy are limited in many countries (5). Vital information is recorded in only 25% of middle-income countries and 5–10% of low-income countries (6,7).

In the Islamic Republic of Iran, various institutions are responsible for registering vital events such as the Civil Registration Office and the Ministry of Health and Medical Education. In addition to these institutions, regarding death registration, the forensic organization has taken some measures and collected useful information on specific causes of death (8). The Civil Registration Office and the Ministry of Health and Medical Education have always had a

percentage of errors in collecting mortality data for several reasons. The vast majority of information collected by demographic experts in the Islamic Republic of Iran, in relation to mortality rates and disagreements in this regard, confirms the failure in accurate registration of death (9).

Studies of the extent and causes of mortality in the Islamic Republic of Iran and many other countries have indicated their direct relation with the level of health and development in the countries. Therefore, such research has a major effect on programmes aimed at promoting community health and livelihood (10).

A similar study by Murray et al. was conducted based on data available in Mexico, in which hospital deaths registered were used to estimate the cause-specific mortality rate in the whole population with the minimum rate of error (11). This highlighted certain novel approaches to estimating cause-specific mortality fractions with data on cause of death collected from different institutions. The Islamic Republic of Iran is also one of the countries that Murray et al. mentioned that has potential for applying the method. In addition, the results of studies by Khosravi et al. (12) and Komijani et al. (13) point out the low registration of deaths in countries that use various statistical methods.

Using the Murray method, and considering that data available in hospitals are the most suitable and accessible source for determining the cause of death, the distribution of the expected mortality was determined based on the international coding of diseases in the whole population of Ardebil (Northwest Islamic Republic of Iran) by sex, age and cause of death. Ardebil Province covers 17 953 km2 and its population is 1 270 420 based on the 2016 census (https://www.amar.org.ir).

In a review of the Human Development Index, Ardebil Province scored 0.692 (middle ranking); for the whole country the Index was 0.742. The effective factors in this index include life expectancy, literacy rate, and per capita income. These data, including distribution of mortality in Ardebil Province by age, sex and cause of mortality, can be used in regional health decision-making as well as for intervention measures and improvements in mortality registration and reporting systems in the province.

Methods

Data collection

This was a descriptive–analytical study. Mortality data for 2011–2015 were extracted from the

Civil Registration Office and the Death Registration System of the Ministry of Health and Medical Education, Tehran, Islamic Republic of Iran, hospitals in Ardebil Province, and Ardebil University of Medical Sciences. The hospital mortality data were collected in accordance with the regulatory checklist. Data were subsequently investigated quantitatively and qualitatively and in terms of the cause of death. In cases where the required information was not correctly registered, the quality of the data was improved by using the medical records of the deceased. The mortality rate was calculated based on the proposed Murray method. We compared this information with the data registered in the Ardebil Province Civil Registration Office and Ministry of Health and Medical Education and obtained the percentage of relative error by year, which was compared with the actual information recorded.

Information analysis

The results were calculated using Excel and the proposed Murray method using the following formula (11):

Dasj is the total death rate for the age group a, sex s, and the cause of death j. Hasj is the mortality rate in the hospital for the age group a, sex s, and the cause of death j. Pasj is the ratio of death in the hospital for age group a, sex s, and cause of death j. The relative error percentage was calculated based on the following formula:

It should be noted that due to the lack of any similar study in the Islamic Republic of Iran and the lack of access to mortality ratios in hospitals, Murray's study ratios were used in this research.

Ethical considerations

Ethical clearance for this study was received from the School of Public Health, Shahid Beheshti University of Medical Sciences, Tehran, Islamic Republic of Iran (reference IR.SBMU.PHNS.REC.2016.141).

Results

There were 12 704 deaths in the hospitals in Ardebil Province from 2011 to 2015, covering all age groups; of which, 7341 cases were male (57.8%) and 5363 female (42.2%), with a male to female ratio of 1.36 (Table 1). The mean (SD) age of death in men was 55.19 (28.72) years compared with 57.29 (29.42) years in women. In the 1–28 days and 15–64 years age groups, the mean age at death was significantly higher in women than in men (P

Table 2 shows the specific estimates of the cause of death obtained using the proposed Murray method. From 2011 to 2015, the rate of expected deaths for the population was 5747.2, 5861.8, 5739.2, 5574.1 and 5845.7. The leading cause of mortality in all years of the study was ischemic heart disease. Other causes of death according to Murray's estimation included: other cardiovascular diseases, hypertension, cerebrovascular disease, other unintentional events, stomach cancer, other malignant neoplasms, other respiratory diseases, lung cancer, low birth weight, birth asphyxia, and birth trauma.

Table 3 shows the relative error percent of the data registered in the Ardebil Province Civil Registration Office in relation to the information based on the proposed Murray method by sex and age. The relative error percent for 2011–2015 was 7.9, 4.7, 8.6, 9.6 and 3.6%, respectively. Among men the smallest difference was observed in 2012 with –0.1%, and the largest difference was in 2013 with 7.2%. Among women, the smallest difference of 4.2% was in 2015, and the largest difference of 15.2% was in 2014. The mortality rates registered by the Civil Registration Office were higher than those estimated in the present study.

Table 4 shows the difference between the data registered in Ardebil Ministry of Health and Medical Education and the information based on the proposed Murray method categorized by sex and age. The smallest difference was –4.9% in 2015 and the highest difference was –21.4% in 2012. Among men, the smallest difference was –5.4% in 2015 and the largest difference was –23% in 2011. Among women, the smallest difference was –4.2% in 2015 and the largest difference was –20% in 2012. In all years of the study, the mortality rates registered by Ardebil Ministry of Health and Medical Education were lower than those in the present study.

Figure 1 shows the obtained relative error percentage from a comparison of the Murray method results with the information from the Civil Registration Office and Ministry of Health and Medical Education over 5 years, which indicates the improvement in information registration. During this period the number of registered deaths in the Civil Registration Office was 6.9% higher compared to the Murray method estimation, while Ardebil Ministry of Health and Medical Education has –13.5% fewer registrations.

Discussion

Registering vital events, especially mortality, is essential in order to research the causes of premature death and plan effectively for health promotion programmes. The mortality rate in hospitals in Ardebil from 2011 to 2015 showed a male to female ratio of 1.36. Among all hospital deaths, 57.8% were male and 42.2% female. Studies by Foruzanfar et al. (14), Tariq et al. (15) and Pattaraarchachai et al. (16) showed similar results in terms of the sex ratio of the deceased. Khosravi et al. (2015) (17) also reported a male/female sex ratio of 1.37 among the deceased

and 57.9% of deaths were in men and 42.1% in women. Moore and Wilson (18) suggested that men are more likely to die from parasitic and infectious diseases than women are, which may be due to differences in male and female immunity to these infections.

In the United States of America, United Kingdom of Great Britain and Northern Ireland, and Japan, men are twice as likely as women to die from parasitic diseases (19). Men also demonstrate more high-risk behaviours such as violence, accidents and suicide (20). Other studies also showed that the average age of death due to accidents, events and cardiovascular disease in men was lower than in women, which explains the difference in age between the sexes, which is consistent with the results of the present study (21–23).

In the present study, we found that the estimated mortality rate in all study years was higher than that registered by the Ministry of Health and Medical Education, which was consistent with previous studies (9,11,13,24,25). However, the estimated mortality rate in our study was lower than that registered by the Civil Registration Office. Given that the causes of mortality in a large number of hospital deaths, especially in the early years, were unclear, these cases were placed in the other causes group and were probably related to the most common causes of death (such as cardiovascular diseases). Clearly, by improving the hospital registration system, it can be expected that the ratio of other causes will be reduced and added to the main groups. Therefore, this study demonstrated that the population mortality estimation was more accurate than that derived from the hospital data and the relative error rate relative to mortality compiled by the Civil Registration Office decreased.

One of the major obstacles to an effective death registration system in the Islamic Republic of Iran is that the responsible authorities act individually and in isolation. Based on the experiences of the electronic system for registration of mortality in high-income countries, which have a central database, we recommend creation of a centralized meta-electronic registration system in the country.

Given the low level of registration of deaths between 2011 and 2015 indicated in this study, and the importance of information registration in health decision-making and policy-making, the current registration system seems unable to provide adequate information for the development of health programmes in the Islamic Republic of Iran. Therefore, alternative, low-cost and timeous methods are needed to enable descriptive epidemiological estimation of the population. The method used in this study has the advantage of comparing the expected rate of mortality in the form of cause-specific mortality groups, which play a significant role in decision-making and formulating health policies.

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Estimation des écarts en matière de mortalité par cause spécifique dans la population de la République islamique d'Iran : validation de la méthode de Murray

Résumé

Contexte : Les faits d'état civil sont enregistrés dans seulement 25 % des pays à revenu intermédiaire.

Objectifs : Estimer le nombre de décès prévus dans la population et leurs causes, en exploitant les données des hôpitaux sur la mortalité et en les comparant avec celles du ministère de la Santé et de l'Éducation médicale et du Bureau d'état civil de Téhéran (République islamique d'Iran).

Méthodes : Les données relatives à la mortalité hospitalière pour la période 2011-2015 ont été extraites, puis corrigées d'un point de vue qualitatif par rapport aux dossiers médicaux. En utilisant la méthode proposée par Murray, une estimation de la mortalité prévue a été obtenue selon la cause du décès.

Résultats : Entre 2011 et 2015, 12 704 décès ont été enregistrés à l'hôpital, et la méthode de Murray a permis d'estimer 28 768 décès pour la population complète. La cause de décès la plus fréquente était la cardiopathie ischémique. Les résultats ont été comparés aux données du ministère de la Santé et de l'Éducation médicale et du Bureau d'état civil, qui montraient des taux d'erreur relative respectifs de 6,9 % et –13,5 %. Les taux de mortalité enregistrés par le Bureau d'état civil étaient supérieurs à ceux estimés par la présente étude. Les taux de

WHO EMRO | Estimating population cause-specific mortality fractions in the Islamic Republic of Iran: val

mortalité enregistrés par le ministère de la Santé et de l’Éducation médicale étaient inférieurs à ceux de la présente étude.

Conclusions : Compte tenu de l’importance de l’enregistrement des décès, des méthodes alternatives, efficaces et économiques, sont requises pour estimer le nombre de décès et leurs causes au sein d’une population.

تقدير الأرقام الكسرية للوفيات التي تُعزَى لأسبابٍ محددة في جمهورية
إيران الإسلامية : التحقق باستخدام طريقة موراي

عباس عليبور، سهيلة خودا كريم، آردشير خسروي، أمين عطائي

الخلاصة

: تُسجَّل المعلومات الحيوية في 25% من البلدان المتوسطة الدخل الخلفية.

: هدفت الدراسة إلى تقدير عدد الوفيات المتوقعة بين السكان وأسبابها، باستخدامالأهداف
بيانات الوفيات الواردة من المستشفيات ومقارنتها ببيانات وزارة الصحة ومكتب تسجيل
الأحوال المدنية في طهران، جمهورية إيران الإسلامية .

: استُخرجت بيانات الوفيات الخاصة بالمستشفيات للفترة بين عامي 2011-2015 ،طرق البحث
وصُحِّحت من الناحية النوعية بالرجوع إلى السجلات الطبية . وقُدر عدد الوفيات المتوقع،
استناداً إلى أسباب الوفاة، باستخدام طريقة موراي .

: في الفترة بين عامي 2011-2015 ، سُجلت 12704 وفيات في المستشفى، وقدرت طريقةالنتائ ج
موراي الوفيات بحوالي 28768 حالة وفاة على مستوى السكان جميعاً . وكان أكثر الأسباب
الشائعة للوفاة هي الإصابة بداء القلب الإقفاري . وقورنت النتائج بالبيانات الخاصة
بوزارة الصحة ومكتب تسجيل الأحوال المدنية، بخطأ نسبي بمقدار 6.9% و13.5-% على
التوالي . وكانت معدلات الوفيات المُسجلة لدى مكتب التسجيلات المدنية أعلى من تلك
المُقدرة في هذه الدراسة . بينما كانت معدلات الوفيات المُسجلة لدى وزارة الصحة أقل من
تلك المُقدرة في هذه الدراسة .

: بالنظر إلى أهمية تسجيل الوفيات، يلزم استخدام طرق بديلة فعالة ومنخفضةالاستنتاجات

8 / 10

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