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2014 Global geographic analysis of mortality from ischaemic heart disease by country, age and income: Statistics from World Health Organisation and United Nations



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ABSTRACT

Background: Ischaemic heart disease (IHD) is the leading cause of death worldwide and its prevention is a public health priority.

Method: We analysed worldwide IHD mortality data from the World Health Organisation as of February 2014 by country, age and income. Age-standardised mortality rates by country were calculated. We constructed a cartogram which is an algorithmically transformed world map that conveys numbers of deaths in the form of spatial area.

Results: Of the countries that provided mortality data, Russia, the United States of America and Ukraine contributed the largest numbers of deaths. India and China were estimated to have even larger numbers of deaths. Death rates from IHD increase rapidly with age. Crude mortality rates appear to be stable whilst age-standardised mortality rates are falling. Over half of the world's countries (113/216) have provided IHD mortality data for 2008 or later. Of these, 13 countries provided data in 2012. No countries have yet provided 2013 data. Of the 103 remaining countries, 24 provided data in 2007 or earlier, and 79 have never provided data in the ICD9 or ICD10 format.

Conclusions: In the countries for which there are good longitudinal data, predominantly European countries, recent years have shown a continuing decline in age-standardised IHD mortality. However, the progressive aging of populations has kept crude IHD mortality high. It is not known whether the pattern is consistent globally because many countries have not provided regular annual data including wealthy countries such as the United Arab Emirates and large countries such as India and China.

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1. Introduction

Ischaemic heart disease (IHD) is the single leading cause of death worldwide, accounting for 11.2% of all deaths globally in 2011 [1], the last year for which a reliable estimate is available. Our group has previously studied the global epidemiology of IHD from 1995 to 2009 [2]. In this paper we provide an update, reporting on the burden of IHD worldwide from 2001 to 2012 using mortality data collected by the World Health Organisation (WHO). We present IHD mortality by country, age and income category.

Our update also provides a geographical analysis of IHD mortality [3] using a cartogram, a world map in which the area of each country is algorithmically transformed so that it is proportional to a measured variable for that country, in this case, number of deaths. The value of cartograms over and above typical map display is that it illustrates the

spatial representation of a variable of interest whilst retaining the semblance of a world map.

Analysing the emerging global pattern of IHD mortality at regular time intervals is necessary to inform and update public health strategy. Collection of raw mortality data categorised by cause of death is integral to this, but limited raw data seem to be available even from countries whose resource position might be expected to permit an exemplary role in the promptness and completeness of data collection and disclosure. Public health bodies such as the WHO and the Institute for Health Metrics and Evaluation (IHME) therefore use sophisticated methods to provide estimates [4,5]. The disadvantage of estimation is the inevitable introduction of some degree of error [6]. In this paper, we highlight countries with limited available data.

2. Methods

2.1. Data sources

IHD mortality and population data were extracted from the online WHO mortality database. This comprises all deaths registered by national civil registration systems

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submitted to the WHO, with underlying cause of death coded by the relevant national authority using the International Statistical Classification of Diseases and Related Health Problems (ICD) 9th and 10th revisions[7]. Gross national income per capita was extracted from the National Accounts Main Aggregates Database from the United Nations Statistics Division [8]. Countries were categorised into high (greater than US \$12,275), upper middle (\$3976 to \$12,275 inclusive), lower middle (\$1006 to \$3975 inclusive) and low (less than \$1006) income countries based on World Bank Income Grouping [9].

2.2. Directly standardised mortality rates

IHD deaths for countries with available age-specific data were standardised to the WHO world standard population [10] to allow direct comparison of IHD mortality rates between countries. Standardised mortality rates were calculated using deaths reported within 5-year age groups. The small numbers of deaths in the "unspecified" age group were discounted in this analysis.

2.3. Cartogram

A cartogram was designed to illustrate the worldwide distribution of IHD deaths using 2010 estimates of IHD deaths from the IHME [11]. The area for each country is algorithmically transformed so that it is proportional to the number of deaths from IHD in each country. After transforming the area to represent number of deaths (the first variable of interest), we use gradations of colour to represent standardised mortality ratio (the second variable of interest) with darker shades of red representing countries with higher standardised mortality ratios.

The cartogram was generated using ScapeToad-v11 and R (Version 3.0, R Foundation) with the following packages: shapefiles, rgdal, RColorBrewer and classInt.

Data analysis was carried out using a custom Python script (Python 2.7.6 with Pandas 0.12.0).

Table 1

Global	burden	of IHD	deaths.	Ranked	by country	/ burc	len.
Data fi	om the	World	Health	Organisa	tion 2010.		

3. Results

3.1. Burden of IHD worldwide in 2010

Table 1 shows the burden of IHD deaths in 2010 in countries for which data were available. Of these 71 countries, Russia, the United States of America and Ukraine account for the largest numbers of deaths. Startlingly, Ukraine had almost as many deaths as the United States of America yet the United States of America's population is over 6 times larger than that of Ukraine.

The global distribution of deaths from IHD has been estimated for the majority of countries in 2010. This is illustrated in Fig. 1 in the form of a map where country area has been transformed to provide a visual representation of the numbers of deaths: larger country areas indicate larger numbers of deaths. The five countries with the greatest numbers of estimated deaths are India, China, Russia, the United States of America and Ukraine in descending order. The darker shaded areas indicate higher standardised mortality ratios. The five with the highest rates are Turkmenistan, Ukraine, Belarus, Uzbekistan and Kazakhstan in descending order.

3.2. Impact of age on IHD mortality

Fig. 2a–d shows the large increase in mortality in each sex in the 4 countries selected (Ukraine, Russia, the United Kingdom and Japan)

High income			Upper middle income			Lower middle income			Low income		
Rank	Country	Number	Rank	Country	Number	Rank	Country	Number	Rank	Country	Number
1	United States of America	379,709	1	Russia	597,921	1	Ukraine	314,672	1	Kyrgyzstan	10,874
2	Germany	133,126	2	Brazil	99,955	2	Moldova	16,566			
3	United Kingdom	80,568	3	Mexico	69,082	3	Egypt	14,213			
4	Japan	77,217	4	Romania	53,297	4	Armenia	8212			
5	Italy	72,498	5	Poland	45,832	5	Georgia	3202			
6	France	35,531	6	Hungary	33,842	6	Paraguay	2404			
7	Spain	35,268	7	Kazakhstan	19,431	7	Nicaragua	2264			
8	Czech Republic	25,178	8	Argentina	19,428						
9	Australia	21,718	9	Cuba	16,630						
10	Slovakia	16,944	10	Lithuania	15,112						
11	Sweden	15,012	11	Bulgaria	13,330						
12	Austria	14,941	12	Serbia	12,082						
13	Republic of Korea	13,336	13	Latvia	8591						
14	Finland	11,767	14	Dominican Republic	4681						
15	Greece	11,332	15	Peru	4580						
16	Croatia	11,264	16	Costa Rica	2578						
17	Netherlands	10,382	17	Ecuador	1994						
18	Belgium	9310	18	TFYR Macedonia	1752						
19	Switzerland	8314	19	Mauritius	1067						
20	Portugal	7504	20	Saint Vincent and Grenadines	105						
21	Norway	5206	21	Maldives	88						
22	Denmark	5091	22	Grenada	83						
23	Hong Kong SAR	4643	23	Dominica	37						
24	Ireland	4625	24	Montserrat	10						
25	Estonia	4323									
26	Israel	4299									
27	Puerto Rico	3207									
28	Singapore	3076									
29	Slovenia	2051									
30	Kuwait	1195									
31	Malta	646									
32	Cyprus	620									
33	Luxembourg	315									
34	Oman	314									
35	Brunei Darussalam	137									
36	Qatar	129									
37	Aruba	49									
38	Saint Kitts and Nevis	25									
39	Anguilla	4									

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