INTRODUCTION

The global burden of cardiovascular disease (CVD) has been increasing over time. At the beginning of the 20th century, CVD accounted for <10% of all deaths worldwide.¹ By the start of the 21st century, it was responsible for approximately 30% of all deaths globally.¹⁻⁴ Cardiovascular diseases have been the leading cause of death in high-income countries for the past 6 decades but are fast becoming the leading cause of death in low- and middle-income countries.⁵ It is estimated that 80% of all CVD deaths occur in low- and middle-income countries. This rapid increase in CVD deaths is coupled with the continuing and significant risk of death from infectious diseases in these countries, in what global and regional experts refer to as a double burden of infectious and chronic diseases.²⁻⁵

In Ghana, CVD is one of the top two causes of death after diarrheal diseases.⁶ In Accra, CVD rose from being the seventh and tenth cause of death in 1953 and 1966 respectively, to the number one cause of death in 1991 and 2001 and it has continued as the major cause of mortality in the country since then.⁷⁻⁸ Despite this increase in deaths from CVD and other chronic non-communicable diseases (NCDs), Ghana has no national policy to deal with this public health issue, and no effective surveillance system is in place to monitor CVD mortality. The dominant assumption among lay communities and experts in Ghana is that CVD is rare and does not pose a serious public health challenge.⁹ Furthermore, Ghana’s health system lacks the optimal resources to address the double burden of NCDs and acute communicable diseases.⁵

Epidemiologic surveillance has been seen as very important in monitoring the burden of diseases in the population.⁹ Although population-based data is mostly suitable for such surveillance because it represents the burden of CVD in a particular country, such data rarely exist in many countries in sub-Saharan Africa. In Ghana, the opportunities provided by the establishment of demographic and surveillance systems in 3 ecological zones of the country (Navrongo, Kintampo and Dodowa) to obtain such data have not been fully exploited.¹⁰⁻¹² However, in the absence of this kind of data, hospital records have been seen as one way of monitoring CVD mortality.⁹ Monitoring the pattern of a particular disease for appropriate dissemination is a process that involves ongoing systematic collection, analysis and interpretation of the data. The development of effective interventions for the disease can be compromised in the absence of monitoring.

There are more than 30 years of medical records characterizing mortality cases at the Korle Bu Teaching Hospital (KBTH), in Ghana’s capital, Accra. However, there has been no systematic analysis and interpretation of these data. Without analysis and interpretation of these data, no effective policies can be put in place to address the disease morbidity and mortality in this region. Our study intends to fill this gap by
analyzing and interpreting the causes of death from CVD, using autopsy cases from Korle Bu Teaching Hospital (KBTH) from 2006 to 2010. Our aim was to provide data to inform effective primary, secondary and tertiary interventions. Specifically, our study examined patterns in the proportionate mortality ratio (PMR) of CVD by age and sex for the 5 years under review.

METHODS

Study Area

Ghana is a middle income country located on the west coast of Africa. The capital is Accra, which is situated in the Greater Accra region of the country. At the most recent national census in 2010, Accra had a population of 2,291,352. The Ga ethnic group is the indigenous population of Accra, however the city is multi-ethnic and multi-cultural. Economic activities in Accra are financial, agriculture, fishing, and manufacturing of processed foods, lumber and plywood, textiles, clothing and chemicals. The cost of living in Accra is very high compared to other places in the country and the city includes residents with varying socioeconomic status. Korle Bu Teaching Hospital, which is the premier health care facility in Ghana, is located in Accra. It is a tertiary institution that serves people from both inside and outside the country.

Source of Data

All cardiovascular deaths diagnosed at autopsy in the 5-year period from the beginning of January 2006 to the end of December 2010 were retrieved from the autopsy logbooks of the department of pathology, Korle Bu Teaching Hospital. During this period, all autopsies performed by pathologists in the mortuary of the Korle Bu Teaching Hospital were documented. The sources of deaths included all deaths that occurred inside and outside the hospital. About 77% of autopsies came from outside the hospital as it is a legal requirement in Ghana that any person who has not been admitted to the hospital 24 hours prior to death needs an autopsy for a cause of death to be established. The causes of deaths were coded based on consensus by two or more pathologists. The medical history and clinical diagnosis before death were unavailable. Cardiovascular deaths as classified by the pathologists referred to deaths resulting from congestive heart failure, myocardial infarction, coronary heart disease, pulmonary heart disease, stroke, congenital heart disease, rheumatic heart disease and hypertensive heart disease.

Method of Data Entry

The coding frame generated captured the following information: the date of the autopsy, case identification number, patient’s name, age, sex and source of death (inside or outside the hospital), causes of death and the name of pathologist(s) who performed the autopsy. The data were entered using Statistical Package for the Social Sciences (SPSS) 16.0, (SPSS Inc. Chicago, United States). The coding frame captured multiple causes of death, from the underlying cause to the immediate cause of death. The multiple causes were entered in sequence, depending on the number of contributing causes. For our study, the immediate cause of death was the primary focus as key to precipitating the event.

Methods of Analysis

Our study used descriptive statistics to summarize continuous variables and cross-tabulations to show the variation between categorical variables. Chi-square tests were also used to examine the association between CVD mortality and sex. The PMR, which is a measure of the proportion of deaths caused by a particular disease, was calculated by dividing the number of cardiovascular disease deaths by total deaths at KBTH in each year and multiplied by 100.

RESULTS

Number of Deaths

Table 1 shows the number of autopsy cases at KBTH from 2006 to 2010. A total of 20,706 autopsy cases were recorded at the hospital within the five-year period. The data show that the number of autopsy cases at Korle-Bu teaching hospital decreased from 2006 through to the year 2010. Some of the autopsy cases were not used in our analysis due to missing information. Generally, within the five-year period, more than 90% of the autopsy cases had complete data, therefore, the number of valid cases we used for analysis was 19,289 (93.2% of the total) giving a
The proportionate mortality ratio of CVD at KBTH fluctuated between 20% and 24% during the five-year study period.

Table 2. Mean age for all causes and CVD mortality at KBTH, 2006–2010, mean (SD)

<table>
<thead>
<tr>
<th>Year</th>
<th>All Causes</th>
<th>CVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>43.0 (20.9)</td>
<td>51.5 (20.4)</td>
</tr>
<tr>
<td>2007</td>
<td>42.5 (20.6)</td>
<td>50.1 (19.9)</td>
</tr>
<tr>
<td>2008</td>
<td>41.5 (21.1)</td>
<td>50.8 (19.6)</td>
</tr>
<tr>
<td>2009</td>
<td>42.0 (21.3)</td>
<td>50.2 (19.8)</td>
</tr>
<tr>
<td>2010</td>
<td>42.2 (20.7)</td>
<td>49.4 (20.1)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>42.3 (20.9)</td>
<td>50.3 (20.0)</td>
</tr>
</tbody>
</table>

Table 3. Sex distribution of all deaths at KBTH, 2006–2010, n (%) |

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>3151 (61.9)</td>
<td>1940 (38.1)</td>
</tr>
<tr>
<td>2007</td>
<td>2583 (59.8)</td>
<td>1736 (40.2)</td>
</tr>
<tr>
<td>2008</td>
<td>2330 (61.2)</td>
<td>1478 (38.8)</td>
</tr>
<tr>
<td>2009</td>
<td>2047 (59.5)</td>
<td>1393 (40.5)</td>
</tr>
<tr>
<td>2010</td>
<td>1573 (59.8)</td>
<td>1058 (40.2)</td>
</tr>
<tr>
<td>TOTAL</td>
<td>11684 (60.6)</td>
<td>7605 (39.4)</td>
</tr>
</tbody>
</table>

Table 4. Proportionate mortality ratio of CVD with RHD, KBTH, 2006–2010

<table>
<thead>
<tr>
<th>Year</th>
<th>CVD</th>
<th>Total Deaths</th>
<th>PMR of CVD</th>
</tr>
</thead>
<tbody>
<tr>
<td>2006</td>
<td>1019</td>
<td>5091</td>
<td>20.0</td>
</tr>
<tr>
<td>2007</td>
<td>1035</td>
<td>4319</td>
<td>24.0</td>
</tr>
<tr>
<td>2008</td>
<td>768</td>
<td>3808</td>
<td>20.2</td>
</tr>
<tr>
<td>2009</td>
<td>841</td>
<td>3440</td>
<td>24.4</td>
</tr>
<tr>
<td>2010</td>
<td>621</td>
<td>2631</td>
<td>23.6</td>
</tr>
<tr>
<td>Total</td>
<td>4284</td>
<td>19289</td>
<td>22.2</td>
</tr>
</tbody>
</table>

Proportionate Mortality Ratio of CVD

Our results showed that cardiovascular disease accounted for more than one-fifth (22.2%) of the causes of death examined at Korle-Bu Teaching Hospital from 2006 to 2010 (Table 2). The highest proportion of CVD deaths occurred in 2009 (24.4%) and the lowest occurred in 2006 (20.0%). The total mean age of CVD mortality for the 5-year period is 50.3 years (SD = 20.0) (Table 2). Also, for each of the five years under review, PMR for CVD deaths significantly increased from young age (15–24 years) with a steep rise in the middle ages to peak in the very old, accounting for almost 50% of deaths examined by age 85 years (Figure 1). Also, of interest is the steep rise in the mortality between 25 and 65 years.

DISCUSSION

The proportionate mortality ratio of CVD at KBTH fluctuated between 20% and 24% during the five-year study period. Although studies have shown that approximately 30% of deaths worldwide are due to CVD, our study shows a lower proportion within the five year period. One plausible explanation why our study shows a lower proportion may be because the data we used were hospital-based. Another reason may be because the proportion of CVD deaths in Ghana may be lower than that of the global estimates, which are weighted based on worldwide data; the proportion of CVD mortality in some countries may be very high.

In view of this, The age pattern of CVD also, studies at KBTH, 2006–2010, and the trends seen in the age-pattern of CVD mortality is actually changing because the age at which people die of the disease is declining. In view of this, caution should be taken to include youth in primary prevention of cardiovascular disease as current data from some countries show a rising burden of the disease among children and adolescents in Ghana.16–18 The age pattern of CVD mortality shown in our study is similar to that shown by Ogeng et al in Kenya indicating an increase in cardiovascular disease mortality between ages 40–60 years. Generally, the age of CVD death is lower in sub-Saharan Africa compared to developed countries.19

On the other hand, the pattern in the United States shows that cardiovascular disease mortality generally occurs at a later age (≥65 years). This may suggest that deaths from cardiovascular disease occur at lower ages in low- and middle-income countries compared to high income countries. Although cardiovascular disease is a threat to both developed and developing countries, it seems the burden of the disease is mostly borne by the developing countries due to many factors ranging from their poor health system to their poverty status.5,13,20
In our study, a higher proportion of CVD deaths occurred among the males within the five-year period. This supports the estimated disease burden for sub-Saharan Africa of a larger proportion of CVD deaths occurring among males. Our results are also consistent with the Framingham study in which men were seen to be at higher risk of CVD compared to women. On the other hand, some studies have shown that CVD is an equal opportunity attacker, striking people from different demographic and socioeconomic characteristics with women disproportionately affected. Several explanations have been given for this. One explanation is that women fail to recognize symptoms related to CVD and they do not get immediate treatment as compared to men. And even when diagnosed, they do not adhere to medications as men do. In addition, some studies have shown that the signs of CVD vary (eg, nausea, vomiting, tightness) and may be more difficult to recognize. Further, particularly in Ghana or Africa in general, females with less autonomy may be less likely to seek hospital attention as the decision to go to the hospital may rest with the husband.

Study Limitations
Hospital admissions are usually selective in relation to personal characteristics, severity of disease, associated conditions and admission policies that vary from hospital to hospital and our data likely suffered from these issues. However, KBTH as a large tertiary hospital receives referral cases from all over the country and could be said to see the most severe cases. Another limitation was that deaths were recorded at KBTH with only age and sex; other demographic data (eg, income status, level of education, occupation, religion) were not available. And since there are variations in diagnostic quality of the hospital records, physicians and clinical services, comparability of results to other hospitals may be difficult. Also, as a hospital-based study, our observations may not be representative of all cases of CVD occurring in Accra or Ghana. Finally, in terms of the clinical and pathological diagnosis, we only analyzed deaths that were recorded at first diagnosis (immediate causes of death) and did not do a detailed analysis of the secondary causes.

Conclusions
The patterns of CVD mortality shown in our study provide a fair idea of the burden of CVD in Ghana, although it is not population-based data. The age pattern of the disease showed an increase in the disease mortality among middle-aged groups, which calls for public health attention.

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REFERENCES

AUTHOR CONTRIBUTIONS
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Manuscript draft: Sanuade, Anarfi, Aikins, Koram
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Administrative: Sanuade, Anarfi, Aikins, Koram
Supervision: Sanuade, Aikins, Koram