Patterns of Cardiovascular Disease Mortality in Ghana: A 5-year Review of Autopsy cases at Korle-Bu Teaching Hospital

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Abstract

This study examined patterns of cardiovascular disease (CVD) mortality among autopsy cases at the Korle Bu Teaching Hospital (KBTH) in Accra, Ghana. All cardiovascular deaths diagnosed at autopsy during the 5-year period beginning January 2006 and ending December 2010 noted in the autopsy logbooks of the Department of Pathology, KBTH, were analyzed for the study. A total of 19,289 complete autopsy cases were used in the analysis. The results show that CVD constituted about one-fifth (22.5%) of all causes of deaths at KBTH within the 5-year period. Also, the proportionate mortality ratio (PMR) for CVD increased with age, rising steeply in the mid-life to peak in the very old, accounting for almost 50% of deaths examined by age 85 years. Further studies on the risk factors of CVD are important for reducing the burden of the disease in Ghana.

Keywords: Cardiovascular disease, mortality, autopsy, Ghana**.**

INTRODUCTION

The global burden of cardiovascular disease (CVD) has been increasing overtime. At the beginning of the 20th century, CVD accounted for less than 10 percent of all deaths worldwide. By the start of the 21st century, it was responsible for about 30 percent of all deaths globally with more than 80 percent of those occurring in low- and middle- income countries.[1] Cardiovascular disease have been the leading cause of death in high income countries for the past 6 decades but now are fast becoming the leading cause of death 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, thereby causing this part of the world to experience a double burden of infectious and chronic diseases.[2]

In Ghana, CVD is one of the top two causes of death after diarrhoeal diseases.[3] 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.[4] Despite this increase in deaths from CVD and other 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 challenges.[2] Furthermore, Ghana's health system is weak in terms of finances and human resources, and it struggles to address the double burden of NCDs and acute communicable diseases.[2]

Epidemiologic surveillance has been seen as very important in monitoring the burden of diseases in the population.[5]Although population-based data is mostly suitable for such surveillance because it gives a representativeness of the burden of CVD in a particular country

but such data rarely exist in many countries in sub-Saharan Africa. In Ghana, the opportunities provided by the establishment of Demographic and Surveillance Systems (DSS) in 3 ecological zones of the country (Navrongo, Kintampo and Dodowa) to obtain such data have not been fully exploited.[6, 7, 8] However, in the absence of this kind of data, hospital records have been seen as one of the ways of monitoring CVD mortality.[5] Monitoring the pattern of a particular disease for appropriate dissemination is a range of process which involves ongoing systematic collection, analysis and interpretation of the data. Without the completion of these processes, developing effective intervention for the disease seems impossible.

There are more than 30 years records of 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. This study intends to fill this gap by analysing and interpreting the causes of death from CVD, using autopsy cases from Korle Bu Teaching Hospital (KBTH) from 2006 to 2010. The aim was to provide data to inform effective primary, secondary and tertiary interventions. Specifically, this study examined the pattern of mortality from all causes among autopsy cases at KBTH within the 5-year period, and; describes the pattern in the proportionate mortality ratio (PMR) of CVD 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. Ghana is bordered by Burkina Faso

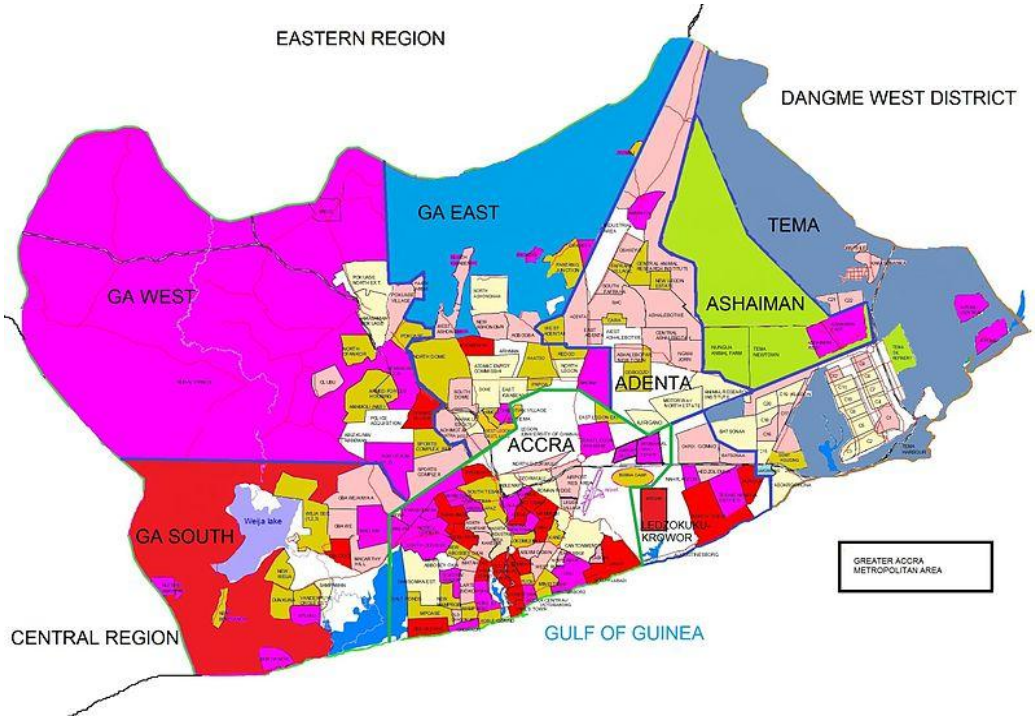
to the north, Togo to the east, Cote D'ivoire to the west and the Atlantic Ocean to south (Figure 1).

Figure 1 Map of Ghana Showing Greater Accra Region and Accra City

Accra has a population of approximately 4,000,000 and has been the capital of Ghana since 1877. It is located at 5°30' North, 0°10' West, and it is the largest city and the administrative, and the economic center in Ghana (Figure 2). It is seen as a melting point of several Ghanaians and other foreign cultures and home to virtually anyone who identifies himself or herself with the city. Although it is the bottom-line of traditional Ga heritage, the population is currently filled with people from all walks of life. 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. The city is made of people with different socio-economic status. Korle Bu Teaching Hospital, which

is the premier health care facility in Ghana, is located in Accra. It is a tertiary institution which serves people from all around the country and outside the country.

Figure 2 Map of Greater Accra



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 of Korle Bu Teaching Hospital. During this period, all autopsies performed in the mortuary of the Korle Bu Teaching Hospital were documented. Autopsies were performed at the pathology department on an unselected basis on all consecutive patients from the hospital wards and more than 70% of the dead bodies were brought by the police. The majority of these were medico-legal cases, that is, autopsies were performed either for legal or

medical purposes. The medical history and clinical diagnosis before death were, for most of the patients, unavailable.

Method of Data Entry

The coding frame generated captured the following information: the date when the autopsy was done, case identification number, name of patients, age, sex, locality, sources of deaths, causes of death and the name of pathologist who performed the autopsy. The sources of deaths in this analysis refer to the institutional body that brought the cases for autopsy to be done at KBTH. While some were brought directly from the wards within the hospital, some were also brought from outside the hospital but with reports from the police (and this basically represents deaths outside the wards). The data were entered using Statistical Package for the Social Sciences (SPSS) 16.0, which was developed by the 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 this study, the immediate cause of death was the primary focus as the key to precipitating the event.

Methods of Analysis

This study used descriptive statistics like median age to summarize the age pattern of CVD and Pearson's Chi-Square to show the association between CVD mortality and the patients' age groupings, sex and locality. Odds ratio, with a 95% confidence interval (95% CI) was also used to show the likelihood of the occurrence of CVD mortality between different patient groupings. The proportionate mortality ratio (PMR), which is a measure of the proportion of deaths caused by a particular disease, was calculated by dividing the number of cardiovascular disease by total deaths at KBTH in each year and multiplied by 100. That is:

$$\text{PMR} = \frac{\text{Number of deaths due to cardiovascular disease}}{\text{Total number of autopsy cases}} * 100$$

RESULTS

Number of deaths

Table 1 shows the number of autopsy cases and the completeness of the records at KBTH from 2006 to 2010. A total of 20,706 autopsy cases were recorded at the hospital within the five-year period. The table shows that the number of autopsy cases at Korle-Bu teaching hospital is seen to be significantly decreasing from 2006 through to the year 2010. Furthermore, some of the autopsy cases were not used in the analysis because some information like age, sex, locality or cause of death were not available and so such cases were not included in the analysis. Generally, more than 90% of the autopsy cases were complete within the five-year period. Therefore, the number of valid cases that was used for analysis in the course of the study was 19,289 (93.2% of the total) giving a yearly of 3858 cases.

Table 1: Number of Autopsy Cases at KBTH (2006 – 2010)

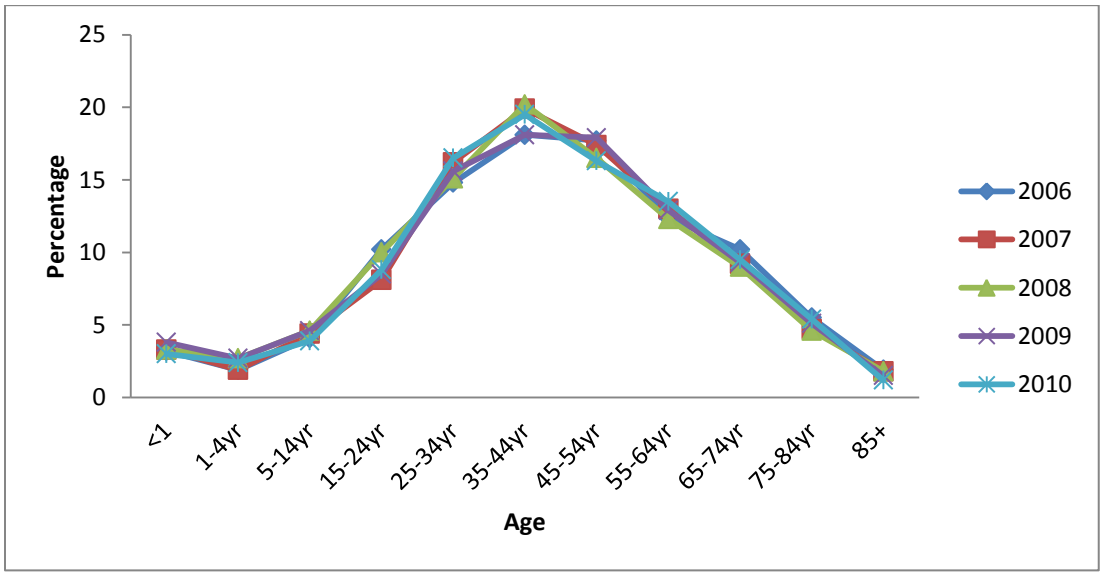
Year	Number of deaths	Missing cases	% missing	Valid cases	% Valid
2006	5450	359	6.4	5091	93.4
2007	4637	318	6.9	4319	93.1
2008	3942	134	3.4	3808	96.6
2009	3770	330	8.8	3440	91.2
2010	2907	276	9.5	2631	90.5
Total	**20706**	**1417**	**6.8**	**19289**	**93.2**

Source: **Computed from autopsy records from the KBTH 2006-2010**

Age and Sex Pattern of Mortality

The results showed that the median age at death for the 5-year period ranged between 41 and 43 years, with the highest occurring in 2006 and the lowest in 2008 (Figure 3). The median age at death for 2007, 2009 and 2010 were the same (42 years). The median age at death among males within the five-year period ranged from 42 years to 44 years while that of females ranged from 39 years to 40 years. The results further showed that the proportion of infant deaths within these periods was higher than the proportion of child deaths. However, the highest proportion of infant and child mortality was recorded in 2008. Also, the figure shows that mortality within these periods picked up after age four and plateaued at ages 35-44 years before it started to decline till ages 85 years.

Figure 3 Age patterns of Mortality at KBTH (2006 to 2010)



Also, about six out of ten deaths at KBTH occurred in the male population (Table 2).The results also showed that the male-female ratio of mortality within this period is 1.5:1.

Table 2: Sex distribution of mortality at KBTH

	Sex		
Year	**Male**	**Female**	**Total**
2006	3164 (62.1%)	1927 (37.9%)	5091 (100.0%)
2007	2590 (60.0%)	1729 (40.0%)	4319 (100.0%)
2008	2267 (61.1%)	1441 (38.9%)	3708 (100.0%)
2009	2057 (59.8%)	1383 (40.2%)	3440 (100.0%)
2010	1575 (59.9%)	1056 (40.1%)	2631 (100.0%)
Total	**11653 (60.7%)**	**7536 (39.3%)**	**19189 (100.0%)**

Source: **Computed from autopsy records from the KBTH 2006-2010**.

Sources of deaths

More than seven out of ten autopsy cases at KBTH from 2006 to 2010 were from outside the hospital. The proportions of deaths brought from the wards at KBTH increased within the 5-year period except between 2007 and 2008. Out of the 11437 cases brought by the Police, more than half of the deaths examined at KBTH from 2007 to 2010 were from the nearby Korle Bu Police Station. The remaining cases were brought in from the outlying police stations in the city, indicating that most of the autopsy cases within the five-year under review were likely to be residents of the Greater Accra Region.

Proportionate Mortality Ratio (PMR) of CVD

The 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 3).

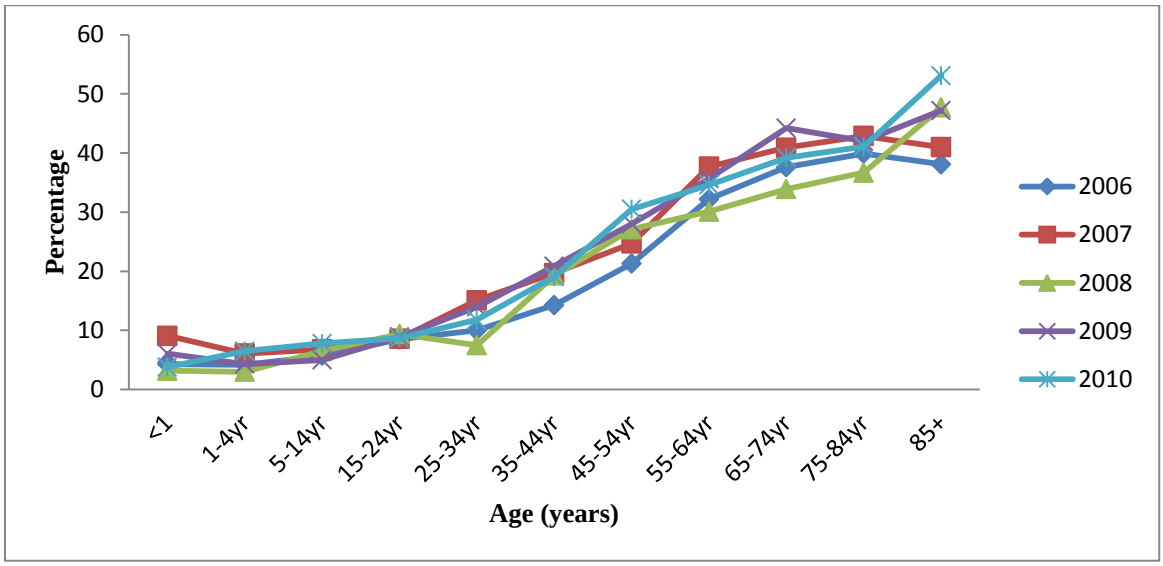
Table 3: Proportionate Mortality Ratio (PMR) of CVD

Year	Number of Deaths		PMR of CVD
	CVD	Total Deaths	
2006	1019	5091	20.0
2007	1035	4319	24.0
2008	768	3808	20.2
2009	841	3440	24.4
2010	621	2631	23.6
Total	**4284**	**19289**	**22.2**

Source: **Computed from autopsy records from the KBTH 2006-2010**.

Also, for each of the five years under review, PMR for CVD 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 4). Also, of interest is the steep rise in the mortality between 25 and 65 years when there was some appearance of plateauing thereafter. For the five years under review, the PMR of CVD significantly increased in each of the age groups as the proportions of deaths from other diseases reduced at each age group.

Figure 4 Age Pattern of Proportionate Mortality Ratios of CVD (2006 to 2010)



CVD mortality was higher among the males compared to females for the five-year period. In general, about three out five cases (57.2%) of CVD mortality from 2006 to 2010 occurred among males indicating a male-female ratio of 1.7: 1. This pattern was also similar to the overall mortality at KBTH which shows a male-female mortality ratio of 1.5: 1. We further analysed the patterns of CVD prevalence and sex by determining the likelihood of excess CVD mortality by sex for each of the 5 year (Table 4). For the five year period, females were approximately 18% more likely to have died from CVD compared to males [OR (95% CI = 1.18(1.01-1.38)] (Table 4). The highest OR of death from CVD (females compared to males) was in 2006 [OR = 1.23 (1.11-1.47), while the lowest occurred in 2008 [OR= 1.02 (0.864-1.200)]. Generally, females were more likely to die from CVD compared to males within the five-year period, although the association was not significant in 2008 and 2010.

Table 4: Cardiovascular Disease' Mortality by Sex (2006 – 2010)

Year	Sex		Odds Ratio (95% CI)	P-Value
	Female	Male		
	N (%)	N (%)		
2006	434 (42.6%)	585 (57.4%)	1.279 (1.111-1.472)	0.048
2007	453 (43.8%)	582 (56.2%)	1.225 (1.062-1.411)	0.005
2008	305 (39.7%)	463 (60.3%)	1.018 (0.864-1.200)	0.830
2009	376 (44.7%)	465 (55.3%)	1.278 (1.089-1.494)	0.003
2010	260 (41.8%)	361 (58.2%)	1.098 (0.907-1.310)	0.358
Total	**2456 (57.2%)**	**1827 (42.8%)**	**1.180 (1.007-1.377)**	**0.021**

Source: **Computed from autopsy records from the KBTH 2006-2010**

DISCUSSION

From the standpoint of studying disease occurrence, expressing mortality in quantitative terms can pinpoint differences in the risk of dying from a disease in a population.[5] The main objective of this study was to examine the patterns of cardiovascular disease (CVD) at Korle Bu Teaching Hospital (KBTH) from 2006 to 2010. The findings showed that mortality within this period picked up after age four and plateaued at ages 35-44 years before declining through 85years. It is important to note that the age pattern of mortality shown in this study does not follow the normal U-shaped pattern of mortality pattern in a population. This is because with respect to age, normal mortality rates start at a high level at birth, fall rapidly to a minimum at about age 10 and thereafter increase throughout life. A plausible reason for the pattern shown in this study may be because of the under-representation of autopsy cases in the population. Also, it is commonly

known that many families in Ghana refuse autopsies and are solely interested in obtaining death certificates. This cultural practice may reduce the number of bodies brought to the hospital for the autopsy and therefore skew the mortality pattern.

In terms of the sex pattern of mortality among the autopsy cases at KBTH, a higher proportion of deaths occurred among males within this period. In essence, the male-female ratio of mortality was 1.5: 1. The pattern of mortality is different from the estimates for sub-Saharan Africa in the Burden of Disease (BOD) and the Global Burden of Disease Study (GBDS).[9, 10] A higher proportion of the autopsy cases were requested from the nearby Korle Bu Police Station most probably because it was the one nearest the hospital and therefore the first point of call for cases that needed to be processed through the medico legal system.

Furthermore, the PMR of CVD at KBTH fluctuated between 20 and 24 percent over the five years under review. The fluctuations in CVD mortality may be because the exposure to the risk factors of CVD in some time in the past is different from year to year within this period. In view of this, the highest PMR (24.4%) which occurred in 2009 may probably be due to higher previous exposure to risk factors in some time in the past. This plausible explanation is based on the premise of health risk transition, which assumes that the changes in the patterns of mortality may not be because of the changes in time but due to the changes in the risk factors.[13] Finally, the fluctuations in the CVD mortality may be a function of the total number of autopsies conducted in each year.

Also, a steep rise of CVD mortality at the middle ages may partly support previous evidence that 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**.**[14] In view of this, caution should be taken by not neglecting the youth in terms of primary prevention of cardiovascular disease because current data from

different countries are showing a rise in the burden of the disease among the youth.[15, 16] Also, studies are showing a decline in physical activities and high prevalence of obesity and overweight, known risk factors of CVD among children and adolescents.[17, 18, 19] The findings from this study may also imply a rise in the level of urbanization in the country which has brought about increase in sedentary lifestyles and the burden of the disease among the youth that is gradually shifting from infectious diseases to chronic non-communicable diseases like cardiovascular disease. This is similar to the study done by Ogeng et al (2011) in Kenya, which showed that cardiovascular disease mortality picks up at ages 40-60 years.

On the other hand, the pattern in the US shows that cardiovascular disease' mortality occurs at later age (65 years and over). This may in a way suggest that deaths from cardiovascular disease actually occur at lower ages in low- and middle-income countries compared to the high income countries. This may probably be because of lack of early diagnosis and treatment which gives CVD a higher fatal impact in developing countries. Also, if this disease is not managed routinely, CVD will result in younger deaths in this part of the world. Generally, 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. [2, 13-14]

Females had a higher likelihood of CVD mortality than males within this period. In other words, the burden of CVD was more on females compared to males within the five years under review. Although CVD is an 'equal opportunity attacker', striking people from different demographic and socio-economic characteristics, studies have shown that women are disproportionately affected.[15-16, 20-22] One explanation is that women fail to recognize symptoms related to CVD and they do not get immediate treatment compared to men.[23] Even when they are diagnosed, they do

not adhere to medications as men do.[24] Also, previous studies have shown that the signs of CVD are well recognized in men (left or mild chest pain) but in women, signs of CVD vary and it can be nausea, vomiting, tightness, etc. Further, in the particular context of Ghana and Africa, females with less autonomy may also be less likely to seek hospital attention because the decision to go to the hospital may rest on the husband. [25, 26]

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 is likely to suffer from similar issues. However, KBTH as a large tertiary hospital receives referral cases from all over the country and could be said to see to most severe cases. A large proportion of the autopsy cases were also brought in by the Police (indicating deaths that had occurred in the community). Another limitation was that deaths from the Pathology Department at KBTH were only recorded by age and sex while the other background characteristics like income status, level of education, occupation, religion, etc were not available. As a result, more detailed analysis could not be performed. Also, records at KBTH are not designed with research in mind but rather for patient care and this may be why the other characteristics were not available. 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, the observations made may not be representative of all cases of CVD occurring in Accra or Ghana. This is because this study used the autopsy cases at the hospital as a proxy for deaths occurring at KBTH within the period.

CONCLUSIONS

The patterns of CVD mortality shown in this study may provide a fair idea of the burden of CVD in Accra, although it is not a population-based data. Therefore, to obtain a national pattern of CVD mortality demands further studies. This may start with the collation of autopsy cases in all the major hospitals across the country, and subsequently followed by the development of a population-based surveillance system. In the interim, specific studies may be conducted exploiting the Demographic and Surveillance Systems that exist in the country.

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