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

Olutobi A. Sanuade, MPhil; John K. Anarfi, PhD; Ama de-Graft Aikins, PhD; Kwadwo A. Koram, MD, PhD

Objectives: Our study examined age and sex patterns of cardiovascular disease (CVD) mortality among autopsy cases at Korle Bu Teaching Hospital (KBTH) in Accra, Ghana from 2006 to 2010.

Design: All cardiovascular deaths diagnosed at autopsy in the 5-year period beginning January 2006 and ending December 2010 located in the autopsy logbooks of the Department of Pathology, KBTH, were analyzed for this study. A total of 20,706 autopsy cases were done at KBTH within the five year period out of which 19,289 (93.2%) were analyzed for this study. Chi-square tests were used to show the association between sex and CVD deaths.

Results: The results show that CVD constituted more than one-fifth (22.2%) of all causes of deaths from autopsy cases at KBTH within the 5-year period. The proportionate mortality ratio (PMR) for CVD increased with age, rising steeply in mid-life to peak in the very old, accounting for almost 50% of deaths examined by age 85 years. Also, the findings showed that for the five year period, males had higher proportion of CVD death compared to females (χ^2=27.284, *P*=.000).

Conclusions: In the absence of population-based data, hospital records may serve as a useful tool in epidemiologic surveillance of disease. Thus, efforts should be made at health facilities to document minimal patient characteristics such as the socioeconomic and demographic characteristics to facilitate such studies in the future. In conclusion, further studies may be needed to primarily help in formulating strategies/policies for prevention of cardiovascular disease. (*Ethn Dis.* 2014;24[1]:55–59)

Key Words: Cardiovascular Disease, Mortality, Autopsy, Ghana

From Regional Institute for Population Studies, University of Ghana (OAS, JKA, ADGA); and Noguchi Memorial Institute for Medical Research, College of Health Sciences, University of Ghana (KAK).

Address correspondence to Olutobi A. Sanuade; P.O. Box LG 96, Regional Institute for Population Studies; University of Ghana, Ghana; +233267543244; +233-302-514745 (fax); oluwatobisanuade@gmail.com

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.[2] 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.[5] 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

Editor's note: Information from this article was first presented at the Population Association of America 2013 Annual Meeting; New Orleans, LA, April 11–13, 2013: Session 126: Advances in Cause of Death Analyses (http://paa2013.princeton.edu/sessions/126).

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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.

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

KBTH, Korle Bu Teaching Hospital.

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 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

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

Year	All Causes	CVD
2006	43.0 (20.9)	51.5 (20.4)
2007	42.5 (20.6)	50.1 (19.9)
2008	41.5 (21.1)	50.8 (19.6)
2009	42.0 (21.3)	50.2 (19.8)
2010	42.2 (20.7)	49.4 (20.1)
TOTAL	42.3 (20.9)	50.3 (20.0)

KBTH, Korle Bu Teaching Hospital.

yearly average of 3858 cases. The mean age at death for all-causes mortality was 42.3 (SD=20.9) (Table 2). Also, a higher proportion of deaths occurred among males (Table 3).

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 4). 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

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

Year	Male	Female
2006	3151 (61.9)	1940 (38.1)
2007	2583 (59.8)	1736 (40.2)
2008	2330 (61.2)	1478 (38.8)
2009	2047 (59.5)	1393 (40.5)
2010	1573 (59.8)	1058 (40.2)
Total	11684 (60.6)	7605 (39.4)

KBTH, Korle Bu Teaching Hospital.

The proportionate mortality ratio of CVD at KBTH fluctuated between 20% and 24% during the five-year study period.

in each of the 5-year period, but there was some appearance of plateauing thereafter for years 2006 and 2007. 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.

Further, the total proportion of CVD mortality was significantly higher among the males compared to females for the five-year period ($\chi^2=27.284$, P=.000) (Table 5). In general, more than half (57.3%) of CVD mortality from 2006 to 2010 occurred among males indicating a male-female ratio of 1.3:1 and there was significant relationship between sex and CVD deaths in 2006, 2007 and 2009.

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,[1] 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.

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

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

PMR, proportionate mortality ratio; RHD, Rheumatic heart disease; KBTH, Korle Bu Teaching Hospital.

Also, a steep rise in CVD mortality at middle age may partly support 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.[13] 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 youth.[14,15] 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 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]

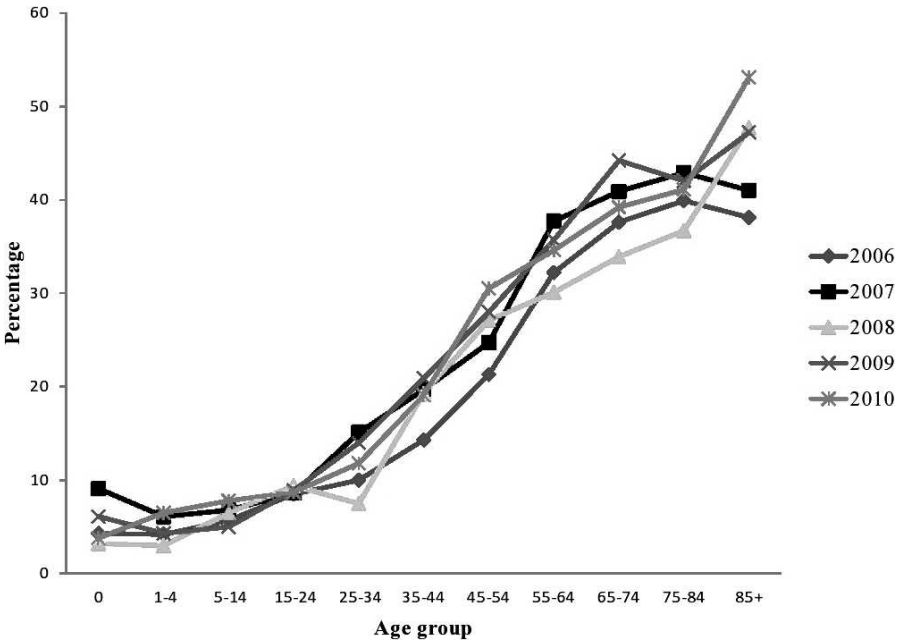

Fig 1. Age Pattern of Proportionate Mortality Ratios of CVD from 2006 to 2010. For each of the five year under review, proportionate mortality ratio of cardiovascular disease increases from young age, with a steep rise in the middle ages to peak in the very old, accounting for almost 50% of deaths examined at age 85 years
KBTH, Korle Bu Teaching Hospital; CVD, Cardiovascular disease

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.[21] Our results are also consistent with the Framingham study in which men were seen to be at higher risk of CVD compared to women.[22] 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.[14,15,23–27] 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.[28] And even when diagnosed, they do not adhere to medications as men do.[29] In addition, some 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 (eg, nausea, vomiting, tightness) and may be more difficult to recognize.[29,30] 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.[31,32]

Table 5. Cardiovascular disease mortality by sex, KBTH, 2006–2010

Year	Female, *n* (%)	Male, *n* (%)	$\chi 2$	*P*
2006	434 (42.6)	585 (57.4)	13.198	.000
2007	453 (43.8)	582 (56.2)	7.663	.006
2008	305 (39.7)	463 (60.3)	.202	.653
2009	376 (44.7)	465 (55.3)	9.886	.002
2010	260 (41.8)	361 (58.2)	2.062	.151
Total	1828 (42.7)	2456 (57.3)	27.284	.000

KBTH, Korle Bu Teaching Hospital.

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.

ACKNOWLEDGMENTS
We are grateful to Prof Richard Gyasi, the Head of Department, Pathology Department,

Korle Bu Teaching Hospital, for the kind access granted to the autopsy records.

REFERENCES

1. Gaziano T, Srinath Reddy K, Paccaud F, Horton S, Chaturvedi V. Cardiovascular Disease. In: Jamison DT, Breman JG, Measham AR, et al, eds. *Disease Control Priorities in Developing Countries, 2nd ed*. Washington, DC: World Bank, 2005;645–662.
2. Mbewu A, Jean-Claude M. Cardiovascular Disease. In: *Disease and Mortality in Sub-Saharan Africa*, Jaminson DT, Feachem RG, Makgoba MW, Bos ER, Baingana FK, Hofman KJ, Rogo KO, eds. Washington, DC: World Bank, 2006;305–327.
3. Murray CJ, Lopez A. *The Global Burden of Disease*. Washington, DC: World Bank; 1996.
4. Reddy KS, Yusuf S. Emerging Epidemic of Cardiovascular Disease in Developing Countries. *Circulation*. 1998;97:596–601.
5. de-Graft Aikins A. Ghana's neglected chronic disease epidemic: a developmental challenge. *Ghana Med J*. 2007;14:154–159.
6. World Health Organization. *The World Health Report on Global Health and Causes of Deaths 2010*. Geneva: World Health Organization; 2010.
7. Agyemang C, Attah-Adjepong G, Owusu-Dabo E, et al. Stroke in Ashanti region of Ghana. *Ghana Med J*. 2012;46:12–17.
8. Agyei-Mensah S. and de-Graft Aikins A. Epidemiological transition and the double burden of disease in Accra, Ghana. *J Urban Health*. 2010;87(5):879–897.
9. Gordis L. *Epidemiology,* 4th ed. Philadelphia: Saunders Elsevier, 2009;375.
10. Binka FN, Ngom P, Phillips JF, Macleod B. Assessing population dynamics in a rural African society: the Navrongo Demographic Surveillance System. *J Biosoc Sci*. 1999;31: 375–391.
11. Baiden F, Hodgson A, Binka FN. Demographic surveillance sites and emerging challenges in international health. *Bull World Health Organ*. 2006;84(3):161–256.
12. Oduro AR, Wak G, Azongo D, et al. Profile of the Navrongo Health and Demographic Surveillance System 2012. *Int J Epidemiol*. 2012;41:968–976.
13. Leeder S, Raymond S, Greenberg H, Liu H, Esson K. *A Race against Time. The Challenge of Cardiovascular Disease in Developing Countries*. New York, NY: Trustees of Columbia University; 2004.
14. Aubert L, Pascal B, Jean-Pierre G, Anne R, Bernard W. Knowledge, attitudes and practices on hypertension in a country in epidemiological transition. *Hypertension*. 1998;31:1136–1145.
15. Ogeng'o JA, Gatonga P, Olabu BO. Cardiovascular causes of death in an east African country: an autopsy study. *Cardiol J*. 2011;18:1–10.
16. Hajian-Tilaki K, Heidari B. Prevalences of overweight and obesity and their association with physical activity pattern among Iranian adolescents aged 12–17 years. *Pub Health Nutr*. 2011;1–7.
17. Koorts H, Mattocks C, Ness AR, et al. The association between the type, context, and levels of physical activity amongst adolescent. *J Phys Act Health*. 2011;8:1057–1065.
18. Peltzer K, Pengpid S. Overweight and obesity and associated factors among school-aged adolescents in Ghana and Uganda. *Int J Environ Res Public Health*. 2011;8:3859–3870.
19. Mensah GA. Epidemiology of stroke and high blood pressure in Africa. *Heart*. 2008;94:697–705.
20. Frenk J, Bobadilla JL, Sepulveda J, Cervantes ML. Health transition in middle-income countries: new challenges for health care. *Health Policy Plan*. 1989;4:29–39.
21. Wurthwein R, Adjima G, Rainer S, Christoph MS. Measuring the local burden of disease. A study of years of potential life lost in sub-Saharan Africa. *Int J Epidemiol*. 2001;30: 501–508.
22. Pencina MJ, D'Agostino RB, Larson MG, Massaro JM Vasan RS. Predicting the 30-year risk of cardiovascular disease: The Framingham Heart Study. *Circulation*. 2009;119: 3078–3084.
23. Fang MC, Singer DE, Chang Y, et al. Gender differences in the risk of ischemic stroke and peripheral embolism in atrial fibrillation. *Circulation*. 2012;112:1687–1691.
24. World Health Organization. *Measuring Health Systems Strengthening and Trends: A Toolkit for Countries*. Geneva: World Health Organization; 2008.
25. Women's Heart Foundation. *Annual Report on Women and Heart Diseases*. West Trenton: Women's Heart Foundation; 2007.
26. Aubert L, Pascal B, Jean-Pierre G, Anne R, Bernard W. Knowledge, attitudes and practices on hypertension in a country in epidemiological transition. *Hypertension*. 1998;31:1136–1145.
27. Bradshaw D, Pam G, Ria L, et al. Initial Burden of Disease Estimates for South Africa, 2000. *SAMJ*. 2003;93(9).
28. Granger BB, Ekman I, Ostergren J, et al. Adherence to medication according to sex and age in the CHARM programme. *Eur J Heart Fail*. 2009;11:1092–1098.
29. Berg J, Bjorck L, Dudas K, Lappas G, Rosengren A. Symptoms of a first myocardial infarction in women and men. *Gender Medicine*. 2009;6(3):454–462.
30. Noureddine S, Arevian M, Adra M, Puzantian H. Response to signs and symptoms of acute coronary syndrome: differences between Lebanese men and women. *American Journal of Critical Care*. 2008;17(1):26–35.
31. Hindin M. Women's autonomy, status, and nutrition in Zimbabwe, Zambia, and Malawi. In: Kishor S, ed. *A Focus on Gender: Collected Papers on Gender using DHS Data*. Calverton, Maryland: ORC Macro, 2005;93–116.
32. Schatz E, Williams J. Measuring gender and reproductive health in Africa using demographic and health surveys: the need for mixed-methods research. *Cult Health Sex*. 2012; 14(7):811–826.

AUTHOR CONTRIBUTIONS

Design and concept of study: Sanuade, Anarfi, Koram

Acquisition of data: Sanuade, Anarfi, Aikins, Koram

Data analysis and interpretation: Sanuade, Anarfi, Koram

Manuscript draft: Sanuade, Anarfi, Aikins, Koram

Statistical expertise: Sanuade, Koram

Administrative: Sanuade, Anarfi, Aikins

Supervision: Anarfi, Aikins, Koram