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20 year trends in renal disease mortality in Ghana: A review of autopsies

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SUMMARY AT A GLANCE

A retrospective analysis of 20 year autopsy records of the Pathology Departments of leading teaching hospitals in Ghana, to identify the contribution of renal disease as a cause of death. 5.9% of all deaths were attributed to renal causes. Mortality rates attributed to renal disease had increased from 5.0% in the 1990s to 10.8% over the past 3 years.

ABSTRACT:

Aim: **Data on the changing levels in renal morbidity and mortality are scant globally. We sought to assess trends in renal disease mortality and attributable causes over a 20 year period in Ghana.**

Methods: **A retrospective analysis of 20 year autopsy records of the Pathology Departments of leading teaching hospitals in Ghana, (Korle-Bu Teaching Hospital (KBTH) in Accra and Komfo Anokye Teaching Hospital (KATH) in Kumasi) from January 1994 to December 2013. Data comprising autopsies from in-patients, community cases and coroners' cases were used. We defined primary cause of death as death directly due to renal disease and secondary cause of death as death in which renal disease was a comorbid or contributing factor.**

Results: **Over the period, there were a total of 94 309 deaths, of which 5608 were attributed to renal disease (5.9/100). Mortality rate remained fairly the same from 1994 to 2009 (5.0%), but doubled from 2010 to 2013 (10.8%). Similar trends were observed among males and females during the same period. However, males had slightly higher mortality rates (6.6%; 95% CI: 46.1%–6.8%) compared to females (5.6%; 95% CI: 5.4%–5.8%; $P = 0.271$). The major leading attributable causes of renal disease death include end stage renal disease 45.0% and acute pyelonephritis accounting for 20.9% of the cases. Hypertensive heart disease accounted for 30.0% of all secondary cause of death while congestive heart disease and septicaemia accounted for 13.0% and 12.0%, respectively.**

Conclusions: **We observed marked increase in the renal disease mortality rate during the last few years predominantly driven by chronic and infectious related renal diseases as a main cause, and hypertensive heart disease and congestive heart failure as the main secondary causes. Measures geared towards prevention, treatment and managing such conditions may impact on the reduction of renal disease mortality rate among Ghanaian populations.**

Recent report from the Global Burden of Disease (GBD) study identified chronic kidney disease (CKD) and its ensuing end stage renal disease (ESRD) as an increasing cause of mortality worldwide.[1,2] According to GBD 2013, CKD is the 19th leading global cause of years of life lost and age-standardized mortality due to CKD increased by 36.9%.[2] Even among individuals with less severe impaired renal function, recent studies have inferred an increased risk of death independent of other risk factors.[3,4] Persons with CKD have been shown to have short life expectancy irrespective of the presence of ESRD resulting in high socio-economic burden on public health of several nations.[5] CKD continues to be a substantial health burden in sub-Saharan Africa.[6] In Ghana, CKD accounts for 5% of medical admissions.[7] Most CKD patients come to the hospital late and cannot afford the cost of treatment.[8]

Information on the changing patterns of renal diseases in relation to cause of death is scanty[9] and largely absent in Ghana.[10] This has been attributed to the absence of renal biopsy registries and published autopsy data.[11] The aetiology, incidence rates and demographic patterns of renal diseases in Ghana are largely unknown. Available information on patterns of renal diseases have mostly come from epidemiological studies in specific subpopulations, clinical studies and community surveys.[8,12,13] Experimental and cohort studies are quite expensive and take considerable time. This underscores the need for fast, cheap, accurate and reliable information on patterns and causes of death attributable to renal diseases for policy planning and formulation. Autopsies are widely accepted as important sources of final diagnosis, which relate the cause of death to its associated pathologies as well as explain the interactions between the two.[14] They also serve as rich source of causes of death information for national health policy planning and monitoring of vital statistics without which a complete and accurate diagnosis cannot be established.[14] All autopsies in Ghana have been reported to have checks in place to ensure high professional standards and best practices.[15] We therefore sought to use autopsy information to assess trends in renal disease mortality and attributable causes over a 20 year period in Ghana.

METHODS

This multi-centre retrospective study was conducted in the Department of Pathology of two Teaching Hospitals (Korle-bu Teaching Hospital, Accra and Komfo Anokye Teaching Hospital, Kumasi) in Ghana from January 1994 to December 2013. Korle-bu Teaching Hospital (KBTH) is the third largest hospital in Africa and the largest in Ghana with a bed capacity of 2000 and 17 clinical and diagnostic Departments/Units. Komfo Anokye Teaching Hospital (KATH) is the second largest hospital in Ghana with a 1200 bed capacity. Both hospitals serve as referral hospitals and receives cases from all over the country. However, KBTH receives most cases from the middle to southern region of Ghana while those of KATH are mainly from the middle to northern regions of Ghana.

Mortuary services in both hospitals (KBTH and KATH) accept for storage and or autopsy dead bodies from within the hospitals and outside from other health facilities and surrounding communities in Accra and Kumasi. Most autopsies (80%) carried out in KBTH and KATH are Coroner's cases. More than 80% of these cases were included in this study and they comprised of deaths from the hospital and outside the hospital.[16] In both hospitals (KBTH and KATH) almost all deaths (90%) from all age groups that occurred in these hospitals are autopsied to tackle clinical problems encountered by clinicians to confirm the cause of death since such cases meet the definition of a Coroner's case.[17] Coroners' cases were defined as deaths from the communities and hospitals for which cause of death were not known, not ascertained or associated with other unknown causes. Autopsies conducted in both hospitals whether for Coroner's or for the hospital are conducted by qualified pathologists or trainee doctors supervised by the pathologist. Per Fobil *et al.*,[15] autopsy in Ghana consists of a review of the history from relatives and/or from medical records (where available), an external examination, and a dissection with internal examination of all major organ systems.[15] The total number of deaths for each year varied per the data obtained from both hospitals. On average, KBTH conducts 3000–5000 autopsies per year[16] while KATH conducts 1200–3000 (unpubl. data). Ghana uses the standard Rokitansky technique in autopsies. Detail report of this procedure has been reported by Fobil *et al.*[15] Also, further studies (histology, microbiology, toxicology) are performed in selected cases, as determined by the pathologist. Using the guidelines and structure provided by the International Classification of Diseases, ICD 10 (10th Edition ICD, World Health Organization) pathologists in both hospitals determine the cause of death of all cases in this study.[18] Per accepted international standards and hospital policies, the cause of death of non-Coroner's cases is issued by the referring physician in consultation with the pathologist who performed the autopsy in the two hospitals.[19]

For each of the cases in this study, we documented demographics (pathology number, age and sex) and both primary and secondary cause of death. All autopsy logbooks and some hospital files from January 1994 through December 2013 were reviewed and exclusively confirmed by Specialist and Consultant Pathologists from the two departments. We defined primary cause of death as death directly due to renal disease and secondary cause of death as death due to another disease with renal disease being a contributing factor. For this study, we combined ESRD, CRF and CKD as per the diagnostic criteria. Only cases with complete information on age, gender, primary cause of death and secondary cause of death were included in this study. We excluded 98 cases based on these criteria. Information was entered into Microsoft excel (2016) and exported into STATA version 14.0 (Stata, Version 14.0, College Station, TX, USA) for analysis. For each variable, we computed descriptive statistics of frequencies and percentages and reported confidence intervals where appropriate. Two sample test of proportions was used to test for differences in proportions of deaths between males and females. The cases were grouped into three age groups (0–29 years); (30–59 years) and ≥ 60 years because of existing evidence of low rates in individuals less than 30 years and higher rates in individuals 60 years and above. Also, partly due to observed smaller numbers in some of the age groups. The data obtained were analyzed according to sex, age group, years and cause of death attributable to renal diseases.

Table 1 Mortality rates of death attributable to renal diseases for each year over the 20 year period

Year	Total deaths	Renal disease	Mortality rates
1994	2597	170	6.55
1995	3478	241	6.93
1996	3868	217	5.61
1997	3715	216	5.81
1998	5312	196	3.69
1999	4386	203	4.63
2000	5486	236	4.30
2001	6204	299	4.82
2002	5577	342	6.13
2003	4987	262	5.25
2004	5837	311	5.33
2005	6436	285	4.43
2006	5984	272	4.55
2007	5535	270	4.88
2008	4932	255	5.17
2009	4684	291	6.21
2010	3876	353	9.11
2011	3986	375	9.41
2012	3571	371	10.39
2013	3858	443	11.48
Total	**94 309**	**5608**	**5.95**

Total death, All-cause death for a particular year; renal disease, all deaths in the year attributable to renal diseases; mortality rates, ratio of total number of deaths attributable to renal disease and total number of all cause deaths in each year.

We obtained formal permission from the heads of the two departments after obtaining ethical approval from the Ethics and Protocol Review Committee of the School of Allied Health Sciences (School of Biomedical and Allied Health Sciences).

RESULTS

There were 94 309 deaths over the 20 year period. The total number of all deaths was however not the same for each year. Death attributable to renal diseases over the 20 year period was 5608 representing 6.0% of all deaths (Table 1). Death attributable to renal diseases was slightly and non-significantly more prevalent among males 3075 (6.3%) (95% CI: 6.1–6.5%) than among females 2532 (5.6%) (95% CI: 5.4–5.8%; p = 0.144) (Table 2). Death attributable to renal diseases was predominantly driven by ESRD, chronic glomerulonephritis, acute and chronic pyelonephritis, from 1994 to 1999. Acute pyelonephritis, and ESRD were more prevalent from 2000 to 2013 (Table 3). Table 4 shows distribution of secondary causes of renal mortality among the various primary cause of renal mortality. Hypertensive heart disease and congestive heart failure were more predominant among ESRD while septicaemia was more predominant in acute pyelonephritis.

Renal disease mortality rates were approximately 5% from 1994 to 2009. We observed a marked rise in renal disease mortality rates from 2010 to 2013. As at 2013, renal mortality rates had doubled (10.1%) compared to that of earlier years (1994–2009) (Fig. 1). Mortality rates attributable to renal diseases were low in age group 0–29 years. Close to half (48%) of deaths attributable to renal disease were in age group 30–59 years. A third of the death attributable to renal disease was observed in age group 60 years and above. Among the lower age group (0–29 years) renal mortality rates were higher in females compared with males. However, renal mortality rates were higher in males

Table 2 Death attributed to renal diseases only for the 20 year period stratified by sex

Year	Total n (MR, 95% CI)	Male n (MR, 95% CI)	Female n (MR, 95% CI)	*P*-value
1994	170 (3.0, 2.6–3.4)	101 (3.3, −0.2-6.7)	69 (2.7, −1.1-6.6)	0.823
1995	241 (4.3, 3.8–4.8)	161 (5.2, 1.8–8.7)	80 (3.2, −0.6-7.1)	0.482
1996	217 (3.9,3.4–4.4)	112 (3.6, 1.5–7.1)	105 (4.2, 3.6–8.1)	0.819
1997	216 (3.9, 3.4–4.4)	123 (4.0, 0.5–7.5)	93 (3.7, −0.1-7.6)	0.909
1998	196 (3.5, 3.0–3.9)	113 (3.7, 0.2–7.2)	83 (3.3, −0.5-7.1)	0.881
1999	203 (3.6, 3.1–4.1)	121 (3.9, 0.5–7.4)	82 (3.2, −0.6-7.1)	0.797
2000	236 (4.2, 3.7–4.7)	123 (4.0, 0.5–7.4)	113 (4.5, 0.6–8.2)	0.852
2001	299 (5.3, 4.7–5.0)	180 (5.9, 2.4–9.3)	119 (4.7, 0.9–8.5)	0.667
2002	342 (6.1, 5.5–6.7)	188 (6.1, 2.7–9.5)	154 (6.1, 2.3–9.9)	0.994
2003	262 (4.7, 4.1–5.3)	150 (4.9, 1.4–8.3)	112 (4.4, 0.6–8.2)	0.862
2004	311 (5.6, 5.0–6.2)	167 (5.4, 1.9–8.9)	144 (5.7, 1.9–9.5)	0.921
2005	285 (5.1, 4.5–5.7)	154 (5.0, 1.6–8.5)	131 (5.2, 1.4–8.9)	0.951
2006	272 (4.9, 4.3–5.5)	136 (4.4, 0.9–7.9)	136 (5.4, 1.6–9.2)	0.716
2007	270 (4.8, 4.2–5.4)	151 (4.9, 1.5–8.4)	119 (4.7, 0.9–8.5)	0.936
2008	255 (4.6, 4.1–5.1)	135 (4.4, 9.3–7.8)	120 (4.7, 0.9–8.5)	0.894
2009	291 (5.2, 4.6–5.8)	144 (4.7, 1.2–8.1)	147 (5.8, 2.0–9.6)	0.666
2010	353 (6.3, 5.7–6.9)	168 (5.5, 2.0–8.9)	185 (7.3, 3.6–11.6)	0.479
2011	375 (6.7, 6.0–7.4)	192 (6.2, 2.8–9.7)	183 (7.2, 3.5–10.9)	0.702
2012	371 (6.6, 6.0–7.2)	201 (6.5, 3.1–9.9)	170 (6.7, 2.9–10.5)	0.948
2013	443 (7.9, 7.2–8.6)	256 (8.3, 4.9–11.7)	187 (7.4, 3.6–11.1)	0.717
Total	**5608 (6.0, 5.4–6.6)**	**3076 (6.3, 6.1,6.5)**	**2532 (5.6, 5.4,5.8)**	0.271

MR, Mortality ratio, number of renal deaths in a year over total number of renal deaths for the 20 year period within the whole group and within gender; CI, Confidence interval.

Table 3 Proportion of primary cause of death attributable to renal disease for each year

Year	ESRD	ARF	Acute P.	Chronic P.	Acute G.	Chronic G.	Others
1994	39.42	10.00	22.35	14.71	0.59	7.06	5.88
1995	48.30	12.29	15.68	12.71	0.00	1.27	9.75
1996	44.70	9.68	13.36	12.44	0.46	14.75	4.61
1997	33.79	10.19	21.30	14.35	0.93	10.65	8.80
1998	27.04	9.69	15.82	12.76	0.51	30.61	3.57
1999	32.01	7.39	11.82	15.27	0.99	21.67	10.84
2000	39.41	8.90	12.71	11.02	0.42	13.98	13.56
2001	41.80	4.35	18.06	8.70	1.34	6.69	19.06
2002	32.17	7.02	28.36	7.60	0.29	7.89	16.67
2003	33.2	4.58	26.72	8.02	0.00	14.5	12.98
2004	39.55	4.50	23.79	8.04	0.00	15.76	8.36
2005	42.82	3.16	25.96	7.72	0.00	11.23	9.12
2006	30.88	6.62	23.90	16.54	0.00	7.72	14.34
2007	56.29	2.22	20.00	4.81	0.00	7.04	9.63
2008	38.87	6.67	15.69	7.84	0.00	16.47	14.51
2009	38.83	8.25	25.43	8.25	0.00	7.22	12.03
2010	54.96	2.27	26.06	3.97	3.12	2.83	6.80
2011	51.47	4.80	25.87	5.33	1.60	3.73	7.20
2012	68.46	4.58	17.52	0.81	0.00	4.31	4.31
2013	66.58	3.61	18.06	2.03	0.23	4.51	4.97

ARF, Acute renal failure; CKD, Chronic kidney disease; CRF, Chronic renal failure; ESRD, End stage renal disease; G, Glomerulonephritis; P, Pyelonephritis; row %, proportion of primary cause of renal deaths in each year.

for ages 60 years and above (Fig. 2). ESRD accounted for 45.0% of primary cause of death attributable to renal diseases. More than a fifth (21%) of all primary causes of death attributable to renal diseases were acute pyelonephritis. Ten percent (10%) of all death attributable to renal disease was because of chronic glomerulonephritis (Fig. 3). Hypertensive heart disease was responsible for 30.0% of secondary cause of renal mortality while congestive heart disease and septicaemia accounted for 13.0% and 12.0% (Fig. 4).

DISCUSSION

Key findings

Our study findings show stable renal mortality rates from 1994 to 2009 of approximately 5%. However, marked increase in the number of deaths attributable to renal disease was observed from 2010 to 2013 (10%). There was no significant difference in renal disease mortality rates among males and females. Death attributable to renal diseases was markedly high in age group 30 years and above. The major leading attributable causes of renal disease death include ESRD, chronic pyelonephritis and chronic glomerulonephritis together accounting for 62.7% and acute pyelonephritis accounting for 20.9% of the cases. More than half of secondary causes of death attributable to renal disease were hypertensive heart disease, congestive cardiac failure, and septicaemia.

Discussion of key findings

Mortality rates

Information on pattern of renal disease morbidity and mortality in Africa is scanty and largely absent in West Africa.

Table 4 Cause of death secondary to renal diseases and its complications (cases where renal disease was not the primary cause of death but a contributing factor to the primary cause of death during the 20 year period)

	n (%) Hypertensive heart disease	*n* (%) Congestive heart failure	*n* (%) Septicaemia	*n* (%) Severe anaemia	*n* (%) Bilateral lobar pneumonia	*n* (%) Pulmonary oedema	(%) Others
ESRD	258 (31.0)	90 (24.0)	46 (14.0)	43 (18.0)	75 (32.0)	35 (28.0)	135 (21.0)
Acute renal failure	183 (22.0)	86 (23.0)	29 (9.0)	16 (7.0)	42 (18.0)	16 (13.0)	109 (17.0)
Acute pyelonephritis	124 (15.0)	30 (8.0)	195 (60.0)	129 (55.0)	38 (16.0)	12 (10.0)	135 (21.0)
Chronic pyelonephritis	834 (10.0)	67 (18.0)	26 (8.0)	7 (3.0)	19 (8.0)	22 (18.0)	122 (19.0)
Acute glomerulonephritis	0 (0.0)	45 (12.0)	9 (3.0)	12 (5.0)	7 (3.0)	9 (7.0)	46 (7.0)
Chronic glomerulonephritis	183 (22.0)	55 (15.0)	20 (6.0)	28 (12.0)	54 (23.0)	30 (24.0)	97 (15.0)
Total	832 (100.0)	373(100.0)	325 (100.0)	235 (100.0)	235 (100.0)	124 (100.0)	644 (100.0)

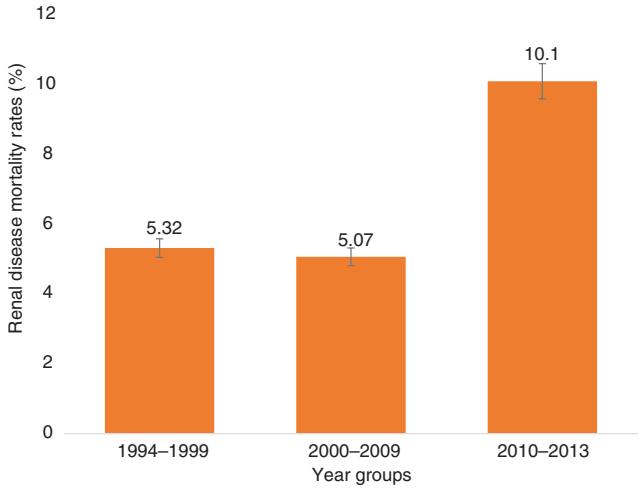

Fig. 1 Mortality rates of death attributable to renal diseases by year groups.

Studies conducted in the sub-region are predominantly cross sectional with varying findings. In Ghana, studies on renal disease are largely focused on sub populations (hypertensive and diabetic patients, rural or urban dwellers, etc.) and do not provide information on prevalence, incidence and risk factors of renal disease that represents the general population. These studies[8,12,13] have provided useful insight into prevalence of CKD in some subpopulations as well as some risk factors of CKD in Ghana. Our study has shown the patterns of renal disease mortality as well as attributable causes over the 20 year period. In this study, mortality rates of death attributable to renal disease was approximately 5% from 1994 to 2009. However, our study showed marked increase in mortality rate attributable to renal disease from 2010 to 2013. Reasons for this sharp increase are unclear. However, the rising prevalence of hypertension and diabetes and the poor control of these conditions in Ghana may contribute to the sharp increase in renal disease mortality observed in this study.[20,21] Inability of patients to afford the

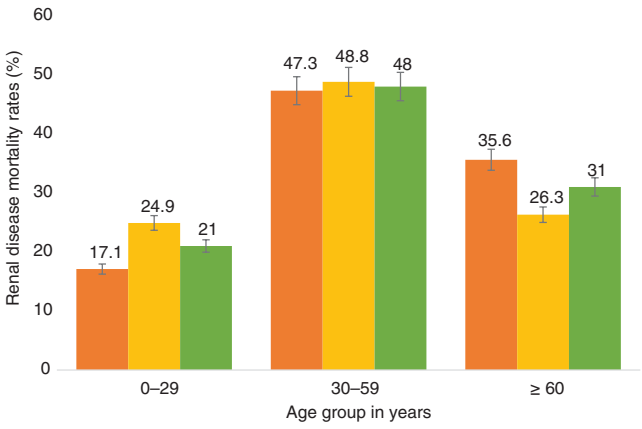

Fig. 2 Mortality rate attributable to renal diseases by age groups and stratified by sex. (■) Male, (■) Female, and (■) Total.

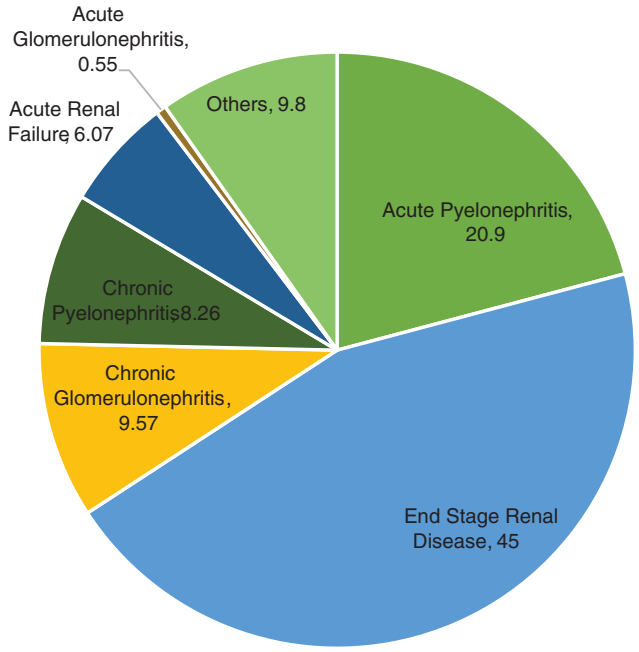

Fig. 3 Primary cause of death attributable to renal diseases (percentage of primary causes of all renal deaths during the 20 year period).

cost of treatment and management of renal diseases and late presentation to the hospital as well as use of herbal medications prescribed by a traditional herbalist have been suggested as major causes of the rise in mortality rates.[22,23] Hypertensive and diabetic patients in Ghana frequently use herbal medications, which do not work to control their sugar and blood pressure levels. Prolonged usage of such herbal medication leads to uncontrolled blood pressure and blood sugar levels for long periods with adverse effect on kidney function. These patients often arrive at the hospital with kidney failure leading to subsequent death. Higher mortality rates have been reported in earlier studies elsewhere. In Brazil, an annual mortality rate of 19.9% was

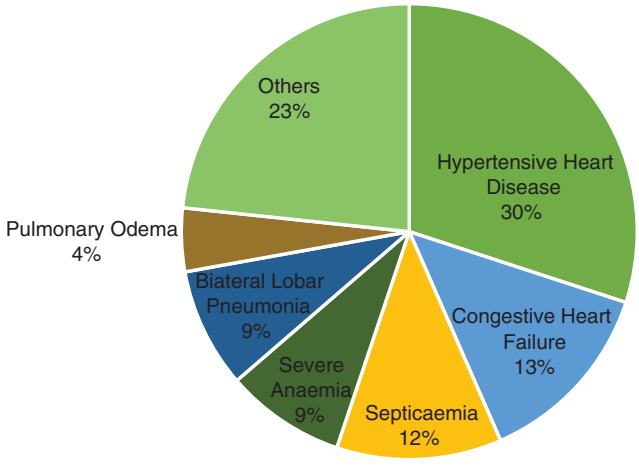

Fig. 4 Secondary cause of death attributable to renal diseases (percentage of secondary causes of all renal deaths during the 20 year period).

reported among renal patients[24] while that of Argentina was 15.6% per 100 patients.[25] The higher mortality rates reported in these studies were attributed to selection: they studied haemodialysis and dialysis patients. In our study, total deaths varied for each year. Autopsies were predominantly performed in the first teaching hospital in Ghana (KBTH) when it was started and KATH was later included. In recent times (last 5 years) a one other regional hospital, police hospital and 37 Military Hospital have started conducting autopsies in their hospitals. This has led to a decrease in the number of autopsies conducted in both teaching hospitals. This reduction is not restricted to only causes of death of other disease conditions but includes that of renal diseases. This suggests that the variations in total cause of death over the years affects all cause of death making it an unlikely artefact in the observed increase in renal disease mortality rate. Secondly, when the renal disease mortality rates were determined without total cause of death the pattern of increase remained though attenuated.

Attributable factors

The renal disease mortality rate was slightly higher in males than in females. Male preponderance in this study is supported by earlier studies.[26,27] Mortality rate was low in the age group less than 30 years. A sharp increase was observed in age group 30–59 years and further maintained in age group 60 years and above. Older age has been shown to significantly influence incidence, prevalence and mortality of renal disease. The mechanism underlying the increased risk of renal disease deaths among older people is unknown, but several reasons have been provided. First, renal disease has been established to coexist with cardiovascular risk factors such as dyslipidaemia, hypertension, smoking and diabetes, which increase the absolute risk of death in the general population. These conditions are also more prevalent in older age and this may significantly contribute to the high risk of death among this age group.[28,29]

This study revealed that the top 5 leading primary attributable causes of renal disease death were ESRD, acute pyelonephritis, chronic pyelonephritis, chronic glomerulonephritis and acute glomerulonephritis. Our findings in this study are supported by earlier studies, which reported higher proportions of renal disease death attributable to infectious and cardiac deaths.[30] In a retrospective study conducted to determine pattern and outcome of renal admissions at Port Harcourt Teaching Hospital in Nigeria, hypertensive nephropathy, diabetic nephropathy, chronic glomerulonephritis and HIV-related renal disease were the common causes of death.[31]

The top 5 leading secondary causes of death attributable to renal disease mortality in this study was hypertensive heart disease, congestive cardiac failure, septicaemia, severe anaemia and bilateral pneumonia. Hypertensive heart disease alone accounted for 30.0% of such cases. The high attributable secondary cause of death to hypertension in our study finding is supported by a recent study that shows a markedly high prevalence of CKD (46.9%) among hypertensive Ghanaians.[12] Similarly, in Burkina Faso, 44% of patients with hypertension who were hospitalized had CRF.[32] Furthermore, in Nigeria, a 19-year review of pattern, clinical characteristics and outcome of ESRD reported that 72.4% of the patients had stage 2 hypertension and 43.7% had chronic glomerulonephritis.[33] This is higher than mortality rates attributable to chronic glomerulonephritis of 10% observed in our study. Contrary to our findings, a study conducted in Peru on mortality rates in patients with CKD undergoing haemodialysis reported 51.9% mortality due to diabetic nephropathy, 24.1% due to chronic glomerulonephritis and 13.0% due to hypertensive nephropathy.[34] This underscores the varying patterns of attributable cause of death among renal patients globally. A quarter of the patients in this study died from congestive cardiac failure.[33] Stringent policies targeted at controlling blood pressure may result in reduction of renal mortality rates among these populations. In our study, septicaemia accounted for 11% of death attributable to renal diseases.

Strength and limitations

This study is the first to be conducted using autopsy data to show pattern of renal diseases mortality in Ghana. The strength of the study lies in the large number of cases obtained over a long period (20 years). The use of both autopsy data and medical information in this study overcomes the inherent bias in using information from either source. This allowed for effective identification of patterns of death attributable to renal disease. The use of data from the two largest referral teaching hospitals in Ghana provides a fairly representative sample. The study was limited by the lack of clinical information on some cases which were included in this study. The possibility of misclassification of underlying cause of death due to errors in medical records and from physician diagnosis may have influenced the findings of this study. Not all pathologists reported comorbidities and this may have also influenced the distribution of secondary causes of death attributable to renal diseases in this study. In the case of physicians, some assigned cause of death without autopsies under compulsion or inducement. The log books used did not report the exact locations where cases were brought from to the hospital, this prevented us from determining rural and urban patterns of mortality rates attributable to renal diseases in Ghana which might deepen our understanding of changing trends in such populations. In Ghana, due to cultural and religious beliefs, most deaths though reported are not allowed to be autopsied. This is supported by a study in North Central Nigeria which reported perceived cultural and religious barriers predominantly an Islamic region where the deceased is buried quickly after death.[35] Therefore, the number of

deaths autopsied annually may not reflect on the total number of deaths in most African countries. However, this is consistent with global reports that indicated sharp decrease in the general rate of autopsy.[36] Reasons for the sharp decline were difficulty in obtaining consent from relatives and advances in modern diagnostic techniques.[36]

CONCLUSION

The study shows a marked increase in death attributable to renal diseases over the study period. We observed high rates of deaths attributable to renal diseases in age group 30 years and above. The major leading primary attributable causes of renal disease death include ESRD, chronic pyelonephritis and chronic glomerulonephritis. More than half of all secondary causes of death attributable to renal disease were hypertensive heart disease, congestive cardiac failure, and septicaemia. Adoption of a multi-faceted and multi-scale approaches targeting the key attributable causes may help to reduce the rising levels of renal disease mortality rates in Ghana.

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DISCLOSURE

I have communicated with all my co-authors and obtained their full disclosures. My co-authors and I declare no conflicts of interest.

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