Socioeconomic status and elderly adult mortality in rural Ghana: evidence from the Navrongo Dss.[1]

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Abstract

Elderly adult health and issues affecting them in Africa have not been adequately addressed by research. This study explored the relationship between socioeconomic status and elderly adult mortality in the Kassena-Nnakana District (KND) of northern Ghana using data from the Navrongo Health and Demographic Surveillance System (HDSS) in 2005-2006. 15,030 adults aged 60 years and over were included in the study, of whom 1315 died. Using Cox proportional hazards regression, we found that socioeconomic status (SES) was not a determinant of elderly mortality. Compared to the lowest SES quintile, the adjusted hazards ratios were: 0.94 (95%CI: 0.79–1.12) for second quintile, 0.91 (95%CI: 0.76–1.08) for third quintile, 0.89 (95%CI: 0.75–1.07) for fourth quintile and 1.02 (95%CI: 0.86–1.21) for the highest income quintile. However, living without a spouse [HR=1.98, 95%CI: 1.74–2.25], being male [HR=1.80, 95%CI: 1.59–2.04] and age [HR=1.05, 95%CI: 1.04–1.05] were significant factors for elderly adult mortality. This shows that companionship and social/family ties are of more importance than household socioeconomic status in determining elderly adult mortality. Efforts should therefore be made to introduce programs and policies to support the elderly, especially those living alone.

Introduction

Elderly adult health in developing countries is a matter of concern due to the many issues that directly affect their wellbeing, yet little is being done to resolve them (Robinson *et al*. 2006). Modernisation, and continued westernisation of African societies has resulted in the collapse of social and cultural ties that communities had with the extended families so the elderly are being left to fend for themselves. This in conjunction with increased rural urban migration among the young and middle-aged, the burden of caring for AIDS orphans and poor social security, among others, has increased the economic burden on elderly adults. This in turn affects their health and the struggle to barely survive overrides their health concerns, resulting in avoidable excess mortality (Oppong 2006).

Higher socio-economic status has been shown to reduce exposure factors that lead to morbidity, disability and eventually mortality. This is because

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people at a higher socio-economic status tend to have better health care, comfortable living conditions, less exposure to hazards and better diets (Rogers, Hummer, & Krueger 2005). Some studies even suggest that people in the higher SES, over the years have been known to practise healthier lifestyles and behaviour (smoking, heavy drinking, sedentary lifestyles) while those in lower SES levels are increasingly embracing them and hence have a higher risk of mortality (House *et al*. 1990).

Socio-economic stratification and its effect on elderly adult mortality is, therefore, an important issue in public health and epidemiology. Studies have shown that elderly adults are almost totally dependent on the middle-aged and working populations in many African countries where health systems are not well managed and social security is almost non-existent or limited to a few individuals (Oppong 2006). These socio-economic disparities in health outcomes among the elderly adults if addressed will go a long way to reducing the burden of morbidity and mortality among people in the lower socioeconomic and hence increased longevity. This increase in elderly populations also brings into focus the issue of a high dependency ratio which is compounded by the emerging issues of rural-urban migration, weakened family bonds, little care for the elderly, poor social security and economic hardships, which as stated by Oppong (2006) all make life harder for elderly adults. Other studies elsewhere show that many factors affect elderly adult mortality in different ways. However, they all highlighted the importance of socioeconomic status as a factor in elderly mortality (Liang *et al*. 2003; Murata *et al*. 2005; Sudore *et al*. 2006; Vrbova *et al*. 2005; Zimmer & Kwong 2004).

Little data on elderly adult mortality is another problem facing researchers who would like to engage in useful analysis of elderly adult health in Africa. One way in which this can be achieved is through health and demographic surveillance systems (HDSS) sites which collect vital demographic event data including mortality information on people in a defined geographical location. Data from these sites can act as a guide for developing countries to look at ways of addressing issues on elderly adult mortality and hence provide proper information that can help in alleviating excess mortality (Baiden, Hogson, & Binka 2006; Chandramohan *et al*. 2008).

In many rural areas of the developing world, and Sub-Saharan Africa in particular, the socioeconomic status of many people can be measured using household wealth and possessions, since information on income and expenditure is hard to come by (Bawah & Zuberi 2004). Use of household assets to measure socioeconomic status has been used extensively in many health related studies in less developed countries and their practicability proven (Filmer & Pritchett 2001; Morris *et al*. 2007; Somi *et al*. 2008; Vyas & Kumaranayake 2006).

In many sub-Saharan countries like Ghana where there is a projected growth of the older populations, there is little data on issues affecting the health of elderly people nor clear policies by the governments about on this ageing population (Robinson, Mosha,

Grainge, & Madeley 2006). Studies have also shown a distinct difference in mortality rates among different groups with different income status (an indicator of socio-economic status) among the elderly. They suggested that decrease in mortality in these elderly adults is not just explained by conditions in early life but by their present status (Catalano 2002; Zimmer 2006). Thus the need to put more emphasis on the prevailing factors affecting mortality among the elderly and in particular their socio-economic status.

Using data from the Navrongo Health and Demographic Surveillance System (NDSS), this study was aimed at investigating the association between household socioeconomic status and individual elderly adult mortality in a harsh climatic and economically deprived region of northern Ghana, where poverty is widespread and asset ownership is almost homogeneous.

Data/methods

The study was based on longitudinal data collected from the Navrongo Demographic Surveillance System (NDSS), which is run by the Navrongo Health Research Centre (NHRC). It is a continuous surveillance of all the residents of the Kassena-Nankana District of northern Ghana. The NDSS was started in July 1993 to monitor demographic dynamics in the district and serve as a platform for launching research on morbidity, mortality and fertility. It started with a baseline census of all the individuals in the district and continuously monitors their vital demographic events (migration, death, pregnancies, and births) after every four months at the household level. Apart from the individual data, household and compound information is also collected and stored in a relational database for easy updates and linkages. More information on the NDSS is published elsewhere (Baiden, Hogson, & Binka 2006; Bawah *et al*. 2003; Bawah *et al*. 2006; Debpuur *et al*. 2005; Nyarko *et al*. 2002).

The stable registered population of the Navrongo DSS was about 145,000 as at June 2006 from a total of over 30,300 households; The Elderly adults (defined as all adults over the age of 60 years) were slightly over 6% of this population. However, since the population is monitored continuously and keeps changing, the total number of elderly adult residents aged 60 years and above included in the study between 01/01/2005 and 31/12/2006 was 15,030 residing in 12,475 households who contributed 27,803 person years and 1315 deaths.[2]

Socio-economic status (SES) was derived from data collected by the NDSS using a standardised questionnaire, that recorded household assets (electronics, car, motorbikes, bicycles, livestock,), water use, waste disposal methods, house type (ownership, building material used), fuel/lighting type, land ownership and availability of food. Using the Principal component analysis technique, as recommended by Filmer and Pritchett (1999) and used in a number of studies (Filmer & Pritchett 2001; Kahn *et al*. 2005; Mwageni *et al*. 2005; Nguyen et al. 2005; Vyas &

2. All adults who were 60 years and above as at 01/01/2005 were observed from the start, while those who turned 60 during the observation period were observed from the date/ birthday they turned 60.

Kumaranayake 2006). We used the first principal component (which explains the most variability in the data) to rank the household into five different quintiles from the lowest to the highest/ richest (poorest, poorer, poor, less poor and least poor).

The SES index was based on the households that had an elderly adult occupant and not all the households in the region. This was done to eliminate the possibility of having a biased distribution of the elderly adult population towards one side of the socioeconomic strata probably due to selective mortality in earlier ages.

Cox hazards proportional analysis with person time as the underlying denominator was used to calculate death rates, draw Kaplan-Meier survival graphs and investigate the effect of socioeconomic status on elderly adult mortality while controlling for the other confounding factors.

Results

Compared to previous years, elderly adult mortality rates in the KND reduced considerably, from a high of 40 deaths per 1000 PY for the ages 60-64 to a low of 28 deaths per 1000 PY and 140 deaths per 1000 PY for the age group 80-84, to 93 deaths per 1000 PY in the two year observation period.

The table below shows the characteristics of the 60 plus population that was studied in the two year period.

Table 1 Demographic and General Population Characteristics

Variable	Total	Dead		Alive		P–Value
		n	(%)	n	(%)	
SES(n,%,)						
Poorest	2892	276	21.8	2616	19.9	
Poorer	2891	252	19.9	2639	20.0	
Poor	2895	240	18.9	2655	20.1	0.251
Less Poor	2881	233	18.4	2648	20.1	
Least Poor	2889	266	21.0	2623	19.9	
Age groups (n, %)						
60-64	5223	276	21.0	4947	36.1	
65-69	4239	317	24.1	3922	28.6	
70-74	2393	234	17.8	2159	15.7	
75-79	1844	219	16.7	1625	11.9	<0.001
80-84	694	116	8.8	578	4.2	
85-89	445	102	7.8	343	2.5	
90+	192	51	3.9	141	1.0	
Sex (n,%,)						
Female	8688	638	48.5	8050	58.7	<0.001
Male	6342	677	51.5	5665	41.3	
Education(n,%,)						
No education	13697	1103	96.5	12594	95.0	0.028
Some Education	696	40	3.5	656	5.0	

Table 1 Demographic and General Population Characteristics

Ethnicity(n,%,)						
Kassim	8015	746	56.9	7269	53.3	0.014
Nankam /Other	6933	566	43.1	6367	46.7	
Residence (n, %)						
Rural	13056	1137	89.7	11919	90.4	0.458
Urban	398	130	10.3	1268	9.6	
Household Size(n,%,)						
Single	988	94	7.2	894	6.5	0.379
Multiple	14042	1221	92.8	12821	93.5	
Spouse(n,%,)						
Lives with spouse	7516	511	38.9	7005	51.1	<0.001
No Spouse	7514	804	61.1	6710	48.9	

*The missing values for the categorical variables have been excluded in the descriptions

There was a distinct difference between males and females during the two-year observation period, with females having a lower overall death rate of 39.5 deaths per 1000 PY compared to males, who had an overall death rate of 58.1 deaths per 1000 PY. In the age specific death rates by sex, males had a higher death rate than females except in the 75-79 and 80-84 age groups. A higher death rate was observed among elderly adults who were not living with a spouse (59.2 deaths per 1000 PY) compared to those who were living with a spouse (35.9 deaths per 1000 PY). The variables that showed statistical differences among categories were presence of a spouse in the same household, ethnicity, education levels, age and sex.

Distribution of household wealth

The elderly adults were grouped in five quintiles after including household wealth, housing type, food availability, water usage, toilet facilities and waste disposal. A total of 41 principal components were used, and the first component accounted for 16.4% of the total variance, the second component accounted for 8.5% and the third accounted for 5.1% of the total variance of all the variables used.

Comparison of the different quintiles showed that there were more assets in the upper quintiles than the lower quintiles; the lower quintiles showed little ownership of almost all the variables included in the analysis while the numbers were higher for the upper SES levels, except for land (for both farming and building), house ownership and goats which were more in households in the lower SES strata. There was a notable lack of sanitation and waste disposal facilities, with over 99% of the household where elderly adults resided lacking toilet facilities, and 94% of these households also lacked proper access to water.

Among the different SES quintiles, there were a relatively higher proportion of the elderly adults living alone being placed in the poorest category (42.0%) in comparison to those who were in households that had more people (18.6%). (See Fig1)

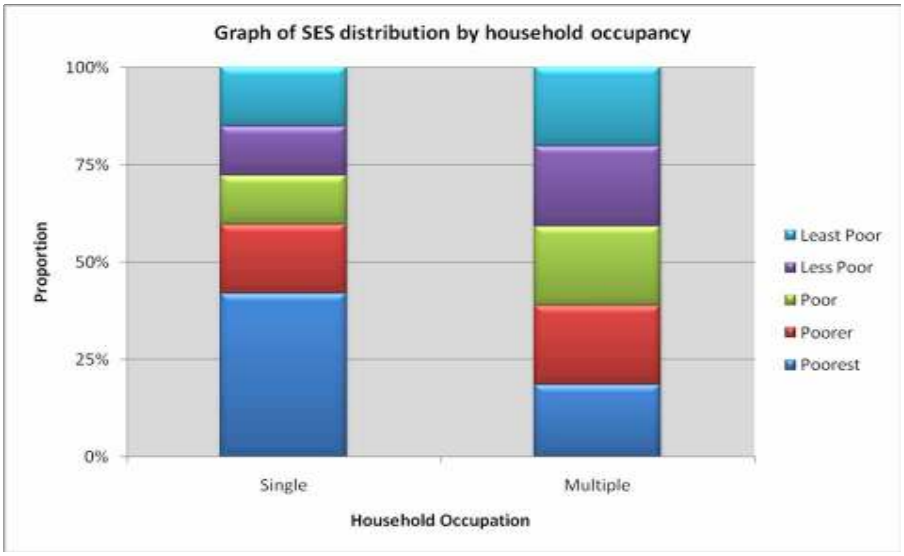

Figure 1

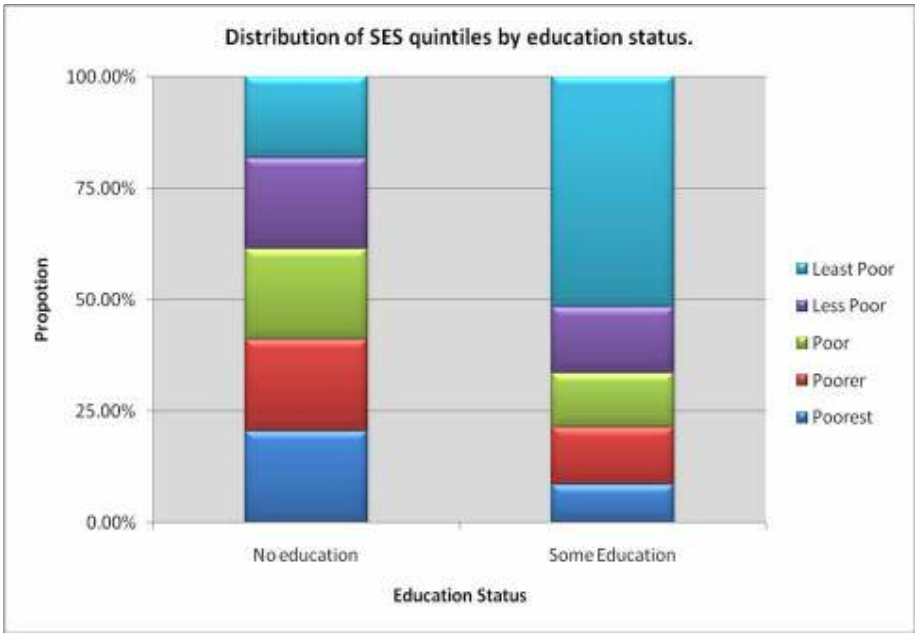

Figure 2

A relatively higher proportion of elderly adults with at least primary education were placed in the Least poor category of SES (51.7%) compared to those who had no education (18.3%), while in the poorest category there was also a relatively higher proportion of adults with no education (20.6%) compared to those with some education (8.6%).(Fig2) Elderly adults with no education were spread almost uniformly in proportions across the quintiles, but for those with primary level of education and above, there was a general increase in proportion with increase in SES such that the higher the SES, the higher the proportion of those who had some education. There were also a relatively higher proportion of women living in single person households (7.6%) than males (5.1%).

Mortality differentials by household socioeconomic status

Analysis of mortality differentials by household SES was done using survival curves over the two year observation period for each of the different SES quintiles and the concentration index was used to check for the levels of inequality among the different strata. The Kaplan-Meier survival curves show no significant difference in mortality between the different SES strata. (Fig 3) The only SES strata that showed a different trend from the others was the poorest group which had the lowest survival probability.

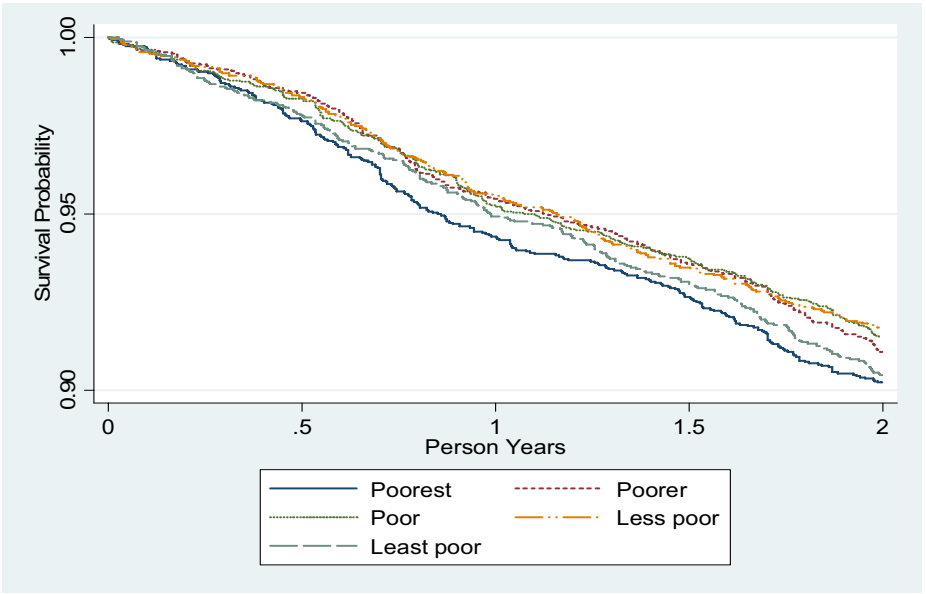

Figure 3 - Kaplan-Meier survival curve of elderly adults in the NDSS by SES

Different SES strata showed slightly varying mortality rates, with the poorest having a death rate of 51.7 deaths per 1000 PY, to the less poor having an overall death rate of 43.2 deaths per 1000, however, the trend reversed in the uppermost SES strata with a death rate of 50.3 deaths per 1000 PY even though the difference between these groups was not statistically significant. The poorest group had the lowest survival probability of all the groups, showing that those with less assets experience higher mortality in this region. This also shows that in the Kassena-Nankana District, there is little difference in overall mortality among the different SES groups. A concentration index of -0.01 (almost zero) and a poorest-poor ratio of 1.03 shows low levels of inequality for mortality among the elderly adults in the KND. (Table 2)

Table 2 Distribution of death rates across the SES quintiles

Quintile	Person Years	No of Deaths	Elderly Adult Mortality Rate/ 1000 PY (95% CI)
1st (Poorest)	5338.9	276	51.7 (45.9 – 58.2)
2nd	5409.5	252	46.6 (41.2 – 52.7)
3rd	5400.1	240	44.4 (39.2 – 50.4)
4th	5391.1	233	43.2 (38.0 – 49.2)
5th (Least Poor)	5290.7	266	50.3 (44.6 – 56.7)
Poorest-Poor Ratio			1.03
Concentration Index			-0.01
Chi-Square Trend			0.251

On plotting a concentration index curve to check the level of health inequality (measured by mortality rates) among the elderly adults by SES, there was no significant differences in death rates among the different quintiles, with the concentration curve (showing the death rates by quintile) and the line of equity (showing an ideal situation of no difference between the quintiles) lying on top of each other with a small level of inequality especially among the poorest. (Fig 3) A big area between the two curves would normally indicate a high inequality between the poorest and the least poor in the given community, but in our case it is almost negligible (same as table 2 above).

Household socio-economic status and mortality

Cox proportional hazards regression modelling was used to investigating the relationship between SES and elderly adult mortality while adjusting for the other independent variables. The following results were obtained for both univariate and multivariate analysis. (Table 2)

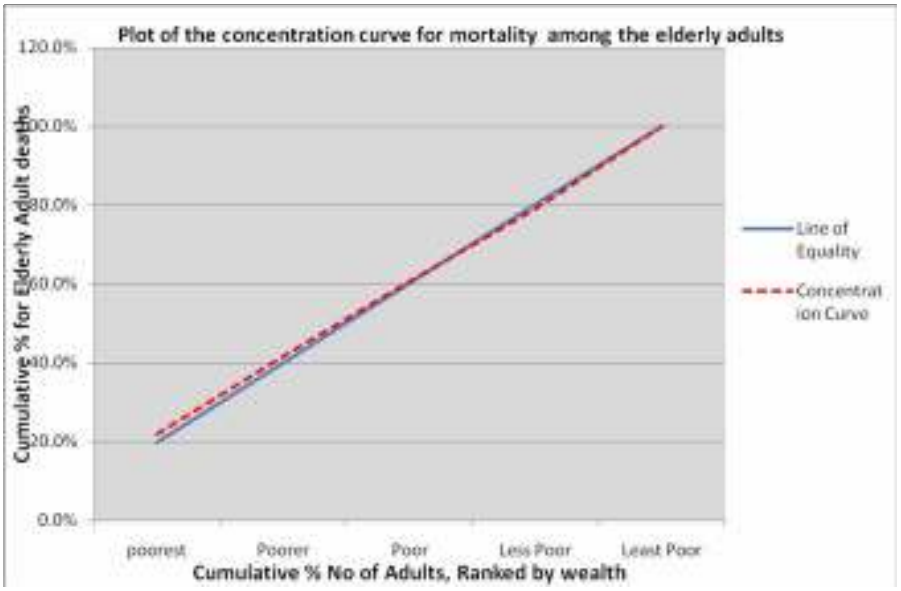

Figure 4 Plot of the concentration curve for mortality among the elderly adults in the NDSS

From the results of the univariate and multivariate analysis, we found no association observed between SES and elderly adult mortality in the Kassena-Nankana District. The hazards ratios for all the different SES quintiles (poorer, poor, less poor and least poor) show minimal deviation from the comparison category (poorest); this was especially true between the poorest and least poor groups where the HR was equal to 1, meaning that elderly adults in the KND have almost equal risk of mortality irrespective of their socioeconomic status. The elderly adults in the four upper categories of SES had lower hazard ratios for mortality compared to those in the poorest category. Their hazards ratios for mortality reduced with increase in SES from the least poor to the poorest. (Table 2)

A look at some of the results in univariate analysis showed that the poorer were 0.1 times less likely to die compared to the poorest; the poor were 0.14 times less likely to die compared to the poorest; the less poor were 0.16 times less likely to die compared to the poorest and the least poor were 0.03 times less likely to die compared to the poorest. However, these differences were very small and not statistically significant at the 95% confidence interval. The same trend in the univariate analysis was observed when we adjusted for the other variables in the other two models. In multivariate modelling, SES was not a predictor of mortality among elderly adults since the hazards ratios among the different levels did not vary from the comparison group in a big way and were also not statistically signifi-

cant. Interestingly, when SES was included in the first and second model during the multivariate analysis, there was absolutely no difference between the poorest and the least poor categories

Presence of a spouse was found to be an important predictor of mortality ($P<0.001$). The elderly adults who were living with a spouse in the same household were almost two times more likely to experience mortality compared to those elderly adults who were not living with their spouse in the same household. This was of more significance since the presence of any other person in the same household was not statistically significant in univariate and multivariate modelling. Similar findings were also reported in a study in elderly adults in Bangladesh (Mostafa & Van Ginneken 2000). Other studies elsewhere and papers also showed that social relations and family support to be an integral part of the wellbeing of elderly adults (Johnson *et al*. 2000; Murata *et al*. 2005; Oppong 2006).

Discussion

From the results we noted that there was a reduction in death rates in the KND over the years compared to earlier reports by the Navrongo Health Research Center; this could be attributed to the mortality diminishing interventions that have been introduced in the district over time (Bawah *et al*. 2003). However, these mortality rates are still quite high compared to other areas like Filabavi in Vietnam which had rates of 9.37 deaths per 1000 PY and 57.24 in the same age groups of 60-64 and 80-84 age groups (Nguyen *et al*. 2005).

Household wealth was not an important predictor of elderly adult mortality in this region. There are other studies elsewhere which also showed lack of a relation between SES and elderly adult mortality (Hoffmann 2005; Vrbova *et al*. 2005). However, the differences between the settings and context of those studies makes it hard for proper comparisons with this study since they were carried out in more developed countries and from hospital data, while this study was done from continuous community surveillance. In a study done in the same region of the KND, Debpuur *et al*. (2005) found that SES was not a predictor of child mortality. Even though this study is not entirely comparable to the child study given the age difference of the participants in both studies, it suggests that SES differentials are minimal or do not predict mortality in the KND. Similar findings were also observed in a Swedish study, that showed that in middle adulthood, the effect of SES on mortality was quite high but converged among the elderly adults (Merlo *et al*. 2003). Our findings were however contradictory to other studies in similar environments which showed an inverse SES-mortality influence among the elderly. In rural Cambodia, rural China and Bangladesh, which have comparatively homogeneous socio-economic regions like the KND, it was found that higher SES was a protective factor for morbidity and mortality whether they used education, household wealth or income. Those in the well off categories always had less risk of mortality compared to the lowest comparison group of SES for all ages of the elderly adults (Mostafa & Van Ginneken 2000; Zhu &

Xie 2007; Zimmer 2006; Zimmer & Kwong 2004). Our findings were different from our hypothesised influence of household SES on elderly adult mortality as stated in the theoretical framework.

When we compared the mortality rates among different groups using the concentration index, the poorest-least poor ratio stood at 1.02, showing little difference between those elderly adults who were in the higher SES quintile and those in the lower quintile. The concentration index, which was used to indicate the levels of inequality depending on how big the value is from 0, was quite minimal (-0.01). From our results, the p-values for the SES hazard ratios were very high in all the models, and all the confidence intervals included unity. We therefore rule out weak association or chance in the lack of any relationship between SES and elderly adult mortality. This alludes to the convergence school of thought where the SES–mortality relationship converges in the elderly population. However, there is need to do a similar study for the whole population in the region and come up with a more concrete comparison for this theory to hold.

The lack of SES effect on mortality in the KND could be due to several hypothesised reasons; first the general homogeneity in terms of SES, such that household wealth and material possessions do not accurately bring out differences in this area. Secondly, in the elderly adults, biological and physiological determinants may be independent of the SES gradient and hence lack of effect. Thirdly, the SES effect wears off with more deaths in the lower and middle age groups such that the effect becomes minimal in old age (House *et al*. 1990).

From our study, the most important predictor of elderly adult mortality in the KND was the presence of a spouse. This was particularly important since just the presence of any other person in the same household was not statistically significant in univariate and multivariate modelling. In the context of this study, it was hard to explain the mechanisms by which the presence of a spouse affects elderly adult mortality even though it suggested a high association. Lund *et al* (2002) stated that the presence of a spouse is more important in determining elderly adult mortality than just being married or living with other people in the same household. In trying to explain the effect of spouses on the elderly, one study noted that elderly adults have unique dietary requirements, require specialised care and drug taking assistance. Companionship therefore serves as a buffer against poor diet and appetite as they will aid in feeding and related activities which in effect ensure good health (McIntosh, Shifflett, & Picou 1989), in addition the psychological boost married spouses have on each other (Davis *et al*. 1992) has been noted to be of importance to survival.

Table 3 Cox proportional hazards regression analysis of mortality risk for elderly adults in the NDSS

Factors	Univariate (unadjusted)			Multivariate (adjusted) (Model 1)			Multivariate (adjusted) (Model 2)		
	HR	(95% CI)	P-value	HR	(95% CI)	P-value	HR	(95% CI)	P-value
SES									
Poorest	1			1			1		
Poorer	0.90	(0.76 – 1.07)	0.230	0.96	(0.80 – 1.15)	0.694	0.94	(0.79 – 1.12)	0.487
Less Poor	0.86	(0.72 – 1.02)	0.086	0.90	(0.74 – 1.08)	0.257	0.91	(0.76 – 1.08)	0.276
Less Poor	0.84	(0.70 – 0.99)	0.043	0.87	(0.72 – 1.05)	0.138	0.89	(0.75 – 1.07)	0.211
Least Poor	0.97	(0.82 – 1.15)	0.745	1.02	(0.84 – 1.25)	0.829	1.02	(0.86 – 1.21)	0.819
Age	1.05	(1.05 – 1.06)	<0.001	1.05	(1.04 – 1.05)	<0.001	1.05	(1.04 – 1.05)	<0.001
Gender									
Females	1			1			1		
Male	1.47	(1.32 – 1.64)	<0.001	1.86	(1.63 – 2.14)	<0.001	1.80	(1.59 – 2.04)	<0.001
Education									
No education	1			1					
Some Education	0.71	(0.52 – 0.98)	0.035	0.76	(0.55 – 1.06)	0.107			
Ethnicity									
Kasssim	1			1					
Nankam / Others	0.87	(0.78 – 0.97)	0.012	0.98	(0.87 – 1.11)	0.766			
Residence									
Rural	1			1					
Urban	1.09	(0.91 – 1.31)	0.333	1.19	(0.96 – 1.48)	0.147			
Household Occupancy									
Single	1			1					
Multiple	0.91	(0.74 – 1.12)	0.363	0.92	(0.73 – 1.15)	0.471			
Spouse									
Lives with spouse	1			1			1		
Doesn't live with Spouse	1.65	(1.48 – 1.84)	<0.001	1.99	(1.74 – 2.29)	<0.001	1.98	(1.74 – 2.25)	<0.001

Conclusion

Even though there was no indication of SES being a major determinant of elderly mortality, there is still need to improve the lives of elderly adults in the KND to ensure a more dignified and comfortable ageing, especially among those with very little resources (poorest). This is due to the fact that among those households that had a single occupant (indicating elderly adults living alone) a bigger proportion was in the poorest category. Even though SES as a factor for mortality has been investigated in many studies, the way the relationship works in the older members of our society should be researched on further, not in an isolated manner, but in relation to the whole population in the region. There is need for another mode of measuring SES, such as use of the real value of the assets to be tried in the KND and hence offer a comparative measure which would consequently confirm if indeed SES does not affect mortality. Although the findings in this study point to the convergence school of thought in the SES mortality relationship, there is need to carry out similar studies in the whole population. This will allow researchers to have a better comparison of all the age groups and the transition from the lower age groups to the older groups and conclusively support it.

We found that living with a spouse was of greatest importance to survival of the elderly adults in the KND although the mechanisms through which this happens is not very clear and requires more research. As stated earlier, living with a spouse is a stronger factor for elderly mortality than just living with other people in the same household. To further understand these findings, the NDSS should in future include in its collection of data, behavioural aspects of participants such as nutrition, alcohol and drug use, morbidity information, or enable more links to other projects data which could help in determining the health conditions of its participants.

Further research on the effect of SES on cause specific mortality would be quite helpful in shedding more light on the real situation and help to zero in on the areas of importance to elderly adult survival.

Ethical considerations

Ethical clearance for the study was sought and granted from the University of Witwatersrand Committee for Research on Human Subjects (medical). Further ethical clearance and permission to use the data was sought from the Navrongo Health Research Centre (NHRC) – Institutional Review Board (IRB), which was also approved. The data set used for this study was anonymised by the NHRC data managers and does not include personal identifiers and therefore no harm is expected on the study participants. The data was only used for the purpose of this study. All the authors declare no competing interests.

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