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Age and gender variation in the impact of household structure on elderly mortality

M Omar Rahman

Background	There is little information about the impact of household structure and composition on elderly mortality in developing countries. This study examines the impact of relationship to head of household, and the presence of co-resident spouses and sons on elderly mortality in rural Bangladesh with a particular focus on age and gender differences.
Methods	A total of 9365 individuals aged ⩾60 at baseline (5128 males and 4237 females) in the Matlab Surveillance area in rural Bangladesh were followed for a period of 8 years (1974–1982) with all predictors (the presence of a spouse, one or more co-resident adult sons, relationship to head of household, household economic status, age and disability status) being measured at the beginning of follow-up. Cox proportional hazard models were used in the analysis.
Results	Being the head of household had a significant impact on reducing elderly mortality for both men and women. The presence of a spouse reduced mortality for all elderly men but had a significant beneficial impact only on women whose husbands were heads of households. Finally the presence of one or more co-resident adult sons reduced mortality for elderly women but not for elderly men. For all three of the above predictors there was a decline in effect with the age of the elderly.
Conclusions	Relationship to head of household and the presence of spouses and sons have powerful impacts on reducing mortality for elderly men and women in rural Bangladesh with the effects varying significantly by gender and age. Furthermore, individual rather than joint access to material resources is an important determinant of elderly mortality.

Keywords	Elderly mortality, household structure, Bangladesh
Accepted	1 October 1998

This study uses high-quality prospective data from a surveillance population in rural Bangladesh to examine how an elderly individual's relationship to the head of household and the presence of co-resident spouses and sons affects elderly mortality. Furthermore it investigates whether these effects vary between men and women and across age groups for the elderly.

There have been a number of studies which have explored the impact of social and kin networks on elderly mortality in the developed world.[1–20] These studies suggest that there may be a relationship between strong social and kin networks and improved survival for older individuals. However, due to the relatively crude nature of measures of social and kin networks and the lack of comparability in these measures across different studies, no definitive conclusions can be reached.[17,20] In contrast to the developed world relatively little attention has been directed to this issue in developing countries.[19–24] Much of the sparse existing literature on the impact of social and kin networks on elderly mortality in developing countries focuses primarily on the impact of spouses. Little is known about how other aspects of household structure and composition such as the presence of adult sons, and relationship to household head may affect elderly mortality.[21,23] Moreover we know even less about how these effects may vary by gender and age.

Rural Bangladesh is a particularly appropriate place to examine the impact of household composition and structure on elderly mortality, because due to the absence of formal mechanisms of social security (e.g. pensions and health insurance) the elderly are to a large extent dependent on their primary kin (mainly spouses and sons) for support, and those without such support are felt to be particularly vulnerable, especially women.[21,23–31] Thus the effects of household composition and structure on elderly mortality if present, may be larger than in other social settings.

While there are inconsistencies in the research literature on the impact of social networks on elderly mortality in the

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developed world,[17,20] a number of studies have suggested that men benefit much more from strong social ties (including kin connections) than do women.[5,9,10,12,15,16,20] *A priori* one might expect a somewhat different picture in a setting such as rural Bangladesh. This is a patrilocal society where married men live close to their fathers and brothers while married women live far away from their natal kin. Moreover women own very few assets, have very little mobility outside the household and are thus arguably much more dependent than their male peers on primary kin (husbands and sons) for their welfare.[24,26,27,29,30]

One major mechanism through which kin may decrease elderly mortality is by improving elderly economic status.[7,16,32,33] Examining the role of economic status is however, complicated by the fact that joint household assets (the usual measure of economic status) may not be the crucial determinant of health and survival if there is differential allocation of resources within the household, both in the developing[34–37] and developed world[38–40] but particularly in the case of developing countries. Thus individuals who are heads of poorer households may not be worse off than their peers who are not heads of households but live in richer households. This issue is particularly germane from a policy point of view given that women heading households in developing countries are thought to be an especially vulnerable group.[34,35] This study examines this important issue by focusing on individual access to resources within the household as proxied by relationship to household head.

Finally, although some attention has been directed towards variation in effects of kin ties on elderly mortality by gender, very little information exists on how this impact may vary by age. Are spouses and sons, and relationship to household head as important a predictor of mortality for the old elderly as they are for the young elderly?

Data, Method and Variables

Study population

The data used in this study come from the Matlab surveillance system in rural Bangladesh, operated by the International Centre for Diarrhoeal Disease Research, Bangladesh. This surveillance system has maintained a continuous register of all vital events (dates of births, marriages, migrations and deaths) on a defined population of 40 000 households and approximately 200 000 individuals in the Matlab sub-province, about 40 miles south east of the capital city of Dhaka, for the last two decades. In addition to the continuous register (which is based on households being visited twice a month to record vital events), censuses were held in 1974 and 1982 to assess a variety of socio-demographic variables, including household assets and household composition. The Matlab surveillance system data have been used extensively in the demographic literature and are considered to be one of the few high-quality (i.e. complete, accurate and up to date) data sources for longitudinal studies in the developing world.[37,41,42] Finally the Matlab surveillance population is considered to be fairly typical of rural Bangladesh.

This analysis uses a data file (subsetted from the regular surveillance and census data) consisting of information on the 8-year mortality experience (March 1974 to June 1982) of all individuals aged $\geqslant$60 years in the Matlab study population as of March 1974. There were a total of 9365 such individuals (5128 males and 4237 females). In addition to information on deaths and out-migrations, this file contains socio-demographic data on the elderly collected at the beginning of the follow-up period from the census of 1974. These data include age, sex, marital status, disability status, presence of co-resident sons, relationship to household head, and elderly household economic status.

A number of definition issues relevant to this analysis are worth noting. Disability was an occupational category reported in the 1974 Matlab socio-demographic census and was defined as the presence of severe physical or mental health problems that precluded any occupational designation. The specificity of the criteria used to designate an individual as disabled are unclear. It is worth noting however, that housewife was the most commonly reported occupational designation for women. Thus it seems that designating a woman as disabled implied that she was not being able to carry out household activities. Co-resident adult sons were sons aged $\geqslant$15 years living in the same household as the elderly respondent at the time of the 1974 census. Relationship to household head was a routine question asked of household respondents in the 1974 census. The designation of household head is one that was reported by household respondents to the surveillance system authorities. No explicit criteria exist for such a classification, and it may vary across households. However, studies suggest that the household head is an important authority figure within the household, and is most likely to be a male.[25,26] Finally, this analysis uses a composite indicator of household economic status which divides households into two groups, those having at the beginning of follow-up at least one of the following household assets (cow, boat, watch, quilt) and those having none of these assets. These household asset indicators have been used in earlier studies to predict child mortality successfully.[43]

Statistical methods

In this paper the focus is primarily on multivariate analysis given the strong possibility of confounding from simultaneous effects of various predictors. Cox proportionate hazard models have been used to investigate the impact of relationship to head of household and co-resident spouses and sons on subsequent elderly mortality over an 8-year follow-up period, controlling for various baseline predictors. Using standard practice for Cox proportionate hazard models, exposure is assigned to each individual until the time of out-migration, death, or end of study, whichever comes first.[44–47] Out of the 9365 individuals in the initial sample, 594 (6.34%) left the surveillance area during the 8-year follow-up period (March 1974 to June 1982).

An important aspect of the hazard regression analyses presented in Tables 2, 3 and 4 is the exploration of differential impacts of various predictors of elderly mortality at different ages of the respondents. For example, one might be interested in knowing if the presence of a spouse, a co-resident adult son or relationship to head of household has a different impact on survival for the young old versus the very elderly. This potential differential impact with age is examined using variables in the regression model which interact age with different predictors (e.g. age interacted with spouse, age interacted with one or more co-resident adult son, age interacted with being head of household). If these 'interaction' variables are statistically significant this suggests that the impact of the predictor in question on elderly survival varies with the age of the respondent.

Table 1a Demographic characteristics of women in study population in 1974

Age group (years)	No.	% disabled	% with spouse	% with sons	% head	% with asset
60–64	1693	8	32	72	13	75
65–69	1209	12	19	70	12	77
70–74	703	19	10	69	10	77
75–79	311	33	4	67	12	77
80–84	172	35	6	66	10	80
85–89	77	52	4	75	6	82
90–94	34	47	6	74	3	85
95–99	38	45	8	50	10	76
Total	4237	15	21	70	12	77

Table 1b Demographic characteristics of men in study population in 1974

Age group (years)	No.	% disabled	% with spouse	% with sons	% head	% with asset
60–64	1855	1	94	76	97	87
65–69	1362	3	92	76	92	87
70–74	905	5	86	73	85	88
75–79	537	14	82	74	76	85
80–84	263	23	80	71	67	87
85–89	106	25	70	74	61	82
90–94	53	28	66	77	55	85
95–99	47	47	55	62	34	94
Total	5128	06	89	75	88	87

Note: Per cent with asset refers to per cent living in households with at least one of (cow, boat, watch, or quilt).

Table 1c Relationship to household head in 1974

	Women %	Men %
Head of household	12	88
Spouse of head	15	0
Parent of head	59	10
Grandparent of head	7	1
Other relationship to head	7	1
Total	100	100

Results

Table 1 shows various descriptive statistics for the study population at the beginning of the 8-year follow-up period. The majority of men and women were under 70 years (women = 68%; men = 63%), with men on average older than women. With regard to disability status, 15% of women and 6% of men were classified as disabled. The vast majority of men were currently married (89%) while the vast majority of women were not (20%). Of those who were not currently married, almost everyone fell into the widowed group, and there were negligible numbers of divorced individuals. Seventy-five per cent of elderly men and 70% of elderly women had one or more co-resident adult sons. With regard to relationship to head of household, the majority of elderly males were 'heads of households' (88%), with the next largest category being 'father of head of household' (10%). For women, the most common relationship to head of household was 'mother of head of household' (59%) followed by 'wife of head of household' (15%) and 'household head' (12%). In this study population 87.07% of elderly men lived in households that had at least one of the following household assets (cow, boat, watch, quilt) versus 76.59% of elderly women. Further breakdowns of the above socio-demographic characteristics by age group are shown in Table 1.

Multivariate results which examine the mortality risks of the elderly as a function of various predictors are shown in Tables 2, 3 and 4. Tables 2 and 3 show log odds of mortality with associated 95% CI separately for elderly men and women. Table 4 shows odds ratios (OR) of mortality (exponentiated estimates from the final models in Tables 2 and 3) along with 95% CI for different aspects of household structure and their variation with age for men and women. These results indicate the following:

(i) Relationship to the head of household has an important impact on elderly mortality. Controlling for disability, joint household economic status, and the presence of spouses and sons, being the head of household significantly reduces mortality for both elderly men and women. However, this effect is not constant but rather declines with the age of the elderly individual, and becomes statistically non-significant after about age 75 years for men and about age 70 years for women (Table 4). The OR of mortality for elderly men for being a head versus not being a head range from 0.64 at age 60 years to 0.87 at age 75 years. For

Table 2 Cox proportional hazard models of mortality for elderly women

Variable	Model 1 log odds	Model 2 log odds	Model 3 log odds	95% CI
Age (years)	0.035*	0.035*	0.035*	(0.025, 0.046)
Disabled	0.641*	0.629*	0.627*	(0.513, 0.741)
Spouse present	–0.373*	–0.117 (NS)		
⩾1 adult son present	–1.689*	–1.700*	–1.700*	(–2.566, –0.837)
Head of household	–1.947*	–2.000*	–1.992*	(–3.356, –0.628)
Household economic status	–0.263*	–0.262*	–0.265*	(–0.379, –0.152)
Age × headship	0.025*	0.026*	0.026*	(0.006, 0.045)
Age × ⩾ 1 son	0.021*	0.021*	0.021*	(0.009, 0.033)
Husband is head of household	–0.371*		–0.480*	(–0.644, –0.316)
–2 log likelihood	29 380.88	29 373.52	29 374.66	
No. parameters	8	9	8	

*P-value ⩽ 0.05, NS = not statistically significant, i.e. P-value > 0.05.

Table 3 Cox proportional hazard models of mortality for elderly men

Variable	Model 1 log odds	Model 2 log odds	95% CI
Age (years)	0.023*	0.023*	(0.010, 0.0353)
Disabled	0.643*	0.645*	(0.442, 0.848)
Spouse present	–1.355*	–1.361*	(–2.392, –0.332)
⩾1 adult son present	0.022 NS		
Head of household	–1.697*	–1.690*	(–2.706, –0.675)
Household economic status	–0.579*	–0.573*	(–0.686, –0.460)
Age × spouse	0.016*	0.016*	(0.003, 0.301)
Age × headship	0.021*	0.021*	(0.007, 0.342)
–2 log likelihood	36 047.45	36 047.65	
No. parameters	8	7	

* *P*-value ⩽ 0.05, NS = not statisticaly significant, i.e. *P*-value > 0.05.

women, the analogous OR range from 0.64 at age 60 years to 0.83 at age 70 years. In Table 4, in the case of elderly men, the reference category for the variable head of household includes all men who are not heads of households. However, in the case of elderly women the reference category for the variable head of household includes all women who are neither heads of households nor wives of heads of households.

In addition to being head of household, another relationship category confers survival advantage for elderly women. Women whose husbands were household heads also enjoy lower mortality than women who are neither heads of households themselves nor wives of heads of households, (i.e. for example mothers of heads of households)—OR = 0.619; (95% CI : 0.525–0.729)—(exponentiated estimates from model 3 in Table 2). Note no variation with age was found for the impact of being a wife of a head of household on elderly female mortality (results not shown).

(ii) For elderly women, once one controls for whether their husbands are the head of household, husbands no longer affect elderly female mortality (Table 2). This is shown by the decline in the odds of mortality associated with having a spouse and its lack of statistical significance as one moves from model 1 to model 2 in Table 2 (model 1 log odds = –0.373—very significant; model 2 log odds = –0.117—not significant). Finally, the lack of impact of husbands who are not heads of households on their wives' mortality does not change with the age of the wife (results not shown).

The presence of a spouse significantly reduces mortality for elderly men with a modest decline in effect with age of the elderly male (Tables 3 and 4). The OR of mortality for having a spouse versus not having a spouse ranges from 0.68 at age 60 years to 0.95 at age 80 years, at which point it is no longer statistically significant (Table 4).

(iii) The presence of one or more sons in the household reduces mortality for elderly women but not for elderly men. Moreover, there is a decline in the beneficial impact of sons on elderly female mortality with increasing age (Tables 2 and 3). For women, the OR of mortality for one or more co-resident son versus no co-resident sons ranges from 0.64 at age 60 years to 0.97 at age 80 years, at which time it is no longer statistically significant (Table 4).

Discussion

The results of this study show that household structure and composition have a powerful impact on elderly mortality in rural Bangladesh with important variation by gender and age of the elderly. One of the major contributions of this paper is

Table 4 Age related changes in odds ratios of mortality for different aspects of household structure

	Age (years)								
	60	65	70	75	80	85	90	95	99
Household head versus non-household head									
Male									
Lower CI	0.50	0.59	0.68	0.77	0.84	0.89	0.94	0.98	1.01
Odds ratio	0.64	0.71	0.79	0.87	0.97	1.07	1.19	1.32	1.43
Upper CI	0.81	0.85	0.91	0.99	1.12	1.30	1.51	1.78	2.03
Female									
Lower CI	0.50	0.60	0.70	0.77	0.83	0.87	0.91	0.94	0.97
Odds ratio	0.64	0.73	0.83	0.95	1.08	1.23	1.40	1.59	1.76
Upper CI	0.83	0.89	0.99	1.16	1.41	1.73	2.15	2.68	3.19
Spouse versus non-spouse									
Male									
Lower CI	0.55	0.63	0.72	0.80	0.85	0.87	0.89	0.91	0.92
Odds ratio	0.68	0.74	0.81	0.87	0.95	1.03	1.12	1.21	1.30
Upper CI	0.85	0.87	0.90	0.96	1.07	1.22	1.40	1.63	1.83
One or more adult sons in household versus no adult sons in household									
Female									
Lower CI	0.54	0.63	0.71	0.78	0.84	0.88	0.93	0.97	1.01
Odds ratio	0.64	0.71	0.78	0.87	0.97	1.07	1.19	1.32	1.43
Upper CI	0.75	0.80	0.86	0.97	1.11	1.30	1.52	1.79	2.03

The above odds ratios represent exponentiated estimates from the final models in Tables 2 and 3 accounting for the age interactions.

that it shows that after controlling for age, disability status, the presence of spouses and sons, and joint household resources, relationship to household head is an important determinant of elderly survival. This suggests that in this study population, there may be differential allocation of resources within the household and that for a given level of joint household resources, some individuals, namely heads of households (whether men or women) and wives of household heads get more resources than they would otherwise with correspondingly beneficial impacts on mortality.

It is worth noting that the majority of studies of the relationship between social and kin ties and subsequent mortality have not paid much attention to controlling for the possible confounding effect of economic status. They have for the most part used crude proxies such as individual educational status. The few studies that have used direct measures of income/wealth have relied on aggregated household assets as an indicator for individual material well-being assuming that individuals living in richer households are automatically better off than their peers living in poorer households. Recent research suggests however, that this may be an oversimplification of reality, particularly in developing countries, and the key to understanding individual welfare outcomes is individual wealth/income rather than joint wealth/income.[34–40] This study indirectly confirms that perspective using mortality as a specific and perhaps one of the more important manifestations of individual welfare. It shows that for both elderly men and women being the head of household reduces mortality significantly. Moreover for elderly women, being the wife of the household head is almost as beneficial as being the head, and it is definitely more beneficial than other much more common relationship categories such as the mother of the head, etc.

The results also demonstrate that the impact of being the head of household on reductions in elderly mortality declines with the age of the elderly respondent, and by age 75 years, being head of household no longer has a significant impact in reducing elderly mortality. There are two possible explanations for this result. The first is that intra-household allocation of resources becomes more egalitarian with respect to the elderly as they age, thus for older elderly, being head of household does not signify greater access to household resources. The second explanation is that household headship is more strongly correlated with good health status for the young old than for the very old. This is consistent with the cultural norms of rural Bangladesh, where the old-old will at some point in their life cycle pass over the mantle of leadership to their sons, i.e. effectively retire from household management. This transfer of power may be unrelated to the health status of the head of household. On the other hand it is very unusual for the young-old not to be head (particularly for males). Thus for this group, not being head of household may be related to ill-health. One might have expected the disability measure to correct for this type of process but it may be too crude to fully account for this effect.

With regard to the impact of spouses on elderly mortality, this study shows that after controlling for relationship to head of household, the presence of a spouse reduces mortality quite substantially for elderly males but not for females. A major contribution and a new finding of this study is that, for women, the impact of husbands on female mortality disappears once one controls for the headship status of the husband. As discussed above, one's relationship to the head of household may be correlated with access to resources within the household. This suggests that husbands improve the survival of elderly women, only to the extent that they can provide these women with greater access to material resources. Thus women married to men who are heads of households do not enjoy any survival advantage relative to their female peers who are widowed, divorced or never-married.

This result is consistent with some research findings in the US, which show that once one controls for a woman's economic status, having a husband no longer improves the survival of women.[32,33] However, one should be cautious about generalizing from these results. It is important to re-iterate that the impact of spouses on elderly mortality remains a somewhat confusing issue in the published literature due to the lack of comparability of various social network measures across different studies.[17,20] Some studies have reported little or no impact of marital status on elderly mortality for either men or women[6,13] while others have reported an impact only for men and not for women.[5,9,10,12,16,20]

Another point worth noting is that the impact of a husband on a woman's survival shows no change with the age of the woman (results not shown). Thus neither in the case where the husband is the head of the household nor in the case where the husband is not the head, is there a different impact with the age of the woman. This lack of statistically significant impact may be due to two reasons: (i) older married women typically have husbands who are frailer than them (as husbands are typically 8–10 years older than their wives) and need support rather than give support;[24] and (ii) the very small numbers of older married women who still have husbands in this study population (approximately 101 women aged $\geqslant$70 years have husbands) may have led to a lack of sufficient power to detect age related differences in the impact of husbands on their wives' survival.

In contrast to elderly women, wives are clearly beneficial in terms of reducing mortality for elderly men in this study population. The fact that such a strong beneficial impact of wives exists in a patriarchal/patrilocal social setting where one might have thought that men would have other kin substitutes for wives suggests a somewhat universal and robust male benefit from marriage. This benefit is probably due to a mix of decreased social isolation, improved home management, and improved care-taking.[4,11,16,17,20,49,50]

The beneficial impact of a wife on her husband's survival however, declines (albeit modestly) with the age of the husband. A plausible explanation for this result is that older men have older wives and that as the wife's health status deteriorates with age she is less likely to be of use from a care-taking point of view. This is consistent with anthropological work[26] and small-scale pilot studies in this population conducted, which indicate that the primary caretakers for elderly men in rural Bangladesh are their wives. The implication of this result is that for the oldest old males (i.e. those aged $\geqslant$80 years), having a spouse is no-longer protective as their wives may not be physically able to take care of them.

In addition to household headship and marital status, the presence of one or more co-resident adult sons has a significant impact on reducing elderly female mortality, but has no impact on elderly male mortality in this study population. Moreover,

further analysis suggests (results not presented) that there is no difference in the impact of a co-resident son for women without a husband and women who still have a husband regardless of whether the husband is head of the household or not. This finding is consistent with the social setting of rural Bangladesh where elderly women own very few assets and due to limited mobility outside the household have few sources of employment. They are thus to a significant extent dependent on their sons who clearly act as more than just substitutes for the lack of a husband. On the other hand elderly males retain economic power either by working outside the household or retaining ownership of the major household asset (land) and thus are not dependent on co-resident sons.[16,23,25,26,48]

In addition to economic support from their sons, elderly women in rural Bangladesh derive a large part of their social standing from having adult co-residing sons, compliant daughter-in-laws to do their bidding and grand children who they can indulge.[27] Social integration theory would suggest that this increased status leads to higher survival due to decreased social isolation, increased stress buffering, better information networks, better access to health care, and healthier habits resulting in improved survival.[2,16,49,50]

An interesting further result shows that for females, the beneficial impact of a co-resident sons goes down with the age of the elderly and having a co-resident son is no longer protective after about age 80. One might have expected that older women would be more in need of help from a son than their younger peers, however our results suggest the opposite is true. There are two potential explanations for this seemingly counter-intuitive result. The first is that on average the age of the co-resident son increases with the age of the elderly respondent and older sons may be less beneficial than younger sons. This could be due to: (i) competing obligations that older sons may have to their wives and children which would lead to less support for elderly mothers; (ii) less earning power due to declines in physical health with age of the son, again leading to less support for elderly mothers. This is consistent with the rural agrarian nature of the study population where physical manual labour in agriculture is the largest source of income. The second explanation for the decline in impact of sons on elderly female mortality is that it may be due to selection, whereby older frailer parents (particularly mothers) move in with their sons as their health declines with age. Some of this should have been accounted for by the controls for baseline disability status, but one could argue that more extensive health measures are needed to fully capture this effect. The lack of appropriate controls for disability may be why after age 80 co-resident sons appear to actually increase the mortality of their mothers (although this effect is not statistically significant—Table 4).

In conclusion, this study has demonstrated that elderly men and women in rural Bangladesh are substantially influenced in terms of survival by the presence of various household members and by their relationship to heads of households. While plausible explanations for the differential effects by gender and age have been offered, further delineation of the mechanisms by which household arrangements influence elderly mortality require more refined measures of: individual physical and mental health status, individual access to material resources, and the quality, content and type of social support provided by co-resident kin.

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