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OLDER WIDOW MORTALITY IN RURAL BANGLADESH

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Abstract—Prospective data from rural Bangladesh are used to explore the adverse impact of widowhood on old age female mortality. The results indicate that widows aged 45 and above have significantly higher mortality than their currently married counterparts. Controlling for age and disability status, much of this excess mortality risk can be accounted for by patterns of living arrangements and household assets. An analysis of older widows suggests that the presence of adult male kin in the household (primarily sons), and to a lesser extent household headship (both of which may be interpreted as reflecting individual access to resources in this society) have a substantial impact on mortality risks for this group of women.

Key words—mortality, old age, widow, Bangladesh

In recent years there has been increased interest in the determinants of old age mortality, but almost exclusively in the developed world. Although the elderly constitute a relatively small fraction of the total population in developing countries, due to the large absolute magnitude of the populations in question they represent a sizeable group numerically [1]. While little attention has in general been focused, on old age mortality in rural non-western societies, even less has been directed towards how mortality risks are modified by marital status. This is an important omission in view of the fact that, due to the large age difference between spouses in many rural non-western societies such as Bangladesh, much of a woman's "old age" is spent in the widowed state. Widowhood for most rural women results in major changes in living arrangements and the formation of new, often more tenuous financial support networks. In developing countries where societal arrangements for old age pensions and social security are not widespread, widowhood very often leads to significant decreases in access to resources and may lead to adverse health outcomes [2–7].

A large number of studies in developed societies [8–11] have documented that older widowed women have significantly higher mortality than their currently married counterparts, with results from some prospectively designed longitudinal studies suggesting that much of this excess mortality can be accounted for by differences in age, economic status and certain behavioral characteristics such as smoking [12–14]. *A priori* it would not be implausible to hypothesize that both the magnitude of and the explanation for the relative disadvantage of widowhood in terms of mortality may be different in varying cultural contexts. In rural Bangladesh, where marriage is universal, remarriage for older women an unlikely prospect and mobility for women outside the home very restricted, loss of a husband may well be catastrophic [7].

While there are a host of factors which potentially modify mortality amongst elderly widows [12–16] one that has particular relevance for high fertility populations is the presence of surviving adult sons. A number of studies [4–7, 17, 18] have postulated that, the desire for an adequate number of surviving mature sons to act as insurance against the adversity of old age and widowhood is the driving force behind continuing high fertility in many developing countries. Other authors [19,20] have however tended to discount this "security" motive.

The intent of this study is to explore the determinants of mortality among widows aged 45 and over in rural Bangladesh with a special focus on the impact of marital status and household structure as reflected in the presence of an adult son and household headship.

EXPERIMENTAL DESIGN AND METHODS

Study population—background

The data for this study come from the Matlab demographic surveillance system (DSS) organized under the aegis of the International Centre For Diarrhoeal Disease Research, Bangladesh (ICDDR, B). The Matlab DSS area is located in the Matlab Upazila (subdistrict) of Chandpur district about 40 miles from Dhaka, the capital of Bangladesh and is considered fairly representative of rural Bangladesh.

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Matlab is a densely populated, low lying deltaic plain where the major means of transportation are by country boat and on foot. Agriculture is the principal economic activity with 47% of households having less than 0.5 acres of land. For these households, share cropping and wage labor are the major sources of livelihood. The *per capita* income of household heads is about U.S.$150 per year.

Villages in Matlab, as in the rest of Bangladesh, are organized by "baris" which constitute the primary residential and social unit and consist of a series of distinct households sharing a common courtyard and inhabited by families linked in a patrilineal fashion [21]. A woman thus typically lives within the confines of a *bari* which consists of households headed by her husband, married sons and first degree male relatives of her husband. Traditionally women are restricted to moving and working within the bari and are economically dependent on male earning members.

The Matlab surveillance system has maintained a continuous register since the mid 1960's of all vital events, births, deaths, marriages and migrations, in a population of about 190,000 people distributed among 149 villages. In addition to registering vital events, censuses were held in 1974 and 1982 to assess a number of different socio-demographic variables including household assets, living arrangements, disability status and educational level. These records were linked for the period 1974–1982, so that all events occurring to a single individual are available, and organized by household residence in 1974. The censuses provide information on the relationship of the individual to the head of the household in which he or she was residing at that time [22].

The implication of the household organization of the database is that, while information is available on all individuals sharing cooking facilities (termed a household), it is not possible to identify family members living in separate households but perhaps sharing financial and other resources. An additional disadvantage of this level of aggregation and of the data collection procedure is that there is no information on individual expenditures, or income. All the information on economic status is in the form of joint household assets assessed at the beginning of the study in 1974.

The Matlab DSS data have been used extensively in the demographic literature and are considered to be one of the few high quality data sources for longitudinal studies in rural traditional non-western societies [22–24]. This study however is the first of its kind to use this rich data source to analyze the impact of marital status on old age mortality.

Study sample selection

For women aged 45 or more, a 50% random sample of married women and a 50% random sample of widowed women as of the census of 1974 were selected from the surveillance data. This yielded 2619 married women and 2998 widowed women as of 4/30/74. These women were then followed for eight years up to 1982 during which period all deaths and all changes in marital status were recorded; person-years were allocated to the relevant marital status category in one year intervals. Each individual was followed until either the end of the study, their date of death or their date of emigration from the study area. During the study period (1974–1982), 801 currently married women became widowed. Thus the study population was categorized into three distinct subgroups: (1) "old widows"—2998 women who entered the study in 4/30/74 already in the widowed state and contributed person-years only to the widowed state. (2) "new widows"—801 women who were currently married at time of entry into the study in 4/30/74 and subsequently became widowed during the study period. Until the point of widowhood, these women contributed person-years to the currently married group. Subsequently they contributed person-years to the widowed group. (3) "Married throughout"—these 1818 women remained married throughout the study period and contributed person-years only to the married category.

The analysis presented in this paper has as a special focus, the impact of household composition on widow mortality. Due to the lack of information about changes in household composition associated with widowhood transitions during the study period we restrict ourselves to examining the (i) 2998 "old widows" and (ii) the 1818 "Married throughout". These women maintained the same marital status throughout the observation period and thus their relationship to the head of the household can be assumed to be whatever was recorded in the 1974 census.*

Statistical methodology

This study uses discrete time hazard models in a logistic regression framework with one year time intervals to analyze event histories of individuals [25–27]. One year time intervals are used as our level of precision for most types of dates (e.g. calendar age, dates of changes in marital status).

Essentially what the discrete time hazard model is doing in the context of this data set is as follows: Every discrete unit of time (in this case the unit is one year) for every individual is treated as an independent observation. An individual is followed from 4/30/74 up to the point where he/she either

*It is important to note that all our information on household structure and relationship to the head of the household is derived from the census of 1974 carried out at the beginning of the study. For women who became widowed while under observation, no information about changes in the head of the household that would typically occur with widowhood is available, except for those who survived until 1982 census when living arrangements were reassessed. Consequently this important variable cannot be specified accurately for the new widows.

withdraws from the study, dies or the study ends. He/she thus contributes an integer number (0–8) of person-years of exposure.

During any one year interval of observation, if a person is lost to follow up, no person-time is allocated for that interval. If the person dies within the interval, the full interval of person-time is allocated. Thus in this scheme, censoring takes place at the beginning of the interval and deaths at the end of the interval. If an interval is truncated by the end of the study, no person-time and consequently no deaths occurring during that time are counted. In terms our data set any death occurring between 4/30/82 and 6/30/82 is not counted. Explanatory variables (most

Table 1(a). Death rates for women by marital status and household headship

Age group	Deaths	Person years	Mortality[a] rate	Age group	Deaths	Person years	Mortality[a] rate
Widows heading households				*Widows living in households headed by their sons*			
45–49	2	365	00.55	45–49	5	575	00.87
50–54	20	948	02.11	50–54	22	1765	01.25
55–59	18	814	02.21	55–59	48	2255	02.13
60–64	16	661	02.42	60–64	88	2281	03.86
65–69	31	596	05.20	65–69	116	2252	05.15
70–74	26	366	07.10	70–74	152	1851	08.21
75–79	22	190	11.58	75–79	126	964	13.07
80–84	8	64	12.50	80–84	60	433	13.86
85 +	9	49	18.37	85 +	62	258	24.03
Total	152	4053	03.75	Total	679	12634	05.37
Widows living in households not headed by themselves or their sons				*Women who remained married without adjusting for headship*			
45–49	0	69	00.00	45–49	21	2184	00.96
50–54	5	238	02.10	50–54	40	4697	00.85
55–59	4	326	01.23	55–59	59	3309	01.78
60–64	25	428	05.84	60–64	50	1614	03.10
65–69	35	388	08.27	65-69	30	788	03.81
70–74	48	409	11.74	70–74	34	340	10.00
75-79	26	225	11.56	75–79	07	95	07.37
80–84	14	83	16.87	80–84	01	14	07.14
85 +	16	79	20.25	85 +	02	18	11.11
Total	173	2280	07.59	Total	244	13059	01.87

[a]Mortality rate = deaths per 100 person-years.

Table 1(b). Regression coefficients (SE) from discrete hazard models of mortality, for females ages 45+, adjusting for marital status and household headship

Model =	1	2	3	4 (3 − Widself) + Widson	
Variable	*B* (SE)	*B* (SE)	*B* (SE)	*B* (SE)	Reference
Intercept	−14.8517* (0.9648)	−14.7465* (0.9744)	−14.5633* (0.9741)	−14.5831* (0.9463)	
Widself	0.0922 (0.1099)	0.1601 (0.1100)	−0.1263 (0.1175)		Married
Widson	0.1642 (0.0850)	0.1249 (0.0855)	−0.0007 (0.0874)		Married
Widother	0.3793* (0.1115)	0.3632* (0.1119)	0.2302* (0.1135)	0.2507* (0.0885)	Married
Age	0.2621* (0.0277)	0.2635* (0.0281)	0.2676* (0.0280)	0.2674* (0.0270)	
Age square	−0.0013* (0.0002)	−0.0013* (0.0002)	−0.0014* (0.0002)	−0.0014* (0.0002)	
(1974–75) famine yr	0.4302* (0.0807)	0.3808* (0.0813)	0.3742* (0.0815)	0.3735* (0.0813)	1977–82
(1975–76)	0.4449* (0.0814)	0.4150* (0.0817)	0.4126* (0.0819)	0.4124* (0.0817)	1977–82
Disabled		0.6094* (0.0862)	0.6023* (0.0861)	0.6222* (0.0846)	Able
>1 Room			−0.2310* (0.0745)	−0.2192* (0.0736)	One room
Quilt			−0.2978 (0.0630)	−0.2924 (0.0624)	No quilt
≥1 cow			−0.1714* (0.0651)	−0.1523* (0.0636)	No cows
−2 Log likelihood	9460.7	9414.1	9360.8	9362.5	
No. parameters	7	8	11	9	

* = $P < 0.05$.
Widself = widow heading household; Widson = widow living in household headed by her son; Widother = widow living in household headed by individual other than herself or her son.

Table 2(a). Mortality rates for widows by living arrangement

Widow status	Deaths	Person-years	Mortality rate (deaths/100 person-years)
Living alone	0181	03027	5.98
Wslfson	0030	02418	1.24
Wslfnson	0082	02851	2.88
Hedson	1322	25696	5.14
Hedother	0352	04662	7.55
Total	1967	38154	5.15

Wslfson = widow heading household with adult son present;
Wslfnson = widow heading household with adult son absent;
Hedson = widow living in household headed by adult son;
Hedother = widow living in household headed by individual other than her self or her son;
"adult son" = son aged 15 years and above.
The deaths and person-years in the above table do not match those of Table 1(a) because Table 1(a) included only a 50% sample of widows while the above table is a 100% sample of widows in the surveillance area.

Table 2(b). Regression coefficients (SE) from discrete hazard models of mortality for widows aged 45+, adjusting for living arrangements

Model =	1	2	
Variable	*B* (SE)	*B* (SE)	Reference
Intercept	−12.715*	−12.9751*	
	(0.8717)	(0.8764)	
Living alone	0.2957*	0.0748	Widow living in household
	(0.0839)	(0.0886)	headed by her son
Heading household with	−0.5825*	−0.6181*	Widow living in household
adult son present	(0.1892)	(0.1898)	headed by her son
Heading household with	0.0552	0.0593	Widow living in household
adult son absent	(0.1183)	(0.1205)	headed by her son
Living in household	0.2334*	0.2104*	Widow living in household
not headed by self or son†	(0.0640)	(0.0645)	headed by her son
Age in completed years	0.2155*	0.2232*	
	(0.0242)	(0.0243)	
Age in yrs squared	−0.0010*	−0.0010*	
	(0.0002)	(0.0002)	
Disabled	0.7372*	0.6784*	Not disabled
	(0.0634)	(0.0640)	
(1974–75) famine yr		0.3638*	(1977–82)
		(0.0637)	
(1975–76)		0.3169*	(1977–82)
		(0.0664)	
Quilt		−0.3071*	No quilt
		(0.0513)	
>1 Room in household		−0.1709*	One room
		(0.0619)	
⩾ One cow in household		−0.1778*	No cows
		(0.0527)	
−2 Log likelihood	14,145.7	14,030.9	
No. parameters	7	12	

* = $P < 0.05$.
† = Typically headed by a son-in-law, grandson, nephew or brother.

importantly marital status) are allowed to change only at the end of each one year interval.

The final step in the estimation procedure is to pool all the observations for each individual and calculated maximum likelihood estimates of the logistic regression model:

$$\log(P/[1-P]) = B_1^* \chi_1 + B_2^* \chi_2 + B_3^* \chi_3 + \cdots + B_k^* \chi_k.$$

In the above model each coefficient $(B_1 - B_k)$ is interpreted as the natural logarithm of the relative risk of dying with and without that characteristic.

RESULTS

In our modelling approach, we have used relationship of the individual widowed woman to the household head as a measure of household and kinship structure. Married women are not disaggregated as in almost all the cases they live in households headed by their husbands. The "headship" categories for widows are (a) a widow heading her own household; (b) a widow living in a household headed by her son and (c) a widow living in a household headed by an individual other than herself or her son (typically an adult male kin such as

son-in-law, nephew, grandson or brother). These categories refer to headship status in 1974 (the beginning of the eight year followup period), so that the sample used in this regressio analysis is comprised of the groups "old widows" and "married throughout". We then test sequential models which add various socio-demographic variables, which may help account for differences in mortality by marital status and household headship (Tables 1a,b).

Model 1 in Table 1(b) shows that once controls for age and famine period are introduced, only widows living in households headed by "others" have higher mortality risks relative to married women. Widows in other "headship" categories do not exhibit statistically significant excess mortality risks relative to their married peers. Given the large age difference between widows and currently married women and the strong negative association between age and mortality, it is not surprising the age is highly significant in accounting for the mortality differential between the different head of household categories for widows and the reference category which consists of married women regardless of headship.*

In model 2 (Table 1b), the presence of disability assessed at the beginning of the study†) is introduced as a variable and not surprisingly is found to be a major predictor of mortality. Furthermore, the introduction of controls for disability substantially reduces the mortality risk for widows living in households headed by their sons relative to their married peers (models 1–2, Table 1b). This suggests that part of the excess risk of mortality for these women compared to their married counterparts can be accounted for by their higher prevalence of disability. This hypothesis is supported by data which indicate that regardless of marital status, disabled women invariably live in households headed by individuals other than themselves, mostly their sons. Analogously, the increase in the relative odds associated with widows living in households headed by themselves (models 1–2, Table 1b) is explained by the fact that no such widow is disabled while there do exist married disabled women.

The addition of controls for household economic status (as reflected in: the number of rooms, the presence of a quilt and the ownership of cows) substantially attenuates the mortality risks of widows in all headship categories relative to their currently married peers‡ (model 3, Table 1b). This suggests that economic decline associated with widowhood accounts for a substantial portion of the excess mortality risk of widows relative to the currently married.

All the economic status indicators used in our analysis (number of rooms in the household, presence of quilt in the household and number of cows owned by the household) are measures of combined household resources as opposed to individual resources and that they are measured only once at the beginning of the study with no further information about changes in assets over time. The correlation between household resources and actual individual access to resources is difficult to assess. One would expect family size to be a very important factor in this relationship, however in preliminary analysis, family size appears to be unimportant. This may be due to the fact that the age and sex composition of household members may be more important than merely the number of individuals in the family.

It is important to note that, in moving from model 1 to model 3 in Table 2(b), each time new variables are added, the fit, as measured by likelihood ratio tests, improves. Model 3 shows, however, that only one category of widows, those living in households headed by someone other than themselves or a son, experience mortality risks different from women who were married throughout the period. Model 4 successively combines the widows who head their own households and those living with sons with women who were married throughout. Model 4 fits the data as well as model 3 and is therefore, our preferred model. Salient features of this model are, that once one controls for age, household assets, disability status and exposure to famine, not all widows suffer an excess risk of dying compared to currently married women. Indeed the only group of widows that remain in the excess group are those living in households headed by "others" (typically son-in-laws, or nephews, grandsons or brothers). Widows living in households headed by themselves or by their sons seem to be at no extra risk compared to their married counterparts.

The presence of adult sons in the household

Apart from household headship, another important dimension of living arrangements in rural developing societies which may have an impact on older widow mortality is the presence of adult sons or some such male surrogate in the household. Some earlier work in rural Bangladesh suggests that the absence of adult sons in the household puts a widowed women at much higher risk of mortality with single widowed women being particularly vulnerable [7].

In order to explore further the relative importance of adult sons in reducing the mortality risks of older widows we analysed the survival experience of

*Sequential additions of age and famine period exposure were tested. The addition of controls for age substantially attenuated the relative mortality risks of the different widow "headship" categories. However, the addition of controls for exposure to famine while strong independent predictors of mortality had little effect on the widow "headship" coefficients.

†Disability is an occupational category which refers to gross, visible handicaps preventing individuals from working, and was measured only at the beginning of the study.

‡In addition to the household assets mentioned above, a variety of other socio-economic/behavioral indicators (the presence of remittances, roof structure) were tested but were not found to be significant independent predictors of mortality.

women who were already widowed prior to entering our study and stratified them on the basis of the presence of adult sons and household headship (Tables 2a,b).* Recall that for the women widowed during the study, we have no information available about changes in living arrangements which would typically accompany widowhood.

Model 1, in Table 2(b) suggests the following ordering of mortality risk categories for widows, controlling for age and disability: {(i) = lowest risk and (iv) = highest risk}.

Widows with adult sons.

(i) Widows who are both household heads and have an adult sone present in the household.

(iia) Widows who live in households headed by their adult sons.

Widows without adult sons.

(iib) Widows who head multi-person households with no adult sons present {(iia) and (iib) are non distinguishable statistically}

(iii) Widows who live in households headed by "others"—(typically a son-in-law, grandson, nephew or brother).

(iv) Widows who head single person households, i.e. live alone.

One interpretation of the above risk ordering is that it represents decreasing individual access to resources, i.e. widows who head households with adult sons present have the most while widows who live alone have the least. An attempt was made to test this hypothesis by introducing controls for household assets (a crude proxy for individual access to resources in the case of women). As shown in model 2, Table 2(b) the controlling for household assets significantly attenuated the relative mortality risk for single widows but had little effect on the other categories of widows.† This result is consistent with the notion that in situations where household assets are a good reflection of individual access to resources for women (as in the case of single widows) they account for a significant proportion of the excess mortality risk. The lack of explanatory power for household assets in the case of multi-person households may be due to the lack of correlation between individual resources for women and joint household resources in such living arrangements.

DISCUSSION

It would not be implausible to hypothesize that an individual's mortality risk is to a large extent dependent on access to resources. The ordering of risk categories amongst widows suggested by model 1, Table 2(b) is consistent with the notion that in rural Bangladesh, where women are almost completely dependent on male kin for their livelihood, the presence of an adult son or some such male surrogate can be thought of as a proxy for individual control of resources. Thus widows with adult sons present have lower mortality risks that those without. However within the category of adult sons present, widows who head households have lower mortality risks than those who don't. This latter result suggests that being designated the head of a household may be associated with a greater degree of control over resources. It is worth noting that the advantages of autonomy within the household vis a vis mortality risks are in keeping with results from studies in the U.S. [28] which have also shown that widows who are heads of households have lower mortality than other widows.

Among widows without adult sons, we find that individuals who live with another first degree adult male relative have lower mortality risks than those living alone. This underscores the importance of women having access to male kin in a society where income generating avenues for women are very limited. The one anomalous result we have is the lack of increased mortality risk (relative to widows living in households headed by their adult sons) for widows heading multi-person families. Two possible explanations for this somewhat surprising result are discussed below:

The first focuses on the fact that widows heading multi-person households without adult sons are not necessarily women without surviving adult sons. A substantial number of these women may be getting significant economic and social support from (sons) outside the household, which may not be reflected in the variables we have available to incorporate in our model. One of the major limitations of our analysis is that we lack direct information about sharing of resources between family members who live in different households. It is not inconceivable that a widow heading such a household may receive substantial support from her adult son who lives in a separate household either in the same village or further away in the city. While it was not possible to evaluate the receipt of support from adjacent sons, we did attempt to explore the impact of remittances received by the household, typically from sons living in the city. However the existence of such remittances when tested, were not found to be significant in predicting mortality for older widowed women.

A second explanation is that these women may actually have access to earnings from sons who while not old enough to be classified as household heads are still sources of income. Typically in rural

*In order for there to be adequate sample sizes, all widows in the Matlab surveillance area were included for this analysis.

†Sequential additions of household asset indicators and famine exposure indicators were tested. As pointed out in the text, household asset indicators had significant impact on the relative mortality risk of the various living arrangement categories. However, famine exposure indicators had relatively little effect on these coefficients.

Bangladesh, children after the age of 10–12 are considered net providers to the household [2]. Thus our definition of adult son may be overly restrictive. This issue will be addressed in subsequent research in which the age/sex composition of households is studied in greater detail.

The ordering of mortality risk categories amongst older widows is broadly consistent with our earlier comparison of mortality risks of widows and their married counterparts (Table 1). In light of the analysis in Table 2, one can interpret the lack of mortality difference between widows heading their own households and married women regardless of headship as arising from the advantageous situation of widows heading households with adult sons present and widows heading multi-person households (with possible access to an adult son). Thus the disadvantageous position of single widows is masked by this heterogenous grouping.

In conclusion this paper has presented evidence which suggests that in rural Bangladesh, access to individual resources for older women is to a large extent dependent on access to male kin with important consequences for mortality risks. While this study has clarified a number of issues *vis a vis* the determinants of mortality for older women in a rural developing society, it has also raised a host of intriguing questions which need to be explored further. A more comprehensive investigation of these issues requires the use of detailed information on individual level expenditures for food and health care similar to that reported by Chen *et al.* [24] and more precise measures of health status with data on changes in these measures over time. In addition an adequate treatment of these topics requires information on changes in living arrangements over time so that household composition can be measured over a woman's lifetime. Perhaps even more important, information on family structure and social networks [15, 29, 30], not just residential arrangements, would enhance our ability to investigate the importance of children and other kin for the elderly. The latter is particularly true in societies such as rural Bangladesh where support systems (both economic and social) for adults span across households and involve the larger kin network.

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