



# ARE DAUGHTERS A BETTER INVESTMENT: GENDER DIFFERENCES IN THE IMPACT OF CHILDREN'S EDUCATION ON THE HEALTH OF ELDERLY PARENTS IN RURAL BANGLADESH

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## Abstract

There is considerable evidence that children are crucial sources of support for elderly populations in developing countries. However, the intervening mechanisms through which children have an impact on the parents' old-age health remains relatively ambiguous. In this paper, elaborate data on the 60+ population (N=1733) from the *Matlab Health and Socioeconomic Survey (MHSS)* conducted in rural Bangladesh has been employed to examine the impact of quality of children (characterised by their level of education) on the health status of elderly parents. Binary logistic regression has been used to test whether the level of education of the highest educated children affects the self-reported health of their parents, and whether there are any gender differences in both ends of the spectrum. The major finding is that educated daughters are strongly associated (OR = 3.06, CI: [1.78, 5.24]) with a significant improvement in the health of elderly mothers (but not fathers), even after controlling for a variety of socio-economic and individual factors. Surprisingly, educated sons, on the other hand, were found to have no such impact (OR = 0.92, CI: [0.52, 1.63]), apparently contradicting traditional beliefs about sons being the main sources of support for the elderly in patrilineal societies like rural Bangladesh. This paper attempts to explain these findings through gender differences in filial roles, mobility and behaviour patterns, and complex interactions between parents and children.

**Keywords:** Gender difference, Children's Education, Daughter, Elderly Health, Old-age Security, Filial Role, Caregiving

## Introduction

In countries where there is a lack of formal mechanisms to take care of the elderly (such as old homes, social security programs, pensions and insurance schemes), security in older ages is thought to depend on a variety of socio-economic factors, but largely on the availability of close family members, especially children, to provide financial and instrumental support (Kohler, Elo, & Kohler, 2004; Martin, 1990; Mason, 1992; Pörtner, 2001; Rahman, 1999b; Rahman, Menken, & Foster, 1992; Wu & Rudkin, 2000). Various studies have shown that the presence of adult children is associated with the wellbeing (both physical and psychological) of older men and women, especially in societies in which the ethos reinforces kinship ties and filial obligations (Eggebeen & Hogan, 1990; Hermalin, Ofstedal, & Chang, 1995; Mutran & Reitzes, 1984; Ofstedal, Knodel, & Chayovan, 1999; C. E. Ross, Mirkowsky, & Goldstein, 1990; Rossi, Rossi,

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& Peter, 1990; Silverstein & Bengston, 1991; Su & Ferraro, 1997; Wu & Rudkin, 2000). Some studies have also suggested that sons are more crucial for old age security than daughters in patrilineal societies, explained by their comparative income-earning advantage, co-residence with the parents after marriage unlike daughters, and also the fact that daughters are exogamous and mainly cater to their in-laws after marriage (Cain, 1984, 1986; Rahman, 1999a; Wolf, 1972).

However, a preceding study on the *Matlab* data showed that elderly women's health essentially requires the presence of the husband, at least one son, and at least one daughter with every category having a unique positive impact and no substitutability (Rahman, Menken, & Kuhn, 2004). In stark contrast, spouse-children combinations did not seem to matter at all for the health of elderly men. Although this shed preliminary light on the differential effect of gender in both ends of the spectrum, the study acknowledged the inability of its models to definitively establish causal relationships.<sup>2</sup> In particular, the study left two important questions unanswered, regarding, a) the mechanism of impact - whether it was the mere presence of children or children's characteristics (wealth, marital status, education, co-residence, etc.) which was causing the positive impact on elderly mothers, and b) the reasons for the gender difference in the impact of children - why sons and daughters were non-substitutable between each other.

This paper derives logically therefrom, and aims at using the same dataset to explore whether the "quality" of children, characterised by their level of education, matters for their parents' health over their mere presence, the "quantity" factor. It looks at two facets of gender variations in interactions between children's education and their parents' health - a) between sons and daughters, and b) between father and mother. In addition to establishing gender differences in impact, and the degree of the same, this paper also tries to illuminate / speculate on mechanisms through which any such impact was taking place.

Literature has explored some mechanisms responsible for interactions between children characteristics and parents' health, with most studies focusing on the children's financial and human capital resources (Hermalin, Ofstedal, & Lee, 1992; Hirosima, 1992; Knodel, Friedman, Anh, & Cuong, 1998; Pörtner, 2001), and a few on the impact of marital status and employment (Lin, Goldman, Weinstein, Lin, Gorrindo, & Seeman, 2003; Stoller, 1983). However, very few have looked at the impact of children's educational status independently. This vacuum in literature is attributable, (a) to an obvious correlation between education and financial resources; (b) to the lack of data from developing countries covering health measures of parents as well as characteristics of children and the type of children-parent interactions; and (c) to the methodological intricacy in eliminating the endogeneity between children's education and parent's health.

The most notable work in this void are probably three studies on elderly Taiwanese (Zimmer, Hermalin, & Lin, 2002; Zimmer, Martin, & Lin, 2005a; Zimmer, Martin, Ofstedal, & Chuang, 2005b), which tested whether their physical functioning and mortality (proxies for health status) were influenced by the educational status of their adult children. The earliest among the studies found that children's education predicted the extent of physical impairments, while the latter analogously showed that mortality risks attenuated significantly for parents with at least one

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<sup>2</sup> It was tentatively suggested that the better health of women might have resulted from the association of presence of children of both sexes with a higher social status. The statistically insignificant impact on men was attributed to the insufficient sample sizes of males in some categories of spouse-child combinations, and also to the fact that men tend to control financial resources even at older ages.



highly educated child. One of the most interesting findings in the second paper was that, having both a son and a daughter with university education had an additional favourable effect on mortality risks, indicating that educated children of each gender might have distinct and complementary health benefits for their elderly parents. This phenomenon has also been observed, also in the Taiwanese context, in a study by Lin and others (2003). Although this study included education as only one of many variables to assess the determinants of various types of support provided by children to their elderly parents, it was nevertheless found in the analyses that education of sons increased their chances of providing financial support to parents, whereas educated daughters were much more likely to provide help with ADLs<sup>3</sup> than the lowest educated children. As a whole, however, education significantly enhanced only the sons' ability to care for their parents, but not that of daughters.

It was very surprising that all prominent studies on this topic were bounded strictly within one country, and even after extensive literature search, no paper could be found illuminating this issue in the South Asian context. Although Bangladesh is similar to Taiwan in having strongly patrilineal societies and highly cohesive families, this study differs in its context and approach from the Taiwanese studies in some very important ways. First and perhaps most important, Taiwan is a developed country compared to Bangladesh, and has much greater levels of formal social security (including a Universal Health Insurance Program (Zimmer et al., 2005a)) for the elderly which are practically absent in the latter. Second, Bangladesh is mostly an agricultural economy and the study setting is absolutely rural, whereas in case of Taiwan, an industrialized country, a majority (over 60%) of the samples in all the studies were from urban or peri-urban localities. Third, Taiwan has a much greater per capita income, and hence the Taiwanese respondents were significantly better-off financially compared to their counterparts in Matlab. Fourth, fathers were separated from mothers in this study, whereas they were analysed as a coherent group in the Taiwanese studies. Almost all of the abovementioned differences can possibly affect any interaction between children's education and parent's health, and also point in the direction that any result found in Taiwan might actually be more exaggerated in Bangladesh.<sup>4</sup> And finally, any differences (which are highly likely) in culture and social dynamics between the two countries could as well have an impact on gender differences, within children and also within parents.

In spite of these differences, this study retains two strengths of the Taiwanese data which are particularly noteworthy. First, data in most surveys are usually taken at the household level; however, in this data set, detailed information was collected on children living away as well as those living with the parents at the time of the survey. Very few surveys, if any, have documented such comprehensive information in a developing country like Bangladesh. Secondly, in Bangladesh, there is a huge gap in intergenerational educational attainment, with the elderly adults much less educated than their children, due to the large-scale improvements in provision of education over the decades preceding the survey. This **difference is even larger** than in the Taiwanese setting, and the impact of the children's education on their parents' health is therefore likely to be even more amplified.

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<sup>3</sup> ADL = Activities of Daily Living; includes bathing, dressing and maintaining toilet functions.

<sup>4</sup> Elderly respondents from the Matlab sample, being rural, poor and having no formal social security, should be more likely to be dependent on their children for support, and hence the education of their children should have a greater impact on their health than in case of their Taiwanese counterparts.



## Design and Methods

This study is based on a typical setting in rural Bangladesh, a district called Matlab 40 miles from the capital Dhaka, that is characterised by very high levels of poverty (annual per capita income of only US\$ 370), illiteracy (almost half of 15+ population), and inadequate access to modern healthcare facilities (patient-physician ratio of 4071:1) (Rahman et al., 2004). Elderly adults aged 60 years and above were the focus of this study; this age group constitutes about 7% of population of Bangladesh, and can expect to live 20 more years at 60 years of age, with men and women faring quite equally. Co-residence with adult children (especially sons) is extremely common, in the absence of alternative means of social and financial support for the elderly. The majority of men are farmers, and unemployment rates are very low even among older men. Women's activities range within homestead activities and small farming in the backyard, traditionally being restricted within the household, and with very little opportunities of venturing outside. The society is strongly patriarchal and village exogamy is typical, a woman moving in with her husband's family and caring for her in-laws after marriage. There have been large scale improvements in the education system and primary school enrolment since mid 1980s, leading to significant intergenerational differences in educational attainment.

The data is obtained from the *Matlab Health and Socioeconomic Survey (MHSS) 1996*, one of the most extensive cross-sectional data ever collected in any developing country. The survey used multi-stage cluster sampling to collect detailed information on approximately 11,200 individuals aged 15 or above in 4,364 households distributed among 2,687 *baris*<sup>5</sup> or residential compounds. The dataset is also unconventionally accurate compared to its counterparts in other developing countries, since its sample was originally derived from a very efficient and high quality surveillance system.

This study analyses all 1733 elderly individuals (988 men and 785 women) aged 60 years and above covered in the survey. For each of these individuals, there was a variety of information on age, educational status, household assets, marital status, number of sons and daughters alive and their characteristics (education, proximity, marital status, etc.), the presence and severity of chronic diseases, and self-reported general health. Individual observations were weighted to reflect the entire elderly population at Matlab and adjust for intra-cluster (*bari*) correlation, but were found to be very similar to the unweighted values. Therefore, the descriptive statistics are presented in unweighted form to avoid complexity.<sup>6</sup> However, in sequential modelling of the impact of children's education on the self-reported health of elderly parents while controlling for other factors (age, own education, economic affluence, presence of spouse, chronic diseases, and number of children), logistic regression was adjusted for clustering (Stata SE 8.0) to precisely reflect reality. The same models were run separately for men and women, because women have been shown to have very different characteristics from men in their perceived health status and its determinants in previous studies (Benyamini, Blumstein, Lusky, & Modan, 2003; Idler, 2003; Rahman & Liu, 2000; Rahman et al., 2004; Spiers, Jagger, Clarke, & Arthur, 2003).

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<sup>5</sup> The *Bari* is the basic unit of social organization in rural Bangladesh. Most comprise a cluster of households that in many instances have kin links, although about 16 percent have a single household. Even in multi-household *baris*, kin connections may link only among a subset of the households.

<sup>6</sup> It is to be noted that these values are biased towards a slightly older population than is representative, due to the tendency of small *baris* (which are more likely to be picked by cluster sampling) to have older people (since younger people have typically migrated out).



## Operationalization of the Variables

The outcome variable in this study was a dichotomous “self-reported good health”, derived from a question in the survey that asked respondents to rate their health as being “good”, “average” or “poor”. Although there has been scepticism about self-reported health being a robust marker of underlying health status, several studies have indicated that it is a robust predictor for mortality (Benyamini, Idler, Leventhal, & Leventhal, 2000; Benyamini, Leventhal, & Leventhal, 1999, 2003), even in Bangladesh (Kuhn, Rahman, & Menken, 2004). The ability of self-reported health to reflect underlying health status and its association with measured physical performance in Bangladesh has also been reported previously (Rahman & Barsky, 2003). It has been speculated that this indicator, although subjective, might be able to capture not only physical health (disease and dysfunctions) but also psychological health and satisfaction with life, which are otherwise extremely difficult to capture quantitatively. Moreover, Rahman *et al.* 2004 used this same variable in inverse form (“self reported poor health”), and splendidly captured the effect of family members, which would perhaps have been difficult with any conventional health indicator. Thus, although other variables such as “absence of major disease” were available in discretion, this versatile and nuanced indicator was favoured.

Children’s education was the main predictor variable of interest. It was hypothesized, conforming to previous research, that having educated children would significantly increase the chances of at least elderly women to be in good health. Two separate variables were constructed for children’s education– one with the number of years of schooling of the highest educated son, and the other similarly for daughters. Since these variables were highly skewed in nature, and for ease of interpretation, they were recoded into two corresponding dichotomous variables, with success being the education of any son/daughter beyond primary (>5 years). Variables on the average level of education of all sons (or all daughters) of a respondent were also generated, but for the reasons mentioned later in the results section, maximum level of education was favoured.

Age of the respondent was the first obvious choice for control variables, and was added as a continuous variable. One of the most significant and established predictors of morbidity and mortality (Alves & Rodrigues, 2005), age could also have an interaction effect on the impact of children’s education. With increasing age, the elderly would be more likely to need assistance and support from their children, and therefore, in older ages the impact of educated children could actually be higher. The heterogeneity in the sample with respect to age was minimized by limiting it to 60+ individuals, rather than at a lower age criterion.

Own education (coded similarly to children’s education in this study) has been shown to be an important determinant of old-age health status and also mortality (Elo & Preston, 1996; Guralnik, Land, Blazer, Fillenbaum, & Branch, 1993; Huisman, Kunst, & Mackenbach, 2003; Kaplan, Strawbridge, Camacho, & Cohen, 1993; C. E. Ross & Wu, 1995; C. E. Ross & Wu, 1996; Zimmer *et al.*, 2002; Zimmer *et al.*, 2005a), although there is a certain degree of endogeneity between health and education (better health leading to greater chances of getting educated). It might also be one of the major confounders in this study, since own education is expected to be highly correlated with children’s education and socioeconomic status. The positive impact of own education on elderly health is explained by reduced risk behaviours, increased knowledge of disease prevention, relatively easy access to medical care, etc., all of which are ways educated children can be expected to contribute to their parents’ health status. It would therefore be interesting to see if a respondent’s own education negates the impact of their



educated children, or whether they have complementary advantages for health, as found in Taiwan (Zimmer et al., 2002).

A more controversial variable that might have a bearing on elderly health status is financial resources. Although numerous studies have previously shown the impact of socioeconomic status on health [though in varying degrees (Alves & Rodrigues, 2005; Hemingway, Nicholson, Stafford, Roberts, & Marmot, 1997; Preston & Taubman, 1994)], recent research suggests that it might be through other pathways not directly related with income/assets ([reference needed](#)). In Matlab, financial resources are inherently very limited, and the wealth distribution is highly skewed, with the top 5% rich households controlling more resources than the rest 95% combined. It is also dubious whether in rural Bangladesh, where access to medical services is so limited, access to financial resources effectively means better health status, since wealth functions as a determinant of health largely through securing access to quality healthcare. One could make a point, however, that people with significant resources could travel to the city to avail health services. Thus, instead of taking “in the lowest quintile of household assets” as a determinant variable (as would be intuitive), the highest quintile, the group most significantly different from rest three quintiles and enjoying much greater economic affluence, was used. This group comprised of respondents whose household assets valued at more **than US\$3265** at 1996 rates. Household assets was employed despite it being a crude measure<sup>7</sup>, since it not only sums up asset values, but might additionally account (at least partially) for inflow of remittance and other financial transfers from migrant or non-coresident children. Finally, one might argue that there is a significant reverse relationship between health and assets, simply because good health might itself help to secure more resources through better employment and higher productivity. This is perhaps true for men (although a large chunk of household assets is usually gained through inheritance); however, exogamy in marriage ensures that in case of women, their household assets are almost totally independent of their own health, since it is in effect the wealth of her husband’s family and not her own.

Chronic diseases are often genetic (Sternesky, 2002) and are also very good predictors of poor health (Alves & Rodrigues, 2005), which prompted its inclusion into the model. It would be interesting to see if children’s educational status played a significant role while controlling for chronic diseases, and also whether the impact of age subsided after introducing this variable. This variable was derived in two steps. From the questionnaire, 13 dichotomous questions were taken which asked the respondents to identify symptoms of major chronic diseases<sup>8</sup> which caused discomfort or hampered physical functions over the past 3 months. These variables were then added to give the number of chronic diseases that any individual had experienced recently, “0” (zero) meaning no chronic disease symptoms (the reference category).

Research has shown that the presence of a spouse holds potential benefits for the health (both physical and mental) of elderly individuals (Gupta & Shankar, 2003; Hu & Goldman, 1990; Mostafa & Van Ginneken, 2000; Rahman et al., 2004). For men, this variable intrinsically held little significance in this study, because there were only 88 elderly males without a wife at the time of the survey. For women, on the other hand, almost half of whom were widowed, it would

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<sup>7</sup> Household assets estimated the money value of all assets, including land resources (homestead and agricultural), jewellery, various household goods (furniture, bicycle, radios, etc.) and livestock. The monetary values were self-reported by the head of the households.

<sup>8</sup> Chronic disease included arthritis, anemia, broken or fractured bones, cataracts and other eye disease, asthma or other breathing disorders, diabetes, pain or burning sensation in urination, paralysis, gastric/ulcer, tuberculosis, edema, and penile/vaginal diseases.





be interesting to see if the presence of the spouse had any additional significant effect on their health status over other factors already in the model.

Finally, we assumed that the number of sons and daughters might affect the health of the parents due to a “quantity effect”. More specifically, we were interested to know whether a woman with five educated children was better off than one with fewer educated children. Of course, theoretically speaking, more sons and daughters could mean more sources of financial and instrumental support and therefore better health. Also, with our previous models, respondents without living children of any one sex (although very few cases) would be included in the children’s education variables with a value zero, but this wouldn’t differentiate them from respondents with uneducated sons/daughters. As a result, the reference category would become heterogeneous, including both men and women with uneducated children and with no children. In order to control for these effects of quantity, the number of sons and daughters (separate variables) were lastly added to the model.

Some other variables were also considered for inclusion in the regression – including (i) degree of social networks (NGO membership, frequency of contact with friends or family); (ii) children’s marital status; (iii) Proximity to health centres; (iv) occupation in working age; (v) media exposure; (vi) smoking habits; and (vii) own cash savings and ability to spend independently. Out of these, we did not expect the first five to be significant because of the fairly homogenous nature of the sample with regard to these characteristics (most children being married, health centres far away, farming as occupation, and limited media exposure). Frequent smoking habit (significant only for men) would usually cause discomfort and health problems through the manifestation of chronic diseases, which has already been covered in the model. And finally, own cash savings and ability to spend independently could potentially be an important indicator for women (since men typically control financial resources) in a setting where healthcare could be availed in return for money. But since that was not the case, this variable was also dropped. Ultimately, for the sake of parsimony, the effects of these variables were ignored in the models.

## RESULTS

Table 1 shows the socio-demographic and health characteristics of the study sample along with the characteristics of their children, all segregated by gender. Women were a slightly younger group than the men, and almost two-thirds did not have their husbands, with most being widowed. Women had received almost no education compared to the men, with only 1.8 percent having crossed primary education, against 19.5 percent of men. Women were also comparatively poorer than men and more likely to be in the worst socioeconomic quintile, owing to the high widowing rates. However, in the richest quintile, women and men showed almost no difference.

The vast majority of respondents had sons and daughters. Only 27 respondents (1.56%) reported having no children, while 88 (5.08%) and 156 (9.00%) had no sons and no daughters respectively. Men typically had more children than women, and number of sons was higher than number of daughters. Men were also better off with regards to the quality of their children. Their children had higher levels of education compared to those of the elderly women, both sons and daughters gaining approximately 1 additional year of education. These differences could

perhaps be due to the fact that women have older children than men of the same age, and in Bangladesh, the school enrolment had increased very sharply over the recent past.

	Percentage/ Mean		
	Men	Women	Total
Sample size	988	785	1733
<i>Respondent (elderly parents) characteristics</i>			
Age (years)*	67.87 (6.68)	67.14 (6.61)	67.55 (6.66)
60-69 (%)*	65.18	70.57	67.57
70-79 (%)*	28.04	21.66	25.21
80+ (%)	6.78	7.77	7.22
Married (%)*	91.09	34.39	65.99
Received 6+ years of education (%)*	19.53	1.78	11.68
Still working (%)			
% In lowest quintile of household assets *	16.70	23.40	19.66
% In highest quintile of household assets	22.57	22.63	19.66
% Having son(s)*	96.46	93.25	95.04
% Having daughter(s) [%]*	93.83	87.90	91.20
Mean no. of living sons*	3.08 (1.60)	2.72 (1.66)	2.92 (1.64)
Mean no. of living daughters*	2.71 (1.57)	2.32 (1.52)	2.54 (1.56)
Mean education of highest educated sons*	7.08 (4.57)	6.18 (4.85)	6.68 (4.71)
Mean education of highest educated daughters*	4.28 (4.01)	3.05 (3.84)	3.74 (3.98)
Mean of average education of sons*	4.97 (3.82)	4.40 (3.94)	4.72 (3.88)
Mean of average education of daughters*	3.10 (3.31)	2.19 (3.02)	2.70 (3.21)
<i>Health of respondents (elderly parents)</i>			
Mean no. of chronic diseases*	1.78 (1.48)	2.24 (1.54)	1.98 (1.52)
% Without any chronic diseases*	19.94	11.46	16.19
% Able to move all extremities <sup>9</sup> *	83.00	51.21	68.92
Mean no. of functional limitations <sup>10</sup> *	0.783	1.92	1.29
% Self-reported good health *	33.40	21.02	27.92
At least one son educated beyond primary*	34.64	23.55 †	30.06 †
At least one daughter educated beyond primary*	35.47	27.40 †	32.44 †
<i>Children characteristics</i>			
% Sons married *	57.89	84.58	68.89
% Daughters married *	77.90	94.46	84.61
% Sons employed			
% Daughters employed			
% Sons co-residing with parent			
% Daughters co-residing with parent			

Note: Standard deviations in brackets

\* Men and women significantly different at  $p < 0.05$

† Chi-square significant at 0.05 confidence level

**Table 1: Socio-demographic and health characteristics of respondents and children's characteristics, by gender**

<sup>9</sup> Extremities included all four limbs, and hip.

<sup>10</sup> There were 13 functional limitations that the respondents were asked about in the survey. These included walking a mile, carrying a 10 kg load for 20 yards, standing up from sitting position, climbing a ladder, sweeping the floor, bathing, dressing up or using toilet without help, etc.





Men were also significantly at an advantage in their health status. Their mean number of chronic diseases was 1.8 compared to 2.2 for women, while almost twice the percentage of men (20.0 versus 11.5%) reported having no chronic disease symptoms in the past 3 months. Men also reported much lesser dysfunction/paralysis of extremities (17% against 49%), and their mean number of functional limitations was also clearly superior, only 0.78 the corresponding 1.92 for women. Not surprisingly, as many as one-third of all men, against only about one-fifth of all women, reported having “good health” at the time of the survey. However, this percentage did not change unevenly for men when cross-tabbed with children’s education, but for women, the chi-square test gave significant results for both son’s and daughter’s education, further supporting our hypothesis that children’s education had an effect on women’s health but not on men’s.

### **Regression results for men**

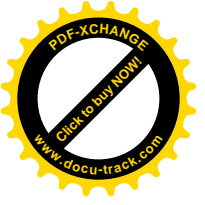
In none of the models constructed for elderly men were the variables of interest, son’s education and daughter’s education, significantly affecting their health. Age remained significant until chronic diseases was entered into the model, but nevertheless did not have any major impact. Own education seemed to be an important predictor of elderly health, with elderly men educated beyond primary more than 1.5 times as likely to be in good health. Supported by literature, this variable could perhaps be acknowledged even at the 0.10 significance level because of the limited sample size of educated men. Another statistically insignificant but noteworthy variable was the presence of a spouse, which increased the odds of a man to be in good health by over 1.65 times. Again due to the insufficient sample sizes, this time of unmarried men, this variable was rendered insignificant by the analysis, but its importance was nevertheless underlined by the coefficient. This was not surprising, however, because numerous studies have previously found the presence of a wife to impact the health of a man in a positive manner (Gupta & Shankar, 2003).

While none of the other variables were at all significant, chronic diseases was the single highly important predictor of good health for men at old ages. Significant even at the 0.001 level in all the models after it was introduced, presence of chronic diseases caused an elderly man to be only half as likely (odds = 0.52 in the final model) to be in good health compared to one without any experience of chronic disease symptoms in the preceding 3 months.

### **Regression results for women**

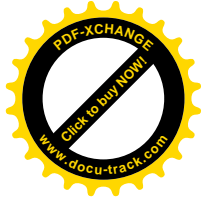
Starting off with son’s education and daughter’s education as the only two explanatory variables, model 1 immediately showed daughters’ education as an extremely significant and highly important predictor of old age health status for women, while, in stark contrast, son’s education was neither significant nor notably important. Equally notable was the fact that these similar variables retained their dissimilar importance and significance levels throughout all the 6 subsequent models that were developed. The only change, if any, was that son’s education shrunk steadily into a worse predictor while daughter’s education only became more and more important with the addition of other variables. Perhaps most startlingly, in the final model, educated sons had a slightly negative influence on the health of their elderly mothers.

Age was insignificant in all the models for women, and did not affect their health in any noteworthy manner. Chronic diseases had an impact as significant and even more important than



in the case of men. Availability of a spouse did not have any favourable impact, unlike the case for men, as was expected due to reasons mentioned earlier.

Apart from the difference in the impact of daughter's education versus son's, the most remarkable thing in these models was the impact of own education. Despite there being as few as 14 women who were educated beyond primary, this variable turned out not only influencing health in a highly positive manner, but also, very surprisingly, holding ground at the 0.05 significance level. According to the last model, women who crossed primary education had 5.24 times higher odds of being in good health than uneducated women.



Explanatory variables	Model 1		Model 2		Model 3		Model 4		Model 5		Model 6		Model 7	
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women
Son's maximum education	1.085	1.215	1.131	1.149	1.087	1.124	1.063	1.026	0.983	1.013	0.978	1.007	0.995	0.921
Daughter's maximum education	1.232	2.439***	1.195	2.366**	1.064	2.283***	1.051	2.343***	1.060	2.902***	1.044	2.891***	1.023	3.057***
Age	-	-	0.963*	0.967	0.963*	0.969	0.962*	0.966†	0.982	0.969	0.984	0.970	0.984	0.970
Own Education	-	-	-	-	1.594†	3.840*	1.554†	3.606*	1.570†	5.605*	1.550	5.643*	1.556†	5.243*
In highest quintile of HH assets	-	-	-	-	-	-	1.186	1.186	1.192	0.999	1.214	0.996	1.223	1.012
No. of Chronic diseases	-	-	-	-	-	-	-	-	0.516***	0.571***	0.517***	0.572***	0.516***	0.568***
Available Spouse	-	-	-	-	-	-	-	-	-	-	1.655	1.047	1.654	1.027
No. of sons	-	-	-	-	-	-	-	-	-	-	-	-	0.990	1.080
No. of daughters	-	-	-	-	-	-	-	-	-	-	-	-	1.018	0.953

\*\*\* Significant at 0.001 confidence level

\*\* Significant at 0.01 confidence level

\* Significant at 0.05 confidence level

† Significant at 0.10 confidence level

Note: All coefficients are odds ratios

**Table 2: Sequential logistic models of good self-reported elderly health**



Initially, maximum level of education of children was chosen intuitively as the variable of interest, because of the apprehension that average education would fail to capture the impact of a few highly educated children. However, to reinforce our decision, we ran the final model using average education in place of maximum. The differences are shown in the table below:

	Maximum			Average		
	Coeff	P >  t	95% Conf. Int.	Coeff	P >  t	95% Conf. Int.
Son's education	0.921155	0.778	[0.521, 1.629]	1.218148	0.464	[0.718, 2.066]
Daughter's education	3.057348	0.000	[1.783, 5.242]	2.596172	0.002	[1.438, 4.687]
Age	0.970365	0.213	[0.925, 1.017]	0.968421	0.189	[0.923, 1.016]
Own Education	5.243069	0.046	[1.033, 26.601]	4.509774	0.074	[0.865, 23.517]
In highest quintile of HH assets	1.012005	0.967	[0.574, 1.783]	1.034593	0.909	[0.578, 1.852]
No. of Chronic diseases	0.568376	0.000	[0.463, 0.698]	0.569591	0.000	[0.461, 0.703]
Available Spouse	1.02699	0.924	[0.595, 1.772]	0.987457	0.964	[0.571, 1.708]
No. of sons	1.079842	0.347	[0.920, 1.268]	1.078768	0.331	[0.926, 1.257]
No. of daughters	0.953091	0.604	[0.795, 1.143]	1.01789	0.833	[0.863, 1.201]

**Table 3: Final model for women compared between average and maximum education of children**

Maximum education gave much more amplified results compared to average, as could be expected instinctively. This could be because average education has a high degree of inherent heterogeneity – for example, 5 children with 2 years of education each, which would perhaps not be very beneficial for the subsequent health of their mother, would give the same average education as 1 child out of 5 with 10 years of education, which could. In the preferred model, the results were much more significant for the key variables as well, with smaller confidence intervals. Contrasting maximum education with average education also gave rise to the question about what would be a wiser investment strategy for parents, and has been discussed in the next section.

## DISCUSSION

This study attempted to look at the impact of children's education on elderly health. Gender differences in both parents and children were explored, and it was found that only the education of daughters was important, and then only for elderly women and not men. This demonstrated the marked and counterintuitive gender differences in filial roles existing in rural Bangladesh, which has thus far remained unexplored. The following subsections describe each important finding, their probable underlying reasons and their implications for policy and future research:

### The indifference of men's health to external factors

Before conducting the analyses, it was hypothesized that there would not be any significant impact of children's education on the health of elderly men. This presumption was grounded on a previous finding by the main author of this study in 2001 that spouse-children



combinations did not matter for elderly men's health. The results from this study supported the initial hypothesis, and additionally found that the only good predictor of elderly health for men was the presence of chronic diseases.

There is need to be cautious about this finding, recalling the fact that men in this study sample were significantly better off compared to women in all health indicators. Therefore, the chance of external factors affecting their health was much smaller than in the case of women, and could be contributing to the insignificance of the results. However, since there were still two-thirds of men reporting poor health, there is reason to believe that there might be other causes which might be equally or even more important.

In Bangladesh, the society is highly male dominated, and even at older ages, men control all the financial resources of the family, including inherited assets. This means that elderly men usually do not have to depend on their children's financial contributions for survival, thus making void one of the primary mechanisms through which educated children could benefit their health. The second important pathway for children's contribution to parents is through caregiving and instrumental support. In rural Bangladesh, the vast majority of men are married with spouses younger by 8-10 years (Rahman et al., 2004), who themselves are therefore in considerably better health. This means that almost all the caregiving needs of a man are fulfilled by their wife, and there is limited room for children to play a crucial role.

Apart from this demand perspective, there could be other less apparent reasons behind this non-association. One could argue that men by nature tend to be materialistic and emotional attachments have relatively less value to them compared to women. Thus, the benefits for health that a woman could draw from having close interactions and bonding with her children might not be valid in the case of men. Moreover, men in their working ages tend to spend a bulk of the day working outside and in the fields, and there are usually very limited interactions between fathers and their children. Children receive all the care from their mothers, and spend most of their time with her, thus developing much stronger attachments with their female parent. Upon reaching adulthood, children could therefore feel, care and contribute more for their mothers than their fathers. However, these effects (if any) are very difficult to define and test quantitatively, and were beyond the scope of this study.

One thing that was notable in the analyses was that even for men, in the final model, son's education had a slightly unfavourable coefficient while daughter's education was beneficial. It is unclear whether this was purely by chance or whether there were any underlying reasons behind it, similar to the case of women explained in the two following subsections.

### **Impact of educated sons on elderly mothers – a detriment in disguise?**

In rural Bangladesh, old parents are generally known to co-reside with their adult sons and not with their married daughters. One would therefore expect that educating sons would benefit the parents in later life by ensuring that the sons garner greater resources and are able to take care of their parents more effectively by providing health care, finances and other forms of old age security. Moreover, elderly mothers, in the absence of their husbands (most being widowed) and without any means of income for themselves, should usually be wholly dependent on their children (particularly sons, who inherit the property after the death of the father) for financial resources. Therefore, this study initially expected to find, in addition to differences in the impact of male and female children, a significantly positive impact of education of children of



both sexes on the health of their elderly mothers. It was also presumed that the impact of sons' education might actually be stronger than the corresponding impact of educated daughters. It was thus a nearly shocking finding in our models that sons seemed not only to be playing a trivial role in their mother's health at old ages, but the impact was potentially negative at least in a majority of the cases. Counterintuitive to say the least, this was immediately identifiable as one of the major potential areas for further probation.

It was speculated that since the sample size was sufficiently large, the only potential reason behind the highly insignificant result could be a high degree of variability in the impact of son's education. In other words, perhaps educated sons were not as reliable as they are usually considered to be when it came to providing care to parents in older ages. The data subset used in this study did not allow anything more than mere speculations into these findings, and some probable underlying reasons have been mentioned subsequently that have not been methodically explored.

Firstly, increasing levels of education could enhance the geographical mobility of sons. Getting jobs in the city would become easier and they could abandon their parents to live in the cities. In unfortunate cases, this would leave the parents, and in particular widowed mothers, with no source of financial or instrumental support in older ages, and could lead to a poorer health status. This "desertion hypothesis" can be backed by the widely known Bangladeshi phenomenon of adult males leaving their wives and children and marrying elsewhere, highlighting their ability to ignore responsibilities towards close kin to boost self-interest. This impact of migration was totally ignored in the models, and could be an interesting area for further research.

Second, contrary to popular beliefs (at least in some schools of thought) that adult children are only a replacement for insurance and old-age benefits, and that sufficient financial and material contributions are the only channels through which the presence of an adult child helps elderly parents with security, it could be that emotional support, caregiving, advice and other instrumental support are equal or even more important contributors. In case it is so, sons, who are known to contribute more financially than through any of the other abovementioned channels<sup>11</sup> (Lin et al., 2003; Montgomery & Kamo, 1989), would not be able to help their mothers sufficiently as far as their health is concerned.

The final possibility involves a subtle social dynamics of rural Bangladesh that is known anecdotally. In rural Bangladesh, although primary education is officially free, there are a large number of hidden costs, including books, donations, bribes, etc., which make it quite expensive for the majority of the population. On the other hand, starting in the late 1970s, following mass publicity promoting the education of children, the demand for education, at least for sons, had increased tremendously. In such a scenario, when faced with a choice, a mother would perhaps readily sacrifice spending on her own healthcare in order to buy education for her son. This could lead to an inverse relationship between son's education and mother's health, and introduce endogeneity in the relationship between the two variables.

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<sup>11</sup> In our analysis there is some indication that this is true. Adding the socio-economic quintile variable into the sequential models significantly reduces the coefficient of son's education. Although the value is still highly insignificant, the attenuation of the coefficient suggests that much of the positive impact of sons, if any, works through increased financial contributions and hence household assets. A more refined financial contribution indicator would have been interesting to observe.





## Impact of daughter's education on elderly mothers – an unanticipated blessing?

Daughters in rural Bangladesh live with their husbands' families after marriage, and therefore their impact on the health of their elderly parents is relatively less explored and well known. Due to non-coresidence, one could make a point that a lot of factors related to daughters that could potentially benefit the health of elderly parents are annulled. However, as suggested by our results, that might after all not be the case.

It was a very unexpected and unique finding of this study that daughter's education was as highly significant and as important as was indicated by the regression models, especially when compared to the corresponding coefficients of their male siblings. The factors that might be contributing to this highly important and significant positive impact are not straight forward for sure, and certainly needs much more sophisticated analyses to uncover quantitatively.

The most common argument used to undermine the impact of daughters is that daughters are generally not income-earners, and that they do not financially contribute to their parents to a great extent. While it is not difficult to argue that this might not be so<sup>12</sup>, our analyses suggest another explanation that might help elucidate the high positive impact of daughters versus the zero impact of sons. Assuming that financial contribution from children matters for elderly health, and that educated daughters contribute financially to elderly parents just like sons, one would expect that adding the household assets quintile variable into the sequential models would decrease the coefficient of daughter's education as it did for sons. However, comparing Models 3 and 4, it can be seen that the opposite occurs, with the coefficient increasing slightly. This contradicts the argument that educated daughters lead to increased household assets, and in addition provides evidence that the positive impact of daughters does not involve monetary mechanisms. This hypothesis is also supported by the corresponding change in the coefficient of son's education. The attenuation in this case to a value closer to 1 suggests that financial contributions might not be the primary mechanism through which sons contribute to their parents, and that this contribution brings little benefit, if any, to the health of their elderly mothers.

With the above results discounting the importance of financial transfers from children to parents as a contributor to old age health status, it appears that the most important and unique way in which daughters contribute to their elderly parents, which results in their high positive impact in our models, might be through caregiving (Lin et al., 2003). It is not difficult to imagine that when a daughter receives some education, the quality of care provided to parents should increase immensely. A daughter can inform and advise her mother regarding nutrition and healthy dietary practices, safe behaviours, hygiene, disease causation and symptom recognition, to-dos during emergencies, where to go for health matters, etc., and her knowledge and hence this transfer of information is greatly enhanced in quality when she is educated.

The innate nurturing and concerned nature of females could be vital in the role of daughters of caring for their old parents. Even while living with the husband's family, a daughter could perhaps visit her parents every so often, and ensure that daily care is being provided as it

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<sup>12</sup> In a country like Bangladesh, where parents usually need to pay large sums of dowry to the groom's family to get a daughter married, an educated daughter has much more value as a commodity and therefore gives the parents stronger ground and negotiating power, leading to much less burdensome financial obligations both pre- and post-marriage. Moreover, an educated daughter is significantly more likely to earn an income of her own, even if through homebound initiatives, and also has a higher chance of being married in a more educated and wealthy family, both of which gives her a greatly improved ability to contribute financially to her parents.



should be. An educated daughter could additionally take her mother to the doctor if necessary due to their increased mobility and decision making power in the family, and also be more efficient in navigating the health system & communicating with medical personnel.

The education of daughters could in another exclusive way bring benefits for the parent's health. In Bangladesh, female children are generally neglected by the parents in various ways, and sons are favoured in all aspects of life, including food, education and clothing. A daughter who receives proper care and support (including education) from her parents in childhood might be more likely to provide her parents with extra care in their old ages simply out of gratefulness towards them. This phenomenon of "reciprocity" of caregiving and contribution towards old parents in return for good care at early ages of children is mentioned by Lin and others (2003) along with four other theoretical schools on the determinants of parental care by children.

An educated daughter is also less prone to being married early, thus living with her family for an additional few years. During this period, besides developing a close relationship with her mother in adolescence (which could later favour greater contributions to the mother), she can also provide caregiving support as well as help in daily activities such as caring for younger siblings and doing household chores. All of these could potentially help, albeit in limited spells, the health of her mother.

One significant burden that parents of daughters face in rural Bangladesh is the pressure to get the daughter married to a good family. In a lot of cases, the groom's families put pressure on the bride's family for dowry and other "gifts". Thus, when an educated daughter is married to a relatively better family with lesser obligations for paying dowry, there could be a mental peace that could potentially contribute to a greater psychosocial satisfaction and hence an enhanced perception of wellbeing.

Last but certainly not the least, there could be a degree of endogeneity in the relationship between daughter's education and mother's health. Unlike the case about educating a son, a mother would perhaps not sacrifice her health for educating her daughter. In a situation where a mother is fragile in health and/or has a major disease, the daughter would be expected to give up her studies, stay at home, and provide care and support for her mother, as well as perform the daily functions of the mother such as cooking and washing. The treatment costs for the mother would also turn out to be a major barrier towards the education of the daughter. Resolving this endogeneity issue was beyond the scope of our study, and would need further research to explore the true impact of daughter's education after controlling for this reverse relationship.

Two things are to be noted here. One is the impact of quantity versus quality. The introduction of number of sons and daughters in the last of the sequential models increases the prominence of education of daughters as a predictor variable.<sup>13</sup> This is an important finding because it explains at least partially the finding of the previous study that daughters are equally important as sons and spouses for old age well-being. With this result in hand, it is now possible to argue that the positive impact is not due to their mere presence but due to the services they provide, which are in turn largely determined by their level of education.

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<sup>13</sup> The result now implies that for two women with the same number of daughters, the woman with an educated daughter will have a three times higher odds of being in good health compared to one with only uneducated daughters.



And secondly, it should be remembered that the presence of chronic diseases, the most important adverse contributor to elderly health, is essentially independent of children's characteristics. Although the contraction of a disease cannot probably be avoided by having an educated daughter<sup>14</sup>, the experience of the disease could be far less distressing in the presence of a wise and caring child. This phenomenon is demonstrated by the fact that the coefficient of daughter's education in the sequential models increases considerably with the introduction of chronic diseases into the model (Model 4 to Model 5, odds = 2.34 to 2.90). Once again, this proves the nuanced nature of our chosen outcome variable, which, if replaced with any quantitative indicator of health, would perhaps fail to capture this dimension of mental health and satisfaction.

### **One for all Vs. All for one – Which is a better investment strategy?**

One of the major dilemmas encountered in the course of this study was the decision to consider the maximum level of education of any child (by gender) as opposed to the average education of all children as the main predictor variables. In the results section, it was shown why maximum education was finally persisted with in favour of the average. However, this distinction also led to the very important policy-relevant question – for a woman looking to raise her stakes of old age security and health, and with limited resources to spend on her children, what would be the optimum investment strategy in educating her boys and girls? Should she spend all of her money on one child (the “*all-for-one*” approach), or should she equally distribute the maximum affordable amount of resources to all her children (the “*one-for-all*” approach)? Due to the marked gender difference between male and female children observed in the contributions to elderly mother's health discussed so far, the answer to this question is also likely to be very different for boys and for girls.

Referring back to the “maximum vs. average” models presented in Table 3, it can be seen that whereas the impact of son's education was slightly negative in the “maximum” model, in the other model it was positive. This could be an indication that rather than equipping fewer sons with higher education, providing a standard level of education to all sons was a better investment strategy. Due to all the reasons mentioned in the previous sections that were argued to make son's education an investment with unpredictable outcomes, averaging it out could be an effective risk-minimization technique. However, caution must be taken in drawing conclusions based on these coefficients because of the high statistical insignificance of the results.

For daughters, on the other hand, the scenario was entirely the opposite. Judging by the coefficients, which were very reliable statistically, it was very clear that investing all available resources in one female child to educate them to the maximum extent possible was more beneficial than providing all daughters with an average level of education. Once again, and conversely to the case of sons, this result could be attributed to the reliability of the female child in taking care of her parents in old ages.

Therefore, this study cautiously speculates, in the absence of more in-depth analysis, that the wisest investment decision, strictly from the point of view of a mother aiming to secure her old age health status, would be to educate at least one daughter without compromising on the level of education, while taking a “one-for-all” scheme for the male children.

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<sup>14</sup> Although own education might help massively in avoiding ominous health problems (Zimmer and others 2002, 2005a, 2005b). This is also supported by the high positive coefficient of own education.



No significant impact of the children's education on the health of the elderly men was expected to be found, conforming to findings from the previous study. But in case of elderly women, it was hypothesized that educated children would be more likely to be providing quality support in various means and thereby influencing their mothers' health in a positive manner. Differences between educated sons versus daughters were also anticipated, but no definitive hypothesis could be framed about whether the results from other countries would be reinforced or contradicted.

In cases where the parents had some education, all the studies suggested that the impact of children's education was more significant in the progression of health disorders as opposed to the onset of new ones. This showed that while own education can increase elderly people's ability to avoid life-threatening health problems, once they contracted one, children's education played the more important role in determining the course and end result of the disease.

There have been numerous studies studying the differences in contribution of adult sons versus daughters to parents (Dwyer & Coward, 1991; Horowitz, 1985; Houser, Berkman, & Bardsley, 1985; Stoller, 1983), but limiting the context to Asian developing countries drastically reduce their number, the only notable studies coming from Taiwan, Japan and Vietnam (Hermalin et al., 1992; Hiroshima, 1992; Knodel et al., 1998; Lee, Parish, & Willis, 1994). None of these studies, however, have looked at the interaction between the sex of children and their educational attainment as a determinant of their parents' old-age security or health status. Only a very recent study, also from Taiwan, by Lin and others (2003) has specifically touched this area, albeit superficially. They broadly looked at the patterns and determinants of various types of support provided by children to their elderly parents, and found that day-to-day care was typically provided by one of the children, while financial responsibilities were shared among siblings. Sons usually assumed the major responsibility in taking care of their elderly parents, with daughters replacing them only when they were not available.

Although intuition (and previous research) suggests that presence of a husband should enhance health status, we speculated that the impact (if any) might actually be adverse, since any spouse of a 60+ year old woman would be much older and therefore typically fragile in their own health status; therefore, their presence would likely be more of a disadvantage for the health of the woman.

Comment [RK1]: Include in discussion

## Limitations

One of the major limitations in the analysis and results of this paper was the endogeneity arising from the potential reverse association between elderly health and their children's education.<sup>15</sup> Since this correlation was ignored, the results are likely to be an overestimate of the influence of children's education on parental health. Several papers were reviewed that tried to deal with this problem using advanced statistical analysis [e.g. the instrumental variable approach (Kohler et al., 2004), (Pal, 2006)], but were not convincing as being absolutely foolproof. It was speculated, however, that in this context, endogeneity was somewhat balanced by the fact that primary education has been all-encompassing for the last two decades. Also, part of this nemesis would remain even after advanced analyses due to the unobserved genetic, social and economic factors which cannot perhaps be eliminated even with the aid of highly complex econometric methods. And lastly but even more importantly, this endogeneity holds true for both sons and daughters, and the clear and robust distinction observed between the two sexes of children indicates that the results are nevertheless convincing.

Another limitation in this data set was that there was no way to identify the child or children who took care of their parents more than other siblings. As Lin and others (2003) found in

<sup>15</sup> This could be due to a variety of factors, including genetic endowments that affect both parent's health and children's education positively, unobserved common benefits of high social status, and more apparently the fact that parents with better health would be more likely to be economically successful and therefore to send their children to school.



Taiwan, day-to-day care is usually provided by one child, or through rotation by some specific children. This study considers the highest education received by any child, ignoring the fact that not all children provide care for the parents equally, but rather is determined by their socio-economic status, proximity to parents, age, sex, and marital status, among other characteristics. This could be an area for further exploration to see if educated children were important irrespective of co-residence or degree of caregiving.

## CONCLUSIONS

The findings of this study highlight the importance of daughters to parents in spite of traditional perceptions about sons being the main caregivers and sources of support in older ages. In Bangladesh, girl's education has been widely promoted and has brought significant benefits, with primary enrolment rates surpassing corresponding rates for males. This paper recommends sustaining and strengthening that drive, in addition to taking other complementary measures, to achieve higher retention beyond primary and, as much as possible, the completion of secondary education. The curriculum of the education system has also to be updated to include more information on hygiene, safe behaviours, etc., since daughters are proving to be effective channels of health-related information and important determinants of old age security and health.

It has to be remembered that the education of girls does not only bring benefits to the parents' health but also to themselves<sup>16</sup> and their own families and children. In addition, it contributes to older age at marriage, which itself greatly enhances maternal health indicators. Also, it reduces the age difference at marriage, leading in the long run to a decrease in widowhood rates and hence helps secure an additional source of security for the older women – husbands. All that said, however, in a male-dominated society such as Bangladesh, the potential of educated women cannot be fully realized unless they can garner support from their husbands, which underlines the need to simultaneously educate men.

In addition to increasing the quality of caregiving support at older ages from close kin such as children, a prerequisite for good health indicators at older ages is cheap and readily available healthcare. In rural Bangladesh, high absenteeism of doctors and other personnel, maltreatment by untrained/uncertified/traditional health practitioners, a dire shortage of medicine, and inadequate infrastructure such as roads to carry patients are huge barriers to providing quality healthcare to the poorer masses. Proper steps must be taken to address these challenges.

This was the first study on this topic in the South Asian region, and pointed towards a totally unique phenomenon that educated daughters were immensely more important for the wellbeing of older adults. It would be interesting to undertake similar studies on other South Asian settings, and also urban contexts, to see if these results are replicated.

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<sup>16</sup> In our model, this is underscored by the fact that own education increased the odds of an elderly woman being in good health by 5 times.



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