A Longitudinal Analysis of Health and Mortality in a Migrant-Sending Region of Bangladesh

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Abstract

Recent theoretical and methodological advances in the study of migration have facilitated analysis of migration's impact not merely on the health of migrants, but on the health and well-being of family members left behind in the migrant's origin household or village. The current paper addresses the impact of children's migration on the health and survival of a cohort of respondents age 50+ living in Matlab, a rural area of Bangladesh with high out-migration rates, by linking detailed household and health survey data to event records from an ongoing demographic surveillance system. The results show that far from having a deleterious impact on elders, children's migration has a strongly positive effect on health and particularly mortality. The effects operate entirely through son's migration in this traditionally patrilineal society, with a significant impact of both internal and international migration. While migrant educational attainment can explain the effects of internal migration, the international migration effects cannot be explained by education or by measures of financial transfers in the year of the survey. The failure to find any relationship between transfers and health draws into the question the value of transfers as a measure of old-age well-being or the strength of parent-child relationships.

I. Introduction

Recent theoretical and methodological advances in the study of migration have facilitated analysis of migration's impact not merely on the health of migrants, but on the health and well-being of family members left behind in the migrant's origin household or village. Contrary to the expectations of modernization theory that migration and urbanization would lead to a breakdown in familial support for the aged, New Economic theories of migration suggest that families may actively encourage and benefit from children's migration (Stark and Bloom 1985; Massey et al. 1997). Methodologically, new survey designs have made it easier to link household survey data on socioeconomic status, kinship, and mobility to self-reported and objective measures of health, as well as longitudinal data on health and mortality (Rahman and Barsky 2002; Beckett et al. 2002; Thomas and Frankenberg 2000).

While a great deal of research has addressed the socioeconomic implications of migration on origin households, particularly through the effects of financial transfers or remittances, little has addressed the impact of migration on the health or survival of origin family members (Frank and Hummer 2002; Kanaiaupuni and Donato 1999). Yet emerging demographic trends and structural changes in the global economy have provoked interest in the relationship between migration and rural health, particularly among aged populations, in numerous rural regions of Less Developed Countries (LDCs). In Matlab, a rural district of Bangladesh, rates of out-migration to cities and abroad have grown even as overall family sizes have begun to decline. As a result, an increasing proportion of elders in rural areas such as Matlab can expect a substantial proportion of their children to live away from home. Second, the tendency for young adults to leave rural areas and return in old age make concerns of old-age health inextricably linked to concerns of the health of residents of migrant-sending areas. Finally, Bangladesh has experienced little of the rapid growth of wages and economic opportunities associated with rapid urbanization in other settings. Supporting parents financially may come at the expense of personal opportunities or well-being.

The current study addresses these concerns using results from the 1996 Matlab Health and Socioeconomic Survey (MHSS), a multistage, multisample survey of household economics, health and social networks conducted in an area of Bangladesh that is also the site of an ongoing demographic surveillance program conducted by the International Centre for Health and Population Research (known as ICDDR,B). When matched together, these two data sources

permit analysis of mortality in the years subsequent to the collection of detailed household survey data. Existing research has demonstrated the importance of migrants, particularly sons, as providers of financial support to the elderly in the form of transfers. This study asks whether children's migration does indeed translate into improved health at the time of survey and improved survival in the subsequent years. In particular, the study addresses the differential impact of migration on health and mortality; the differential impact of internal and international moves and moves by sons and daughters; the effects of migrant education; and the extent to which migrant financial transfer measures mediate the impact of migration.

II. Theoretical Background

Expectations about the impact of children's migration on old-age support and well-being began with theories about the role of children as a principal means of old-age support in "traditional agrarian" societies, and the nature of any changes stemming from transitions in mobility, economic opportunity, and the balance of power between the young and the old (Boserup 1965; Nugent 1985; Willis 1980; Mamdami 1972; Cain 1983). The old age security hypothesis suggested that high fertility levels in traditional agriculturally-based societies are sustained by the absence of banks, insurance mechanisms and government social safety nets (Boserup 1965; Nugent 1985; Willis 1980; Mamdami 1972; Cain 1983). Modernization theory sought to explain the causes and consequences of individualization which are thought to both cause and be caused by processes of socioeconomic development (Parsons 1943, Parsons 1946). According to modernization theory, the family's role in providing assistance to members diminishes as agriculture wanes in importance, industry rises, and nucleated family norms pervade (Dharmalingam 1994; Cowgill 1986). Models of family change based on modernization or convergence theories predicted a crisis in support for the aged as Western-style families nucleated and societies urbanized along the lines of crises of old-age support which emerged in Victorian-era England and depression-era United States before government pension systems filled the gap once filled by familial support.

Beyond the dubious expectation that western family systems were an inevitable endpoint, evidence from ongoing transitions in fertility and urbanization, particularly in Asia, have thus far found little evidence of a relationship between demographic change or economic modernization and declining support for the aged (Knodel et al. 1992; Lillard and Willis 1997; Mason 1992; Rahman 1999; Lee R 2000; Lee YJ 2000; Biddlecom et al. 2002; Lucas and Stark 1985; Massey

et al. 1999). While demographic change may introduce greater complexity and risk into elderly support systems, it rarely leads to a systematic breakdown (Knodel et al. 1992; Asis et al. 1995). Although a relationship between modernization and declining parent-child coresidence is suggestive of a decline in familial support both between settings and over time (Chan and DaVanzo 1991; Hermalin et al. 1990), other forms of support, such as neighboring residence, financial support, and institutional support, often replace more traditional forms of support (Lillard et al. 1999; Frankenberg and Kuhn 2001; Siriboon and Knodel 1995).

While some have argued that the tendency towards consistent support from migrant children results from a distinctly set of familial and cultural values, others have argued quite persuasively that they may suggest a form of incomplete modernization whereby failing markets and institutions create a context in which intergenerational support and exchange not only persist as children move away from home, but parents actively encourage such movement. *Social capital* theories offer a general explanation for the continued prominence of family connections as countries modernize. They posit that the expectations, information flows, and norms associated with families, communities, and workplaces provide a social structure that shapes an individual's choices and behaviors on many dimensions (Coleman 1988; Portes and Sensenbrenner 1993; Granovetter 1985; Litwak 1960; see Hays 2002; Iwasaki et al. 2002; Wu and Rudkin 2000 for references specific to health and mortality). As countries have industrialized, norms have evolved to favor a small numbers of well-educated children and increasingly some offspring to migrate in order to diversify a family's income sources (Becker and Tomes 1976; Lillard and Willis 1994; Massey et al. 1987; Rosenzweig and Stark 1989; Massey and Espinosa 1997; Palloni et al. 2001; Hermalin and Myers 2002).

In societies with low levels of institutional change but extensive access to global economic opportunities, as in Bangladesh, migration may represent a mutual opportunity for older rural family members and their migrant children to improve their joint economic position by improving access to capital and diversifying their income sources into the urban and rural sector (Massey et al. 1999; Cox et al. 1998; Cox 1987; Lucas and Stark 1985). This framework, known as "The New Economics of Labor Migration", has most frequently been applied to the context of international migration, where legal barriers and restrictions typically require that migrants return, or at least anticipate return, and thus encourage migrants to transfer substantial portions of their income to rural areas (Stark 1982; Stark and Bloom 1985; Lucas and Stark

1985). Yet these expectations can also be applied to rural-urban migration. In Bangladesh and other LDCs, limited economic growth, earnings and job-related benefits as well as high housing and consumption costs encourage migrants to rear children in rural areas and return to rural areas during periods of unemployment and during retirement, reinforcing migrants' desire to provide extensive support to rural parents, who may offer land and other heritable resources desired by the migrant (Afsar 1999; Shaw 1988; Lucas and Stark 1985).

The literature on migration and old-age support provides substantial evidence that migrant children compensate parents for their absence by providing substantial amounts of support in the form of financial transfers, particularly in settings in which markets for credit, capital and insurance remain underdeveloped (Massey et al. 1999; Cox et al. 1998; Cox 1987; Lucas and Stark 1985; see Lillard and Willis 1997; Lee, Parish and Willis 1994 for Asian examples). While out-migration may have a more deleterious impact on marginal populations such as women, widows, the oldest old, the infirm, the landless, and those living in areas of high HIV prevalence (Martin 1990; Rahman et al. 1992; Rahman 1993; Mason 1992; Knodel et al. 2000), the accumulated body of evidence suggests that migration would on average have positive effects on the support and health status of parents of out-migrants. In this context, both internal and international migration may best be viewed not as a means by which children gain leverage over and independence from parents, but as an opportunity that might be encouraged by parents.

Since parents may be likely to encourage migration, it is also likely that patterns of old-age support from migrants will be structured by preexisting cultural norms and kinship systems (Caldwell et al. 1988). Asis et al. summarize this process by stating that "Social change may simply lead to an adaptation that serves the same culturally determined goal but in a new socio-economic setting" (Asis et al. 1995; Mason 1992; Knodel et al. 1992). Studies of intergenerational transfer flows in Taiwan and South Korea, both historically patriarchal societies, suggest that sons play a more important role than daughters in providing financial support to elders, particularly following marriage (Lee YJ 2000; Lee, Parrish, and Willis 1994). Ofstedal, Knodel, and Chayovan (1999) contrast the roles of sons and daughters in Taiwan, Thailand, and the Philippines, and find evidence that the gender patterns predicted by systems of family organization operate in these contexts.

III. Migration, Urbanization and Old-Age Support in Bangladesh

Although it remains one of the least urbanized countries in Asia, Bangladesh has urbanized rapidly since gaining independence 1971. The proportion of Bangladesh's population living in cities, just eight percent in 1971, has grown to 24 percent, as the population Dhaka, the capital city, has grown from 1.3 million to over 8.5 million (United Nations 1995, 1996). Medium-level United Nations projects estimate that the proportion of Bangladeshis living in cities will rise top 41% by 2030, with Dhaka growing to 19.5 million people, or the fifth largest city in the world (United Nations 1996). Previously, Bangladesh could be placed in a larger Asian pattern of strong correlation between per capital Gross Domestic Product and urbanization, yet coming decades will see Bangladesh overtake several large Asian countries in urbanization (India, Thailand, Indonesia) even as its income and productivity remain lower.

A considerable amount of migration also flows to overseas destinations. Overseas migrants send substantial sums of money back to Bangladesh. In the late 1990s exports of manpower were the 2nd or 3rd largest source of foreign currency earnings in Bangladesh. In 1998, for example, 3 million overseas workers sent back a total of 1.5 billion dollars (Rahman 2000). Generally individuals in Bangladesh who wish to work overseas contract to migrate for a fixed period of time to a destination in the Middle East or Southeast Asia, where they work as unskilled laborers (Shah and Menon 1999; Rahman 2000). Most migrants typically acquire few skills while overseas and return to Bangladesh at the end of their contract, where they may well face unemployment.

The intensity of internal and international migration can be seen at an even more advanced level in Matlab, the rural study site, which is located 55km (and six hours travel time) from Dhaka, the capital city, and less than six hours travel time from all other major cities in the industrial belt of southeastern Bangladesh. Matlab's relative proximity to typical migrant destination areas reduces the costs and risks to migration, further reinforcing the strength of networks of social support, information and job opportunity linking Matlab to urban areas, thus encouraging further migration. Using data from the Demographic Surveillance System (DSS) in place in Matlab, the hypothetical population of the area can be estimated supposing no migration had occurred. Between mid-1982 and 1996, fertility and mortality alone would have led to population growth from 186,000 to 248,000, or 33%. Yet population during the period grew only 209,000, or 12% due to out-migration rates of up to 3% per year. Of the resulting 16%

decrease in the eventual population stemming from migration, rural-urban migration accounted for 11% of the decrease, while international migration accounted for a further 4%.

Spatial proximity to destination areas also reduces travel expenditures and opportunity costs associated with rural-urban travel, thus facilitating continued participation in rural economic activities and frequent visits to the rural household. As a result, the practices of solo migration and circular migration predominate even after marriage for adult males. A look at Matlab's age-sex distribution in 1996 demonstrates the extent to which this process is dominated by male individual migration (Mostafa et al. 1998). While the ratio of males to females stands at 1.08 for the 10-14 and 15-19 age groups, it drops to 0.95 for ages 20-24, 0.78 for 25-29, and 0.79 for 30-34. The pattern of return migration in Matlab reflects not just the tendency for many migrants to fail and quickly return home, but also the gradual return of many migrants after years of urban residence. Among all recorded instances of married male out-migration from Matlab between 1982 and 1984, sixty five percent had re-established residence in Matlab by the end of a twelve year follow-up period. Among those instances in which the migrant remained in the city for four years uninterrupted, forty percent eventually re-established residence in Matlab (Kuhn 1999). Matlab, like many other areas of Southeastern Bangladesh, also sends a number of international migrants to countries in the Persian Gulf and Pacific Rim, where strict regulations on permanent settlement create a strong incentive for continued cooperation with family in the origin area. In one qualitative study village in Matlab in 1998, over 8% of the male population was estimated to be living abroad at any given point in time, with a considerably higher proportion having ever lived abroad.

Out-migrant children also constitute a principal source of financial support for households in Matlab, particular those with elderly members. Among couples responding to the MHSS in which one member was over age 50, the average couple received $159 transfer income from non-household children in the preceding calendar year, or 40% of total household income. The average rises to $455 for the 40% of households that actually reported receiving any transfer income. The bulk of aggregate transfer income came from international migrants, who accounted for 62%, or internal migrants living outside the district, who contributed 34%. While international migrants provided more income in aggregate, a higher proportion of respondent couples received any transfers from internal migrants, 24%, than from international ones, 11%. Transfers flows are also dominated by migrants sons, who accounted for 98% of net transfer

income, rather than daughters. The gap between smaller but still sizable in terms of receiving any transfer income, with 36% of couples receiving transfers from sons compared to 11% from daughters.

The gap between sons' and daughters' transfer provision, in spite of the relative frequency of daughters' migration, largely reflects societal preferences for receiving support from sons and their wives (Frankenberg and Kuhn 2003). Sons in Bangladesh have been described as the best risk insurance available in old age, particularly for women (Cain, Khanam and Nahar 1979; Arthur and McNicoll 1978). This difference in the relative importance of sons and daughters is deeply rooted in Bangladesh's patrilineal system of family organization, which shows a historic preference for joint family residence. Marriages are arranged by a couple's parents with the groom typically considerably older than the bride (Arthur and McNicoll 1978). After marriage, the woman becomes part of her husband's family, moving in with him, his parents, and his other brothers. Her own parents no longer have any claim on her labor (Cain 1978). Moreover, she is unlikely to return to living with or near her own parents unless she is divorced or she and her husband suffer an economic calamity (Indra and Buchignani 1997). Because village exogamy is practiced, marriage usually takes a woman some distance from her own parents' home. The strictness with which these traditions are upheld in Bangladesh may be diminishing. Simmons (1996), analyzing data from focus groups conducted with women of reproductive age in Matlab, Bangladesh, provides evidence to suggest that young wives have much greater independence in the 1990s than in the recent past.

IV. Hypotheses and Measurement Issues

While a great deal of research suggests that migration should be of net benefit to the parents of out-migrants, and previous research using MHSS data finds substantial transfer flows from migrants to parents (Frankenberg and Kuhn), it is first important first to confirm that this is the case. The first hypothesis suggests that an additional international or rural-urban migrant child, as a proportion of total children, should lead to more frequent reports of good health at the time of survey and, controlling for health at the time of survey, higher survival in the longitudinal followup period.

A second hypothesis relates to the role of preexisting familial preferences in determining the nature of the migration/health relationship. Because migration occurs in a context of patriarchal preference, and past research has shown that only migrant sons provide greater

financial support, it is expected that migrant sons, and not migrant daughters, will have a positive effect on respondent health and mortality.

The third and fourth hypotheses seek to explain the effects of migrant children on health in terms of specific attributes of migrants and of their relationships with respondents. The first relates to education. While very little research has addressed the impact of migrant education on the health or well-being of origin-area family members, past work does suggest a stronger effect educational attainment on internal migrant earnings than on international migrant earnings (Massey et al. 1987; VanWey 2000). This is largely due to the nature of employment among the two types of migrants; internal migrants often find long-term employment with substantial returns to education, while international migrants typically find short-term employment, often at high wages, but requiring little education. A strong relationship is anticipated between internal migrant education and respondent health/mortality, but less so for international migrants.

A final hypothesis relates migrant financial transfers. The tentative hypothesis suggests that some of the relationship between children's migration and health should in fact be attributable to the extent of financial transfers received from migrant children. The hypothesis is tentative due to the difficulties inherent in estimating both the true value and meaning of transfers. While almost all transfer income received by the respondents comes from internal and international migrants, the specific relationship between transfers and mortality may be lost amidst the diverse motivations for and uses of transfer income (spousal support, land investment, debt repayment), and the wide gulf between the value of transfers received in any particular year and the true strength of a child-parent transfer relationship. Take the example of two migrants. One is a circular migrant working in a factory and the other is a successful professional living in the city with his wife, yet both transfer the same amount of income in a year. The latter migrant sends money only to support his father, while the former sends money for his wife and children as well. The latter's money is invested in land accumulation while the former's is invested in debt service and consumption. The latter earns 10 times more income in any given year. Clearly the transfers made in that particular year have only limited bearing on their ability or desire to help their fathers in the long run.

Transfers received in any single year may be particularly unsuited to understand an extreme event such as mortality, which can often be prevented only through cash expenditures well beyond the means of all but the wealthiest families. It is unlikely that even the most

successful migrant would transfer the $3-5,000 it might cost to treat coronary heart disease in any year but the year in which the intervention took place. Quite to the contrary, it is likely that successful migrants with economically self-sufficient parents would choose to send little or no transfer income in typical years on the expectation that they would instead provide a large amount of income when it was really needed. As time passes between measurement of transfers and a longitudinal mortality observation, transfers are likely to have even less relevance. While transfers must be a principal factor mediating any relationship between children's migration and parental health, the connection could be quite difficult to establish in this context.

V. Data and Methods

Data for the study result from the integration of survey and demographic surveillance data sets from Matlab, a rural area of Bangladesh. While these data are unique and important on their own, they gain considerable power when combined. All dependent variables and data on baseline health status come from the Matlab Health and Socio-Economic Survey (MHSS), a multistage multisample household survey collected in Matlab, Bangladesh in 1996. The MHSS gained detailed health and socio-economic information on approximately 11,200 individuals aged 15 and over in 4,538 households. In particular, these data include detailed modules on non-household kin, particularly children, which collect data on location, age, educational attainment and marital status as well as information pertaining to the relationship between the respondent and non-household children such as contact, communication and financial transfers.

While designed for comparability to similar nationally representative family life surveys such as the Indonesian and Malaysian Family Life Surveys (IFLS, MFLS), MHSS eschewed a nationally representative sample in favor of a sample based entirely in Matlab, where the ICDDR,B has operated the Demographic Surveillance System (DSS) since 1966 (Rahman, Menken, Foster, Peterson et al, 1999). Matlab DSS data have been used extensively in the demographic literature and are considered to be one of the few high quality (i.e. complete, accurate and up to date) data sources in the developing world (Fauveau 1994). In particular, age reporting is considered to be highly accurate, a feature not found in other South Asian data sources (Menken and Phillips, 1990).

The DSS constitutes the second data source for this study. As part of a collaborative study between Harvard School of Public Health , the University of Colorado at Boulder, and the ICDDR,B, individuals responding to the MHSS in 1996 were tracked through the DSS from

1996 through 2000. The resulting match produced an event history database which identifies whether a respondent died in a particular calendar year and whether they were censored from the DSS population through migration. The technique of matching survey data to mortality surveillance data, often employed using Current Population Survey data in the United States, offers a number of advantages over a panel survey. Foremost among these is cost, since longitudinal analysis only requires matching the survey to existing data rather than fielding a followup study. Furthermore, such a study offers greater reliability in terms of identifying the appropriate timing of mortality or censoring, and effectively distinguishing between these two means of exiting the sample. Panel surveys of this sort collected in other LDCs have typically faced attrition rates of 10% or more, leading to uncertainty about the cause of attrition and potential bias, and survey costs can rise considerably as followup efforts intensify (Frankenberg and Thomas 2000). While followup surveys offer far more detailed data on longitudinal changes in health status, nutrition and morbidity, longitudinal mortality followup offers a crucial opportunity to study the determinants of health between survey rounds.

For the purposes of this analysis, we begin by focusing on the 1,666 women and 1,719 men aged 50 and over (3,385 total) who responded to the MHSS individual survey module (Book III).[1] Because of the multistage nature of the sample, individual observations have been weighted appropriately to reflect population representation (Rahman, Menken, Foster, Peterson et al., 1999). For these respondents, we include statistical controls based on information on the respondent's age, sex, marital status, educational attainment and employment status. By matching spouses to one another, we also control for spouse's age, education, employment status and coresidence. Data from detailed household economic modules provide controls for household land holdings and income, which are crucial given the strong relationship between household assets and migration, particularly to overseas destinations (Kuhn 1999).

Crucially, MHSS also provides data on the respondent's health status at the time of survey based on general health self-reports, self-reported physical disability and objective tests of physical function (see below for more). Because a small, random sample of respondents did not perform physical tests, the sample is reduced to 1,475 women and 1,581 men (3,056 total).

[1] While Book III was given to only a sub-sample of some age groups, all household members age 50 and over were interviewed irrespective of the respondent load.

These data are used to generate dependent variables in models of health status at the time of survey, as well as crucial statistical controls in longitudinal mortality models.

Finally, data on the total number of surviving adult children in four locations (in household, in district/village, internal migrant, international migrant) are generated from household rosters and respondent self-reports of non-household children. These data are used to provide controls for total number of surviving adult children, and the average age of children (with separate controls broken out by male/female and in-household/out of household). Most importantly, the non-household child modules provide the variables of interest for the study: counts of migrants (broken out separately for male/female children and for internal/international migrants), educational attainment of migrants, and inter-generational transfer data.

Models

Cross-sectional models: One set of statistical models predicts the determinants of good health status at the time of survey in terms of children's characteristics (*Child)* at the time of survey while controlling for respondent (*Resp)* and spousal (*Sp)* characteristics and household income and assets (*Wealth)*:

$$Log(\frac{G}{1-G}) = \beta_0 + \beta_1 Child + \beta_2 \,\mathrm{Re}\, sp + \beta_3 Sp + \beta_4 Wealth + \varepsilon \,,$$

where G is a categorical measure of good health constructed from the combination of the global health self-report, self-reports of Activities of Daily Living (ADLs), and physical functioning tests. For each of these health dimensions, a categorical index was constructed to indicate severe disability. A ***health status index*** was constructed as the sum of these three indicator variables. A categorical health measure was constructed based on the health status index, with respondents showing severe disability along zero or one of these dimensions characterized as being in good health (67.8%) and those with severe disability along two or more dimensions characterized as being in poor health (32.2%). For further detail on the construction of the health indicator variables which constitute the health status index, see Rahman et al. 2003.

Categorical models of health status offer a useful comparison to models of subsequent mortality events because they convey a different set of information than the extreme event of mortality. It is likely, for instance, that mortality will depend more clearly on access to financial resources, while health reports may reflect a more broad-based set of factors. Yet health status models also present important drawbacks. First and foremost, the models are subject to

substantial concerns over the direction of causality in relating health to a number of the control variables (such as assets, income and employment) and even some of the variables of interest. First, it is quite likely that children's financial transfers are in fact driven by parental health status rather than the reverse. As a result, health status models do not factor into tests of Hypothesis #4 regarding the effects of financial transfers. Second, it is also likely that poor health status at the time of survey may have been determined by poor health status at times prior to survey, which might been a direct cause of children's migration activity prior to the survey itself. While it is unlikely that children's migration episodes in the survey year 1996 were initiated as a result of poor respondent health status in 1996, it is quite likely that health status in 1996 may reflect both the effects of children's migration behavior as well as a cause of children's current migration patterns.

Longitudinal Models: Longitudinal models of mortality subsequent to MHSS fieldwork offer an opportunity to address many of the endogeneity concerns inherent to the cross-sectional health status models. A logistic hazards model of mortality is tested according to the following form:

$$Log(\frac{\mu_t}{1-\mu_t}) = \beta_0 + \beta_1 Child + \beta_2 \,\mathrm{Re}\, sp + \beta_{2t} \,\mathrm{Re}\, sp_t + \beta_3 Sp + \beta_{3t} Sp_t + \beta_4 Wealth + \beta_5 Health + \beta_6 Year + \varepsilon$$

where child characteristics (*Child)* including total numbers, locations, educational attainment, and transfers represent the variables of interest, alongside controls for fixed respondent and spouse characteristics, time-varying age measures for respondent and spouse ($Resp_t$, Sp_t), household resource measures, and a control for between-year mortality differences. The models also control for health status at the time of survey by entering controls for each of three health indicator variables (general health, self-reported disability, objective disability test), which is crucial to isolating the effects of migration on mortality net of the prior impact of migration on health and disability.

Each respondent contributes an observation for each person year from 1996 to 2000 unless they are censored by death or out-migration. Estimation of models incorporates a Huber-White correction for intra-cluster correlation in the distribution of the probability or mortality across observation years for a given respondent. Results presented in the tables display the relative odds associated with a variable, or the relative change in $\frac{\mu_t}{1-\mu_t}$ resulting from a one-unit change in a variable. Summary results presented in figures at the end will relate these findings to

changes in the probability of survival/death associated with a particular predictor when all other predictors are held at their means.

Dependent Variable Measurement:

Child counts / child location counts: The principal dependent variables of interest are counts of living adult children, or children over age 15, based on household rosters (for in-household children) and non-household kin rosters. All models control for the total number of living adult children, so that gender- and location-specific child counts can be interpreted as proportional to the total the number of children. For example, if total children and total internal migrant sons are entered, then the effect of internal migrant sons can be interpreted as the effect of one additional migrant son on mortality for a family that still has the same number of total children, not as the effect of adding an additional living adult child who is also an internal migrant son.

Child locations are disaggregated into in-household, out of household but in district (referred to as nearby), internal migrant children (indicated in the survey by children living outside the district), and international migrant children. Early models distinguished children living in the same village or residential compound from children living in more distant parts of the same district, and found no statistical difference between the two groups in terms of predicting respondent health or mortality, so these distinctions were not employed. All models also include controls (not shown) for children under age 15, children who have died, and children who are completely out of contact with the respondent (determined by the respondent's failure to specify the location variable).

The first two columns in Table 1 summarizes the average number of children by child's location and sex for each respondent.[2] While a far greater proportion of daughters (80%) reside away from home than sons (52%), most daughters remain relatively close to home (55% of living daughters, 69% of those living out of household). In contrast, 24% of all sons, and 48% of those out of household, live in another district, while 9% of all sons, and 18% of those out of the household, live abroad. Given the relatively high completed family sizes among the study population, these probabilities result in 37% of all respondents having at least one internal migrant son (15% have more than one) while 18% of all respondents have at least one

[2] Given the small percentage of cases censored due to mortality and migration, child location distributions for each person-year observation in longitudinal models remain similar to within 1% of the comparable respondent-level values.

international migrant son (5% have more than one). A comparable proportion of daughters (24%) and sons live outside the district, and a comparable proportion of respondents have at least one daughter living outside the district (35%), but very few daughters live abroad (0.03, or 1% of the total).

The third, fourth and fifth columns in Table 1 summarize children's schooling and age. Schooling is measured in the statistical models by the schooling of the most educated member of a particular category. For instance, if a parent has three migrant sons with 0, 4, and 8 years of schooling and no international migrant sons, then the values would be 8 for internal and 0 for international. Averages within a particular location/sex group are also presented for comparability, but maximum is used in the model because it better captures the earnings and parental support potential of the child most likely to provide support. Respondents' sons have considerably more schooling than their daughters, with a 1.8 year advantage in terms of average schooling and a 2.4 year advantage on average in terms of the most educated sibling. Migrant sons have a distinct educational advantage over non-migrants, with 6.5 years of schooling for the average internal migrant son and 7.1 for the average international migrant son compared to 5.4 years for the average in-household son and 3.2 for sons living elsewhere in the district. Children living outside the household, both male and female, tend to be older than those living in the household.

The last four columns of Table 1 summarize transfers from non-household kin. The distributions largely mirror the discussion of transfers in Section III, with the exception that both a respondent's own transfers and his/her spouse's transfers are considered together. As a result, transfers to married couples are double-counted towards the mean. This specification was chosen both because it better represents the financial support available to any individual and because couple transfer measures universally fit the data better than individual measures. The mean value of transfers are overwhelmingly dominated by transfers from sons, particularly internal and international migrant sons, who account for 93% of transfers received from all non-household children (32% from internal, 61% from international). Transfers given to sons are quite minimal, amounting to 15% of the value of transfers received, while only 5% of respondents give transfers compared to 36% who receive. Analytic models actually measure transfers in terms of gross flows, the sum of transfers received and given, and net flows, the difference between transfers received minus transfers given.

VI. Results

The base models of health and survival in Table 2 address the first hypothesis, that children's migration should not have a negative effect on respondent health and survival, and that they may have a positive effect. Controlling for the total number living children, the number of children living outside the district and the number outside Bangladesh tend to have negative associations with poor health status and mortality, yet these effects rarely approach the level of statistical significance. Each additional child out of district is associated with a 13% decrease in the likelihood of poor health, an effect that is significant only at the $p<0.10$% level, while a negative association with mortality does not approach statistical significance. Additional overseas children also have a negative association with poor health and especially with mortality, but neither effect is significant at the $p<0.10$ level. While having migrant children is clearly not associated with increased likelihood of poor health or mortality, the results are inconclusive regarding the potential impact of migration on improved health or survival.

Table 3 seeks to address the second hypothesis that the positive effects of migration on respondent health should primarily operate through via sons' migration by breaking the effects of migrant children into sons and daughters separately.[3] Controlling for total living children, each additional son living outside the district is associated with a 24% lower risk of reporting poor health at the time of survey (significant at the $p<0.01$ level), while each additional rural-urban migrant daughter is not statistically different from other daughters or from the reference category, in-household sons. International migrant sons and daughters have no effect on the poor health report.

The effects of male migrants are even more striking as predictors of mortality risk in the years subsequent to the survey. When controlling for the three indicators of health status at the time of the survey, all of which are highly significant, an additional international migrant son is still associated with a 30% decline in the risk of mortality, significant at the $p<0.05$ level, while each additional rural-urban migrant son is associated with a 20% decline in mortality risk. The effect for rural-urban migrant sons is significant at the $p<0.05$ level in the absence of controls for health at the time of survey, while the effect is slightly diminished once controls are introduced,

[3] Separate models also addressed distinctions between married and unmarried sons and daughters living abroad and elsewhere in Bangladesh (not shown). These models found no statistically significant differences between married and unmarried children within each location/sex category.

with the effect differing from the reference category only at the p<0.0x level. The results suggest that in this context the effects of out-migration on health and survival are largely positive, yet they operate largely within pre-existing structures of son preference; while the effects of daughters' migration are statistically insignificant, increased survival odds are associated both with sons living abroad and outside the district. While rural-urban migration appears to be a strong predictor of both health status and mortality, international migrant sons appear to be a stronger predictor of decreased mortality risk. The resulting best model, which includes location-specific controls for sons but not for daughters, is shown in the final two columns of Table 3.

The models in Table 4 address the third hypothesis, which suggests that migrant education, particularly for internal migrants, can explain much of the relationship between migration and health. Two education specifications are included for the maximum educational attainment internal and international migrant sons – the first includes linear and square terms for completed years of schooling, the second includes categorical controls for completing some or all primary school (up to 5 years), completion of some or all secondary school (6-10 years), and completion of post-secondary schooling (10+ years). Since the maximum migrant schooling is by necessity zero if there are no migrants, the reference category of no completed schooling in the second specification groups respondents with no migrant sons together with those who have migrant children with no schooling, but differences between the two groups are still captured by the control for total number of migrant sons. In each specification, migrant educational attainment has no significant effect on health at the time of survey. While both specifications show no relationship between international migrant education and mortality, both show a strong positive association between internal migrant schooling on and survival.

The effect of internal migrant schooling on survival, however, is not perfectly linear. The first specification shows a positive linear effect on survival as well as a negative square effect, suggesting that the impact of migrant sons' schooling on respondent survival peaks at eight years of schooling. This finding is also borne out by the second specification, where only respondents with sons having at most a secondary education have improved survival, with an 83% reduced odds of dying. Under both education specifications, the entire effect of internal migration on survival is explained by the increased survival prospects of parents with children having at most a secondary education, but the effect of internal migrants on health status remains significant.

The first column of Table 5 presents the best-fitting model of mortality, which includes main effects for son's location and a categorical education specification only for internal migrants. The two factors which predict mortality are whether any internal migrants have completed secondary schooling and no more. Based on this coefficient, a hypothetical survival projection was estimated over the entire five-year followup period. While the mean mortality rate of 2.5% implies a 12% likelihood of death over the followup period, respondents who have internal migrant children with secondary schooling would have only a 4% likelihood of death over the followup period. The international migrant son coefficient would result in a 9% likelihood of death through the followup period for respondents with one international migrant son.

The results thus far suggest that migrant children who can provide particularly lucrative financial support may have a particularly important effect on parental survival, which is unsurprising given the potentially greater role of costly medical interventions and hospital care in preventing survival amongst those who are ill. International migrants can provide large transfers by virtue of higher salaries in overseas labor markets, while studies in a number of contexts suggest that educated internal migrants may actually earn more than international migrants. Yet for international migrants and educated international migrants to have a more substantial impact on parental health, these effects would most likely operate through the mechanism of increased financial support among respondents who have such migrant children. Hypothesis 4 addresses this concern, suggesting that the receipt of financial transfers can explain much of the impact of son's migration on health and mortality.

Table 5 displays the results of a number of specifications relating respondent/child transfer relationships to mortality, focusing on gross and net transfers, incorporating both value of transfers and indicators of any transfer activity, and estimating total transfers as well as separate measures for internal and international migrants. The models focus on mortality because of obvious concerns over reverse causation between transfers in a given year and health status in that year. While these models as well as a number of other omitted models suggest a general tendency for transfer activity to predict improved survival prospects, not one of the transfer measures shown produces anything close to a significant association with survival. The inclusion of specific international migrant transfer controls tends always to reduce the size and significance of the total international migrant sons variable, but none approaches significance.

Furthermore, the models suggest that gross transfer activity serves as a better predictor of survival than net transfer receipts. While this is not inconsistent with new economic models of migration, which might suggest that this year's transfers will be repaid through future support, the results still cast doubt on the effectiveness of using cross-sectional transfer measures to predict mortality in a longitudinal followup.

VII. Conclusion

The preceding analysis confirms some important hypotheses relating migration to the health of the parents of internal and international migrants from Matlab, Bangladesh. First, children's out-migration cannot be linked, on average, to any deleterious effects on health. Second, children's migration does have a positive impact on health, relating almost entirely to the migration of sons. Yet perhaps the most important outcome of this research is a crucial non-finding: no specification of parent-child transfer relationships – continuous or discrete; transformed or untransformed; aggregated or disaggregated; net, gross, in or out – has a statistically significant impact on mortality, nor does any explain away the impact on mortality of internal migrant sons with secondary education, and international migrant sons.

It is therefore worthwhile to address a crucial methodological concern impinging on the migration-health linkage and indeed on any research question that lies at the nexus of demographic change, social networks and health. It is difficult to construct a meaningful model relating demographic processes, much less demographic change, to health given the many layers of causality linking these processes. The truly interesting and informative models are often impossible to estimate, while the straightforward models often leave us wishing we knew more. Few surveys have the budget to incorporate detailed objective and subjective health measures; thorough asset; and income data and demographically correct social network data into a multi-round panel survey design.

Yet even if several consecutive years of detailed transfer data do accompany longitudinal health and mortality data, their utility would still remain unclear. In a particular calendar year, the relevance of a transfer measure is likely to be determined in large part by the circumstances impinging on the transfer, most notably the presence of any economic or health catastrophes. While it might be possible to use econometric techniques to identify the direction of causality between transfers and health under such circumstances, it might only be possible by stripping away the most interesting aspects of the question.

The genuine concern inherent to research on migration and health, however, is not about the role of transfers - themselves the outcome of numerous social, economic and demographic chains of events -- but on the role of migration itself. This research raises a number of important questions in this regard that beg for further research. First, why do internal migrant sons appear to have a more substantial impact on health and mortality than international migrants? Is it due to the risks associated with international migration? Second, is the relationship between secondary education of internal migrants and parental health being driven by migrants' need to secure their own futures in the rural area? If so, are there respondents for whom migration potentially can have a negative impact on health? Since we've seen that most internal migrants actually do not affect parental health, and we see the suggestion that parents may do best when children need their help, could there exist interaction effects that cause particularly vulnerable groups such as women, the oldest old, or the landless to actually do worse when their children migrate? Lastly, what would the static models employed in this paper look like if children's locations were updated on a yearly basis to reflect ongoing processes of demographic change? What is the impact on old-age health in subsequent years when a child moves to the city or

Finally, although these results come with a number of caveats and represent only what occurs at the mean, it is worth wondering if we aren't asking completely the wrong questions about migration and health, at least with regard to the effects of migration on those left behind in the origin area. Under circumstances under which support from a migrant would desirable and necessary, even under Bangladesh's poor labor market conditions, migration appears to be above all an opportunity for elders and other rural residents to improve their health, wealth and well-being. While concerns about the potential negative impacts of migration and effort to harness the full power of migration as a development tool are important, perhaps it would also be crucial to ask what can be done to improve the health and well-being of those who don't, or can't, send household members to distant cities or nations?

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Table 1: Characteristics of Respondents' Sons and Daughters
Counts, Characteristics, Transfers

Sons

	Child Counts		Mean Child Characteristics			Percent with Any Transfer		Mean Transfer Value	
Location	Mean	Percent of Total	Max Schooling	Average Schooling	Average Age	Any In	Any Out	Mean In	Mean Out
Out of Household, In District	0.44	18%	3.69	3.23	34.00	8%	2%	$5	$2
Internal Migrant	0.60	24%	7.13	6.48	30.70	23%	3%	$74	$5
International Migrant	0.23	9%	7.44	7.09	29.60	12%	1%	$141	$26
Total Non-Household	1.26	52%	6.65	5.68	31.10	36%	5%	$220	$33
In Household	1.17	48%	6.23	5.43	25.00				
Total Living	2.43	100%	7.01	5.44	27.60				

Daughters

Location	Child Counts		Mean Child Characteristics			Percent with Any Transfer		Mean Transfer Value	
	Mean	Percent of Total	Maximum Schooling	Average Schooling	Average Age	Any In	Any Out	Mean In	Mean Out
Out of Household, In District	1.21	55%	3.33	2.86	29.60	8%	10%	$ 5	$2
Internal Migrant	0.52	24%	4.33	3.97	29.7	8%	5%	$ 4	$5
International Migrant	0.03	1%	4.25	4.18	30.4	0%	1%	$1	$7
Total Non-Household	1.75	80%	3.87	3.2	29.4	16%	16%	$10	$14
In Household	0.44	20%	5.67	5.4	20.7				
Total Living	2.19	100%	4.63	3.64	27.4				

Table 2: Base Models of Health and Mortality
Child Counts Disaggregated by Location, but not by Sex

	Good Health	Survival - no health control	Survival – with health control
Total Living Children	-0.02	0.06	0.05
	-0.06	-0.08	-0.07
Total Children Out of Household, in District	0.02	0.05	0.07
	-0.07	-0.09	-0.09
Total Internal Migrant Children	0.13*	0.14	0.12
	-0.07	-0.09	-0.09
Total International Migration Children	0.13	0.23*	0.19
	-0.11	-0.13	-0.13
Disability measured from ADL self-reports			-0.56***
			-0.19
Bad performance on physical test			-0.81***
			-0.18
Poor self-reported global health			-0.49***
			-0.17
Good Health Index			
Constant	6.63***	8.37***	7.92***
	-1.02	-1.35	-1.32
Observations	3056	14598	14598
Log Likelihood:	309.13	410.2	521.35
DF	22	26	29

Robust standard errors in parentheses
** significant at 5%; *** significant at 1%

Table 3: Models of Health and Mortality
with Child Counts Disaggregated by Location and Sex

	Including Women's Location Effects			Removing women's location effects	
	Good Health	Survival – no health control	Survival – with health control		
Total Living Children	-0.06	0.04	0.03	-0.06	0.02
	-0.07	-0.09	-0.09	-0.07	-0.09
Total Male Children Out of Household, in District	0.06	-0.05	-0.02	0.06	-0.00
	-0.09	-0.11	-0.11	-0.09	-0.12
Total Male Internal Migrant Children	0.24***	0.23**	0.21*	0.23***	0.22*
	-0.09	-0.11	-0.11	-0.09	-0.12
Total Male International Migration Children	0.13	0.32**	0.30**	0.14	0.30*
	-0.12	-0.15	-0.15	-0.12	-0.15
Total Female coresident children	0.14	0.08	0.10		
	-0.12	-0.16	-0.15		
Total Female Children Out of Household, in District	0.04	0.14	0.17		
	-0.08	-0.11	-0.11		
Total Female Internal Migrant Children	0.06	0.07	0.06		
	-0.09	-0.12	-0.12		
Total Female International Migration Children	0.41	-0.09	-0.26		
	-0.25	-0.33	-0.31		
Total Female Children				0.07	0.14
				-0.07	-0.10
Disability measured from ADL self-reports			-0.54***		-0.55***
			-0.19		-0.19
Bad performance on physical test			-0.83***		-0.81***
			-0.18		-0.18
Poor self-reported global health			-0.50***		-0.49***
			-0.17		-0.17
Constant	6.58***	8.39***	8.04***	6.58***	7.91***
	-1.03	-1.36	-1.34	-1.03	-1.34
Observations	3056	14598	14598	3056	14598
Log Likelihood:	316.3	423.8	538.9	314.3	536.1
DF	25	29	32	23	30

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 4: Models of Health and Mortality
Including Continuous and Categorical Specifications for Migrant Son's Education

	Continuous Education Specification		Categorical Education Specification	
	Good Health	Survival	Good Health	Survival
Total Living Children	-0.06	0.03	-0.06	0.02
	-0.07	-0.09	-0.07	-0.09
Total Male Children Out of Household, in District	0.06	-0.02	0.06	-0.01
	-0.09	-0.12	-0.09	-0.12
Total Male Internal Migrant Children	0.26**	0.02	0.23**	0.05
	-0.11	-0.14	-0.11	-0.15
Total Male International Migration Children	0.16	0.10	0.19	0.12
	-0.20	-0.28	-0.20	-0.29
Total Female Children	0.07	0.12	0.07	0.13
	-0.08	-0.10	-0.08	-0.10
Max Internal Migrant Male Schooling	-0.05	0.18**		
	-0.06	-0.08		
Max Internal Migrant Male Schooling – Squared	0.01	-0.01*		
	-0.01	-0.01		
Max International Migrant Male Schooling	-0.02	-0.12		
	-0.08	-0.14		
Max International Migrant Male Schooling - Squared	0.00	0.02		
	-0.01	-0.01		
Max Internal Migrant Male Schooling = Primary			-0.14	0.09
			-0.26	-0.34
Max Internal Migrant Male Schooling = Secondary			-0.16	0.83***
			-0.23	-0.31
Max Internal Migrant Male Schooling = Post-Secondary			0.34	0.27
			-0.26	-0.37
Max International Migrant Male Schooling = Primary			-0.38	-0.15
			-0.37	-0.48
Max International Migrant Male Schooling = Secondary			-0.06	0.31
			-0.34	-0.52
Max International Migrant Male Schooling = Post-Secondary			0.05	0.94
			-0.41	-0.71
Constant	6.73***	7.96***	6.90***	8.09***
	-1.03	-1.29	-1.04	-1.32
Observations	3056	14598	3056	14598
Log Likelihood:	324.1	529.3	330.0	550.3
DF	27	34	29	36

Robust standard errors in parentheses
* significant at 10%; ** significant at 5%; *** significant at 1%

Table 5: Models of Mortality
Testing Various Specifications of Parent-Child Transfer Relationships

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Total Male Internal Migrant Children	0.05	0.02	0.01	0.05	0.04	0.04	0.08	0.06	0.09
	-0.15	-0.15	-0.15	-0.16	-0.15	-0.15	-0.15	-0.15	-0.15
Total Male International Migration Children	0.28*	0.24	0.21	0.22	0.22	0.26*	0.19	0.29*	0.19
	-0.15	-0.15	-0.15	-0.18	-0.17	-0.15	-0.17	-0.15	-0.16
Max Internal Migrant Male Schooling = Primary	0.08	0.03	0.03	0.07	0.06	0.07	0.12	0.10	0.12
	-0.34	-0.35	-0.35	-0.36	-0.35	-0.35	-0.36	-0.34	-0.35
Max Internal Migrant Male Schooling = Secondary	0.86***	0.83***	0.83***	0.86***	0.85**	0.85***	0.90***	0.87***	0.90***
	-0.32	-0.32	-0.32	-0.33	-0.33	-0.32	-0.33	-0.32	-0.32
Max Internal Migrant Male Schooling = Post-Secondary	0.31	0.26	0.24	0.30	0.28	0.30	0.36	0.34	0.38
	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.37	-0.36
Any Gross Transfer Activity		0.26							
		-0.17							
Log Total Gross Transfers			0.03						
			-0.02						
Any Gross Transfer Activity with Internal Migrants				0.01					
				-0.30					
Any Gross Transfer Activity with International Migrants				0.15					
				-0.37					
Log Total Gross Transfers with Internal Migrants					0.01				
					-0.03				
Log Total Gross Transfers with International Migrants					0.02				
					-0.04				
Any Net Transfer Activity						0.06			
						-0.17			
Log Total Net Transfers							-0.16		
							-0.29		
Any Net Transfer Activity with Internal Migrants							0.21		
							-0.39		
Any Net Transfer Activity with International Migrants								-0.01	
								-0.02	
Log Total Net Transfers with Internal Migrants									-0.03
									-0.03
Log Total Net Transfers with International Migrants									0.02
									-0.03
Log Likelihood:	538.0	530.5	532.0	540.4	544.8	537.4	535.8	536.6	534.3
DF	31	32	32	33	33	32	33	32	33

Robust standard errors in parentheses
** significant at 5%; *** significant at 1%