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Strauss, J.

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II. Health

Gender and Life-Cycle Differentials in the Patterns and Determinants of Adult Health

John Strauss
Paul J. Gertler
Omar Rahman
Kristin Fox

ABSTRACT

This study investigates the socioeconomic determinants of adult ill-health in developing countries. We use as measures of health, self-reported general health plus a variety of measures of problems in physical functioning. We begin by comparing measures of adult ill-health in four countries: Bangladesh, Jamaica, Malaysia, and the United States, finding that women report more problems and at earlier ages than do men; this despite the greater longevity of women. We examine the sensi-

John Strauss is as professor of economics at Michigan State University, Paul J. Gertler and Omar Rahman are researchers at the RAND Corporation, and Kristin Fox is a researcher in the Jamaican Ministry of Health. *This research was partly funded by U.S. Bureau of Census contract number 50-YABC-1-66007, U.S. National Institutes of Child Health and Human Development grant number P01-HD28372-01 and the Safe Motherhood Initiative of the World Bank. The authors are grateful to Barbara Torrey and Kevin Kinsella for initial encouragement; to Mark Rosenzweig and T. Paul Schultz for detailed comments on an earlier draft; to Michael Grossman, Mark McClellan, Henry Mosely, Guilherme Sedlacek, James P. Smith, Duncan Thomas, and participants of the Rockefeller Foundation Conference on Women's Human Capital and Development for helpful suggestions; to the Planning Institute of Jamaica for making the data available; and to Carol Edwards, Adnan Rahman, My Vuong, and Nga Vuong for excellent programming assistance. The data used in this article can be obtained from June 1994 through June 1997 from the authors at the following address: Professor John Strauss, Department of Economics, Michigan State University, Marshall Hall, East Lansing, MI 48824.*

tivity of these gender differentials to mortality selection and find that while accounting for this does cut down the differentials, they remain. We discuss potential reasons for these findings and then examine the Jamaican data in more detail. We formulate and estimate a reduced form economic model, focusing on the effects of education. We find strong positive effects of own education on health, mirroring results commonly found in the child health literature. At older ages, however, the education differential disappears. Per capita household expenditure, treated as endogenous, is added to the model to attempt to control for long-run income. It is not found to affect adult female health, but limited evidence is found for an effect on males. Strong residential effects exist, although the factors behind them remain to be investigated. Our most robust finding is that even controlling for socioeconomic covariates, strong life-cycle effects exist and are different for men and women. Controlling for these factors, women still report more health problems at earlier ages than do men.

I. Introduction

Adult health is becoming an issue of increasing importance in developing countries. Population structures are beginning to age in many Asian, Caribbean and Latin American countries as a result of large fertility declines and longer life expectancies (Kinsella 1988). The health status of adults is of great importance both because there are direct productivity losses (World Bank 1991), potentially large indirect costs (Over et al., 1992) and because adult ill-health can place large demands on already stretched health systems. In particular treating the health problems of older populations often requires a different health infrastructure than the currently child oriented health systems available in most developing countries. Indeed current health systems are often inadequately prepared to cope with health problems due to advancing age, including cancer, circulatory problems and dementia. Moreover, formal institutions such as social security, pensions and health insurance that financially support older people in times of poor health cover only a small portion of society (for example, Martin 1988 or Ju and Jones 1989). Yet despite the pressing policy relevance and in contrast to child health, surprisingly little research has been done on adult health in developing countries.[1]

This study begins to fill this gap by investigating the patterns and socioeconomic determinants of adult ill-health. We begin by comparing measures of adult ill-health in four countries: Bangladesh, Jamaica, Malaysia, and the United States. We find very robust gender differentials over the life-cycle. Specifically, despite

1. Among the studies that do examine socioeconomic influences on illness are Wolfe and Behrman (1984), Pitt and Rosenzweig (1985), Behrman and Wolfe (1989), and Schultz and Tanzel (1992). These papers estimate reduced form equations explaining whether or not adults experienced an illness (or the number of days ill), using individual, household and community-level covariates. Other studies have examined factors underlying incidence of specific diseases. For instance, Castro and Mokate (1988) and Fernandez and Sawyer (1988) both study the impact of socioeconomic variables on the incidence of malaria in Colombia and the Amazon region of Brazil, respectively.

greater longevity of women, they report significantly more problems with physical functioning and with general health across all ages. That this pattern is repeated across such different economic and cultural settings as the United States, Jamaica, Malaysia, and Bangladesh suggests that it is unlikely to be a reflection only of reporting bias.

Since one of the potential biases in the gender comparisons is mortality selection (if men have higher mortality, more men in poor health would have died than women in poor health), we recalculate the percentages in poor health by adding to that group the expected number (of men or women) who have died and would presumably have been in poor health. While the mortality adjustment does substantially cut the gender gaps, it does not eliminate them. A strong implication of this result is that current developing country policy emphasis on longevity and mortality, to the exclusion of quality of life (health status), is likely to lead to a misallocation of resources.[2]

This raises the question of why such a gap should exist; different hypotheses are discussed and investigated in a multivariate analysis using data from Jamaica. An explicit economic model is introduced, which along with the descriptive results, serves to motivate the multivariate analysis. Specifically, we investigate in detail, the socioeconomic determinants of various dimensions of ill-health in Jamaica, for adults spanning the life-cycle, from age 14 to death. To do this, we use a unique data set, the third round (November, 1989) of the Jamaican Survey of Living Conditions (SLC). This nationally representative survey combines detailed individual-level health data on adults of all ages with extensive individual and household socioeconomic information. This is in contrast with many household surveys, which collect at most limited information on health and often exclude the elderly (for example, labor force surveys).[3]

Jamaica is an interesting case study because its population structure is aging far more quickly than in most developing countries and because of the availability of a very good data set. Jamaica is estimated to have had 12 percent of its population older than 55 in 1988 (Kinsella 1988), a percentage projected to increase to 16.6 by 2020. This relatively large older population enables an examination of life-cycle differences in the various influences on adult health. To contrast, in 1980 only 5.6 percent of Malaysia's population was older than 60 (Andrews et al. 1986), while in 1988 in Bangladesh only 7.9 percent were over the age of 55 (Kinsella 1988). On the other hand 21 percent in the United States were over 55 years in 1989 (U.S. Bureau of the Census 1991).

Among the key results we find in the multivariate analyses is first: there are dramatic age/cohort differentials in health, and important differences between men and women. Many problems of physical functioning begin by age 40, but become pronounced at older ages. Women report more health problems than men across the life-cycle. Furthermore, these age-related gender differentials persist after controlling for education and location factors. Second, higher education

2. For example, Feachem et al. (1992) in a review of adult health status and policy in developing countries focuses much of the book on mortality, in part because of data availability.

3. A few surveys of the elderly exist (for example, the WHO or ASEAN surveys; Andrews et al. 1986; Ju and Jones 1989). However they did not collect much information on the household in which the seniors reside and thus did not collect nonhealth and health information on younger adults.

lowers the probabilities of having problems with physical functioning and other dimensions of health. Third, we find evidence that it matters where one lives. Whether the availability and quality of health care underlies part of the community influence will be the subject of extensions to this work. Fourth, we find some evidence that long-run income (treated as endogenous) may affect the health of men, though there is some reason to doubt the adequacy of our income measure and our instruments. We also find some evidence of positive correlations between moderate measures of physical functioning and having had children, although we can't infer causality.

Finally, we find many fewer socioeconomic influences for older adults, particularly those over 70 years. A leveling of socioeconomic differences among older Jamaicans could imply that there exists less of a role for these factors; that nonbehavioral biological factors become more important. Part of this result could also be attributable to selective mortality of older adults in worse health (and with lower education and income); this is an important avenue for future research.

II. Adult Health and its Measurement

In contrast to child health and survival, very little is known about the patterns and effects of underlying socioeconomic factors on adult health in developing countries. Furthermore, much of what little discussion exists centers mostly around mortality. For instance in a recent World Bank volume morbidity is not addressed until chapter three (Feachem et al. 1992) and the chapter is entitled "Limited Data and Methodological Uncertainty." Even for adult mortality, knowledge of its underlying determinants is scant as most of the literature is still concerned with ways to estimate levels from existing, imperfect data. A recent exception is a study by Rahman, Foster, and Menken (1992) using data from Bangladesh, which investigates the impacts of widowhood and marriage on survival.[4]

Many analysts shy away from other types of health data, such as on morbidity, because of potentially severe reporting biases when the information is self- or proxy-reported (see Hill and Mamdani 1989, for a good discussion of various morbidity and mortality measures, and their potential drawbacks). As one illustration of potential difficulties, Schultz and Tanzel (1992), using the World Bank's Living Standards Surveys from Côte d'Ivoire and Ghana, find significantly positive effects of primary schooling on the number of days ill reported by adults.[5] Using the same data, Over et al. (1992) find that persons in households with higher per capita expenditure are more likely to report an illness. Self-reported

4. Rahman et al. find marriage is correlated with high survival probabilities. Hu and Goldman (1990) find similar results across a wide range of industrialized countries. A potential statistical reason for this finding is selective mortality and marital sorting. A paper by Goldman (1993) explores whether similar correlations in Japanese data can be plausibly caused by selective mortality, finding that such biases are quite consistent with observed correlations.

5. When they stratify by wage earners, the effects become insignificant. However, it may be that these workers have a higher opportunity cost of time, which may make them less likely to allow a given illness to interfere with normal activities. This would result in a negative bias.

measures of general health are also sharply criticized, as in the U.S. labor supply and retirement literature.[6]

Focusing only on mortality, however, gives only a very partial picture of adult health. Health arguably has multiple dimensions (Ware, Davies-Avery, and Brook 1980) and indeed the measures used in this study are supportive of that interpretation. Diseases which can have very acute symptoms, including death, may have very little long run consequences on survivors. For instance, in Bangladesh cholera and dysentery are leading causes of adult mortality, yet will have little long-run consequences on survivors. To rely only on mortality measures, then, will miss very important aspects of the health status of the living. As we argue in this paper there exist measures of adult health, which, though not without their problems, are quite useful.

In this study we compare adult health using both self-reported measures of general health and a variety of measures of physical functioning (so-called activity of daily living, ADL, measures). The general health measures are based on self-evaluations of health on an ordinal scale: typically ranging from excellent to good to fair to poor, with possibly more or less categories.[7] The measures of physical functioning derive from questions asking whether one's health limits (possibly with gradations as to the degree) specific activities, such as bending, walking uphill, "moderate" activities or "vigorous" activities.[8] A range of limitations are covered, from less severe: such as limitations in performing vigorous activities; to more moderately severe: such as limitations in walking uphill or walking one mile; to the very severe: such as walking 100 yards, or at the extreme eating, bathing or using the toilet. This range of outcomes may reflect different dimensions of health limitations, so that combining these into a single index may not be a useful way to begin analyzing them.

Self-reported physical functioning and general health measures have been used widely in studying the health of the elderly in the United States.[9] ADL measures have been used in southeast Asia in a series of recent surveys by the World Health Organization (WHO) and the Association of Southeast Asian Nations (ASEAN).[10]

Considerable effort has gone into testing these self-reported measures for reliability and validity. Examples include testing done for the RAND health insurance study (Stewart, Ware, Brook, and Davies-Avery 1978; Ware, Davies-Avery, and Brook 1980), the RAND Medical Outcomes Study (Stewart, Hays, and Ware

6. Recent studies include Bound (1991) and Stern (1989). Also see Anderson and Burkhauser (1984, 1985).

7. The Jamaican data have five categories, very good being the fifth; the Malaysian data have only three: good, fair, poor.

8. Examples of what is considered "moderate" or "vigorous" are provided to the respondent; for example, in Jamaica examples of "vigorous" activities include running, lifting heavy objects, doing hard labor, or participating in strenuous sports.

9. Studies that have used ADL measures include the RAND health insurance study (for instance, Manning, Newhouse, and Ware 1982), the RAND medical outcomes study (Stewart, Hays, and Ware 1988) and various studies of Ken Manton and his colleagues (for example, Manton, Woodbury, and Stallard 1991).

10. See Andrews et al. (1986) and Ju and Jones (1989). To date analyses of the ASEAN data have focused on living arrangements and not on health (for example, Martin 1989a, 1989b).

1988) and WHO surveys in Korea, Malaysia, and the Philippines (Andrews et al. 1986) and the ASEAN surveys in Indonesia, Malaysia, the Philippines, and Singapore (Ju and Jones 1989). Reliability tests are usually of the test-retest variety, persons being revisited within a short time of the initial interview and asked the same battery of health questions. Experience in the United States and southeast Asia has shown that self-reported measures of physical functioning are reliable in this sense. Validation has been done in several ways: first internal consistency is examined between the various physical functioning measures and between these and self-reported measures of general health. It should be the case, for example, that persons reporting extreme difficulties in walking should be much less likely to report being in excellent general health. The RAND, WHO, and ASEAN studies all find high degrees of internal consistency. Correlations between physical functioning and socioeconomic measures, particularly education, are also examined to check for clear patterns of misreporting, such as often exhibited by illness measures. The RAND studies have demonstrated that in U.S. populations at least, fewer difficulties are reported in physical functioning by better-educated persons. In some cases it may be possible to develop measure more objective measures; for instance, people can be timed walking one mile.[11] A recent review by Guralnik et al. (1989) suggests using this approach when possible, however there is as yet limited experience, particularly in developing countries.[12]

III. Descriptive Results From Four Surveys

In this section we use comparable data from four countries to look for robust patterns in adult health status. Each of these surveys have collected both extensive health and socioeconomic data at the individual and household levels, unlike some of the earlier health surveys. Measures of physical functioning along with a general health measure were collected in each case. The RAND Health Insurance Experiment (HIE) was conducted in the United States from 1974 to 1982 in six sites.[13] While many measures of limitations on physical functioning were collected (see Ware, Davies-Avery, and Brook 1980), we use a subset that is comparable to those collected in Jamaica, Malaysia, and Bangladesh. The 1982 sample includes 5,244 persons, aged 14 to 65, of which 2,455 are males and 2,789 are females. While a few groups were excluded from the HIE, it is a reasonably representative sample of the population, excluding the oldest old.[14] The third round of the Jamaican Survey of Living Conditions (SLC) was

11. At least for persons who are physically able to complete it.
12. For many measures, such as difficulty in eating or using the toilet, measurements by enumerators might raise even more questions of interpretation than self-reported measures.
13. These were Seattle, Washington; Fitchburg, Massachusetts; Franklin County, Massachusetts; Dayton, Ohio; Charleston, South Carolina; and Georgetown County, South Carolina. See Manning et al. (1987) for more details.
14. Those excluded include persons older than 62 at their enrollment in the experiment and persons with very high incomes.

collected by the Statistical and Planning Institutes of Jamaica, with assistance from the World Bank's Living Standards Measurement Studies division and RAND. This round has broad-based economic, demographic, and health information on 4,000 households. The health questionnaire contains information on a variety of health measures for adults, including measures of physical functioning and of general health. The sample is nationally representative. It includes 5,223 males and 5,350 females aged 14 and over. The Malaysian data come from the Senior Sample of the second Malaysian Family Life Survey (MFLS-2), fielded by RAND in 1988. MFLS-2 is representative of peninsula Malaysia; the Senior sample includes one person over 50 years (if one existed) randomly drawn from each survey household. Some 671 men and 686 women are covered. The Bangladesh sample comes from a pilot survey conducted by Omar Rahman in the Matlab surveillance area of the International Center for Diarrheal Disease Research (ICDDR-B). The survey canvassed 114 seniors: 60 females and 54 males aged 60 and older; drawn by a stratified (on age, land ownership, and marital status), random sample from a frame based on ICDDR-B's population census.

A. Data Validity

Although other studies have looked at the validity of measures of physical functioning, it is still useful to verify that these measures make sense in the data we use. Appendix Table 1 reports the cross-tabulation for one such indicator, walking uphill, against the general health measure, using the Jamaica SLC. The two health measures are highly correlated, moreover this pattern is repeated for the other ADL measures for the Jamaica data, as well as for the MFLS-2, HIE, and Bangladesh data.[15]

Systematic reporting bias often exists for morbidity measures. In particular, it is common to find that better-educated persons from higher income households report more illness. While we cannot test the existence of reporting bias we can examine whether such biases are so strong as to result in positive correlations with socioeconomic variables such as education. Appendix Tables 2A and 2B show for the Jamaican and Malaysian data that, controlling for age and gender, more education is associated with fewer reported problems. This pattern exists for the general health indicator as well as the physical activity limitations.[16,17] In the Jamaica sample there appears to be some evidence that education differentials disappear for the older old. Data for Malaysian seniors (those over 50) exhibit the same general pattern; more highly educated persons are less likely to report difficulties. Thus, these bivariate results suggest that the general health and physical functioning measures are not as plagued by systematic reporting problems as are measures of morbidity.

15. Details are available from the authors.

16. In these tables fair and poor health are grouped together as are being limited a lot and a little. In the regressions these aggregations are relaxed.

17. The Health Insurance Experiment data show the same patterns with education; see Stewart et al. (1978).

B. Gender and Age Patterns

Figure 1 exhibits the incidence of reported health problems for men and women 50 years or older in each of the four surveys.[18] All measures are included, both general health and measures of physical functioning.[19] The physical functioning measures are roughly ordered from less to more severe. Correspondingly, a much lower proportion of people report being limited by the more severe measures. This pattern suggests that to aggregate these measures into a single index will result in loss of information.

A strong and consistent pattern that appears in the data is that women report more problems and begin reporting them earlier than do men, despite their greater longevity.[20] In some cases the differences in proportions reporting problems is large; for example in the Jamaican SLC 52 percent of women 50 or older report difficulty in walking uphill, compared to 36 percent of men in the same age group.[21]

It may be that part of the difference in reported health results from age differences, particularly if women tend to be older because their adult mortality rates are lower. To check for that possibility we stratify by age group. Figure 2 shows the patterns in Jamaica for four physical functioning measures. It is apparent that gender differences within age groups persist.[22] Note that the ages at which the largest gaps appear are quite different for the different measures. For limitations on performing vigorous activities, for example, the gap exists across all age groups and is largest among persons aged 30–49. This pattern suggests a potential role of childbearing. For walking uphill the largest difference occurs among people in their 60s, while for having trouble eating, bathing, or using the toilet, gender differentials are largest among the older old, those older than 70. Thus there is some indication that gaps for the more severe measures occur later in life. This is not surprising given that small proportions of younger persons are afflicted by more severe problems of functioning and again is evidence that combining these measures hides much useful information.

Figure 2 shows age to be a critical factor in self-reports of different dimensions of ill-health, as one would expect. Nearly 15 percent of Jamaican males in their 30s and 40s report problems in engaging in vigorous activities. This escalates rapidly to nearly 45 percent between ages 50 and 59, reaching over 80 percent

18. The ages underlying this figure are kept to 50 and older (except for Bangladesh, for which it is 60 and older) for comparability, as the four surveys include differing age groups.

19. A general health measure does not exist for Bangladesh. Rather, health was scored as "good" if a person had no problem with any of the 12 measures of physical functioning.

20. That adult mortality rates are higher for men than women is well known and can be seen from vital statistics data; for instance U.S. National Center for Health Statistics (1991) and the Statistical Institute of Jamaica (1990). Male mortality is not, however, greater for all adult age groups. Often female mortality is higher for young adult and child bearing years.

21. Tests based on analysis of variance indicats that these differences are generally significant at under the 5 percent level.

22. The same is true for the Malaysian and U.S. data, when broken down by age. Results are available from the authors.

for men in their 70s.[23] For women in their 30s and 40s, 30 percent report problems in performing vigorous activities, which rises to 55 percent for those in their 50s and to almost 90 percent by the 70s. More severe limitations afflict fewer people and later in life, with some tendency for a jump in difficulties during one's 50s.[24]

C. Corrections for Differential Mortality

One possible explanation for these gender differences in health, especially for the older population, may be differential mortality by gender. Given that men are more likely to die, if the less healthy are dying first, then the proportion of those living who claim to be in fair or poor health will be understated compared to what would exist if those who died were still living. To attempt to gage the importance of selective mortality, we assume that those who died would have been in fair or poor general health. This is an extreme assumption since mortality and reported general health are not likely to be perfectly correlated; the estimate should thus provide a lower bound for the gender differential.[25] We use auxiliary information on age and gender specific death rates, obtained from national vital statistics for the United States and Jamaica, from vital statistics from the International Center for Diarrheal Disease Research, Bangladesh (ICDDR-B), and from MFLS-1 and -2 for Malaysia, to estimate the number of persons in each age group who would have died.[26] This estimate is then added to the number in fair or poor health and new proportions are calculated.[27]

Figure 3 presents these results for the general health measure in the Jamaican and Malaysian surveys.[28] Differential mortality does make a difference in the magnitude of the gender gaps, but only at older ages. For instance, in both Jamaica and Malaysia the corrections make little difference until age 60. The gender gap is narrowed for those in their 60s and roughly halved for those over 70. For the United States, the difference is eliminated for those over 50, consistent with other evidence cited by Wingard (1984). For Bangladesh, the gap is halved for those in their 70s. Thus it appears that correcting for differential mortality does make a difference to gender comparisons of poor health; however, such correc-

23. Since the data are from a cross-section, cohort effects also play a role.

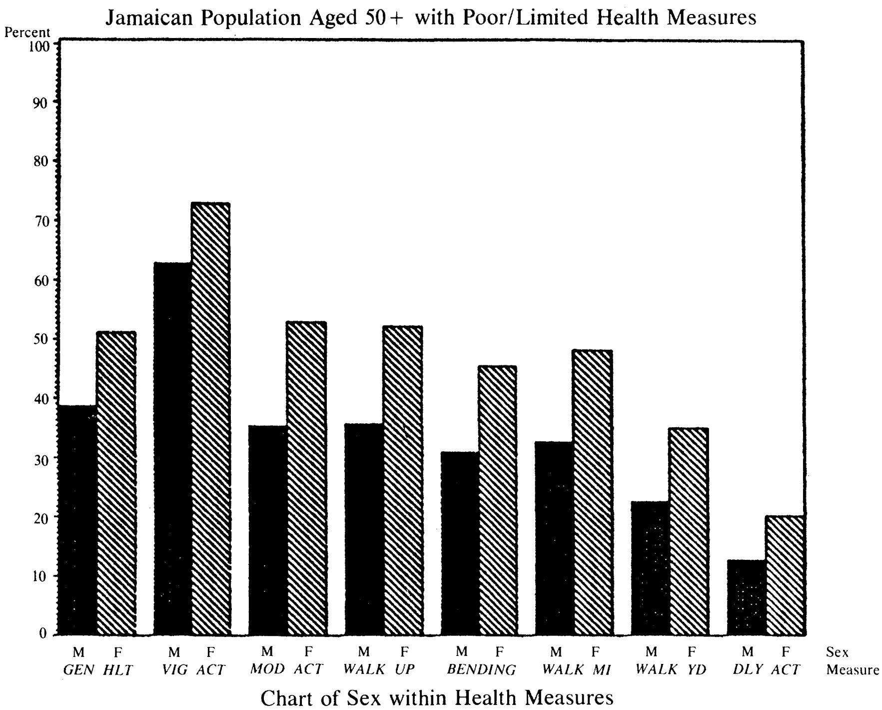
24. The age gradient is much less steep in the U.S. data, perhaps reflecting a health care system better geared towards care for an older population.

25. It would be heroic to assume that the dead would have reported problems with physical functioning, so we do not attempt to correct those figures.

26. In Jamaica accidents and violence are quite important as causes of death and accounting for it vastly increases the gender differentials in mortality (Statistical Institute of Jamaica 1990). Since there is no reason to suppose that persons dying a violent death would be in fair or poor health we use only the mortality differentials in deaths due to natural causes.

27. More specifically, we use the gender-specific probability of survival from age 15 to roughly the midpoint age of each group to estimate the number of men and women who would have died from age 15 to the particular age-group. For the Malaysian data we use the fact that we have a panel covering the 12 year span, 1976 to 1988. We know the proportion of men and women 38 years or older in the 1976 sample, MFLS-1 (these people would have been 50 or older in 1988 and thus eligible to be in the Senior Sample) who died by 1988. We use these proportions to make the corrections for the MFLS-2 data.

28. An analogous figure using the U.S. and Bangladesh data is available from the authors.


Jamaican Population Aged 50+ with Poor/Limited Health Measures
Percent
100
90
80
70
60
50
40
30
20
10
0
M F M F M F M F M F M F M F M F Sex
GEN HLT VIG ACT MOD ACT WALK UP BENDING WALK MI WALK YD DLY ACT Measure
Chart of Sex within Health Measures

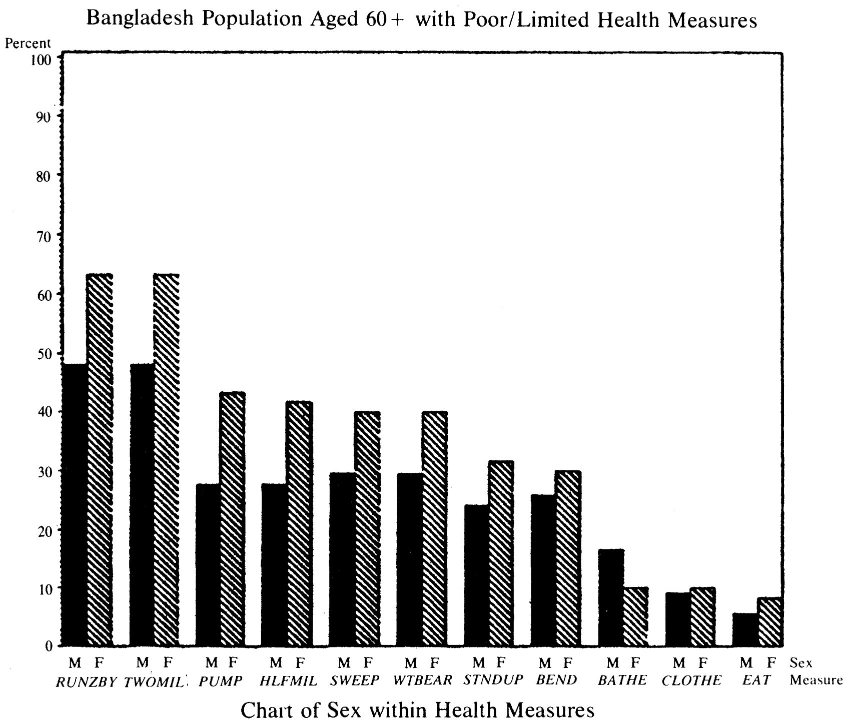

Bangladesh Population Aged 60+ with Poor/Limited Health Measures
Percent
100
90
80
70
60
50
40
30
20
10
0
M F M F M F M F M F M F M F M F M F M F M F Sex
RUNZBY TWOMIL PUMP HLFMIL SWEEP WTBEAR STNDUP BEND BATHE CLOTHE EAT Measure
Chart of Sex within Health Measures

Figure 1

Malaysian Population Aged 50+ with Poor/Limited Health Measures

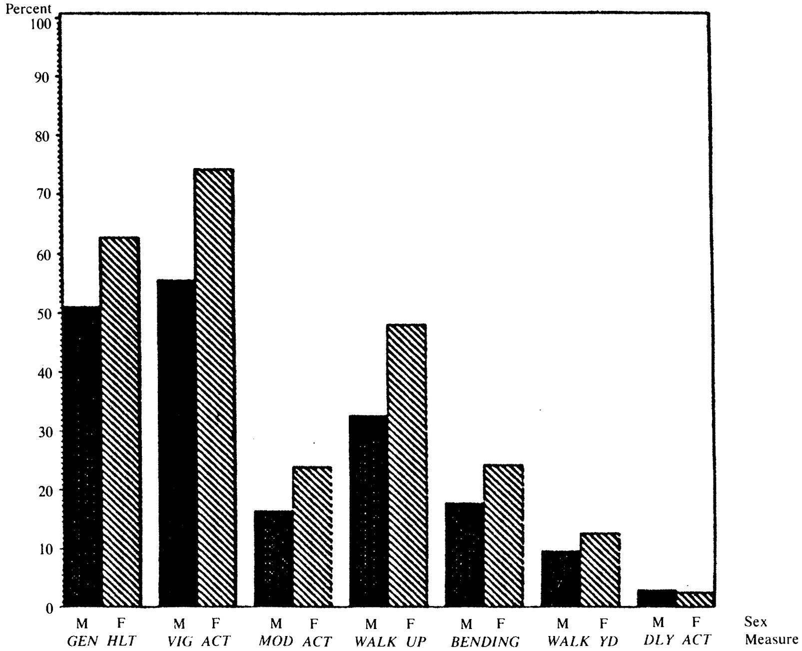


Chart of Sex within Health Measures

U.S. Population Aged 50+ with Poor/Limited Health Measures

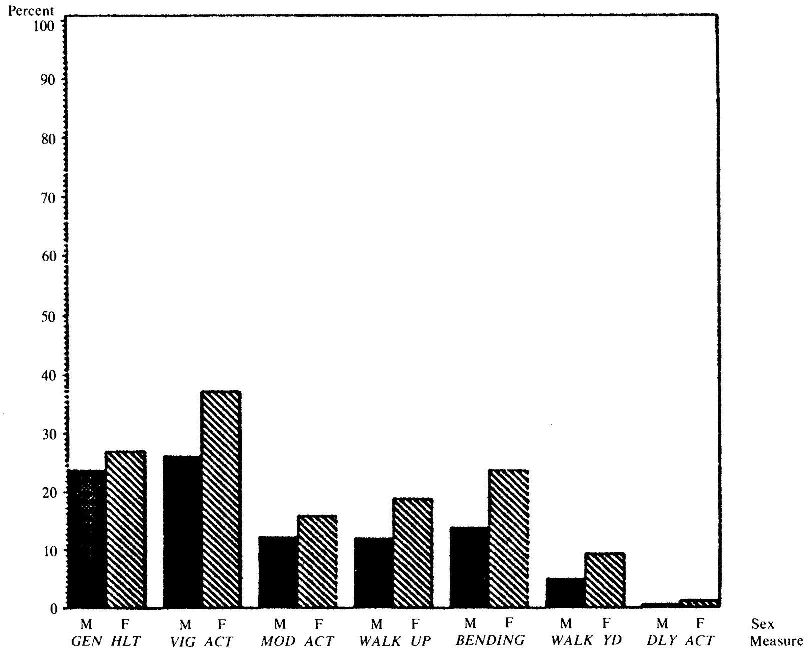


Chart of Sex within Health Measures

Figure 1 (*continued*)

Jamaican Population with Limitations to Vigorous Activities

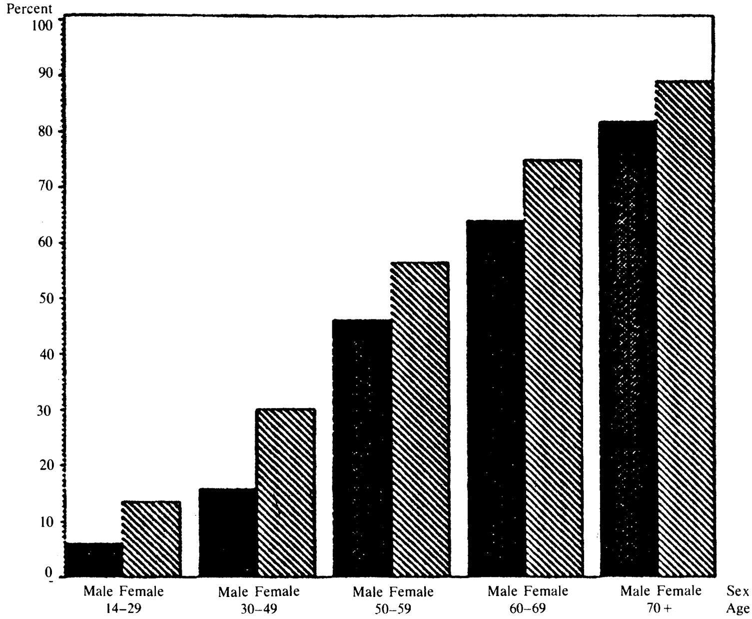


Chart of Sex within Age Categories

Jamaican Population with Limitations to Walking Uphill

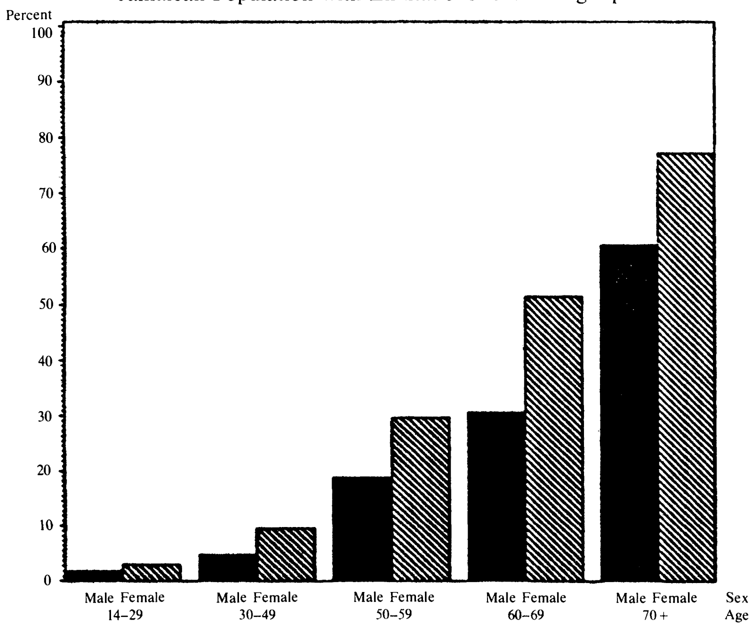


Chart of Sex within Age Categories

Figure 2

Jamaican Population with Limitations to Moderate Activities

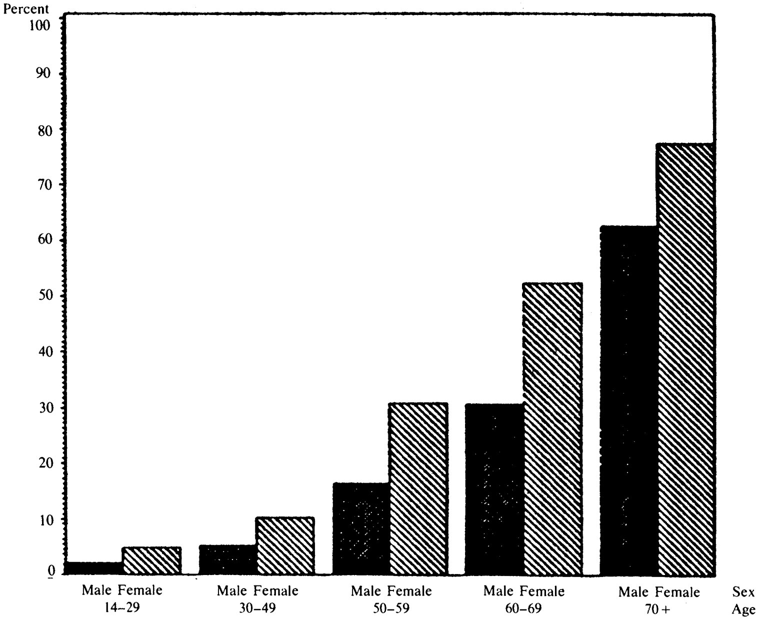


Chart of Sex Within Age Categories

Jamaican Population With Limitations to Daily Activities
Eating, Bathing or Using a Toilet

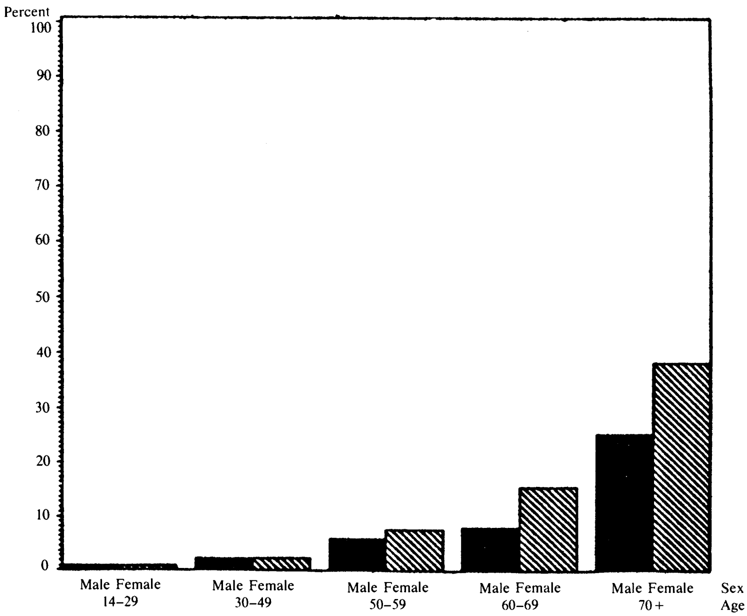
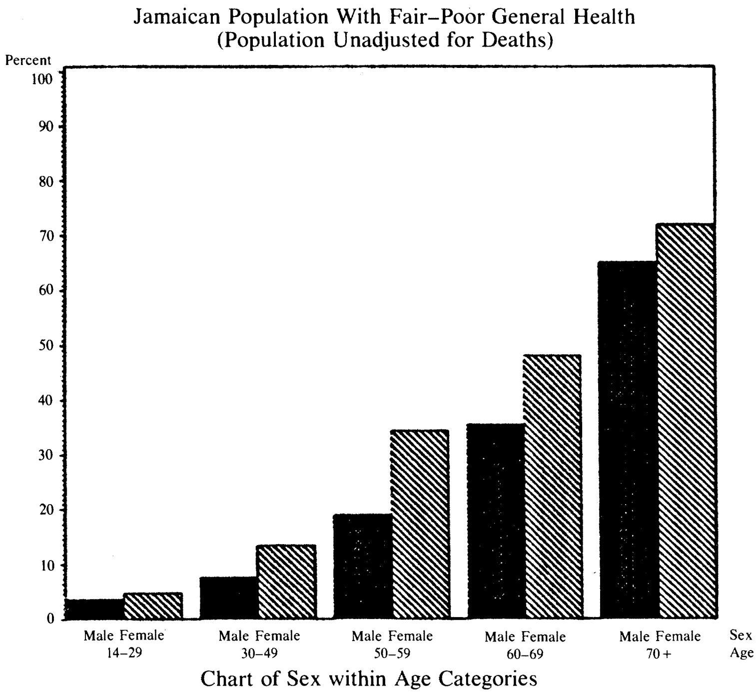


Chart of Sex within Age Categories

Figure 2 (*continued*)


Jamaican Population With Fair–Poor General Health
(Population Unadjusted for Deaths)
Percent
100
90
80
70
60
50
40
30
20
10
0
Male Female
14–29
Male Female
30–49
Male Female
50–59
Male Female
60–69
Male Female
70+
Sex
Age
Chart of Sex within Age Categories

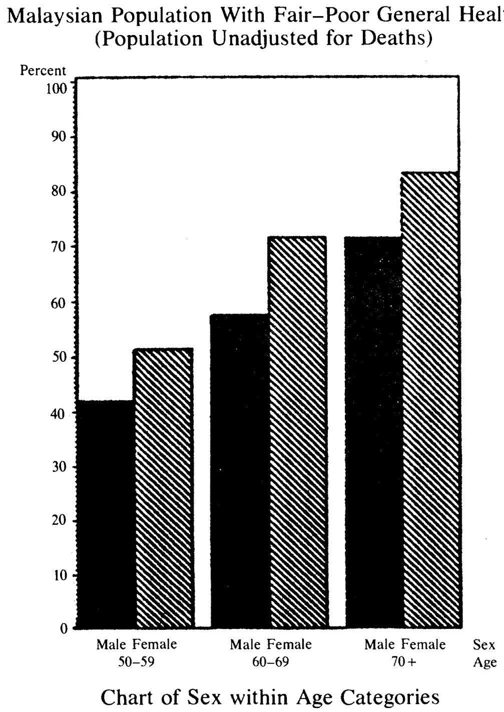

Malaysian Population With Fair–Poor General Health
(Population Unadjusted for Deaths)
Percent
100
90
80
70
60
50
40
30
20
10
0
Male Female
50–59
Male Female
60–69
Male Female
70+
Sex
Age
Chart of Sex within Age Categories

Figure 3

Jamaican Population With Fair–Poor General Health
(Population Adjusted for Deaths)

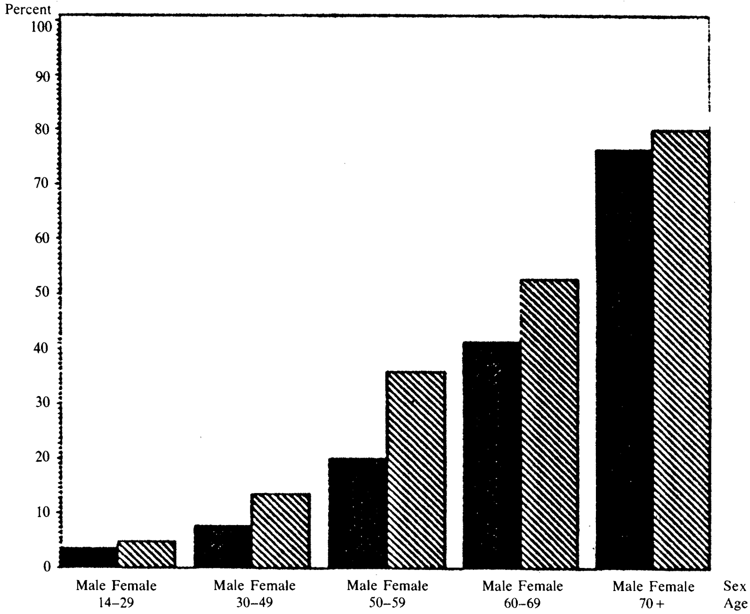


Chart of Sex within Age Categories

Malaysian Population With Fair–Poor General Health
(Population Adjusted for Deaths)

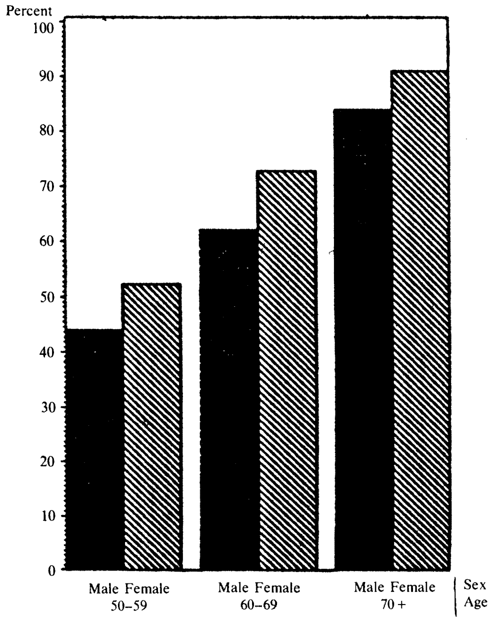


Chart of Sex within Age Categories

Figure 3 (*continued*)

tions do not eliminate the gaps, except perhaps among older age groups in some countries.[29]

D. Discussion

How can we explain the excess ill-health of adult women relative to men, particularly accounting for the excess mortality of adult men? A large literature has emerged on this in the United States.[30] On one level this literature explores differences in the types of diseases prevalent among men and women in the United States. Alternative biological and behavioral hypotheses to explain these patterns also have been offered.

In the United States, women suffer more from illnesses that are not life threatening, specifically acute and chronic nonfatal diseases.[31] Acute conditions that women in the United States suffer from more than men include infective/parasitic, respiratory, and digestive. Nonfatal chronic conditions that women suffer more from include varicose veins, constipation, gallbladder problems, arthritis, anemia, and chronic enteritis and colitis. Many of these conditions could well lead to reports of ill-health and of various problems of physical functioning. At least until very recently, men in the United States have higher rates of life-threatening chronic diseases such as coronary heart disease, arteriosclerosis, and emphysema. For Jamaica, unpublished Ministry of Health data from hospital records indicate that women suffer more from hypertension and diabetes, while men from coronary illnesses. Unfortunately good quality morbidity and cause of death data is scant in Malaysia and Bangladesh, so similar comparisons cannot be made.

Three broad groups of explanations have been offered to explain gender differentials in ill-health: biological, differences in behavior, and reporting differences. Biological explanations center around genes and hormones. Prior to menopause, for instance, women may have less risk to certain cardiovascular diseases due to endogenous sex hormones (Verbrugge 1985).

Behavioral choices are thought to have a very important effect on the gender differential in health. Bearing children may have negative influences for women, particularly in areas with high fertility rates and poor health infrastructure. Women who have many closely-spaced children may suffer from maternal depletion, which could well affect physical functioning.[32] Different occupational and time allocation choices by gender may result in quite different physical and mental stresses, leading to different levels of health and physical functioning. Differing behaviors with respect to smoking and drinking is yet another example. Finally, there may be quite different access to medical care, resulting from both household

29. It is tempting to speculate that the disappearance at older ages may be a function of the level of economic and health development. However, data from many more countries would be necessary to show this convincingly.

30. See, for example, Waldron (1983), Verbrugge (1976, 1980, 1985, 1989) or Wingard (1984). Sindelar (1982) is one of the few economists who has analyzed this issue, focusing on medical care use.

31. This summary relies heavily on Verbrugge (1985).

32. The importance of maternal depletion is not well established (see, for example, Miller et al. 1992 or Pebley and DaVanzo 1988). To date studies have not controlled for the fact that child-spacing is a choice of women and families, thus endogenous in empirical models.

choices and from health provider behavior. As a group, these behaviors are not likely to work favoring men or women exclusively; it is not clear which ones are most important and with what effect.[33]

Various hypotheses have been put forth explaining why there might be systematic reporting bias (see Verbrugge 1985 for a summary). The fact that gender health differences exist in such a variety of economic, social and cultural settings as the United States, Jamaica, Malaysia, and Bangladesh would seem to counsel against accepting reporting bias as being the principal explanation. If this conclusion is accepted then it is important to explore potential reasons. We turn to this task with multivariate analysis of the Jamaican data.

IV. Analysis of the Jamaican SLC Data

Our aim is to investigate how age and socioeconomic factors affect adult health outcomes. We are particularly interested in how these influences may differ between genders and between younger and older adults.

A. Model and Empirical Specification

To better understand these influences, we outline and estimate a reduced form household production model of the outcomes, relating the outcomes to the underlying constraints faced by the individuals and the households in which they reside. Because the health outcome measures are long-run, we relate them to long-run constraints. These constraints are at the individual, household, and community levels. Individual and household-level constraints include the person's age and sex, and education, which are related to life-cycle resources but may also have independent effects. Constraints at the community level include the disease environment and the availability and quality of health care facilities. The constraints work their influences through more immediate factors such as health care utilization, which directly affect health outcomes. In some cases there may be a direct effect as well.

The model we develop follows Grossman (1972) in treating health as a stock of human capital. An individual's health stock at a point in time is determined by an initial genetic endowment, subsequent behavioral choices (such as levels of work activity and exercise, medical care choices, or smoking), and effects of the public health environment, such as contracting cancer from toxic waste. Over a period of time, the change in a person's health status is determined through a production function which transforms inputs, such as individual behaviors and the public health environment, into health:

(1) $H_t = H(H_{t-1}, X_{ht}, \hat{\mu}_{ft}, \hat{\mu}_{ct}, \varepsilon_t)$

33. A paper by Verbrugge (1989) attempts to shed light on these questions using cross-sectional data from Detroit. The analysis, however, estimates a hybrid function, mixing elements of a health production function with elements of a reduced form. Also, simultaneity of variables subject to choice is not treated. In consequence, the results cannot be interpreted as Verbrugge would like.

where H_t is health at time t; X_h is a vector of health-related inputs including time allocated to different activities; $\hat{\mu}_f$ is a vector of individual and family characteristics such as age, gender or education of caregivers; $\hat{\mu}_c$ is a vector of community characteristics, such as environmental factors and availability and quality of health infrastructure; and ε is a term which covers unobserved individual endowments. The change in health over a period of time may also depend on the stock of health at the beginning of the period(s). For example a frail person's health may depreciate faster than that of someone who is robust.

In terms of the health variables available for this study, it is reasonable to suppose that health has several dimensions, which these measures are capturing. In the extreme, each measure may have its own production function. How to specify these biological production functions is not at all clear to us, in contrast to child growth or to certain childhood illnesses such as diarrhea, for which the biological processes are better known.[34] Even if we could specify the biology, to estimate the adult health production functions requires an enormous amount of data, which are certainly not available in the data we use, nor to our knowledge in other data sets. We consequently take the approach of estimating the reduced form determinants of these health outcomes.

To derive the reduced forms we make the standard economic assumption that households are making decisions rationally by maximizing their overall welfare as they define it; *given* their resources, the information available to them, their beliefs and the underlying health and sanitation environment. This assumption provides the mechanism by which those individual and household behaviors, the X_h's, which directly affect health are decided. The reduced form equations for health status are then derived from this behavior, taken together with the underlying health production, income, and time constraints.

Formally, we assume the household maximizes a weakly time-separable utility function and that the felicity function in each period, U_t, is a function of a vector of consumption goods, X_{ct}, a vector of health stocks of each family member, H_t, and a vector of family members' leisure, l_t:

$$(2) \quad U_t = U(X_{ct}, H_t, l_t; \tilde{\mu}_{ht})$$

Preferences may also be affected by household characteristics, $\tilde{\mu}_h$, such as education of various members.

The budget constraint relates current wealth as the present value of wealth left over from the previous period, the excess of income over expenditure, plus any net borrowing:

$$(3) \quad W_t = W_{t-1} + (1 + r)(Y_t - p_t X_t) + B$$

where Y is household income, the sum of labor earnings and nonlabor income, p_t is a vector of prices, X the vector of goods purchased (both those in the utility function and purchased health inputs), r is a (time-invariant) real interest rate, and B is net borrowing (or, more generally, transfers). Labor earnings are, of course, the product of hours supplied and a wage rate, both of which may be affected by current health status; thus implying that income is endogenous.

34. For instance, see the volumes by Falkner and Tanner (1986) and Waterlow (1988).

The reduced form health equations can be derived as:

$$(4) \quad H_t = H'(\mu_f, \mu_c, W_0, H_0)$$

where the subscript, $_0$, refers to the initial period (of adulthood). One important implication of the conceptualization is that measures of a health stock, such as indicators of physical limitations, are a function of *past* as well as of *current* values of the constraints. Indeed, because the model is dynamic *future* values of constraints, such as prices, matter as well.[35] For some of the conditioning variables, such as education, this does not present a problem, since adult education is usually time-invariant. For future time-varying variables, such as prices or expected prices, this means that we have omitted variables to the extent that the time-invariant covariates we use do not span the information set used to form expectations. However, it is not at all clear how this will affect either the age or education coefficients. A more serious potential source of bias derives from the common problem of missing measures of health and wealth at early adulthood.[36] To the extent that own education is correlated with both early adult health and initial family wealth, it will pick up those effects as well as its own effect on current resource availability and allocation.

B. Results: Ages Pooled

The multivariate analysis concentrates on the effects of individual and household covariates, controlling for community influences with parish-level dummy variables plus a dummy for urban location. All analyses are stratified by gender, testing differences between coefficients. Five year age-cohort dummies are included in addition. For a subset of results, we also stratify on age: less than 50 years, between 50 and 69 and 70 or over; still including five year age-group dummies within these broader age classes. Ordered probits are estimated, separating the categories of having serious difficulties, limited difficulties, or no difficulties for the ADLs, and reporting poor, fair, and good (or better) health. Table 1 and Figure 4 report the main set of results for women and men, pooled across age groups. We focus on the effects of own education and also include tests of location dummies and of differences in sets of coefficients between men and women. Graphic representation offers an easy way to see the life-cycle/cohort gender differences; in Figure 4 we plot a subset of the simulated age-profiles for the probabilities of having health problems, using the ordered probit estimates.[37]

35. In a perfect foresight model all future values of time-varying constraints would affect current outcomes. If uncertainty is allowed, then the determinants of their expectations would enter the reduced forms.

36. Note that because lagged health affects current health and is unobserved, even reduced forms derived from constant marginal utility of wealth (or Frisch) functions (for example, MaCurdy 1981; Browning, Deaton, and Irish 1985) with preferences that are time-additive will be a function of past constraints.

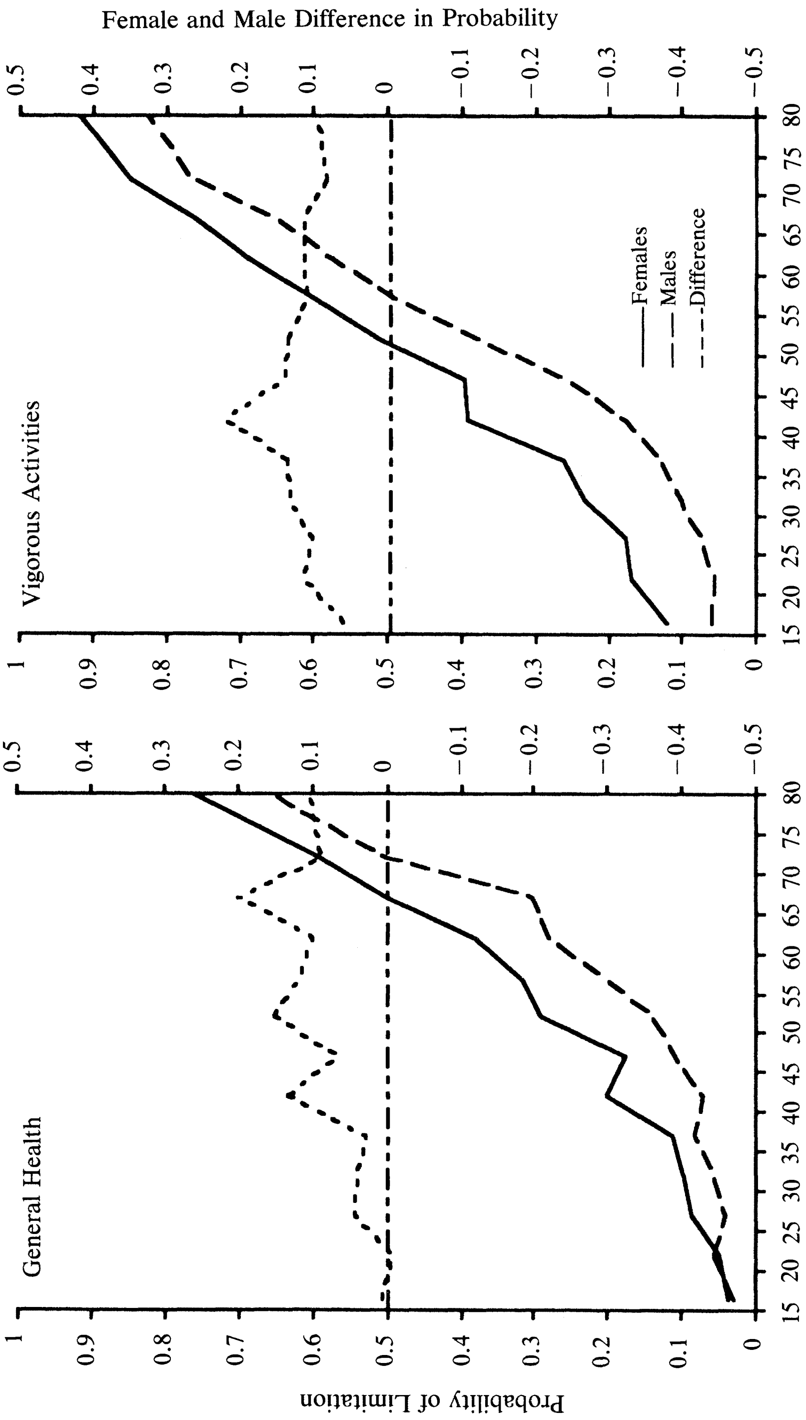
37. Specifically, we plot the expected probability of having a health problem (either with some or much difficulty) for the same age groups as we have dummies in the ordered probits. To do this, we hold constant for each person their nonage characteristics, vary their ages from 14–19 to over 75, and in each case calculate the resultant probability of having a problem. For each age group we then average probabilities over all individuals to arrive at the expected value.

Table 1
Education Influences on Female and Male Ill-Health: Age Pooled[a]

Limitations on	General Health		Vigorous Activities		Moderate Activities		Walking Uphill	
	Female	Male	Female	Male	Female	Male	Female	Male
Education (years)	−.038	−0.48	−.005	−.014	−.037	−.026	−.030	−.028
	(3.79)	(4.52)	(0.59)	(1.40)	(3.60)	(2.22)	(2.81)	(2.31)
Simulated probabilities								
Education = 6 years	.207	.140	.348	.224	.205	.112	.187	.108
Education = 11 years	.169	.104	.340	.211	.170	.095	.162	.091
χ^2 test statistics								
Location dummies (14 df)	168.0	116.8	412.3	216.5	129.3	67.4	67.2	49.1
Equality of male and female								
Education (1 df)		0.4		0.4		0.4		0.0
Location dummies (14 df)		17.2		53.2		33.8		20.8
Age dummies (12 df)		28.5		15.2		12.8		18.4

	Bending		Walking 1 Mile		Walking 100 yards		Eating, Bathing, Toiletry	
Education (years)	−.034	−.046	−.033	−.034	−.028	−.039	−.039	−.048
	(2.94)	(3.68)	(2.99)	(2.73)	(2.13)	(2.84)	(2.66)	(3.20)
Simulated probabilities								
Education = 6 years	.150	.094	.170	.098	.110	.068	.065	.043
Education = 11 years	.126	.070	.144	.079	.094	.051	.049	.028
χ^2 test statistics								
Location dummies (14 df)	50.4	48.9	31.6	29.3	50.0	44.2	36.6	24.2
Equality of male and female								
Education (1 df)		0.6		0.0		0.4		0.2
Location dummies (14 df)		22.9		23.4		14.6		14.9
Age dummies (12 df)		35.5		30.8		21.6		23.9

a. From ordered probits including parish, urban, and five-year age group dummies, Asymptotic normal z-statistics in parentheses.


Female and Male Difference in Probability
General Health
Vigorous Activities
Females
Males
Difference
Probability of Limitation

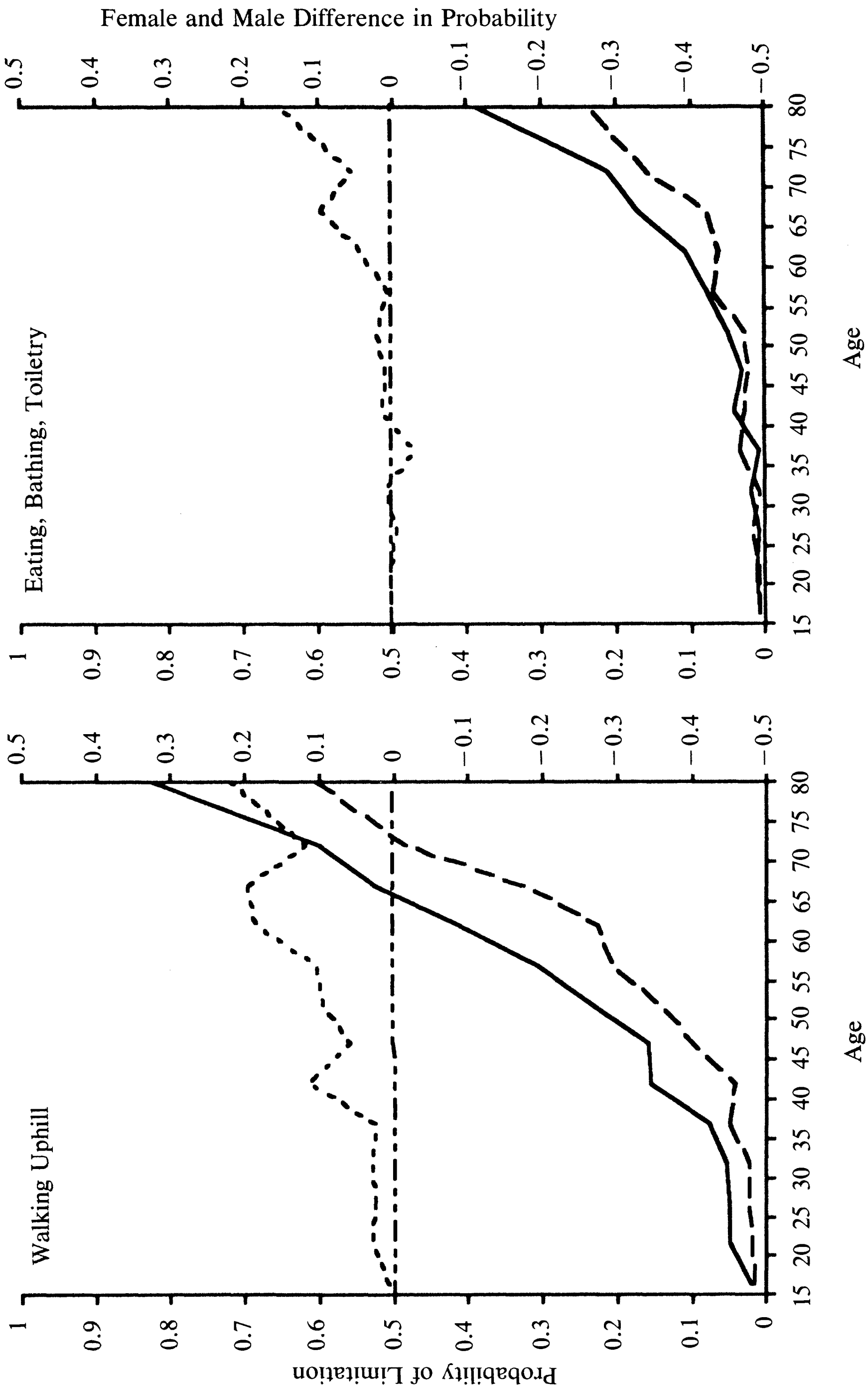


Figure 4
Simulated Probabilities of Health Limitations by Age

We concentrate not only on the main effects, but also on whether there are differential effects across gender as a potential way of explaining the gender gaps in reported health.

1. Education Effects

Among the socioeconomic variables, own education turns out to be very important. A linear term in completed years of education significantly reduces the probability of reporting a problem for the general health measure as well as for six of the seven physical functioning measures, for both men and women.[38] Education is related to health measures of varying severity, even for the most severe measures. As will be seen below, once we stratify on age, these results are strengthened for prime-aged adults. Thus, as it does for child mortality and child health, education plays an important role in affecting health of adults.

To gain a sense of the magnitudes involved, we simulate the probabilities of having health problems for someone with six years (completion of primary school) and 11 years (secondary school completion). These are also reported in Table 1.[39] For men, the probability of being in poor health drops by 25 percent (from 14 to 10.4 percent) as education is increased from six to 11 years. The probabilities of experiencing difficulties with walking uphill decline from 10.8 to 9.1 percent, bending from 9.4 to 7.0 percent and eating, bathing, or using the toilet from 4.3 to 2.8 percent. For women, the magnitudes are similar; comparing completion of primary to secondary school results in a decline in the probability of having poor or fair general health from 20.7 to 16.9 percent. For problems with walking uphill, the decrease is from 18.7 to 16.2 percent; bending, from 15.0 to 12.6 percent; and for eating, bathing, and using the toilet, from 6.5 to 4.9 percent.

A linear specification is reported in Table 1. Nonlinearities in education were examined and found not to be important for women, based both on polynomials, dummy variables, and splines. For men, some evidence exists that the marginal effect of education declines at post primary levels. For instance, using dummy variables for completing exactly six years, completing seven or eight years (some middle school) or completing nine or more years (the end of middle school); we find for general health that completion of primary school has a coefficient of −.28 (asymptotic z-score of 3.35), while the coefficient on completing middle school or higher is only −.32 (z-score of 3.87). Not completing middle school actually provides no advantage over not completing primary school, which may reflect unobserved characteristics of those dropping out of middle school.[40] The same nonlinear pattern is found for bending, walking one mile, walking 100 yards, and for eating, bathing, or using the toilet.

As can be seen in Table 1, chi-square tests do not permit us to distinguish the effects of education between men and women. Furthermore, it can be seen from Appendix Table 3 that the distribution of education is quite similar among men

38. A negative coefficient means the probability of reporting a problem is decreasing in that variable.
39. The simulations are done in the same way as the age simulations; see footnote 36.
40. Strauss and Thomas (1991) find similar relationships of not completing education levels on wage outcomes in Brazil.

and women in Jamaica. Thus differences in education or its effect cannot explain the gender differences in adult health in Jamaica.

2. Location Effects

The parish and urban dummy variables are significant at 5 percent or under for all the male and female equations. Conditional on parish of current residency, whether the person is living in an urban area has a positive effect on some of the ADLs for women, though generally not for men. The parish effects suggest that factors related to residency may be important. Obviously, several factors could be responsible and this is an area that bears further investigation. In particular it would be interesting to examine whether different levels of public and private health facility quality were partly responsible.

For the most mild problems of physical functioning, such as problems with vigorous or moderate activities, there is a differential effect of parish on men and women. However, for more moderate and severe measures, no significant differences of parish appear. These gender-specific effects of location on mild limitation measures could arise for several reasons, including differential access to health care or differential treatment by physicians. Of course, other infrastructure could also have effects which affect men and women heterogeneously.

3. Differences Over the Life-Cycle

In Figure 4 one can immediately see the enormous differences in reported problems by age net of education and location influences and that the gender differences vary by the severity of the problem.[41] Since the data are from a cross-section, these patterns also reflect cohort differences.[42] In general, the age/cohort profiles for both men and women look convex; although the ages at which the profiles begin turning up varies with the problem. Thus as individuals age (or for older cohorts), their health deteriorates at an increasing rate.

For general health, women begin to report significantly greater problems by the time they are 25 to 29, both relative to the younger aged women and to men. The difference grows after that until age 65 or so, after which it declines some. For the less severe limitations on physical functioning, such as in performing vigorous activities, women report more difficulties than men throughout the age distribution, starting in their teens. Furthermore the age-cohort profile is steeper for women than men until roughly age 40, after which gender differences actually decline.

For more severe measures, the age-profiles don't begin rising until later ages, nor do gender differentials become large until later. Moderate activities displays

41. Data for the remaining functioning measures are available from the authors.

42. The economy in Jamaica was stagnant during the 1980s. Very little investment occurred in health infrastructure (Lewis 1988). In consequence at least during this period it can be argued that different cohorts faced similar health conditions. Furthermore, although the slope of the age-profiles may be biased upwards if more recent age cohorts did experience better health conditions, the *differences* across gender should be relatively free of bias provided different cohorts of men and women experienced similar differential conditions.

a much flatter age/cohort profile until the late 30s for women and early 40s for men. After these points the profiles become quite steep, with the gender gap slowly rising until age 60, after which it flattens. A similar pattern emerges for problems in walking uphill. For the most severe measure, problems in eating, bathing, or using the toilet, the age/cohort profiles show very low probabilities at younger ages. Probabilities of having difficulties don't rise over 10 percent until age 60 for women and during the late 60s for men. Gender differentials don't appear until the late 50s, rising for older ages.

It is interesting that for general health and the less severe measures that the age gradients for women are steeper than for men beginning in the 20s. Note too, that there exist jumps for women in the probabilities of having difficulties with physical functioning in the late 30s and early 40s. This is most pronounced for general health and vigorous activities, but is apparent for walking uphill and even eating, bathing, and toiletry. The other ages at which there seem to be common jumps are the early 50s and, except for vigorous activities, the early 70s. Notice that men don't seem to exhibit common jumps in the late 30s. Both the jumps in gender differentials during the late 30s plus the emergence of differentials in the 20s suggests childbearing as being one of the underlying factors. The jumps at older ages suggest other factors are likely to be responsible as well.

4. Discussion

To sum up, there are several results that come out of the age-pooled health probits. First, higher education lowers the probabilities of reporting problems of ill-health for both men and women. Second, controlling for education, and area of residence, most of the differences between men and women in their reported health status appears to be related to different life-cycle or cohort profiles. Jamaican women, like women in other countries, tend to report more non–life-threatening health problems and at earlier ages than do men. This could result from many factors, both biological and behavioral (such as childbearing); since we are estimating reduced forms it is not possible to distinguish between different factors. Third, where one lives does matter; which dimensions of location are important cannot be determined from the results in this paper.

C. Results: By Age Group

Log-likelihood ratio tests strongly reject equality of all slope coefficients by age group; we thus estimate the models stratified by age. Table 2 reports these statistics, plus the coefficients and asymptotic normal statistics from the by-age results, using the same specification as in Table 1.

Strong differences exist in the effect of education and other variables between younger and older ages. Education clearly discriminates between those with various health problems and those without for both men and women under 50 years. Indeed the magnitude of the coefficients rises considerably above the age-pooled results. For those aged 50 to 69, however, the estimated coefficients decline dramatically and are significant for only one measure of function for women and for one measure of function, plus general health for men. For persons older than 70, education is only significantly related to problems for the most severe functioning measure (eating, bathing, or using the toilet) and only for men.

The parish dummy variables again tend to be significant in the age-stratified results. For the more severe measures it is interesting that the χ^2 statistics are larger for the older age groups, implying that the parish dummies have more explanatory power for these groups.

One caveat to these age-stratified results needs to be made: if mortality is linked to factors which we aren't able to measure and if these same factors are linked to health status for survivors then our comparisons between age groups will be biased. In particular, it is plausible that if the less well-educated and lower income persons die earlier, the education coefficient will be biased toward zero.[43] Mortality selection is likely to be an issue only for the older part of the sample, as adult mortality rates are probably too low to have much of an effect for prime-aged adults; the results depicted in Figure 3 are consistent with this supposition. Unfortunately, the Jamaican SLC does not contain the data necessary to test the existence and strength of this potential effect. This is a potentially useful avenue for research with other data.

D. Additional Explanations: Expenditures, Partner, and Fertility Effects

In this section we take advantage of data available in the Jamaican SLC to augment our base specification. As discussed in section IVA, one would ideally want to have information on initial wealth and health endowment. Although no measure of initial assets is available in the SLC, there is a measure which might be related to long-run income: per capita household expenditure (PCE). If households try to smooth consumption over time, this should be a measure of permanent income. Per capita household consumption has been successfully used in studies of child health (Thomas, Strauss, and Henriques 1990). Here we explore the use of PCE to explain adult health. Using PCE raises several issues, such as the likelihood that causation runs in both directions; since income, even permanent, may be a function of long-run health. We use an instrumental variables approach to address this issue (see Rivers and Vuong 1988, for an application to probit regressions), by including the residual from a regression predicting per capita expenditure (PCE), or its log. The instrument set includes, in addition to the other variables in the health equations, years of education, age, and age squared of the senior male and senior female in the household.[44,45]

43. Menchik (1993) shows strong permanent income differentials in mortality for men in the United States, using the National Longitudinal Survey. As noted below, we are not able to measure permanent income well in the Jamaica SLC.

44. In Jamaica, some 40 percent of adults live in households headed by women, hence using head of household and spouse would confound potential separate effects of men and women. Because there are cases in which a male or female household head has no partner, we also include dummies measuring the existence of a senior male or female.

45. Quadratics in education are not used because we have opted for linear term in education in the health probits. The first stage regressions explaining the log PCE have R^2s of around .3 for women and .35 for men. The identifying variables are significant; for instance, in the male regression the eight coefficients on existence of the senior male and female and their education, age, and age squared have

Table 2

Education Influences on Female and Male Ill-Health: By Age Group[a]

Limitations on	General Health			Vigorous Activities			Moderate Activities			Walking Uphill		
Age Group	14–49	50–69	70+	14–49	50–69	70+	14–49	50–69	70+	14–49	50–69	70+
Females												
Education	−.051	−.031	−.002	−.008	−.003	.020	−.055	−.027	.004	−.055	−.009	.008
	(3.69)	(1.70)	(0.06)	(0.66)	(0.20)	(0.68)	(3.75)	(1.52)	(0.16)	(3.56)	(0.47)	(0.31)
χ^2 test statistics												
Location dummies (14 df)	69.1	70.1	31.1	265.3	75.2	37.6	107.4	22.6	19.5	31.3	45.9	25.6
Age-pooling (32 df)			34.4			71.9			69.1			60.8
Males												
Education	−.055	−.055	−.025	−.028	.005	−.045	−.062	−.002	−.022	−.067	−.009	.007
	(4.72)	(2.86)	(0.90)	(2.05)	(0.29)	(1.60)	(3.44)	(0.08)	(0.81)	(3.68)	(0.49)	(0.24)
χ^2 test statistics												
Location dummies (14 df)	45.8	77.8	37.8	154.8	66.0	34.0	58.3	20.3	24.4	27.8	30.5	24.5
Age-pooling (32 df)			52.7			94.3			53.0			63.1

	Bending			Walking One Mile			Walking 100 Yards			Eating, Bathing, Toiletry		
Females												
Education	−.050	−.044	.028	−.053	−.024	.005	−.055	−.022	.011	−.059	−.014	−.022
	(2.78)	(2.33)	(1.08)	(3.22)	(1.30)	(0.17)	(2.64)	(1.07)	(0.41)	(2.43)	(0.59)	(0.80)
χ^2 test statistics												
Location dummies (14 df)	22.3	33.6	39.8	23.7	20.7	17.4	18.8	22.1	38.7	16.9	11.0	27.7
Age-pooling (32 df)			79.9			52.3			50.5			47.2
Males												
Education	−.082	−.042	−.005	−.078	−.016	.003	−.088	−.006	−.011	−.063	−.025	−.067
	(4.38)	(1.97)	(0.19)	(4.09)	(0.79)	(0.12)	(4.27)	(0.24)	(0.37)	(2.77)	(0.92)	(2.10)
χ^2 test statistics												
Location dummies (14 df)	28.3	31.0	36.2	20.5	21.0	28.3	20.6	24.1	48.6	11.8	15.8	35.4
Age-pooling (32 df)			78.5			60.6			62.6			32.7

a. From ordered probits with parish, urban, and five-year age-group dummies.

We also allow the partner's characteristics to directly affect health by including his or her age, education, and whether he or she exists.[46,47] However, it is arguable that the existence of a partner is a reflection of the health of both partners, hence endogenous within our model. For this reason the base specification does not include partner characteristics. As will be seen below, our results are consistent with an interpretation of endogeneity.[48]

For per capita expenditure, partner and senior male and female characteristics there is an additional potential problem; the expenditure of the household in which the respondent currently resides (or characteristics of the current partner or current household senior male and female) may be only weakly related to expenditure (characteristics) over the bulk of the life-cycle. This is especially likely to be a problem for older adults who may have moved into their children's households late in life; their children being on a different expenditure trajectory than they were.[49] To minimize this potential problem we estimate specifications with per capita expenditure (treated as endogenous) and partner characteristics on the sample of younger adults (14–49 years).

Tables 3A and 3B report for women and men the results for the baseline specifications for 14–49 year olds (specification 1), plus ones adding per capita expenditure and its residual from the first-stage regression (specification 2) and partner characteristics (specification 3).[50] The log of household per capita expenditure (logPCE) does not significantly affect health of women. For men, the expenditure variable is just significant at 5 percent for bending and walking 100 yards and at just above 5 percent for walking one mile.[51] Thus, for men some evidence exists that long-run income may be related to ill-health. In general the education coefficients don't decline, they even rise a little in some instances. Thus as is true for child health, the role of education seems to be largely independent of income for both men and women.

The residual term for log PCE is not significant,[52] suggesting that endogeneity

an F-statistic of 73.4. These variables are also jointly significant in the female log PCE regression, although the F-statistic is much lower, 23.4.

46. In Jamaica partner and spouse are distinct. We use the characteristics of partners, which include spouses, and common law partners.

47. It would also be interesting to explore the effects of characteristics of the children, possibly including whether the parent is living with the child. In the Jamaican SLC data information is only available on children who are living in the household. As this may be a very select set of available children, we choose not to explore this dimension with these data.

48. It may be possible to use unobserved factor models as one way around the potential endogeneity of the spouse variables. We could take advantage of having data on multiple health variables by adding to the model a person-specific unobserved variable that belongs in each health equation, though with a different coefficient in each. By allowing the unobservable to depend upon the right-hand side covariates we could allow for covariation between the person-invariant unobserved factors that presumably are behind the potential correlation between spouse variables and own health (see Chamberlain 1984, Gertler 1988). In order to identify the parameters, however, we would have to assume that a subset of the health outcomes are indicators of the same underlying health variable, which we are loath to do.

49. We are indebted to Jim Smith for this point.

50. Polynomials and splines in log PCE were experimented with, but were also not significant.

51. Since we had some evidence of nonlinearities in education for men, we also replaced the linear education term with a set of dummy variables, the expenditure results being essentially the same.

52. The significance of its parameter is a test of exogeneity of expenditure (see Rivers and Vuong 1988).

of PCE may not be a problem. However when log PCE is treated as exogenous, it is significant for men for general health and six out of seven ADLs. Furthermore many of the coefficients are altered substantially, as well as the standard errors becoming lower.[53] It seems prudent not to rely on the exogenous PCE results, given the small number of identifying variables and thus the potential poor power of the Wu-Hausman test; the strong presumption that health problems, at least serious ones, do affect wages and perhaps labor supply; and the possibility that PCE is only weakly related to initial wealth or even life-cycle income. For women, log PCE is never close to significance, even when it is treated as exogenous.

When characteristics of the partner are added, they are jointly significant in the male equations, but generally not in the female equations. For males, evidently, having a female partner present in the household is associated with better reported health, an effect mitigated by advancing age of the partner.[54] Education of the partner does not have a significant impact on male adult health, although the direction is usually to improve it. Presence of a male partner has, if anything, a negative impact on female health, but one which as mentioned, is usually not jointly significant. These partner effects are quite similar in direction to the marriage premia found in labor market earnings in the United States and to the health premia found in adult mortality.[55] Just as in those other examples, it is not clear from these results whether the effect of a female partner being present is real or represents nonrandom selection together with positive assortative mating on health.[56]

Finally, for a subset of the female sample, we have complete fertility histories. Fertility histories were collected on one woman aged 14–45 per household, ''randomly'' chosen. Because of the potential importance of childbearing in explaining excess female health problems, we add this information to the baseline specification. Although childbearing decisions should be treated as endogenous within a life-cycle model for women, given data limitations we treat it as exogenous, trying to see if sensible correlations exist.

Unfortunately, the subsample of women having fertility histories is not exactly comparable to the general sample. The sample of women, aged 14–45, with fertility histories, is a subset of the 3,580 women aged 14–49 we analyze; 2,016 having complete data. Differences arise both because households with two or more women of childbearing age have different characteristics from households with only one such woman and possibly because women given the fertility histories were not chosen completely randomly. The subsample with fertility data tend to be younger than the women who were not respondents (partly since 46–49 year-olds are excluded), but also are more likely to be the head of household (25 versus 18.7 percent), have a partner living with them (38.7 versus 23.9 percent), have

53. The coefficients are actually higher in the instrumental variables estimation, which is consistent with PCE being an error-ridden measure of life-cycle income or initial wealth, or with the instruments being correlated with unobserved health-related factors.

54. In results not reported, characteristics of the partner do not have significant effects for men 50 and older.

55. For instance, Korenman and Neumark (1991, 1992) and Hu and Goldman (1990).

56. For example, female partners may be present because they are in better health.

Table 3A
Education, Income, and Partner Influences on Female Ill-Health: 14–49 Year-Olds[a]

Limitations on Specification	General Health			Vigorous Activities			Moderate Activities			Walking Uphill		
	1	2	3	1	2	3	1	2	3	1	2	3
Own education (years)	−.051	−.051	−.046	−.008	−.024	−.014	−.055	−.063	−.056	−.055	−.073	−.053
	(3.69)	(2.54)	(3.21)	(0.66)	(1.54)	(1.12)	(3.75)	(3.19)	(3.68)	(3.56)	(3.46)	(3.31)
Log household per capita expenditure (PCE)		−.012			.249			.124			.286	
		(0.05)			(1.59)			(.057)			(1.19)	
Residual log PCE[b]		−.038			−.256			−.155			−.331	
		(0.05)			(1.58)			(0.69)			(1.33)	
(1) if partner in HH			.326			.198			.573			.536
			(1.13)			(0.82)			(1.93)			(1.72)
Partner education			−.026			.023			−.007			−.011
			(1.29)			(1.38)			(0.32)			(0.49)
Partner age			−.004			−.005			−.008			−.006
			(.070)			(1.10)			(1.42)			(1.10)
χ^2 for partner covs (3 df)			1.9			18.5			11.3			8.1

	Bending			Walking One Mile			Walking 100 Yards			Eating, Bathing, Toiletry		
Own education	−.050	−.056	−.045	−.053	−.066	−.054	−.055	−.072	−.063	−.059	−.056	−.064
	(2.78)	(2.28)	(2.39)	(3.22)	(2.97)	(3.20)	(2.64)	(2.50)	(2.97)	(2.43)	(1.50)	(2.52)
Log household per capita expenditure (PCE)		.094			.229			.274			−.075	
		(0.32)			(0.92)			(0.79)			(0.16)	
Residual log PCE[b]		−.140			−.203			−.345			−.042	
		(0.96)			(0.78)			(0.96)			(0.09)	
(1) if partner in HH			.389			.230			.031			.059
			(1.11)			(0.69)			(0.07)			(0.12)
Partner education			−.022			.005			.036			.017
			(0.88)			(0.23)			(1.14)			(0.45)
Partner age			−.001			−.003			−.004			−.005
			(0.18)			(0.48)			(0.52)			(0.56)
χ^2 for partner covs (3 df)			4.3			4.1			3.5			0.6

a. Five year age-group and location dummies are also included.
b. From regression of log household per capita expenditure. Identifying instruments include education and age of the senior male and female in the household, plus quadratics in their ages.

Table 3B
Education, Income, and Partner Influences on Male Ill-Health: 14–49 Year-Olds[a]

Limitations on Specification	General Health			Vigorous Activities			Moderate Activities			Walking Uphill		
	1	2	3	1	2	3	1	2	3	1	2	3
Own education (years)	−.055	−.046	−.062	−.028	−.036	−.026	−.055	−.047	−.054	−.055	−.053	−.058
	(4.72)	(2.71)	(4.08)	(2.05)	(2.31)	(1.76)	(3.75)	(2.24)	(2.84)	(3.56)	(2.46)	(3.03)
Log household per capita expenditure (PCE)		−.183			.128			−.309			−.307	
		(1.17)			(1.00)			(1.63)			(1.53)	
Residual log PCE[b]		.061			−.205			.160			.133	
		(0.36)			(1.50)			(0.80)			(0.63)	
(1) if partner in HH			−1.44			−.319			−.487			−.360
			(3.00)			(0.98)			(1.16)			(0.85)
Partner education			.065			−.006			−.034			−.039
			(1.98)			(0.26)			(1.13)			(1.28)
Partner age			.023			.013			.023			.020
			(2.62)			(2.00)			(2.67)			(2.36)
χ^2 for partner covs (3 df)			11.0			4.9			9.6			8.3

	Bending			Walking One Mile			Walking 100 Yards			Eating, Bathing, Toiletry		
Own education (years)	−.050	−.062	−.073	−.053	−.059	−.070	−.055	−.068	−.089	−.059	−.057	−.068
	(2.78)	(2.75)	(3.74)	(3.22)	(2.59)	(3.55)	(2.64)	(2.68)	(4.12)	(2.43)	(2.12)	(2.91)
Log household per capita expenditure (PCE)		−.460			−.417			−.508			−.142	
		(2.11)			(1.90)			(2.00)			(0.56)	
Residual log PCE[b]		.257			.250			.250			−.051	
		(1.12)			(1.09)			(0.94)			(0.19)	
(1) if partner in HH			−.690			−.557			−1.465			−1.852
			(1.54)			(1.24)			(2.38)			(2.70)
Partner education			−.039			−.031			.013			.037
			(1.21)			(0.97)			(0.31)			(0.83)
Partner age			.030			.024			.040			.043
			(3.30)			(2.61)			(3.51)			(3.51)
χ^2 for partner covs 3 df)			14.0			8.7			13.4			13.0

a. Five-year age-group and location dummies are also included.

b. From regression of log household per capita expenditure. Identifying instruments include education and age of the senior male and senior female in the household, plus quadratics in their ages.

higher mean education (9.24 versus 8.91 years; 49 percent having some secondary school versus 41.5 percent), and be in households with higher log PCE (8.51 versus 8.36). Differences in health between the two samples are fairly small. Thus, less well-educated women, who are not heads of households and who have no male partners living with them are less likely to be included in the fertility sample.

With that caveat in mind, we turn to discussing the results, which are reported in Table 4. We do find some correlations between having had children and the less severe measures of physical functioning. The relationship, moreover, appears to be quite nonlinear. The number of children ever born has no measurable effect on any of our health outcomes. However, once we specify a dummy variable for having any children, we do see a significantly negative effect (at the 5 percent level) on the probability of having difficulties with vigorous activities. Furthermore, having a second or three or more children has no additional effect; it is the first child that is responsible for the partial correlation. While having a child has a positive partial correlation with problems in performing moderate activities, walking uphill, and bending, the coefficients are not significant. Having three or more children has a marginally significant (at the 10 percent level) partial correlation with walking uphill and likewise, there appears to be an effect (though not significant) of having two and three or more children on problems with bending. Note, however, that having had children makes no difference on reporting problems with more severe measures. Furthermore, it is correlated with women being more likely to report having good overall health. Why this should be is unclear; it may emanate in part from higher self-esteem associated with having children; it may also be that a few women in bad health have difficulty in bearing children. The difference in the fertility correlations is another demonstration that various health measures are not capturing identical dimensions. However, overall, it appears that while fertility may play a role in explaining the gender gap in physical functioning, it is probably small and then limited to less severe problems. One must be careful in making this claim too strongly from this evidence because we have not accounted for potential biases from fertility being endogenous, also we do not have enough data on health experiences during childbirth to carefully examine whether having had certain health problems may lead to later difficulties in physical functioning.[57]

VI. Summary

This paper has attempted to cover several areas related to the determinants of adult health in developing countries. First, we argue that not enough attention has been paid to the underlying causes of adult health and not enough to nonmortality dimensions of health. Second, we argue that measures of physical functioning, together with a measure of general health form a useful,

57. Although data do exist on health problems, they are only for pregnancies during the past five years. A significant part of the already reduced sample would thus be excluded. Furthermore, such exclusion would raise nontrivial sample selection issues that would further complicate any interpretation.

Table 4
Correlations of Fertility With Female Ill-Health: 14–45 Year-Olds[a]

	Number of Children			
Health Measure	1+, 1	2	3+	χ^2 test (3 df)
General health	−.187			—
	(1.64)			
	−.169	−.154	−.223	3.0
	(1.22)	(1.07)	(1.70)	
Vigorous activities	.179			—
	(2.03)			
	.190	.142	.188	4.5
	(1.89)	(1.25)	(1.81)	
Moderate activities	.122			—
	(1.05)			
	.138	.125	.101	1.2
	(1.03)	(0.83)	(0.73)	
Walking uphill	.171			—
	(1.20)			
	.051	.199	.264	3.6
	(0.30)	(1.13)	(1.64)	
Bending	.174			—
	(0.98)			
	.067	.213	.266	2.2
	(0.31)	(0.96)	(1.30)	
Walking one mile	−.053			—
	(0.37)			
	−.065	−.045	−.047	0.2
	(0.38)	(0.25)	(0.29)	
Walking 100 yards	−.008			—
	(0.03)			
	−.077	.109	−.025	0.6
	(0.29)	(0.41)	(0.09)	
Eating, bathing, toiletry	−.251			—
	(1.11)			
	−.271	−.205	−.263	1.3
	(0.98)	(0.71)	(1.00)	

a. From ordered probits with reduced sample having fertility information. Years of education, age, and location dummies are also included. Asymptotic normal statistics in parentheses.

though not exhaustive, set of adult health measures. Using these measures, we add to the evidence that women report more problems of ill-health across all age categories and adjusted for mortality. Moreover, our evidence on a gender adult health differential cuts across both economic and cultural dimensions, casting doubt on systematic reporting bias as the cause.

We then use the Jamaican Survey of Living Conditions data to examine in more detail the underlying determinants of adult health. We find strong effects of own education. While some of the measured effect may represent the impact of endowed health or initial wealth, we find the effect is robust to inclusion of a measure of long-run income, per capita household expenditures. This robustness suggests a role for education apart from generating higher incomes, similar to results on the effects of parental education on child health. Presumably part of the education effect is transmitted by affecting health related behaviors, although we can not demonstrate how from our reduced form evidence on outcomes.

The education effects seem to dissipate as people age. That socioeconomic differentials decline with age is potentially important. It suggests that policies focusing on the health and health behaviors of prime-aged adults may be the most effective way to improve health of adults.

Further, these education effects are quite similar for men and women. This finding, together with the fact that the distribution of years of education is quite close for men and women in Jamaica, suggests that education is not an explanation for the observed gender differentials in reported health status.

We also find that location has a significant effect on health. This effect differs by gender for the more mild measures, a finding which could indicate an explanatory role for heterogeneous influence of health services (or other infrastructure) on the health outcome of women and men. For instance, it could be that women have less access to health care than men. Such hypotheses need to be verified by disaggregating community factors.

Our most robust finding is a set of very strong life-cycle/cohort patterns, which do differ across the health measures used and by gender, even after controlling for socioeconomic status and community environment. For most of the measures, the gender gap seems to appear during an age window that varies by severity of the problem, although there seems to be some evidence that for many measures the gap begins during child-bearing years. Indeed, for the more mild measures, particularly problems in doing vigorous activities, there does seem to be direct correlations with having had a child. For severe problems, however, the gender differentials are largest at older ages and no correlation exists with childbearing. These life-cycle/cohort profiles seem to explain most of the reported gender gap in Jamaica; exactly what biological or behavioral factors it represents is not as yet clear.

Appendix Table 1
Cross-Tabulation of Problems Walking Uphill by General Health: Jamaican SLC, Men and Women

	General Health					
Walking Uphill	Excellent	Very Good	Good	Fair	Poor	Total
Limited a lot						
Frequency	13	17	59	147	351	587
Percent	0.12	0.16	0.56	1.40	3.34	5.58
Row percentage	2.21	2.90	10.05	25.04	59.80	
Column percentage	0.39	0.63	2.11	13.03	59.90	
Limited a little						
Frequency	26	107	257	379	147	916
Percent	0.25	1.02	2.44	3.60	1.40	8.71
Row percentage	2.84	11.68	28.06	41.38	16.05	
Column percentage	0.79	3.96	9.19	33.60	25.09	
Not limited						
Frequency	3,260	2,580	2,481	602	88	9011
Percent	31.01	24.54	23.60	5.73	0.84	85.70
Row percentage	36.18	28.63	27.53	6.68	0.98	
Column percentage	98.82	95.41	88.70	53.37	15.02	
Total	3,299	2,704	2,797	1,128	586	10,514
	31.38	25.72	26.60	10.73	5.57	100.00

Appendix Table 2A
Percent of Jamaicans with Poor/Fair and Limited Health Measures by Education Level and Age Group

	General Health		Moderate Activities		Bending, Kneeling, and Stooping	
	<9 years	> = 9 years	<9 years	> = 9 years	<9 years	> = 9 years
Females						
14–29	4.9	4.8	3.5	1.7	2.6	2.3
30–49	17.1	10.5	7.8	3.7	6.0	8.2
50–59	36.6	29.3	16.3	18.4	13.0	24.5
60–69	47.1	50.5	33.3	24.0	28.4	46.8
70+	70.7	76.0	64.3	55.1	58.0	69.9
Males						
14–29	5.0	3.2	7.1	4.6	1.0	1.8
30–49	10.8	5.5	12.1	9.3	2.5	3.5
50–59	21.5	15.7	32.9	28.0	9.5	14.7
60–69	38.3	28.0	53.5	48.5	18.0	41.8
70+	64.9	65.4	76.4	82.0	62.8	75.0

Appendix Table 2B
Percent of Malaysians (>50 years) with Poor and Limited Health Measures by Education Level

	Females		Males	
	<8 years	> = 8 years	<8 years	> = 8 years
General health	63.3	51.4	53.3	36.8
Vigorous activities	75.0	60.0	58.7	34.5
Moderate activities	24.4	14.3	17.8	6.9
Walking uphill	48.5	37.1	35.5	13.8
Bending	24.1	25.7	18.8	10.3
Walking 100 yards	12.9	5.7	10.6	3.5
Daily activities	2.6	0.0	3.3	1.2

Appendix Table 3
Jamaican SLC Variable Means and Standard Deviations

	Pooled Ages		14–49		50–69		70 Plus	
	Female	Male	Female	Male	Female	Male	Female	Male
Sample size	4,896	4,847	3,580	3,688	883	794	433	365
Health indicators								
General health								
% Poor	6.8	4.2	1.5	1.1	12.4	6.4	39.5	31.0
% Fair	12.7	8.9	6.5	3.9	28.0	20.3	32.1	34.0
% Good +	80.5	86.9	92.0	95.0	59.6	73.3	28.4	35.1
Vigorous activities								
% limited a lot	16.9	9.3	6.9	2.8	31.1	20.2	70.8	51.8
% limited a little	18.0	13.1	13.7	6.7	35.2	35.3	18.5	29.6
% not limited	65.1	77.5	79.4	90.5	33.7	44.5	10.6	18.6
Moderate activities								
% limited a lot	7.5	3.6	1.7	0.8	11.3	5.5	47.2	27.7
% limited a little	12.1	7.3	5.5	2.4	30.1	17.5	30.3	34.6
% not limited	80.4	89.1	92.8	96.8	58.6	76.9	22.5	37.6
Walking uphill								
% limited a lot	7.2	3.7	1.5	0.9	11.2	5.8	46.8	27.1
% limited a little	11.0	7.0	4.2	1.9	28.9	18.5	30.1	32.6
% not limited	81.8	89.4	94.4	97.2	59.8	75.7	23.1	40.3
Bending								
% limited a lot	5.7	3.0	1.0	0.8	7.6	3.8	40.0	23.8
% limited a little	9.0	6.1	2.3	1.5	25.1	14.0	31.3	34.8
% not limited	85.4	90.9	96.7	97.7	67.3	82.2	28.7	41.4

Walk one mile								
% limited a lot	7.5	3.9	1.5	0.9	11.2	5.7	49.5	31.0
% limited a little	8.9	5.6	3.2	1.4	24.4	14.9	24.1	27.1
% not limited	83.6	90.5	95.3	97.7	64.4	79.5	26.4	41.9
Walk 100 yards								
% limited a lot	4.5	2.6	0.8	0.7	6.3	3.0	31.7	21.7
% limited a little	6.4	3.9	1.2	1.0	15.6	8.6	29.9	23.1
% not limited	89.1	93.5	98.0	98.4	78.2	88.4	38.4	55.2
Eating, bathing, toiletry								
% limited a lot	2.3	1.5	0.6	0.5	3.4	2.1	14.6	9.9
% limited a little	4.0	2.5	0.8	0.8	7.9	4.8	22.7	14.8
% not limited	93.7	96.0	98.7	98.7	88.6	93.1	62.7	75.3
Covariates, (1) If Age								
14–19	.19	.22	.28	.29				
20–24	.14	.14	.19	.18				
25–29	.12	.12	.16	.15				
30–34	.10	.10	.13	.13				
35–39	.08	.07	.10	.09				
40–44	.05	.06	.07	.08				
45–49	.05	.06	.07	.07				
50–54	.05	.05			.29	.28		
55–59	.04	.04			.24	.27		
60–64	.05	.05			.26	.23		
65–69	.04	.04			.21	.22		
70–74	.03	.03					.37	.39
75 Plus	.06	.05					.63	.61

Appendix Table 3 (*continued*)

	Pooled Ages		14–49		50–69		70 Plus	
	Female	Male	Female	Male	Female	Male	Female	Male
Education (years)	8.4	8.4	9.1	9.0	6.5	6.5	6.2	6.0
	(2.6)	(2.6)	(2.3)	(2.3)	(2.4)	(2.6)	(2.3)	(2.5)
% 0–6 years	.27	.25	.14	.15	.59	.56	.66	.66
% 7–9 years	.39	.41	.40	.43	.37	.39	.32	.31
% 10 years plus	.34	.33	.45	.43	.03	.05	.02	.03
Log household	8.44	8.52	8.44	8.51	8.47	8.60	8.41	8.48
Per capita expenditure	(0.78)	(0.81)	(0.78)	(0.81)	(0.78)	(0.83)	(0.76)	(0.78)
(1) If Urban	.45	.41	.48	.43	.39	.38	.33	.28
(1) If partner in house	.35	.35	.32	.28	.49	.61	.28	.55
Partner's age	46.7	42.2	38.1	32.2	61.5	52.9	74.3	67.6
	(16.4)	(15.9)	(10.6)	(8.8)	(9.6)	(9.9)	(12.5)	(9.9)
Partner's education	7.6	7.9	8.1	8.7	6.5	6.9	6.1	6.5
	(2.7)	(2.6)	(2.6)	(2.5)	(2.5)	(2.5)	(2.6)	(2.1)
(1) If senior female exists	.94	.73	.93	.77	.98	.65	.95	.58
Education of senior female	7.6	7.5	7.9	7.7	6.6	7.0	6.5	6.7
	(2.7)	(2.4)	(2.4)	(2.4)	(2.4)	(2.4)	(2.3)	(2.2)
Age of senior female	48.1	47.3	42.4	44.8	58.4	53.3	72.7	65.8
	(16.0)	(15.0)	(13.6)	(14.6)	(8.0)	(11.0)	(12.9)	(12.1)
(1) If senior male exists	.58	.81	.61	.76	.53	.96	.39	.96
Education of senior male	7.3	7.4	7.6	7.8	6.5	6.5	6.6	6.1
	(2.6)	(2.6)	(2.5)	(2.5)	(2.5)	(2.6)	(2.5)	(2.5)
Age of senior male	50.2	49.7	46.6	44.2	61.0	58.7	66.6	74.8
	(15.2)	(16.2)	(14.1)	(14.7)	(10.3)	(6.8)	(15.7)	(8.6)

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