Links Between Women's Health
and Labor Market Outcomes in Indonesia

Working Paper #2

Date:	April 2000
Subcontractor:	RAND
Project Name:	The POLICY Project
Project Number:	936-3078
Prime Contract:	CCP-C-00-95-00023-04
Subcontract Number:	5401.07.RAND
Investigators:	Duncan Thomas Elizabeth Frankenberg

The POLICY Project is a five-year project funded by USAID/G/PHN/POP/PE. It is implemented by The Futures Group International in collaboration with Research Triangle Institute (RTI) and The Centre for Development and Population Activities (CEDPA).

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Working paper prepared for The POLICY Project in partial fulfillment of contract 5401.07.RAND.

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Abstract

Health status is generally recognized as an important element of well-being that is valued, in and of itself, by both individuals and society. To the extent that better health yields a pay-off in terms of higher income, efforts on the part of governments to promote good health may also contribute to increasing the rate of economic growth. This paper examines the relationships between health status and economic output, focusing primarily on women. The data are drawn from a longitudinal household survey conducted in Indonesia, the Indonesia Family Life Survey (IFLS). Four dimensions of labor market performance are examined: the decision to work, hours spent working, income earned from the prior year and hourly earnings from work. We adopt two complementary empirical strategies to address the empirical concerns of reverse causality and measurement error, and we show that conclusions about whether health does affect labor outcomes are very sensitive to these concerns. On balance, we believe that the evidence points to a causal effect of women's weight on earnings and that labor supply is curtailed among women who have difficulties with physical activities like walking a long distance and carrying a heavy load.

1. INTRODUCTION

Health status is generally recognized as an important element of well-being that is valued, in and of itself, by both individuals and society. Good health status may also yield returns in terms of elevated productivity and higher earning potential, greater social success, improved health of one's children and so on.

To the extent that better health yields a pay-off in terms of higher income, efforts on the part of governments to promote good health may also contribute to increasing the rate of economic growth. These issues may be particularly salient in low income populations. First, biomedical evidence suggests there are important thresholds in health status and that functional capacity typically deteriorates rapidly when a person falls below these thresholds. Since levels of health are typically low in developing countries, the probability that a person falls below a threshold is greater than in higher income societies. Second, there exist interventions of demonstrated effectiveness at addressing many of the causes of common health problems in low income settings -- particularly those associated with nutritional deprivation and infectious diseases. Third, since many jobs in low income contexts involve considerable physical activity and energy expenditure, strength and stamina are likely to be associated with labor productivity and output.

This paper examines the relationships between health status and economic output, focusing primarily on women. The data are drawn from a longitudinal household survey conducted in Indonesia, the Indonesia Family Life Survey (IFLS). The IFLS contains an unusually rich array of information on health, earnings and the allocation of time to work.

We take as a given that health is multi-dimensional and that different health difficulties will likely have different effects on one's choices regarding work as well as one's productivity. There is remarkably little empirical evidence on how these associations vary across indicators of health and labor activities. As a first step, therefore, we exploit the richness of the Indonesian survey to lay out some basic facts about the correlations between multiple indicators of health and performance in the labor market.

Four dimensions of labor market performance are examined: the decision to work, hours spent working, income earned from the prior year and hourly earnings from work. The correlations between these labor outcomes and an array of health status indicators are presented for both women and men. We find that women who report themselves as having difficulty with walking or carrying heavy loads are significantly less likely to work but, conditional on working, these women appear to be no less productive than women who do not report such difficulties. Women who report themselves as being in "good" health and women who are heavier, given height, tend to have higher earnings. Heavier men (conditional on height) also earn more and there is evidence that micro-nutrient deficiencies are associated with reduced productivity among working males.

There is a good deal of evidence indicating that income and the probability of morbidity (or mortality) are negatively correlated. In part, this surely reflects increases in investments in health care (and health-enhancing behaviors) as income rises. Causality may also run in the opposite direction. Experimental evidence in the biomedical and nutrition literatures indicate that improved health is associated with elevated work capacity. If this translates into greater work effort, extended work hours or increased productivity, improved health will generate higher income. Parsing out the proportion of the correlation that is due to the impact of income on health and the part that is due to the effect of health on income is not straightforward. It is, however, critically important for understanding behavior and designing policy.

These empirical difficulties are further compounded by the fact that a respondent in good health might report her health status as being poor precisely because she is not working or because she is working in a less arduous (and remunerative) position. There is a good deal of evidence that this sort of systematic reporting error is prevalent in the United States and Europe.

We adopt two complementary empirical strategies to address these empirical concerns, and we show that conclusions about whether health does affect labor outcomes are very sensitive to these concerns. On balance, we believe that the evidence points to a causal effect of weight on earnings and that labor supply is curtailed among women who have difficulties with physical activities like walking a long distance and carrying a heavy load.

In the next section we review important issues regarding measurement of labor outcomes and measurement of health status, focussing on their implications for empirical estimation of the relationship between health status and labor market outcomes. The data we use to assess the link between health status and various measures of labor force outcomes are then described. The following section discusses the methods used and presents our main results. The final section concludes.

2. BACKGROUND

This section begins with a description of the indicators of work activity that will be examined. We then turn to health status. After discussing issues related to the measurement of health and the implications for interpretation of the relationships between health and work, we outline some of the biomedical mechanisms that motivate an examination of the effect of improved health on labor outcomes. The final sub-section describes the statistical difficulties associated with establishing a causal relationship between health status and labor market outcomes.

Measurement of labor outcomes

In order to assess whether (and how) health affects work activities, we examine several different dimensions of work choices. These include whether an individual works or does not work (the participation decision), the intensity of work or number of hours worked per year (labor supply), how much an individual earns per unit of time worked (hourly earnings) and total earnings which is the product of hours worked last year and hourly earnings.[1]

We treat any work that is associated with earning income as a labor market activity; this includes work in the formal sector, informal sector, self-employment and working in a family business. Earnings are reported either as income from market sector jobs or as profits from own (or family) businesses; hourly earnings are calculated as income from the previous month divided by the number of hours worked in the previous week (multiplied by 4.13). Hourly earnings are our best measure of "productivity". If all workers were paid on a piece rate, hourly earnings would probably be a very good proxy for productivity. The link is less direct for time-based wage rates.

The vast majority of the biomedical literature on links between health and work has focused on the link between health and work capacity or energy expenditure per unit of work -- usually in animals and less frequently in humans. Demonstrating there is a link between dimensions of health and work capacity, however, is not enough to conclude that improving health would increase income and therefore lead to faster rates of economic growth. Work or aerobic capacity is not equivalent to labor productivity and workers do not sustain maximal work capacity for extended periods of time.

Even if health improvements do increase labor productivity, it is not obvious that increased labor productivity will also be manifested in higher earnings. Since increased productivity implies a higher value of time, a worker is likely to spend less time at work and more time on leisure activities. The impact on earnings will depend on the magnitude of this response. In our view, it is only by simultaneously examining labor supply, hourly earnings and income that it is possible to trace out

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[1]We refer to these collectively as labor market outcomes although it should be clear that they do not necessarily involve market transactions.

the mechanisms through which health might affect economic growth, while also taking into account the behavioral responses that are likely to occur.

The decision to work is also examined. It provides information on the link between health and labor outcomes in the extreme. If health seriously limits activity then we would expect that a very unhealthy person would not participate in the labor force at all. (This is one of the ideas that underlies the nutrition version of the efficiency wage hypothesis, Leibenstein, 1957).

Measurement and interpretation of health status indicators

An examination of health in a population-based survey requires specificity in defining "health." Many agree that measuring health is hard, few agree on how best to measure it. We take the view that it is sensible to examine the relationship between an outcome, such as wages, and *multiple* health indicators simultaneously. Of course, the interpretation of any particular health indicator will depend on what other (health and non-health) characteristics are controlled.

A variety of measures of health have been used in the existing literature. We review those measures that are related to the indicators we use in our empirical work, distinguishing broadly between two classes of measures: physical assessments (or so-called "objective" measures) and self-reports (or "subjective" measures).

Physical assessments

Among physical assessments, the anthropometric measures of height and weight have proven to be powerful predictors of economic prosperity in the economic literature on development and history. Height primarily reflects genotype influences with phenotype influences being limited to nutrition during early childhood. It may be interpreted as indicative of human capital investments in early life. Weight, however, varies in the short run and so it combines information about both longer-term health status and also some information about current nutritional status. Weight is difficult to interpret on its own. A light person may also be small, and thus not underweight given height (and, conversely, a heavy, tall person may not be overweight). Nutritionists have therefore found it convenient to analyze weight given height.

Body Mass Index

There are many potential ways of expressing the ratio of weight to height. A common expression for adults is body mass index (BMI), the ratio of weight (in kilograms) to height (in meters) squared. When BMI is very low (below 18 or 20) or very high (above 28 or 30), there is a clear association between it and mortality. People at the extremes of the distribution are far more likely to die (or be in poor health) than those in the range between, say 20 and 28. (Waaler, 1984; Fogel, Costa, and Kim, 1992). In the United States, the BMI of roughly 9 out 10 adults lies between 20 and 30. In many developing countries, however, one-quarter of the adult population has a BMI less than 20. Therefore, to the extent that low BMI reduces functionality, the aggregate effects on productivity of the labor force will be larger in developing countries than in developed countries.

BMI is associated with strength and robustness. In addition, the biomedical literature suggests there are good reasons to expect BMI to be associated with physical work capacity. It is related to maximum oxygen uptake during physical work (VO_2max), which, in turn, affects maximum physical capacity independent of energy intake (Spurr, 1983, 1988; Martorell and Arroyave, 1988). Moreover, BMI is indicative of the amount of energy that is stored in the body which can be drawn upon when needed. It will, therefore, likely fluctuate with incomes and prices (particularly the price of foods). It is important, however, to recognize that BMI reflects previous health and human capital investments and so a correlation between BMI and productivity may simply be capturing the influence of these investments. Controlling levels of education and prior health status are likely to be useful for clarifying the relationship between current BMI and wages. A small number of studies have documented relationships between BMI and productivity (see Strauss and Thomas, 1998 for a review).

Micronutrients

BMI provides insights into the cumulative effects of prior nutritional and health insults and so should be interpreted as a general indicator of health status. More specific nutritional deficiencies can be identified by measuring an individual's levels of nutrient intakes -- be it calories, protein or micronutrients. Measurement of nutrient intakes at the individual level is extremely difficult in a large scale household survey setting for several reasons. Intakes vary a good deal from day to day (requiring repeated measures), it is necessary to either measure every food item consumed (which is very hard) or estimate the nutrient content of each food (which is prone to considerable error) and it is important to control for food waste. For some micro-nutrients, it may be sufficient to simply determine whether the respondent regularly consumes specific foods that are rich in those nutrients to determine whether the respondent is likely to suffer from a deficiency. We did not attempt this in the IFLS.

There is evidence from human and animal experiments in the biomedical literature that a small number of key micronutrients are associated with physical activity, work capacity and cognitive development. For several of these micronutrients, it is possible to detect deficiency from biological samples. In IFLS, we drew blood from each respondent in order to measure hemoglobin levels which provides an indicator of iron deficiency. Putting aside the complex issues associated with attempting to measure iron intake, this has the clear advantage of measuring iron absorption which is important since absorption depends on a number of factors including diet and prior disease insults. For example, diets that are rich in rice are associated with reduced capacity to absorb iron, particularly from vegetable sources. Second, the presence of worms retards the absorption of iron.

Several experimental studies have demonstrated that iron supplementation is associated with elevated levels of work productivity. For example, in a carefully designed experiment in Indonesia, iron supplements added to the diets of male workers resulted in greater productivity gains among those who were anemic than among those who were not anemic (Basta et al, 1979). More recent experimental studies on both animals and human subjects have sought to understand the mechanisms that underlie these observations. Those experiments have consistently demonstrated that severe and moderate iron deficiency (Hb<120g/L) are causally associated with reduced aerobic capacity (measured by VO_2max, for example) and impaired endurance capacity (Haas, Brownlie and Zhu, 2000). Laboratory experiments suggest there is essentially a linear association between hemoglobin level and reduced aerobic capacity for levels above 70g/L but that below that threshold, aerobic capacity declines precipitously (Perkkio et al, 1985). There is evidence from cotton factory workers in China indicating that even at relatively low levels of physical activity, the physiological costs of that activity are greater among women who are anemic (have low hemoglobin levels) (Li et al, 1995); laboratory studies indicate that even in non-anemic women, iron deficiency accounts for a substantially greater energy cost to perform the same amount of physical work than women who are not iron deficient.

As noted above, it is not obvious that reduced work capacity (or greater energy cost for the same amount of work) because of iron deficiency will translate into reduced hours of work or even lower productivity. Whether such a reduction occurs incorporates behavioral responses and is fundamentally an empirical question.

The second micronutrient that we examine is iodine. Iodine deficiency results in an enlargemement in the size of the thyroid gland (as its cells expand in an attempt to capture more iodine) which results in swelling of the neck, goiter. It is associated with fatigue, sluggishness and weight gain. Unlike iron, iodine is not stored in the body but needs to be replenished regularly. Salt-water fish is a good source of iodine although nowadays a substantial fraction of commercial salt is iodine-enriched and its use has certainly reduced the incidence of iodine deficiency. In IFLS, we attempted to assess whether iodine deficiency was likely by testing the salt consumed in the household. Salt in about 50% of households was iodized. Respondents living in those households are very unlikely not to be consuming adequate iodine given that it takes only 2 grams of iodized salt to exceed the recommended daily allowance of iodine.

Other physical assessments

There are many other dimensions of physical health that are likely to be associated with performance at work. These include, for example, measures of lung capacity which is a measure of cardio-pulmonary functioning and likely reflects the combined effects of stature, strength and respiratory difficulties. Elevated blood pressure in early life is a very good predictor of subsequent health problems and is another indicator of cardio-pulmonary functioning along with being indicative of stress and diet. Several surveys contain direct assessments of gait, balance, and strength which also provide indications of physical functioning. We will focus on one such assessment -- the time taken to stand from a sitting position (repeated five times). This measure is surely associated with upper-body muscular-skeletal difficulties although it likely also captures exuberance and energy levels.

Self-reported indicators

The next class of health measures that we discuss are more subjective in nature and involve respondent self-evaluations of their own health status. These include perceptions of general health status and reports of diseases and symptoms and functional limitations.

General Health Status

General Health Status (GHS), in which individuals rate their health as falling within four or five categories, is probably the single most common index used in the empirical literature on health status and socioeconomic outcomes. GHS has been shown to contain a good deal of information about a respondent's health. In fact, one of the most extensively documented relationships to emerge in the literature on health status is that self-reported GHS is a significant predictor of subsequent mortality (Ware, 1978; see Idler and Benyamini, 1997, for a recent review of the literature from industrialized countries). While GHS may be a good overall summary, GHS alone cannot possibly do justice to the complexity and diversity of health status of individuals. Moreover, there is some evidence suggesting that "good health" does not mean the same thing to all people in any society: specifically, there is some experimental evidence suggesting that those people who have greater exposure to the health care system are likely to rate their health as being less good, *ceteris paribus*. If higher income people use more health care, it is obvious that this systematic difference in the meaning of "good health" could seriously contaminate inferences drawn about the relationship between self-reported GHS and labor market indicators.

Beyond assessments of general health status, a number of other specific self-reported indicators have been included in many surveys. Disease-oriented definitions are favored by many clinicians and some epidemiologists (see the discussion, for instance, in Jamison *et al.*, 1993 and World Bank, 1993) because they have the advantage of a foundation in medical practice. However, from a social science and public health perspective, it is often the functional consequences of ill-health that are of primary interest and those consequences typically cut across diseases. Moreover, an individual's ability to report the specific diseases that account for reduced functionality is also likely to be correlated with his or her exposure to the health system, which in turn likely reflects socioeconomic status.

Morbidities

Many household surveys ask respondents questions about symptoms. Answers to these questions are also subject to measurement error that may be systematically related to socio-economic status (although the extent and nature of the error is likely to vary from measure to measure, see Stewart and Ware, 1992, for a comprehensive and thoughtful discussion). For instance, it is common in surveys to ask questions about fevers, diarrhea, and respiratory problems during a reference period. If what is deemed an "illness" or a "problem" varies across respondents, interpreting these measures will be difficult. Differences in meaning across respondents may account for the counter-intuitive finding in many setting that as socio-economic status rises, so does the prevalence of (self-reported) illness. For example, in Ghana and the Cote d'Ivoire, the propensity for adults to report being ill in the last four weeks is positively associated with own education (Schultz and Tansel, 1992) and with *per capita* household expenditures (Over *et al.*, 1992).

Given the abundant evidence that mortality and socio-economic status are negatively related, these indicators are likely reflecting the combination of underlying health status as well as knowledge about health and perceptions of "normal" health.

Economic incentives may also influence self-reports. For instance, an individual who is not working may be more likely to report being in poor health to become eligible for health-related benefits (Bound, 1991). If this occurs, then attributing causality to the impact of health on labor force participation is complicated. Relatively few studies have estimated the impact of illness measures on productivity in a way that establishes a causal link.

Activities of Daily Living

It has been argued that functional limitations (such as difficulty walking) are less prone to systematic measurement error than are symptoms or morbidities, because questions tend to be very specific and to relate to activities that are well-defined. Various studies have compared self-reports on functioning, or Activities of Daily Living (ADLs) to more objective measurements of physical ability (Daltroy et al., 1995; Hoeymans, 1996). Other studies have examined the correlations between ADLs and socio-economic status, (Strauss, Gertler, Rahman and Fox, 1996). In general, these authors argue that relative to specific morbidities and possibly GHS, ADLs are likely to be less prone to systematic differences in reporting behavior that is correlated with socio-economic status.

It is clear that how one feels about one's own health contains important information. Two people who have the same level of underlying physical health but have different perceptions of their own health arguably should be treated differently. There is, however, good reason to be cautious and not interpret self-reported health at face value if, *ceteris paribus*, the propensity to report poor health rises with income. From the point of view of interpreting correlations between health status and economic success, it will be important to take into account the possibility that there may be differences in the propensity to report poor health across the distribution of socio-economic status. These differences might be thought of as systematic (or time persistent) differences in the extent of measurement error in self-reported health.

Empirical issues: Causality and systematic measurement error

The discussion thus far has highlighted two issues that complicate empirical tests of the hypothesis that health affects income. First, identifying the direction of causality has played a central role in this literature. A positive correlation between health and labor outcomes -- BMI and wages for example -- may be because BMI affects work capacity and productivity. It may also be because workers who earn a higher wage invest part of their earnings in improved nutrition or health care which in turn results in increased BMI.

Second, the issue of systematic measurement error -- due, for example, to reporting differences -- has received less attention in the health literature. It is a special case of contamination due to time-persistent unobserved heterogeneity which has been a dominant theme in much of the closely related literature on the links between investments in education and labor market outcomes (Griliches, 1977; Willis, 1986; Ashenfelter and Krueger, 1994).

The two most commonly used empirical methods to address the issues of simultaneity and time-invariant unobservables are instrumental variables (IV) and fixed effects (FE) estimators. Neither is a panacea for all potential problems and both invoke additional assumptions that need to be taken into account when interpreting empirical estimates that adopt these methods.

Use of IV estimators requires identifying variables that predict health status, but that on theoretical grounds do not belong in the regression explaining the labor market outcome of interest, and that are uncorrelated with the unobservables in the regression of that outcome. Which variables satisfy these conditions will depend on whether the regression of interest is a wage function, labor force participation, hours, or income, and on the specific health measures under consideration.

In a wage equation at one point in time, prices of health inputs and outputs are potential identifying instruments for health. Explicit health prices seldom exist for most indicators (such as physical functioning) but implicit prices include the monetary cost of health care visits and time costs of traveling to (and waiting at) facilities (Acton, 1975). More generally, measures of the availability and quality of health services (such as clinics and hospitals), as well as health-related infrastructure (such as water and sanitation), in the community may serve as instruments. For nutrition-related health indicators, relative food prices are natural instruments since they affect consumption and thus nutrient intakes as well as anthropometric outcomes such as body mass.

The appropriate instruments are services and prices *available* in the community and not those actually *used or paid* since the latter are chosen and probably correlated with the error (Deaton, 1988). Using health services as the instruments, it is important to control in the second stage function (the labor market function) for other more general infrastructure (such as transport or industrialization) that may operate through their effect on the demand for labor or by affecting the costs of searching for a job. Otherwise, the impact of all community-level heterogeneity will be forced to operate entirely through health, a restriction which has little *a priori* rationale. For the same reason, an aggregate price index should be included in the second stage so that it is the price of foods, relative to one another, that provides identification in the labor market function.

Identifying instruments need to satisfy two conditions. First, they should do a good job of prediction in the "first stage" (health) function. This can be assessed by testing whether the instruments are able to explain a significant proportion of the variation in health, after controlling all other characteristics that are included in the "second stage" (labor) function. Second, the identifying instruments should not be correlated with unobservables in the second stage function. If there are more instruments than health indicators, then this can be tested by assessing whether the instruments can explain any of the variation in the predicted residuals from the labor function (Newey, 1985); those "overidentification" tests will also be presented below.

These tests are important since it is not obvious that, for example, relative food prices will not affect labor market choices. If a respondent is a net producer of a particular food (such as rice), it is plausible that relative food prices will have a direct effect on his or her time allocation. In that case, prices will be correlated with unexplained variation in hours of work -- and the overidentification tests will fail.

Longitudinal data offer several additional and potentially important advantages over a single cross-section. By examining changes in labor outcomes and changes in health indicators for a particular individual, we remove all characteristics from the model that do not vary with time. This has the disadvantage of sweeping out characteristics that may be of interest in a labor market function, such as height, education, family background and fixed characteristics of the community. But, it has the advantage of also sweeping out all unobserved characteristics that do not vary with time, including, for example, the propensity of an individual to report herself as ill. To the extent that propensity is individual-idiosyncratic characteristic and does not vary over time, reporting error does not contaminate the relationship between health and labor outcomes. These fixed effect (or difference) estimates place the spotlight on the relationship between health flows (rather than stocks) and changes in productivity, wages or other labor outcomes.

This interpretation suggests that income changes may have a contemporaneous impact on changes in health in which case the fixed effects estimates will suffer from reverse causality. A natural approach to addressing that concern is to employ a fixed effect instrument variable (FE-IV) estimator in which changes in health status are predicted in the first stage and those predicted changes are included as covariates in the second stage. The appropriate instruments will be changes in health infrastructure and changes in relative food prices. We will explore this strategy although note that it is very demanding of data.

3. DATA

The data we use for this study are from two rounds of the IFLS which is a longitudinal survey of individuals, households, communities, and facilities. The first round, IFLS1, was collected in 1993 and included interviews with 7,224 households and with 22,347 of the some 30,000 individuals within those households (in IFLS1, by design, not all household members were interviewed) (Frankenberg and Karoly, 1995). The IFLS is representative of about 83% of the Indonesian population.

In 1997 a resurvey was conducted of the IFLS1 individuals, households, communities, and facilities. This survey, IFLS2, sought to reinterview all IFLS1 households (and all members of these households in 1997) as well as a set of target members of IFLS1 households in 1993 who had migrated out by 1997 (Frankenberg and Thomas, 2000). The survey succeeded at reinterviewing 94% of IFLS1 households and 92% of target individuals.[2]

The IFLS household and individual questionnaires cover an array of topics that are central to the questions we address. All household members that completed detailed individual-level interviews were asked to describe their primary activity in the week before the survey. If they reported an activity other than working, they were asked a series of screener questions designed to identify whether they had worked even a very small amount, were temporarily not working, or worked for a family business of some kind.

All respondents who reported working were asked the number of hours they worked in the past week, the number of hours they usually worked per week, and the number of weeks they worked in the past year. Respondents were also asked their monthly and annual salary or, if they were self-employed, their monthly and annual profit. By design, questions were identical in 1993 and in 1997. In addition to questions on current labor force participation, in both years of the survey respondents were asked a series of questions about work, hours, and earnings in

[2]IFLS2 was directed by Elizabeth Frankenberg and Duncan Thomas. It was a collaborative project of RAND, UCLA, and the Demographic Institute of the University of Indonesia, conducted with funding from the National Institute on Aging, the National Institute of Child Health and Human Development, The Futures Group (the POLICY Project), the Hewlett Foundation, the International Food Policy Research Institute, John Snow International (the OMNI Project), USAID, and the World Health Organization. The IFLS1 was directed by Elizabeth Frankenberg, Paul Gertler, and Lynn Karoly. It was a collaborative project of RAND and the Demographic Institute of the University of Indonesia, conducted with funding from the National Institute of Child Health and Human Development, USAID, the Ford Foundation, and the World Health Organization.

the past, including questions about their first job.

The upper panel of Table 1 presents summary statistics on labor market outcomes for women in 1993 and 1997 (and men in 1997 for comparison purposes). Approximately half the women report working in either year. Among those who do work, on average a woman spends about 30 hours per week working and reports earning around Rp 1.4 million in 1997 (about 20% more than in 1993). Hourly wages are, on average, Rp1,250 in 1997 (about 25% higher than in 1993) and are calculated using monthly income (and hours) reported by the respondents. They are substantially higher than hourly earnings implied by reports of annual income and hours. This may be because the women do not work throughout the year or because income fluctuates over months (and incomes are higher during the survey months which were July through December). Men are more likely to be working, they work longer hours on average, earn higher wages and, therefore, higher annual incomes.

IFLS (and IFLS2 in particular), contains a rich array of health status indicators. In IFLS2 a nurse or recently qualified doctor traveled with the interviewing team and visited each household to record various measures of physical health for each household member. Each healthworker received special training in taking the measurements. Both height and weight were measured in 1993 and 1997. On average there is very little change in the weight of women between 1993 and 1997 although there is considerable variation over time for individuals. About one quarter of women have low BMI (below 18.5 kg/m^2).

Several physical assessments were added in 1997. Hemoglobin levels were measured using a pin-prick; about 9% of women would be considered severely anemic (Hb<100g/L); the rate of anemia among men is considerably lower. In an effort to determine whether household members were likely to be iodine-deficient, the iodine content of salt in the household was tested; about half the population consumes salt that has not been iodized.

To detect cardio-pulmonary problems, blood pressure and lung capacity were measured. Lung capacity also reflects strength (and is therefore related to height).

At the end of the physical assessment, the healthworker evaluated each respondent's health status on a 9-point scale (1=poor, 9=excellent) and recorded comments about the individual's health.[3]

Respondents in IFLS1 and IFLS2 were also individually interviewed by a trained enumerator who asked detailed questions ranging over their entire life histories. These included a battery of questions about health status and use of health care. We focus on two classes of health status indicators: self-reported general health status (GHS) and difficulties performing basic and intermediate tasks associated with daily living (ADLs). About 12% of women reported themselves as being in "good" health, and about 10% in "poor" health. While these fractions remained approximately constant 1993 and 1997, a very large fraction of respondents transitioned into (or out of) good (or poor) health during this time. About 8% of women reported having difficulty carrying a heavy load and 16% reported having difficulty walking one kilometer.

In both waves of the survey, detailed data were collected about respondents' communities and about public and private facilities available for health care and schooling. In addition, information on prices of food and non-food items was collected from up to three community-level informants and at three markets. The community-facility data are a rich source of information on the availability and price of health care within each IFLS community, as well on the prices of food and other goods, and on general levels of infrastructure within the communities.

4. RESULTS

[3]Measures of weight were taken using Seca UNICEF scales, and recumbent length or standing height was measured with Shorr measuring boards. Both instruments have been used in survey work in other countries and are suitable for fieldwork given their portability, durability, and accuracy. The floor-model scales have a digital readout and are accurate to the nearest 0.1 kg. Children who were unable to stand on their own were held by a parent and weighed (after the scale had been adjusted to zero with just the parent alone on the scale). Standing height was measured for adults and children over age 2, and recumbent length was measured for younger children. Blood pressure and pulse were measured with an Omron digital measuring device. Hemoglobin was assessed using the hemocue method. Three measurements of lung capacity were recorded using Personal Best peak flow meters.

Because the IFLS contains extensive data on labor force outcomes and health status at two points in time, and extensive data on community characteristics, the econometric techniques described above can be implemented with these data. Our analyses explore the relationship between health status and labor force outcomes, focusing on results for women. We concentrate on women for two main reasons. First, the relationship between women's health status and labor force outcomes has received relatively little attention in the literature to date. Second, many of the recent health sector public policy initiative and investments in health infrastructure in Indonesia have focussed on improving the health of women. We will exploit the variation associated with these changes to uncover any causal effects of health on economic success. In particular, we use access to health services as identifying instruments for health status, and many of the services offered by public health clinics, such as family planning and pre- and post-natal care, are services of which women tend to be the primary recipients.

Labor outcomes and health service availability

The first regression model that we report addresses the basic question: are any of the four labor market outcomes associated with variation in access to health care? Access to care is measured by the distance (in kilometers) from each IFLS community to the nearest government health center (a public health clinic) and to the nearest private practitioner (a private clinic or a practicing doctor, nurse, midwife, or paramedic) measured in 1993 and 1997. In order to isolate the effect of health infrastructure, the models include controls for other infrastructure in the community.[4] Individual characteristics included in the models -- age, sex, education, province of residence and urban residence -- are measured in 1993.

OLS regression results from these reduced form models for 1997 are presented in Table 2. Labor force participation is measured as a dichotomous

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[4]These include measures of the level and distribution of resources in the community (the mean and standard deviation of the logarithm of *per capita* household expenditure in 1993), a community-specific price index (measured in 1993 and 1997), the fraction of households in the community that own their home in 1993, the fraction with electricity in 1993 and 1997 and indicator variables for whether the community has sewerage services, telephone services, banking services, paved roads and a regular market, all measured in 1993 and 1997.

variable (taking the value 1 if the respondent is working in the week prior to the survey). The estimates, reported in the first column of the table, indicate that the probability a woman works declines the further away she is from a public health clinic. The remaining three columns indicate that, conditional on working, distance to a government clinic is not related to hours of work or earnings. Access to private practitioners is negatively and statistically significantly correlated with hourly earnings, but not with any of the other labor outcomes.

Two interpretations suggest themselves. First, if women who live nearer public and private health services are more likely to use those services (because the effective costs of obtaining the services are lower), they should also be in better health and, if health reaps rewards in the labor market, we will observe that people who live closer to health services are more likely to work and earn higher wages.

A second interpretation might be that public health facilities are located in more densely populated areas and those are where the jobs are also located; similarly private practitioners might choose to locate themselves where wages are relatively high. If this is true, we would expect to see a similar negative correlation between access to health care and labor outcomes of men. The bottom panel presents the reduced form estimates for men. In fact, there is no association between health services and labor outcomes of men, indicating that selective placement of health services probably does not explain the reduced form effects. For women, health service access appears to increase the chance of labor market success.

Before attempting to determine whether this effect operates through health status, we discuss the remaining covariates in the table which are reported as a simple check on the quality of the data. Table 2 includes age and education. The basic shapes of the relationships between these variables and labor outcomes have been well-established in the literature and the shapes reported in the table follow those general patterns.

Education which, like health, is an indicator of human capital investments is of special interest. It is modeled as a spline function, with knots at 6 and 12 years of education. With respect to labor force participation, the coefficients for the various levels of education make it clear that the relationship is nonlinear. Among women with 0 to 5 years of education, the likelihood of working does not change as the number of years of schooling rises. For women with between 6 and 11 years of education, however, an additional year of education is associated with a decrease in the likelihood of working. Above 11 years, the sign on the education coefficient becomes positive, much larger, and it is statistically significant.

Education appears to have little relationship with hours worked, but is strongly and positively associated with both annual earnings and hourly earnings. As the level of education rises, so do earnings and wage rates. The effect of an additional year of education is larger for those in the higher education categories. That is, an additional year of schooling has a larger effect on earnings of someone who has at least 12 years of schooling than on someone who has 6-11 years or 0-5 years.

Correlations between labor outcomes and health status

The results in Table 2 establish the existence of a correlation between access to health services and some aspects of labor force outcomes. To the extent that access to health services is associated with labor market outcomes, the impact of access may operate through health status. We now turn to models of labor force outcomes as a function of health status.

Our first approach to this question is simply to establish whether there are any correlations between various measures of health status and each of the labor force outcomes. The results from these models cannot speak to the issue of causality. Any statistically significant coefficients on the health status variables may arise because aspects of labor force outcomes affect health status, rather than because health status affects labor force outcomes.

Table 3.1 presents the results (for women) from regression of a broad array of health measures on the four labor market outcomes. (The models also include the controls for age, education, province, urban residence, levels of community infrastructure, and a community-level prices described above.)

The first measure of health status that we consider is height, which we interpret as a measure of both family background and investments in health status during childhood. Because height is largely determined during childhood, there is not an issue of reverse causality (although there may be legitimate concerns about unobserved heterogeneity associated with intergenerational transmission of human capital).

Height is negatively correlated with women's labor force participation, suggesting that women from more favorable backgrounds are less likely to work. However, among women who do work, height is positively associated with annual earnings and with hourly earnings. There is no relationship between height and hours worked per year, suggesting that the results for annual earnings are a reflection of productivity rather than of labor supply.

The next group of health measures that we consider exploit the longitudinal dimension of the survey and include health recorded in 1993 and again in 1997. In these models, if it is the stock component of health status that is important in labor market outcomes, the effect of health in 1993 and health in 1997 will be indistinguishable (since they will both be an indicator of the underlying stock). In that case, health in 1993 and 1997 will be jointly significant correlates of labor outcomes in 1997. If, however, transitions in health are important, then these will be captured by the differential effect of health in 1997, say, relative to health in 1993. For example, it may be that it is changes in health that are associated with labor outcomes -- people who move from being in good health to poor health may leave the labor market. In that case, it will be the change between 1997 and 1993 that is associated with not working in 1997: health in 1997 will be a significant predictor of labor outcomes in 1997. It may be that health innovations are of relatively little importance -- minor fluctuations in one's health may have little effect on one's choices regarding time allocation. In that case, controlling health in 1993, changes between 1993 and 1997 will have no impact on labor outcomes. Under this model, health in 1993 will be a significant predictor of labor outcomes in 1997, but health in 1997 will not.

By including health in 1993 and in 1997, it is possible to empirically distinguish among these hypotheses. Five health status indicators are available in both years: BMI, self-reported measures of being in good or bad general health, and self-reported difficulties with walking a kilometer and with carrying a heavy load.

The evidence does not suggest that long run BMI is associated with labor force outcomes. However, an increase in BMI between 1993 and 1997 is associated with an increase in annual earnings (but not with hourly wages). Moreover, the association with hours worked is positive and closer to statistical significance, suggesting that the relationship between change in BMI and annual earnings works primarily through variation in work effort rather than through productivity. We have included BMI in a (log) linear form. Explorations into the shape of the relationship between BMI and labor outcomes indicates that it tends to be flatter at very low BMI and at very high BMI, we are unable to reject the hypothesis that a (log) linear form does a good job of summarizing the data. We adopt this simpler specification because as we adopt other estimation methods, our scope for picking up these sorts of non-linearities is severely diminished.

We turn next to the correlations between the self-reports of being in good general health status and labor force outcomes, and the correlations between the self-reports of being in bad general health status and labor force outcomes. The respondents' reports of their health status, good or bad, in 1993, are not related to labor force outcomes. However, conditional on health status in 1993, being in good health status in 1997 is positively related to annual earnings, while being in bad health status is negatively related to annual earnings.

Finally, in both 1993 and 1997 respondents were asked whether they had difficulty with walking one kilometer or with carrying a heavy load. Difficulty with either of these activities is associated with a lower probability of being in the labor force in 1997, and difficulty with walking is associated with lower annual earnings. There is also a suggestion that difficulty with walking in 1993 is associated with fewer annual hours worked in 1997.

The correlations between health and labor outcomes are not much changed if we exclude the 1993 indicators from the regressions. On balance, the results indicate that labor market outcomes are more closely aligned to changes in health status than to longer run stocks of health. These results again highlight the central place that issues regarding the direction of causality take in this literature.

In addition to the health measures described thus far, several other physical health assessments were collected in the 1997 survey. Two of these relate to adequacy of micronutrients. We include a measure of hemoglobin level (specified as a spline function with a knot at 10, which demarcates severe anemia), and a measure of whether the household's salt is iodized.

Somewhat surprisingly, perhaps, women's hemoglobin levels are not associated with any of the labor force outcomes. This result stands in contrast to results that other studies have obtained for men. Possibly loss of iron through menstruation causes enough fluctuation in women's hemoglobin levels that it is difficult to detect a relationship between hemoglobin level at a point in time and labor force outcomes.

Whether the household's salt is iodized does seem to be related to labor force outcomes. Women in households where salt is iodized are less likely to work, but those who do work earn more on both an annual and an hourly basis.

Moving away from measures that are related to nutrition, we also include a measure of lung capacity and indicators for whether blood pressure is in the range associated with either mild or moderate hypertension. Lung capacity is not associated with any of the labor market outcomes. Moderate hypertension reduces the likelihood that a woman works, while mild hypertension reduces the annual earnings of those who do work.

As discussed in the section on data, the physical assessments were collected by a nurse who traveled with the interviewing teams and visited each respondent's home to conduct the measurements. In addition to measuring respondents, the nurse was asked to evaluate the respondent's health status on a 9 point scale.

Controlling for the other measures of health status, this evaluation may pick up additional aspects of health not captured by the physical assessments. It does appear that better evaluations by the nurse are positively associated with labor force participation, with the number of hours worked, and to some extent with annual earnings (but not hourly earnings). Possibly the nurse's evaluation responds to things such as the quality of the home environment or the woman's clothing or grooming, and these are associated with labor force outcomes.

The results presented in Table 3.1 suggest that health status is correlated with labor force outcomes, particularly with labor force participation and with annual earnings. Chi-square tests for the joint significance of all the health status measures as a group are significant for each of the outcomes except hourly earnings. For labor force participation and for annual earnings, the 1997 measures by themselves are also jointly significant. There is rather little evidence that health and productivity (as measured by wages) are positively correlated.

For the measures that were available in both 1993 and 1997, it is quite consistently the 1997 measures (which are picking up change in health status) that are correlated with labor market outcomes, rather than the 1993 measures (which in the presence of the 1997 indicators can be interpreted as long run measures).

Our health measures include physical assessments and self-reported assessments, measures that reflect general health status, and measures that reflect more specific dimensions of health, such as nutrition and cardio-pulmonary functioning. From the perspective of identifying which types of measures tend to matter most, none of these categories stand out as especially strongly or poorly correlated with labor market outcomes.

Since the vast majority of the literature on health and labor outcomes has focussed on men, we provide similar estimates for males in the IFLS in Table 3.2

for comparison purposes. We will very briefly summarize the main conclusions from that table. First, consistent with the experimental evidence, nutritional status and productivity are positively associated for men. BMI is associated with higher hourly earnings and higher work intensity which translates into higher annual earnings. Micro-nutrients also matter: iron deficiency and (the probability of) iodine deficiency are correlated with higher hourly earnings. Men who report themselves as being in poor health tend to work less -- and those who report having difficulty walking or carrying a heavy load are less likely to be working. While current health is considerably more highly correlated with labor outcomes -- as is true for women -- there is some evidence suggesting that health stocks are also important for labor outcomes of men.

Controlling for unobserved heterogeneity

The results presented in Table 3 cannot speak to whether health status has a causal impact on labor market outcomes. However, our data will support statistical estimation strategies that attempt to isolate a causal relationship between health status and labor force outcomes. We pursue two methods of controlling for unobserved heterogeneity in the regressions in order to identify whether there is a causal mechanism underlying the correlations reported in Table 3.

The first of these is a two-stage instrumental variables approach. First, we use the community-level data on food prices (relative to the prices of other goods) and on access to health care as instruments for health status. That is, we argue that if there is any impact on labor force outcomes of access to health care and of food prices, that impact must work through health status. If we predict health status as a function of access to health care and relative food prices, the predicted values will be purged of the component of health status that is caused by labor force outcomes. We can then use these predicted values of health status as regressors in estimations of labor force outcomes. The coefficients on the predicted health status measures are estimates of the causal effects of health status on labor force outcomes. However, if the predicted values of health status are not estimated very precisely, the ability to observe an impact of health status on labor force outcomes will be reduced.

The second strategy we use in estimating the causal impact of health status on labor force participation is a fixed-effects approach. This approach exploits the fact that the IFLS is a panel survey and that observations are available from two points in time. In the fixed effects models, changes in labor force outcomes are regressed on changes in health status between 1993 and 1997. One advantage of this approach is that differences across individuals that are systematic but fixed over time (for example the propensity to report poor health) will be wiped out. A disadvantage is that the specifications rely on changes in health status rather than on levels of health status, and changes in health status may be picking up random measurement error at one or both points in time, rather than true change in health status.

The fixed effects specification requires data from two points in time. The health measures that were collected in both 1993 and 1997 include BMI, assessment of general health status, and difficulties with walking and with carrying a heavy load. It is these measures that we include in the IV and fixed effects models. In the IV models, we include the 1993 and 1997 values. As discussed previously, because we control for the value of a particular measure in 1993, we can interpret the 1997 measure as an indicator of the change in the measure between 1993 and 1997. In the fixed effects models we include the change in the measure between 1993 and 1997 and estimate the impact of the change on change in the labor force outcomes.

Instrumental variables

Table 4 presents the results of the instrumental variables estimation. The model regresses the four labor market outcomes on predicted levels of health in 1993 and in 1997. The health status indicators are predicted using community-level measures of food prices and access to public and to private services. To the extent that health status is predicted well with characteristics that are exogenous to the labor force outcomes, the coefficient estimates presented in Table 4 will not be biased by simultaneity.

Recall these instruments must satisfy two conditions. First, they should be correlated with the health indicators. Tests for significance of the instruments in the first stage regression (controlling all other covariates) are reported in the footnote to the table. In all cases, they are significant. However, we note that the fraction of the variance in health that they explain is not overwhelming which suggests caution in interpreting the results. Second, the instruments should not be correlated with the residuals from the labor market regressions. The GMM test at the foot of the table provides a test of this condition. In all cases it is satisfied although the p-value for labor force participation suggests that health services and relative prices are somewhat related to decisions to work; conditional on that decision, however, they seem to not affect labor choices.

With respect to labor force participation, none of the health measures exerts a statistically significant impact on women's choices to work. Nor does any of the health measures appear to affect the number of hours women work in a year.

There does appear to be an impact of health status on women's annual earnings. BMI in 1997 and reporting oneself to be in good health status in 1997 both have positive and statistically significant effects on annual earnings. None of the measures of health status in 1993 appear to be significantly related to annual earnings, suggesting that it is changes in health status that affect earnings rather than health status over the long run.

The final column of Table 4 presents the results for the effects of predicted health status on hourly wage rates, or productivity. As with annual earnings, the sign on the coefficient for BMI in 1997 is positive and the magnitude is large. Since higher BMI is associated with lower hours of work, we are inclined to think that increases in BMI probably do result in elevated productivity. However, the standard error on the estimated effect is large and the impact of a gain in BMI between 1993 and 1997 is not statistically significant.

Counter-intuitively, the coefficient on difficulty carrying a heavy load is positive and significant. Possibly this reflects an issue related to reporting, where women who have relatively sedentary jobs are more likely to perceive themselves as unable to carry a heavy load than are women with relatively less sedentary jobs. It may also reflect choice of type of work: women who (think they) cannot carry a heavy load may choose less physically demanding jobs and those jobs often pay higher wages.

This result highlights two important issues. First, it suggests that it may be important to take into account behavioral decisions when thinking about the links between health and labor market outcomes. Knowledge that there is an association between health and work capacity in a laboratory setting may not be enough. Second, it makes clear that instrumental variables cannot address the concern raised earlier regarding differences in the propensity to report health problems. To address this issue, we turn next to fixed effects models.

Fixed effects

Table 5 presents results from fixed effects models. These models estimate the impact of a change in health status between 1993 and 1997 on change in labor market outcomes between 1993 and 1997. Unobserved factors that are constant over time but that differ across individuals will be differenced out in these models. By construction, these models can only include health indicators that were measured in both 1993 and 1997.

The results in these models differ from the IV estimations reported in Table 4. First, we are no longer able to detect a significant effect of BMI on hourly earnings or annual earnings. While the coefficient on BMI is large, so is the standard error and we cannot reject the hypothesis the effect is zero. The relationship between annual earnings and good health appear to be entirely explained by reporting differences: women who report themselves as being in better health in 1997, relative to 1993, are women whose incomes are higher in 1997.

Increased difficulty with walking one kilometer and with carrying a heavy load both reduce labor force participation, and there is a suggestion that (self-reported) transition into bad health does the same. The effects of increased difficulty walking carry over to annual earnings and hourly earnings—exerting a negative effect on each of these outcomes. These effects were not detected in the IV estimates. In fact, in the IV estimates, we observed there is a (counter-intuitive) positive impact of difficulty carrying a heavy load on hourly wage rates. Taking the IV and FE results together, the balance of the evidence suggests that for self-reports it may be very important to pay attention to the systematic components of reporting propensities.

Of course, it may be that reporting propensities are not fixed -- but change as one experiences health difficulties or changes in other dimensions of one's life. If these changes are not correlated with changes in labor outcomes, then the FE estimates should not be affected. If they are, however, then the fixed effects estimates will continue to be contaminated by reporting bias.

In principle, we could combine the FE and IV approaches and attempt to predict changes in health status (using changes in access to health care and changes in relative food prices). For this procedure to be informative, there has to be considerable heterogeneity in price changes and health changes. We find there is not enough to yield good first stage predictions of health and so, in the second, stage, none of the health covariates is significant. We are inclined to think this says more about the limits of the variation in prices and health during the inter-survey period than about the relationships between health and labor outcomes. Future work which will exploit the dramatic shifts in relative prices that have been observed since the collapse of the rupiah and subsequent very high inflation may provide the innovations that will support precise estimation of these relationships.

5. CONCLUSIONS

Drawing on very rich longitudinal survey data from Indonesia, the links between women's health status and labor outcomes have been explored. There is evidence that for women, better access to health care is associated with greater participation in the labor market and in higher productivity. There are also correlations between health status and labor outcomes although these correlations are considerably weaker for women, relative to men.

Detecting a causal effect of health on labor outcomes proves to be extremely difficult. We focus on two concerns that we view as central. First, observing that health and income are positively correlated does not tell us whether better health causes higher productivity and therefore increases earnings or whether higher income is spent on improving health through better health care, improved nutrition or other behaviors. Second, many studies of health and labor outcomes rely on self-reported health indicators. If the meaning of "good" or "poor" health varies among respondents and this variation is correlated with socio-economic status or income, then the associated differences in reporting will contaminate the interpretation of a relationship between health and income.

Taking our results together, we conclude that, among women in Indonesia, there is evidence that greater BMI results in higher annual earnings and possibly even greater productivity although the latter effect is not significant. We argue that systematic differences in the propensity to report oneself as having health difficulties complicates interpretation of the relationship between these indicators of health status and labor outcomes. To the extent these reporting differences are fixed for an individual, they can be controlled by looking at differences in health status and differences in labor outcomes. Under that assumption, we find that the incidence of physical difficulties (carrying a heavy load or walking 1 kilometer) reduces labor force participation and also annual earnings (probably both through reduced hours of work and lower productivity).

Attempts to combine an empirical strategy that takes into account both differences in reporting behavior and reverse causality were not successful. We think this is primarily because the heterogeneity in health status and the heterogeneity in the prices of inputs in the production of health are not sufficient to yield unbiased estimates of the effect of health on labor outcomes for women.

Table 1: Labor market outcomes and health status
Summary statistics

	FEMALES		MALES
	1993	1997	1997
Labor market outcomes			
% Working	49	46	81
Hours worked last year	1538	1534	1862
conditional on working			
Earnings (last year)	1.181	1.403	2.020
(Rp million)			
Hourly earnings (last month)	1.040	1.250	1.813
(Rp 000)			
Physical health status			
Height (cm)	148.9		159.3
BMI (kg/m^2)	21.23	21.20	21.25
	[0.04]	[0.05]	[0.04]
% BMI <18.5	24	24	17
Hemoglobin (g/L)		122.9	138.0
		[0.20]	[0.25]
% Hb <100g/L		8.7	3.2
Iodized salt in HH (%)		56	55
Lung capacity		274	382
		[0.68]	[1.48]
Blood pressure			
% mild		11.5	13.5
% moderate		4.1	4.0
Healthworker evaluation of health		6.08	6.26
status (0=poor, 9=excellent)			
Self reported health: % report			
General health status is good	12.0	12.4	9.0
General health status is poor	10.2	9.9	13.5
Activities of daily living			
difficulty walking 1 km	16.7	16.6	17.5

difficulty carry heavy load	8.7	8.4	10.8
Demographics characteristics (as of 1993)			
Age	38.2		40.3
Years of education	5.0		6.2

Sample sizes are 10,666 females and 9,023 males.

Table 2: Labor market outcomes and health services
Reduced form estimates

	Labor force participation	ln hours per year	ln annual earnings	ln hourly earnings
FEMALES				
Distance to health services (kms)				
Puskesmas	-0.015	-0.022	0.006	0.027
	[2.04]	[0.91]	[0.21]	[1.19]
Private prac	0.017	0.032	-0.029	-0.050
	[1.65]	[1.59]	[1.32]	[2.98]
Education (spline)				
0-5 yrs	0.002	0.026	0.071	0.041
	[0.46]	[2.03]	[4.87]	[3.28]
6-11 yrs	-0.011	-0.012	0.107	0.120
	[3.1]	[1.09]	[8.58]	[10.01]
12-20 yrs	0.046	-0.008	0.130	0.153
	[8.33]	[0.53]	[7.21]	[9.62]
Age (spline)				
20-25 yrs	0.010	0.032	0.043	0.033
	[6.98]	[4.33]	[5.04]	[5.43]
25-35 yrs	0.013	0.003	0.035	0.033
	[6.45]	[0.39]	[4.42]	[4.54]
35-45 yrs	-0.006	-0.003	-0.014	-0.014
	[2.46]	[0.38]	[1.48]	[1.46]
45-55 yrs	-0.011	-0.013	-0.013	0.010
	[4.64]	[1.4]	[1.22]	[0.80]
>55 yrs	-0.012	-0.005	-0.022	-0.017
	[10.87]	[0.67]	[2.90]	[1.81]
F(all covariates)	66.71	8.52	43.36	49.95
	[0.00]	[0.00]	[0.00]	[0.00]
R^2	0.183	0.079	0.324	0.306
MALES				
Dist to puskesmas	-0.008	0.015	0.016	0.019
	[1.68]	[1.15]	[0.93]	[1.06]
Dist to pvt prac	0.01	0.024	0.03	-0.003
	[1.53]	[1.43]	[1.95]	[0.15]

Notes: Sample sizes are 10,666 females and 9,023 males. Regressions include controls for province of residence, urban location, characteristics of local infrastructure (including mean and standard deviation of ln(per capita expenditure) in the community in 1993, % in community own home in 1993, % in community have electricity in 1993 and 1997, whether community has telephone service, sewerage services, paved roads, a bank and a market in 1993 and 1997, community-specific price level in 1993 and 1997.) t statistics in parentheses below coefficient estimates based on estimates of variance covariance matrix that permit arbitrary forms of heteroskedasticity and correlations within clusters. p-values below test statistics.

Table 3.1: Labor market outcomes and health indicators				
OLS estimates for females				
	Labor force participation	n hours per year	n annual earnings	n hourly earnings
n Height	-0.319	-0.252	1.468	1.684
	[1.87]	[0.42]	[2.06]	[2.37]
n BMI (97)	0.021	0.308	0.684	0.041
	[0.38]	[1.5]	[2.89]	[0.17]
n BMI (93)	-0.023	0.005	-0.055	0.289
	[0.41]	[0.02]	[0.23]	[1.25]
(1)GHS - good (97)	0.002	0.009	0.183	0.122
	[0.09]	[0.13]	[2.12]	[1.51]
(1)GHS - good (93)	0.009	-0.059	-0.011	0.032
	[0.48]	[0.99]	[0.16]	[0.48]
(1)GHS - poor (97)	0.01	-0.044	-0.144	-0.068
	[0.71]	[0.79]	[2.1]	[0.85]
(1)GHS - poor (93)	-0.008	0.047	0.027	-0.079
	[0.43]	[0.66]	[0.31]	[0.89]
(1)Walk 1km-hard(97)	-0.03	0.01	-0.114	-0.073
	[2.09]	[0.23]	[1.78]	[1.27]
(1)Walk 1km-hard(93)	-0.015	-0.115	0.053	0.08
	[0.9]	[1.84]	[0.77]	[1.02]
(1)Heavy load-hard(97)	-0.077	-0.002	0.088	0.102
	[4.4]	[0.03]	[1.16]	[1.28]
(1)Heavy load-hard(93)	0.013	-0.034	-0.069	0.026
	[0.6]	[0.4]	[0.68]	[0.26]
Hemoglob spline<10mg	0.002	0.062	0.082	0.071
	[0.13]	[1.16]	[1.3]	[1.1]
Hemoglob spline>10mg	0.002	0.001	0.006	-0.011
	[0.42]	[0.06]	[0.33]	[0.62]
(1)HH iodized salt	-0.037	0.041	0.12	0.112
	[2.45]	[0.74]	[1.94]	[1.89]
n Lung capacity	0.016	0.065	-0.029	0.031
	[0.62]	[0.79]	[0.28]	[0.3]
(1)Blood press (mild)	-0.013	-0.012	-0.159	-0.08
	[0.71]	[0.18]	[1.96]	[1.01]
(1)Blood press (mod)	-0.074	0.096	0.044	-0.038
	[2.81]	[0.93]	[0.34]	[0.32]
Healthworker evaluation (1-9)	0.016	0.06	0.055	0.018
	[2.04]	[1.99]	[1.89]	[0.68]
R^2	0.246	0.09	0.344	0.298
F(all covar)	57.47	5.91	26.65	25.72
	[0.00]	[0.00]	[0.00]	[0.00]

^{2}(all health)	4.42	1.77	3.36	1.16
	[0.00]	[0.03]	[0.00]	[0.30]
^{2}(97 health)	5.55	1.33	3.67	1.19
	[0.00]	[0.20]	[0.00]	[0.30]

Notes: See Table 2.

Table 3.2: Labor market outcomes and health indicators

OLS estimates for males

	Labor force participation	n hours per year	n annual earnings	n hourly earnings
n Height	-0.157	-0.001	1.26	1.658
	[1.22]	[0.00]	[2.76]	[3.58]
n BMI (97)	-0.005	0.347	0.952	0.800
	[0.09]	[2.43]	[5.47]	[4.60]
n BMI (93)	0.065	-0.03	0.202	0.187
	[1.38]	[0.2]	[1.11]	[1.02]
(1)GHS - good (97)	-0.026	0.018	-0.027	0.047
	[1.89]	[0.36]	[0.47]	[0.88]
(1)GHS - good (93)	0.01	0.025	0.047	0.058
	[1.01]	[0.69]	[1.1]	[1.33]
(1)GHS - poor (97)	-0.037	-0.162	-0.105	0.072
	[2.44]	[3.37]	[1.54]	[1.16]
(1)GHS - poor (93)	-0.022	-0.002	0.018	-0.007
	[1.2]	[0.03]	[0.25]	[0.10]
(1)Walk 1km-hard(97)	-0.055	-0.057	0.021	0.169
	[2.88]	[1.32]	[0.33]	[2.53]
(1)Walk 1km-hard(93)	0.024	0.03	-0.047	-0.050
	[0.96]	[0.49]	[0.55]	[0.51]
(1)Heavy load-hard(97)	-0.133	0.052	-0.082	-0.09
	[5.03]	[0.93]	[0.95]	[0.97]
(1)Heavy load-hard(93)	-0.108	-0.068	-0.192	-0.047
	[3.14]	[0.69]	[1.47]	[0.32]
Hemoglob spline<10mg	-0.019	0.046	0.04	0.048
	[0.83]	[1.04]	[0.67]	[0.63]
Hemoglob spline>10mg	-0.002	-0.01	0.026	0.027
	[0.86]	[1.12]	[2.26]	[2.47]
(1)HH iodized salt	-0.02	-0.01	0.119	0.074
	[1.8]	[0.3]	[2.66]	[1.70]
n Lung capacity	0.024	0.046	0.129	0.008
	[1.37]	[0.94]	[1.79]	[0.11]
(1)Blood press (mild)	-0.027	-0.041	0.032	-0.039
	[1.76]	[0.98]	[0.59]	[0.69]
(1)Blood press (mod)	-0.053	-0.067	-0.045	0.142
	[1.77]	[0.85]	[0.38]	[1.34]
Healthworker evaluation (1-9)	0.009	-0.003	-0.034	-0.008

	[1.62]	[0.15]	[1.45]	[0.35]
R^2	0.439	0.098	0.393	0.312
F(all covariates)	44.58	9.16	48.56	29.41
	[0.00]	[0.00]	[0.00]	[0.00]
^{2}(All health)	9.45	2.45	7.85	6.73
	[0.00]	[0.03]	[0.00]	[0.00]
^{2}(97 health)	9.79	2.58	6.07	4.9
	[0.00]	[0.03]	[0.00]	[0.00]

Notes: See Table 2.

Table 4: Labor market outcomes and health indicators for females
Instrumental variables estimates

	Labor force participation	n hours per year	n annual earnings	n hourly earnings
n Height	-0.339	-0.125	1.253	1.635
	[0.93]	[0.13]	[0.76]	[1.45]
n BMI (97)	-0.574	-0.701	8.43	3.976
	[0.44]	[0.2]	[2.12]	[1.55]
n BMI (93)	0.509	0.635	-4.075	-0.589
	[0.38]	[0.26]	[1.09]	[0.25]
(1)GHS - good (97)	0.065	1.188	3.602	1.484
	[0.15]	[1.02]	[2.21]	[1.3]
(1)GHS - good (93)	0.229	-0.579	0.695	0.818
	[0.87]	[0.78]	[0.6]	[0.97]
(1)GHS - poor (97)	0.178	-0.55	2.099	1.102
	[0.49]	[0.47]	[1.02]	[1.13]
(1)GHS - poor (93)	0.838	-1.378	-3.305	0.127
	[1.65]	[0.87]	[1.06]	[0.07]
(1)Walk 1km-hard(97)	-0.405	0.745	0.11	-1.036
	[1.52]	[0.88]	[0.09]	[1.56]
(1)Walk 1km-hard(93)	-0.597	1.138	1.69	-0.182
	[1.13]	[0.89]	[0.73]	[0.14]
(1)Heavy load-hard(97)	0.047	-1.04	-0.18	1.811
	[0.15]	[1.23]	[0.13]	[1.97]
(1)Heavy load-hard(93)	0.842	0.25	-0.99	-1.18
	[1.24]	[0.13]	[0.34]	[0.64]
F(all covariates)	38.4	4.64	11.48	14.34
	[0.00]	[0.00]	[0.00]	[0.00]
GMM overidentification test (^{2})	1.46	1.27	0.22	0.23
	[0.06]	[0.16]	[1.00]	[1.00]

Notes: See Table 2. Instruments are relative price of 10 food items, distance to puskesmas and distance to private practitioner all measured in 1993 and 1997. GMM overidentification test is a test of the validity of the instruments and tests whether the instruments are correlated with the residuals from the second stage regressions. F test for significance of instruments in first stage regressions indicates instruments have predictive power: F=2.85 (p-value=0.00) for BMI; 1.98 (0.00) for GHS good; 2.45 (0.00) for GHS bad; 6.22 (0.00) for walk 1km hard; 3.60 (0.00) for carry heavy load hard.

Table 5: Labor market outcomes and health indicators for females
Fixed effects estimates

	Labor force participation	n hours per year	n annual earnings	n hourly earnings
n BMI	0.013	-0.005	0.289	0.349
	[0.3]	[0.03]	[1.2]	[1.52]
(1)GHS - good	0.002	-0.046	-0.005	0.083
	[0.09]	[0.81]	[0.06]	[1.15]
(1)GHS - bad	-0.025	-0.067	-0.001	0.048
	[1.64]	[1.15]	[0.02]	[0.64]
(1)Walk 1km-hard	-0.033	-0.017	-0.145	-0.105
	[2.48]	[0.36]	[2.24]	[1.68]
(1)Heavy load-hard	-0.075	-0.017	0.073	0.068
	[4.67]	[0.29]	[0.93]	[0.89]
Overall R^2	0.277	0.013	0.092	0.089
F(all covariates)	216.09	7.37	20.92	18.70
	[0.00]	[0.00]	[0.00]	[0.00]
F(fixed effect)	1.40	1.68	2.19	2.14
	[0.00]	[0.00]	[0.00]	[0.00]
^{2}(All health)	10.91	0.50	1.35	1.39
	[0.00]	[0.78]	[0.24]	[0.23]
Notes: See Table 2.				

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