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Self Rated Health and Mortality: Does the Relationship Extend to a Low Income Setting?

Elizabeth Frankenberg
Nathan R. Jones

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Elizabeth Frankenberg
Department of Sociology
UCLA
Los Angeles, CA 90095-1551

Nathan R. Jones
Labor and Population Program
RAND
Los Angeles, CA 90407

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ABSTRACT

Although a relationship between poor self-reported health status and excess mortality risks has been well-established for industrialized countries, almost no research considers developing countries. We use data from Indonesia to show that in a low-income setting, as in more advantaged parts of the world, individuals who perceive their health to be poor are significantly more likely to die in subsequent follow-up periods than their counterparts who view their health as good. This result characterizes both men and women, holds for multiple time periods, and remains after inclusion of measures of nutritional status, physical functioning, symptoms of poor physical health and depression, and hypertension. We also consider the correlates of self-rated health. Symptoms and physical functioning are strong predictors of reporting poor rather than good health, but neither these indicators nor other covariates we consider distinguish between reports of excellent rather than good health.

Introduction

The term "self-rated health" (SRH) refers to a measure of health status constructed from individuals' answers to a question such as "In general, would you say that your health is excellent, very good, good, fair, or poor?" A number of studies document a strong relationship between self-rated health and subsequent mortality. Individuals who report poor or fair health are two or more times more likely to die in the next several years than are individuals who report very good or excellent health. The relationship holds for a wide range of ages and follow up periods and is robust to the inclusion of many other measures of health status (see Idler and Benyamini 1997 and Benyamini and Idler 1999 for thorough reviews).

To date, however, almost no research focuses on poor countries. Of the more than 45 studies cited in the Idler and Benyamini reviews, only one (Yu et al. 1998) analyzes data from a country in which per capita GDP is less than $1000. Our searches of bibliographic databases failed to uncover any other analyses of the SRH-mortality relationship in developing countries.

We use nationally-representative panel data collected in three waves of the Indonesia Family Life Survey to explore whether the association between SRH and subsequent mortality extends to a low-income setting. We have two goals. First, we examine the correlations between SRH and other measures of health status. Second, we examine the relationship between SRH and subsequent mortality. This relationship may be weaker in developing countries because individuals have less access to information about their own health (and that of family members) than is the case in developed countries. Additionally, deaths from infectious diseases and injuries are common in developing countries but are less likely to be preceded by gradual declines in health status that individuals incorporate into perceptions of their health.

Background and Setting

Researchers have sought to clarify the mechanisms underlying the SRH-mortality link by identifying the conditions most salient to SRH. Several recent analyses of data from Asia suggest that reports of SRH contain information about health status that will predict subsequent mortality.

Two studies document a strong relationship between SRH and physical functioning (Wu and Rudkin 2000; Zimmer et al. 2000). Zimmer and colleagues, using data from the Philippines, Taiwan, and Thailand, find that a functional limitation scale is strongly associated with SRH in all three countries: the more functioning difficulties reported, the poorer is self-reported health. A study of Malaysia finds that for the three main ethnic groups (Malay, Chinese, Indian), higher scores on a physical limitation scale are associated with a greater likelihood of reporting relatively poorer health (Wu and Rudkin 2000). The results from Asia are consistent with analyses of developed country data that indicate a strong relationship between SRH and functional disability (see, for example, Idler 1993).

Zimmer et al. (2001) and a study of the Indonesia Family Life Survey (Thomas and Frankenberg 2002) provide insights into how other dimensions of health are related to SRH in Asian countries. The analyses of the Philippines, Taiwan, and Thailand include respondent reports of seven chronic conditions, such as high blood pressure and diabetes. With only a few exceptions the dichotomous indicators of chronic conditions reduce the likelihood of reporting relatively good SRH. Thomas and Frankenberg (2002) explore the relationship between physical assessments of health (lung function, blood pressure, hemoglobin, and body mass index) and SRH in Indonesia. For men and women whose body mass index is below 18 or whose hemoglobin level is below 12 (anemic), reports of poor health are significantly less likely with increases in body mass index or with increases in hemoglobin. The authors conclude that in

Indonesia SRH summarizes information about health status, although the relationship is complicated.

The only study our literature searches revealed that links SRH to subsequent mortality in a developing country is Yu et al. (1998), which analyzes data from respondents to a population-based survey conducted among individuals 55 and older in one district of the city of Shanghai, in the People's Republic of China. Those reporting poor or fair health are about twice as likely to die in the next five years than those reporting good or excellent health. The relationship is robust to inclusion of indicators of depression, disability, and diagnoses of illnesses.

Our research extends analysis of SRH and mortality to Indonesia, a country far more disadvantaged with respect to health and socioeconomic development than any other previously analyzed. Although still poor in relative terms, Indonesia was regarded as a development success story prior to the economic crisis of the late 1990s. By 1999 *per capita* GDP had increased more than ten-fold since the late 1960s, to U.S. $580. Health outcomes also improved. The infant mortality rate was 46 per 1,000 live births in 1999 (about one-third its 1967 level) and life expectancy was in the mid-60s (World Bank 2000).

Improvements in health likely reflect both strong economic growth and government efforts to strengthen the health sector. Beginning in the 1970s the Indonesian Ministry of Health expanded access to primary health care by building, staffing, and equipping government health centers (MOH 1990). Maternal and child health are priorities because of high mortality rates for these groups. Preventive services for adults receive far less attention.

As health outcomes for mothers and children have improved, the structure of mortality has begun to change. Data from the National Household Health Surveys show that the percentage of deaths accounted for by infectious diseases declined from 60% in 1980 to 43% in

1992 (Soemantri and Siregar 1993). Over this period cancer and cardiovascular disease rose in prominence as causes of death. Indonesian adults, however, pay little attention to obtaining preventive care or information about their health status. For example, only about 20% of the population 30 and older has had a check up in the past five years (MOH 2002).

Data and Descriptive Statistics

We use data from the Indonesian Family Life Survey (IFLS), an on-going longitudinal survey of individuals, households, families, and communities. The first wave, conducted in 1993, included a sample of 7,224 households (Frankenberg and Karoly 1995). The sample represents 83% of the population of Indonesia. The second wave (IFLS2) reinterviewed IFLS1 respondents four years later in 1997, and a third wave (IFLS3) reinterviewed IFLS respondents in 2000. Over 94% of the IFLS1 households were located and reinterviewed in IFLS2 and in IFLS3 (Frankenberg and Thomas 2000; Strauss et al. 2002). Funding for the surveys was provided by the National Institute on Aging, the National Institute for Child Health and Human Development, the U.S. Agency for International Development, the Ford Foundation, the Futures Group, the William and Flora Hewlett Foundation, the International Food Policy Research Institute, John Snow International, and the World Health Organization.

In each wave a household roster provides basic socioeconomic and demographic information about household members. In 1997 and 2000 the rosters listed all household members in previous rounds and ascertained whether each person was still alive. Information about expenditure patterns, income, and assets was also collected at the household level in all three rounds.

In 1993, individuals were sampled within each household and interviewed about a range of topics. All adults had a chance of being interviewed, but greater priority was given to the

head of the household, to that person's spouse, and to household members at least 50 years of age. In 1997 and 2000 detailed individual interviews were attempted with all household members.

All waves contain extensive information about health status. Individuals rate their overall health status, report on their ability to perform activities of daily living and more physically demanding activities, and recount recent experiences of various symptoms of poor physical and mental health. In addition, a trained nurse visits each household to conduct physical health assessments. In 1993 the assessments are limited to height and weight. The 1997 and 2000 rounds include assessments of hemoglobin and blood pressure conducted by a nurse.

In the following analyses, we draw on data from all three waves of the IFLS. We analyze respondents who: 1) are at least 50 years old and provided detailed individual information in 1993, or are at least 50 years old and provided detailed individual information in 1997, and 2) whose household was interviewed in a subsequent round of the survey. Individuals who meet these criteria have the necessary baseline individual-level data from either 1993 or 1997 and have follow-up information on survival status in at least one subsequent wave. These restrictions yield 3,527 respondents from the 1993 wave and 4,437 respondents from the 1997 wave. Descriptive statistics for the analytical sample are presented in Table 1.

The mean age of respondents interviewed in 1993 is 59 years for women and 61 years for men. The maximum age reported in 1993 is 96. In 1997, men and women are 61 years old, on average, and the maximum age reported is 99. In both waves levels of education are low. Women have about two years of schooling on average, and men have about four. About 60% of

women and 25–30% of men have no schooling at all. Less than 3% of the respondents have more than 12 years of schooling.

Economic resources may affect health and mortality. For developing countries, *per capita* household expenditures are often used as a summary measure of economic resources. In each wave of the survey a respondent answers detailed questions about household spending. Median monthly per capita expenditures are *Rupiah* (Rp) 58,000 in 1993 ($32 at a 1993 exchange rate of 1800 Rp/$) and Rp. 77,000 in 1997 ($33 at a 1997 exchange rate of 2300 Rp/$).

Urban residence may affect reports of health status and health outcomes if urban and rural areas differ with respect to access to health services or levels of health hazards in the environment. Individuals are classified as living in an urban area if, at the time of the interview, they resided in an administrative area classified as urban by Indonesia's Central Bureau of Statistics (CBS). The CBS algorithm for distinguishing urban from rural areas is based on physical infrastructure, population density, and the proportion of the population working in agriculture. About 30% of our respondents live in urban areas.

With respect to SRH, respondents are asked how they consider their health at the time of the survey. The four response categories literally translate to "very healthy", "sufficiently healthy", "less than healthy", and "unhealthy". We combined the last two categories because less than one percent of respondents chose the "unhealthy" category. Hereafter we refer to the three categories as poor, good, and excellent health. Good health, the modal category, accounts for almost 70% of respondents in 1993, and over 70% of respondents in 1997. Reports of poor health account for 19-22% of respondents in each year.

With respect to self-reports of physical functioning, respondents are asked whether they often, sometimes, or never experienced difficulties with performing various activities. We focus

on four activities ranging from strenuous to basic and involving both the upper and lower body. These are walking five kilometers, carrying a heavy load (such as a pail of water) for 20 meters, standing up from the floor, and dressing without assistance. Between one-fifth and one-third of male respondents report difficulty walking five kilometers. Levels are higher for women. Difficulties standing up from the floor and dressing were rare for both men and women.

The survey also asked about experience with various symptoms in the four weeks before the survey. We consider three symptoms. Joint pain and respiratory difficulties (defined as wheezing and shortness of breath) are likely to be associated with chronic health problems. Nausea and vomiting more likely reflect an acute condition.

Height and weight were measured in both 1993 and 1997. Height is considered a good indicator childhood health (Hill and Upchurch 1995; Fogel and Costa 1997). Mean height is about 147 centimeters (five feet) for women, and about 158 centimeters (five feet three inches) for men.

We use the measures of height and weight to calculate Body Mass Index (the ratio of weight in kilograms to height in meters squared). BMI has been linked to morbidity and mortality in developing countries (Garcia and Kennedy 1994; Yuan et al. 1998). The National Heart, Lung, and Blood Institute recommends BMI cut-offs of 18.5, 25, and 30 to distinguish underweight, healthy, overweight, and obese individuals, respectively (National Heart, Lung, and Blood Institute 1998). We divide our respondents into four groups, but because only about 150 individuals have a BMI of 30 or higher, we use an uppermost cut-off of 28 rather than 30. About 30% of our respondents fall into the underweight category. About 15% of women and 8% of men have a BMI of 25 or higher.

The 1993 survey included questions about mental health that correlate with depression. We construct dichotomous indicators of whether respondents reported difficulty sleeping, fatigue, or sadness in the four weeks before the interview. Each of these symptoms is reported by 4-9% of the sample.

The 1997 survey did not repeat the mental health questions but did conduct physical assessments of respondents' blood pressure and hemoglobin levels. We include a dichotomous indicator of whether a respondent has moderate hypertension (defined by the American Medical Association as a systolic blood pressure of at least 160 or diastolic blood pressure of at least 100). By these criteria about 10% of respondents have moderate hypertension. We also include indicators of whether the respondent's hemoglobin level is less than 11 g/dl or between 11 and 12 g/dl. Respondents with a hemoglobin level of less than 12 g/dl are considered to be anemic (based on the cut-offs recommended by the World Health Organization).

The last row of the table presents the percentages of respondents who died by the subsequent wave of the survey. About 6% of women interviewed in 1993 died by 1997, whereas 11% of men died. By 2000 about 10% of the women and 17% of the men interviewed in 1993 had died. Of individuals interviewed in 1997, 7% of women and 8% of men died by 2000.

Several differences emerge between the 1993 and 1997 samples, particularly for women. The mean age of female respondents is higher in 1997 than in 1993. For both men and women reports of difficulty with physical functioning are higher in 1997 than in 1993, and fewer respondents report excellent health. These changes reflect the fact that in 1993 a subset of household members was interviewed, whereas all members of the household were targeted for interview in 1997. The within-household sampling protocol resulted in somewhat younger and healthier respondents in 1993, particularly among women.

Analysis

We analyze two types of outcome variables. To explore the correlates of SRH at a point in time, we use multinomial logistic regression. The models estimate the association between the likelihood that a respondent reports poor health relative to good health or excellent health relative to good health. This approach allows asymmetries in the relationship that covariates exhibit either with excellent or with poor health (each relative to the reference category of good health). We estimate these models for 1993 and 1997 and stratify by gender.

To analyze the relationship between SRH and mortality, we use logistic regression models in which the outcome is death (coded as one) rather than survival (coded as zero) prior to the next wave of the survey. We stratify by gender and consider the correlates of subsequent mortality for three time periods: 1993-1997, 1997-2000, and 1993-2000.

Rather than analyzing death as a dichotomous outcome, many other studies have analyzed survival time from the baseline survey, treating as censored individuals who are still alive at follow-up rounds of data collection. This approach is not possible with the Indonesian data because we do not have accurate information on the timing of death. Although the surveys included questions on date of death, no month was reported for about 25% of the deaths.

As regressors in both the models of SRH and subsequent mortality, we include the health status measures described above and summarized in Table 1. In addition to interpreting the statistical significance of the coefficients for individual variables, we use chi-square statistics to test whether groups of covariates jointly equal zero. When the chi-square test statistic is significant we conclude that the covariates jointly add significantly to the amount of variation accounted for by the model. The range of health status controls is comparable in scope to those

typically included in analyses of the SRH-mortality relationship that use data from large-scale nationally representative surveys of developed country populations.

As further controls we include measures of age and socioeconomic status. We do not present the results for these controls in the tables because our focus is on the role of health status. Age is specified as a piecewise linear spline, with knots at 60 and 70. The knots were chosen after inspecting graphs to determine the ranges within which the relationship between age and subsequent mortality appeared to be linear. Education is included as a categorical variable, with divisions that reflect both the relatively low levels of education of older Indonesians and the structure of the Indonesian schooling system. Individuals with one to five years of education, with six years of education (completion of primary school), and with seven or more years of education are contrasted with individuals with no education. Household *per capita* expenditure is included as a dichotomous variable. Respondents are classified on the basis of whether expenditures are equal to or greater than the median. A dummy variable indicates urban (rather than rural) residence.

Correlates of Self-Rated Health

In Table 2 we present the exponentiated coefficients for the various measures of health status. The numbers represent the multiplicative effect of a particular attribute on the odds of reporting either poor or excellent health rather than good health.

If height confers health benefits that last into adulthood, such a relationship does not emerge in reports of health status. For neither gender nor in any of the time periods is height significantly associated with SRH.

Body Mass Index, on the other hand, is associated with SRH for women. For example, the odds that women report their health as poor when their BMI is between 18.5 and 25 are about

40% lower than the odds for women whose BMI is less than 18.5. BMI is not closely associated with men's SRH.

The measures of physical functioning are strongly related to reporting poor rather than good health, both in terms of size and statistical significance. The risk of reporting poor health is about two times greater for respondents who find it difficult to stand up from the floor than for those who do not. The effects of these measures are larger for men than for women and are larger in 1993 than in 1997.

Experiencing either respiratory difficulties or joint pain also elevates the risk of reporting poor health. The increase in the odds of poor health is particularly large for respiratory difficulties, ranging from 2.4 to 3.5.

Reports of depressive symptoms were collected in 1993. Both men and women who report difficulty sleeping are at about double the risk of viewing their health as poor. Additionally, women who report sadness and men who report fatigue are more likely to view their health as poor.

Physical health assessments were conducted in 1997. Although high blood pressure is not typically accompanied by symptoms, women whose blood pressure indicates moderate degree of hypertension have 50% higher odds of reporting poor health than are their counterparts with lower blood pressure. Hypertension is not related to SRH for men. Moderate anemia is not related to reports of poor health for either men or women.

Mortality Models

We now turn to the question of whether perceptions of health status are associated with subsequent mortality. We introduce sets of control variables sequentially into logistic regression models in which the explanatory variable of primary interest is SRH and the outcome is a

respondent's survival status at a later point. Our results are summarized in Table 3. We present, for those reporting poor rather than good health at baseline, the odds ratios for death prior to the subsequent wave of the survey (z-statistics are shown in parentheses). We do not present results for those who report excellent rather than good health because the odds never differ significantly from one.

"Table 3 About Here"

In the model displayed in the first column age is the only control variable. The odds of death for those reporting poor health are between 1.9 and 2.8 times greater than for those reporting good health. In all periods, the excess mortality risk associated with poor SRH is higher for men than for women. We next add controls for socioeconomic status and for the anthropometric measurements (specifications two and three, respectively). These controls do not appreciably alter the estimates of the relationship between poor self-reported health and mortality.

In contrast, for all periods and both genders, the odds ratios decline to less than two after inclusion of controls for physical functioning (specification four). Addition of the functioning indicators reduces the excess risk of death associated with SRH by 6-20% for women. For men, the odds of mortality for those in poor health fall by 35-40% after including the controls for physical functioning (and for the 1993-1997 period men in poor health are no longer significantly more likely to die by the follow-up survey). Introducing controls for symptoms of poor physical health (specification five) reduces the odds of death for those in poor health somewhat further for both men and women.

Specification six introduces controls for depressive symptoms for the two periods in which 1993 serves as the baseline year. Specification seven introduces controls for hypertension

and moderate anemia for the 1997-2000 period. Based on the results from specifications six and seven (which contain the fullest set of health status controls), the odds of death are about 50-75% higher for those in poor rather than good health. For women the significance level associated with poor SRH is less than 5% for the two shorter periods and is 7% for the longer period. For men the significance level associated with poor health is 3% for the 1993-2000 period and 6% for the 1997 and 2000 level.

Relationship of other health indicators to mortality

Because the relationship of other health status variables to subsequent mortality is of interest we present the results for all the health covariates included in specifications 6 and 7.

"Table 4 About Here"

Although the addition of the indicators for Body Mass Index did not appreciably change the relationship between poor perceived health and subsequent mortality, BMI is associated with subsequent mortality. Thus, BMI appears to reflect factors that are important for mortality but that are unrelated to the components of health captured by self-assessments.

Difficulties with physical functioning are somewhat related to subsequent mortality for women. Women reporting difficulty carrying a heavy load in 1997 have 84% higher odds of death by 2000 than those with no such difficulty, and the functioning measures are jointly significant. In the earlier period and over the longer term, however, physical functioning is unrelated to subsequent mortality for women. The relationship between physical functioning and mortality is much stronger for men in terms of the magnitude of effects and the statistical significance of the variables, individually and as a group.

The only physical symptom that displays a significant relationship with subsequent mortality is respiratory difficulty. For women over the longer period and men over all three

periods, reporting a respiratory difficulty is associated with elevated odds of death of 72-115%. None of the symptoms of poor mental health are associated with subsequent mortality either individually or as a group.

Moderate hypertension raises the odds of death by 60% for women, by 150% men. Additionally, both women and men have about 80% higher odds of death when their hemoglobin levels are below 11 g/dl.

Discussion

A strong and persistent association between SRH and subsequent mortality is well-established for populations in the industrialized world. Almost no research has explored this relationship in settings where income and educational levels are relatively low, access to health care and health information is limited, and infectious diseases and undernutrition remain important health problems.

Using data from Indonesia, we show that in a low-income setting, as in more advantaged parts of the world, individuals who perceive that their health is poor are significantly more likely to die in subsequent follow-up periods than their counterparts who view their health as good. This result characterizes both men and women, holds for multiple time periods, and remains statistically significant after inclusion of anthropometric measures, indicators of physical functioning, symptoms of physical illness and depression, and indicators of high blood pressure and anemia.

The excess mortality risks associated with reports of poor self-rated health are somewhat smaller in our analysis than in many of the studies for developed countries. Most proximately, this result likely arises because the Indonesian respondents tend to cluster on the categories of

good or poor health, whereas in developed countries survey respondents spread themselves over a wider range of SRH categories.

In our analyses of the SRH-mortality relationship, we sequentially introduce controls for other dimensions of health status. The addition of the indicators of physical functioning substantially reduces the estimated excess mortality risk associated with reports of poor health. This reduction and the fact that physical functioning is highly correlated with the likelihood of reporting poor health suggest that in formulating perceptions of their health status, individuals are strongly influenced by their physical capacity. Our results are consistent with other studies of correlates of SRH in Asia (Wu and Rudkin 2000; Zimmer et al. 2000).

Our work also yields insights into the factors associated with SRH in Indonesia. One aspect of our results regarding the correlates of SRH is of particular interest. The relative risks (and statistical significance) associated with the health indicators we consider differ dramatically depending on whether the contrast is between poor and good health or between excellent and good health. For the most part the health indicators are strongly related to reports of poor health, but are unassociated with reports of excellent health.

The results suggest that, for Indonesians, the distinction between good and excellent health is quite blurred. A possible explanation is that individuals whose health is adequate or better have relatively little information to use in distinguishing good from excellent health. No norm of annual check-ups insures that Indonesian adults receive regular screening for (or exchange of information about) nutritional status, blood pressure, cholesterol, or diabetes.

We end with a summary of the results for women and men, focusing on the results for the 1997-2000 period (the group for which no within-household sampling scheme was used). Prior to adding controls for physical functioning, it appears that poor SRH is of more negative

consequence for men's survival chances than for women's, at least with respect to the size of the odds ratio. Once we control for physical functioning, the odds of subsequent death are reduced much more sharply for men than for women. Ultimately, in the final models that include the complete set of controls for health status, the excess risks of mortality for individuals reporting poor health rather than good health are similar for men and women. Thus, in Indonesia SRH does not appear to be more closely associated with mortality for men than for women, as has been shown to be the case in a number of developed countries (Jylha et al. 1998; Benyamini, Leventhal, and Leventhal 2000).

Our analyses suggest several important questions future work might fruitfully address. First, further consideration of asymmetries in the factors that explain self-reports of poor health versus excellent health is warranted. Second, in contexts where the health sector provides adults with relatively little information about their health status, exploring the extent to which self-reports are shaped by access to information about health may shed light on the process by which self-reports are formulated. Third, additional analyses of data from developing countries will help in quantifying the magnitude of excess mortality risk associated with self-reports of poor health in low-income settings, particularly when the data contain a wide array of other physically-assessed and self-reported health indicators.

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Table 1
Summary Statistics for Age, Socioeconomic Status, and Health Status Measures for the Analytical Sample

	Women		Men	
	1993	1997	1993	1997
N	1,798	2,396	1,729	2,041
Mean age	59	61	61	61
Standard deviation	(7.7)	(9.0)	(8.4)	(8.6)
Socioeconomic characteristics				
Mean years of education	1.8	2.0	3.8	4.4
Standard deviation	(3.0)	(3.2)	(3.8)	(4.0)
Median monthly *per capita* expenditure (*Rupiah*)[a]	57,840	77,397	58,070	77,724
% residing in an urban area at the time of interview[b]	29	33	29	34
Self-rated health status				
Poor	19	22	19	22
Good	68	74	69	73
Excellent	13	4	12	5
Anthropometric indicators				
% with Body Mass Index (BMI) < 18.5	31	29	31	31
% with BMI 18.5-24.9	54	55	61	61
% with BMI 25-27.9	8	10	5	6
% with BMI 28 or higher	7	6	3	3
Median height (cm)	147	147	158	158
Physical functioning				
% with difficulty walking 5 kilometers	34	60	21	33
% with difficulty carrying a heavy load (eg. pail of water)	21	43	13	24
% with difficulty rising from sitting on the floor	7	13	5	8
% with difficulty dressing	2	3	1	2
Symptoms of poor physical health (last 4 weeks)				
% reporting respiratory difficulty[c]	9	14	12	17
% reporting joint pain	30	50	27	41
% reporting nausea or vomiting	9	10	5	7
Symptoms of depression				
% reporting difficulty sleeping	9		7	
% reporting fatigue	9		8	
% reporting sadness	6		4	
Physical health assessments				
% with moderate hypertension[d]		12		9
% with hemoglobin <11 g/dl		22		13
% with hemoglobin 11-11.9 g/dl		20		12
% with hemoglobin >= 12 g/dl		58		75
% dead by 1997	6		11	
% dead by 2000	10	7	17	8

The analytical sample consists of respondents who 1) are at least 50 years old and provided detailed individual information in 1993, or who are at least 50 years old and provided detailed individual information in 1997 and 2) whose household was interviewed in a subsequent round of the survey. Respondents with missing values on any of the items in this table are excluded from analysis.

[a] Median per capita expenditure levels are calculated from respondent information on expenditures in the last month. The exchange rate was 1800 Rp/$ in 1993, 2300 Rp/$ in 1997. Monthly per capita expenditure is about $33 in both years.

[b] Individuals are defined as living in an urban (rather than rural) area if at the time of the interview their household was located in an administrative are Indonesia's Central Bureau of Statistics considers urban on the basis of physical infrastructure, population density, and the proportion of the population working in agriculture.

[c] Respiratory difficulties encompass conditions such as wheezing or shortness of breath.

[d] Moderate hypertension is defined as systolic blood pressure of 160 or higher or diastolic blood pressure of 100 or higher.

Table 2: Odds Ratios for Reporting Poor or Excellent rather than Good Health, as a Function of other Measures of Health Status

	Women				Men			
	1993		1997		1993		1997	
	Poor	Excellent	Poor	Excellent	Poor	Excellent	Poor	Excellent
Height (in cm)	1.000	1.000	1.003	1.036	0.989	0.997	1.007	1.017
Body Mass Index (reference: <18.5)								
18.5-24.9	0.627**	1.312	0.623**	1.477	1.044	0.861	0.895	0.805
25-27.9	0.831	1.143	0.728	2.733*	1.511	0.766	0.531*	0.407
28 or higher	0.527*	2.477**	0.455**	2.292	1.901	1.297	0.536	0.669
Physical functioning								
Difficulty walking 5 kilometers	3.560**	0.458**	1.567**	0.620	3.709**	0.415*	2.591**	0.546
Difficulty carrying a heavy load (eg. pail of water)	3.088**	0.540	1.878**	0.801	3.316**	0.420	2.724**	1.139
Difficulty standing up from the floor	1.951**	0.303	1.916**	0.676	2.156*	1.355	2.292**	0.594
Difficulty dressing					0.914	4.000	0.960	2.251
Symptoms of poor physical health (last 4 weeks)								
Respiratory difficulties	2.715**	0.540	2.411**	0.858	3.549**	0.360	2.673**	0.564
Nausea	1.812**	1.254	0.925	0.417	2.116*	0.148	1.584	0.581
Joint pain	1.999**	0.610*	1.706**	0.609	1.697*	0.770	2.080*	1.019
Symptoms of depression (last 4 weeks)								
Difficulty sleeping	2.321**	0.740			1.867*	0.479		
Fatigue	1.267**	0.774			2.030**	1.103		
Sadness	2.372**	0.624			1.716	1.488		
Physical health assessments								
Moderate hypertension			1.486**	0.651			1.344	1.208
Hemoglobin level (ref: >=12 g/dl)								
Hemoglobin < 11 g/dl			1.031	1.117			0.858	1.159
Hemoglobin 11-11.9 g/dl			0.917	0.773			0.893	1.506
Chi-square statistics								
Height and Body Mass Index	10.0*	7.3	19.9**	9.0	3.7	1.5	5.9	3.3
Physical functioning	192.9**	16.1**	98.0**	6.4	157.1**	7.7	184.2**	3.6
Symptoms of poor physical health	61.4**	6.0	74.0**	6.7	61.4**	8.7*	94.2**	2.6
Symptoms of depression	43.1**	2.0			24.4**	1.7		
Physical health assessments			7.9	1.9			3.0	1.9
N	1,798		2,396		1,729		2,041	

* p <.05, ** p<.01. We present exponentiated coefficients (odds ratios) from a multinomial logistic regression in which the reference category is good self-reported health. Both self-reported health and the covariates are measured in the year indicated (either 1993 or 1997). Additional controls are included for age (specified as a piecewise linear spline with knots at 60 and 70), education (1-5 years, 6 years, and 7 or more years, relative to 0 years), per capita expenditures (a dichotomous indicator of whether per capita expenditures exceed the median), and urban (rather than rural) residence. The Chi-square statistics test the joint significance of groups of covariates.

Table 3: Odds of death by the end of the period for those reporting poor (rather than good) health at the beginning of the period

		1	2	3	4	5	6	7	N
Females	1993-1997	2.306	2.36	2.329	1.935	1.835	1.739		1,798
		(4.05)	(4.13)	(4.05)	(2.69)	(2.35)	(2.11)		
	1997-2000	2.008	2.026	1.941	1.555	1.541		1.530	2,396
		(4.04)	(4.09)	(3.8)	(2.41)	(2.31)		(2.27)	
	1993-2000	1.923	1.947	1.881	1.777	1.581	1.521		1,729
		(3.66)	(3.7)	(3.49)	(2.69)	(2.02)	(1.83)		
Males	1993-1997	2.497	2.53	2.395	1.417	1.282	1.328		1,729
		(5.27)	(5.31)	(4.95)	(1.64)	(1.12)	(1.27)		
	1997-2000	2.639	2.692	2.568	1.646	1.458		1.480	2,041
		(5.63)	(5.71)	(5.39)	(2.56)	(1.85)		(1.91)	
	1993-2000	2.765	2.828	2.733	1.692	1.511	1.51		1,679
		(6.84)	(6.92)	(6.64)	(2.9)	(2.18)	(2.14)		
Controls	Age[a]	Yes	Yes	Yes	Yes	Yes	Yes	Yes	
	Socioeconomic status[a]		Yes	Yes	Yes	Yes	Yes	Yes	
	Height and Body Mass Index[b]			Yes	Yes	Yes	Yes	Yes	
	Physical functioning[c]				Yes	Yes	Yes	Yes	
	Symptoms of poor physical health[d]					Yes	Yes	Yes	
	Symptoms of depression[e]						Yes	No	
	Physical health assessments[f]						No	Yes	

We present exponentiated coefficients for poor (relative to good) self-rated health at the beginning of the period, from a logistic regression in which the outcome is death (coded as one) rather than survival (coded as zero) by the end of the period. Z-statistics are included in parentheses. Each of the specifications introduces an additional set of controls relative to the previous specification. The Chi-square statistics test the joint significance of groups of covariates.

[a] Age, education, per capita expenditure, and residence are specified as described in Table 2.

[b] Height is included as a linear variable. Individuals are classified as falling into one of four BMI groups: <18.5, 18.5-24.9, 25-27.9, or 28+.

[c] Physical functioning indicators include dichotomous measures of difficulty walking 5 kilometers, carrying a heavy load, standing up from the floor, and dressing.

[d] Symptoms of poor physical health include dichotomous measures of experiencing respiratory difficulties, joint pain, and nausea or vomiting.

[e] Symptoms of depression include dichotomous measures of experiencing difficulty sleeping, fatigue, or sadness.

[f] Physical health assessments include an indicator of moderate hypertension and indicators for 3 groups of hemoglobin levels: <11 g/dl, 11-11.9 g/dl, >= 12 g/dl.

Table 4: Odds of death by the end of each period as a function of self-rated and other health status measures at the beginning of the period

	Females			Males		
	1993-1997	1997-2000	1993-2000	1993-1997	1997-2000	1993-2000
SRH (reference: good)						
Poor	1.739*	1.530*	1.521	1.328	1.480	1.51*
Excellent	0.72	0.36	1.209	1.233	1.094	1.435
Body Mass Index (reference: <18.5)						
18.5-24.9	0.887	0.657*	0.716	0.6*	0.506**	0.637**
25-27.9	0.958	0.385*	0.467	0.998	0.182**	1.083
28 or higher	0.902	0.715	1.273	1.5	0.364	1.083
Height (in cm)	1.008	1.014	1.012	0.979	0.977	0.985
Physical functioning						
Difficulty walking 5 kilometers	1.004	1.224	0.868	1.677*	1.376	1.31
Difficulty carrying a heavy load (eg. pail of water)	1.216	1.840*	0.834	1.613	1.764*	1.751*
Difficulty standing up from the floor	1.274	1.237	1.679	2.458	1.135	2.337
Difficulty dressing	1.313	1.286	1.675	1.125	2.696*	1.405
Symptoms of poor physical health						
Respiratory difficulties	1.635	1.329	2.167**	1.722*	2.063**	1.829**
Nausea	0.971	0.641	0.936	1.005	0.978	0.7
Joint pain	0.793	0.853	0.825	0.994	0.782	1.048
Symptoms of depression (last 4 weeks)						
Difficulty sleeping	1.208		1.14	0.831		0.766
Fatigue	0.923		1.246	0.99		1.168
Sadness	1.46		1.096	0.605		1.296
Physical health assessments						
Moderate hypertension		1.606*			2.442**	
Hemoglobin level (ref: >=12 g/dl)						
Hemoglobin < 11 g/dl		1.818**			1.429	
Hemoglobin 11-11.9 g/dl		0.995				
Chi-square statistics						
Height and Body Mass Index	0.51	10.02*	8.57	13.98**	19.90**	13.32**
Physical functioning	2.64	16.70**	6.47	25.54**	28.71**	27.25**
Symptoms of poor physical health	3.65	4.05	9.84*	5.98	15.32**	10.73*
Symptoms of depression	1.95		1.70	2.13		1.75
Physical health assessments		6.92*			16.78**	
N	1798	2398	1718	1728	2035	1679

* p <.05, ** p<.01. We present exponentiated coefficients for the indicators of health status (measured at the beginning of the period), from a logistic regression in which the outcome is death (coded as one) rather than survival (coded as zero) by the end of the period. Age, education, per capita expenditure, and residence are included as additional controls, specified as described in Table 2. The Chi-square statistics test the joint significance of groups of covariates.