NBER WORKING PAPER SERIES

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Working Paper 25304
http://www.nber.org/papers/w25304

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
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November 2018

Preparation of this paper was supported by a grant from the Norwegian Agency for Development Cooperation (QZA-0408 QZA-12/0628). The funders had no role in data collection and analysis, decision to publish, or preparation of the manuscript. The authors do not have any competing interests in the manuscript. The authors are grateful to Eda Algur for helpful research assistance. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research. The datasets generated and/or analyzed during the current study are available in the RAND Indonesia Family Life Surveys repository, https://www.rand.org/labor/FLS/IFLS.html

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NBER Working Paper No. 25304
November 2018
JEL No. I10,J13,J24

ABSTRACT

This paper investigates the economic returns to parental health. To account for potential endogeneity between parental health and child outcomes, we leverage longitudinal microdata from Indonesia to estimate individual fixed effects models. Our results show that the economic returns to parental health are high. We show that maternal health not only significantly affects her children's health, but is also intrinsically linked to her spouse's labor market status and earnings. Paternal health appears to be more linked to child schooling outcomes, especially for girls. When both parents are in poor health, the negative effects on their children are compounded. Additionally, the consequences of poor parental health are enduring. Longer-run effects of poor parental health manifest in a lower likelihood of high school completion, fewer years of schooling, and poorer adult health.

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I. Introduction

Scholars and policymakers increasingly recognize that health is important not only for its own sake, but also for its impacts on human capital development and economic well-being. Less recognized is how an individual's health may affect his or her family. Because the primary income earner has traditionally been the father—especially in developing country settings—some have surmised that paternal health may be the main determinant of familial well-being. Indeed, previous literature has shown that health shocks to the household head could have dire consequences for the family (Gertler and Gruber 2002). However, because mothers tend to be the primary caregiver in the family, maternal health arguably plays a role that is at least equally important. Mothers tend to allocate more household resources to investment in their children's human capital outcomes relative to fathers (Thomas 1990). In addition, the in-utero environment, which is strongly linked to maternal health, has been shown to be crucial in later life outcomes of the child (Almond and Currie 2011). Overall, evidence of widespread cross-generation transmission of health from mothers to children is mounting, although the mechanisms for transmission are not entirely clear (Bhalotra and Rawlings 2011).

This paper attempts to provide a more comprehensive picture of how maternal and paternal health affect household well-being. The main challenge of identifying the impact of parental health is the issue of endogeneity, i.e., parents who invest less in their own health may also invest less in their children's health and human capital outcomes. Unobserved factors, such as high discount rates or genetic factors, could influence both parental health and children's outcomes. We address this issue by utilizing individual fixed effects models in our main analysis and detailed longitudinal microdata from Indonesia.

Our analysis shows both paternal and maternal health are significant influences on household welfare. First, we show that—consistent with studies from other settings—own health matters. Regardless of gender, each parent's health is significantly linked to his or her own labor market activity and earnings. Next, we examine how parental health matters for other members of the family. We show that maternal health not only affects her children's health, but is also intrinsically linked to her spouse's labor market status and earnings. Paternal health appears to be more linked to child schooling outcomes, especially for girls. However, child schooling outcomes are substantially and negatively affected when both parents suffer health shocks, suggesting that the role of maternal health cannot be discounted either. Health shocks to the father negatively affect aggregate household consumption, particularly for food and education expenditures. Because the dataset we use follows individuals over time, even after they have left their nuclear households, we can also explore the longer-term effects of parental health. These results suggest that the long-run effects of poor parental health may be far-reaching, resulting in lower educational attainment and poorer adult health for their children.

To our knowledge, this paper is the first to demonstrate both the short- and longer-run consequences of both maternal and paternal health on important health and human capital outcomes. Our results show that the economic returns to parental health are high. Consistent with previous literature, an individual's health matters significantly for his or her capital outcomes, such as earnings and labor force participation. Moreover, the spillover effects on the rest of the household are substantial. Both parents' health plays an important role in a child's human capital production. From a public health perspective, the findings of this paper suggest that policymakers should consider these complex and substantial spillover effects when designing health interventions.

The rest of the paper proceeds as follows: Section II briefly surveys the related literature. Section III describes the data and identification strategy. Section IV reports and discusses the findings. Sections V offers alternative health measures as robustness checks. Section VI presents our conclusions.

II. Related literature

In developing countries where insurance and access to credit are limited, unexpected health shocks can be financially devastating. A broad extant literature examines the extent to which households can manage these risks ex-ante and consumption smooth ex-post. Gertler and Gruber (2002) focus on understanding households' ability to insure their consumption against illness (rather than general income shocks) in a developing country context. Using data from the Indonesian Resource Mobilization Study (IRMS), the authors found that labor supply, earnings, and consumption are significantly and negatively associated with illness and hence reject the hypothesis of full insurance. Subsequent papers demonstrate similar conclusions using data from other countries ranging from Ethiopia (Asfaw and von Braun 2004; Dercon and Krishnan 2000) to Vietnam (Wagstaff 2007) to the Western Balkans (Bredenkamp et al. 2010).

These papers, which also reject the notion of consumption smoothing, have in turn inspired another branch of literature that delves into the subsequent impact of such shocks on the household. Within this literature, several papers describe the impact of parental death. Gertler et al. (2004) analyze three repeated cross-sections of household data from Indonesia and find that a parent's recent death has a large negative effect on their child's school enrollment, irrespective of the gender of the child or the parent who dies. Case and Ardington (2006) and Chen et al. (2009) also show that maternal death has a large negative impact on child education using data from sub-Saharan Africa and Taiwan, respectively.

A related vein of literature examines the impact of the prenatal environment on child outcomes. Drawing from the "fetal origins hypothesis" (Barker 1995)—which posits that fetal malnutrition could lead to poor adult health outcomes—this literature investigates the long-run significance of the in-utero environment. Almond (2006) shows that children who were exposed in utero to the influenza pandemic of 1918 grew up to attain fewer years of schooling. Natural experiments utilizing in-utero exposure to famines also show that poor nutrition in utero is associated with worse adult health and human capital outcomes (Almond et al. 2007; Chen and Zhou 2007; Neelsen and Stratmann 2011).

Fewer papers focus on the impact of morbidity, in part due to the endogenous nature of illness. In other words, whether any observed correlations between parental health and child outcomes are causal, or due to some other unobserved factors that affect both variables, is unclear. In the context of morbidity, poor parental health could have multipronged impacts. There may be direct out-of-pocket medical expenditures to treat the ill, in addition to indirect costs due to potential lost wages from fewer days at work and/or lower productivity. Other members of the household may have to take time off from work or school to care for the sick, potentially compounding the income loss. There could be psychological costs from having a sick parent; the quantity and quality of time spent by the ill parent with the children could be compromised as well. Household resources may be diverted from other expenditures (such as schooling) to medical expenses in response to the negative income shock (Frankenberg et al. 2003; Jacoby and Skoufias 1997).

Our paper further explores the impact of both parents' health on the family. To combat potential endogeneity bias, we utilize individual fixed effects to exploit changes in parents' health status over survey waves. To our knowledge, there are only two other papers that utilize a similar empirical strategy. First, Bratti and Mendola (2014) employ panel data from Bosnia and Herzegovina to investigate the effect of parental morbidity on child school enrollment. That paper shows that a young adult (age 15–24) with an ill mother but healthy father is significantly less likely to be enrolled in school. Second, Alam (2015) use longitudinal data from Tanzania to find that—in contrast to Bratti and Mendola (2014)—only father's illness reduces children's education by decreasing their attendance. In this paper, we build upon the existing literature to examine the impact on parental health on their own as well as each other's health and labor market activity, in addition to their children's health and educational attainment. Furthermore, because the IFLS (Indonesian Family Life Survey) follows families over time (even children after they are grown and split from their original family), we can examine short-term outcomes, such as school enrollment and child health, and longer-term outcomes, such as educational attainment. The results demonstrate that interventions that improve the health of a single generation could potentially produce multigenerational effects.

III. Data description and identification strategy

III.A. IFLS (Indonesian Family Life Survey)

For this study, we use data from the IFLS, a nationally representative longitudinal survey covering rural and urban areas. This dataset gives a nationwide sample of households spreading across 13 of 26 provinces and represents about 80 percent of the country's population. The IFLS contains a wealth of socioeconomic and demographic information about each household and detailed individual-level information on health status, education, and labor market behavior. The first wave of the survey was conducted in 1993 (IFLS1), with three more waves conducted in 1997 (IFLS2), 2000 (IFLS3), and 2007 (IFLS4) (Frankenberg et al. 1993, 1997; Strauss et al. 2000, 2007). Importantly, the survey not only re-interviews original households sampled in the previous wave, but also all households split off from the original households. This allows us to identify the health status of parents, contemporaneous or short-run effects on their children within the same wave, and longer-term effects (such as children's income and schooling) even after they become adults and split off into separate households. Further, tracking rates across waves are very high, alleviating attenuation bias due to nonrandom attrition: 94 percent of IFLS1 households participated in IFLS2, 95.3 percent in the IFLS3, and 81.7 percent in the IFLS4 14 years later.

In 2014, Indonesia began rolling out an ambitious universal health care program, aiming to cover all citizens by 2019.[1] Before 2014, social safety nets and formal health insurance were limited and high out-of-pocket health expenditures were common, hence providing an archetypal setting to study the impact of morbidity on the household in a lower-middle-income country (Rokx et al. 2009).

We measure health throughout the paper in two ways. First, we use self-reported health status. Respondents above age 15 were asked to self-assess their health in response to the question, "Generally, how is your health?" and choose among the following four categories: very healthy, somewhat healthy, somewhat unhealthy, and unhealthy. Parents were asked to choose among the same categories regarding their children's health if the children were under the age of 15. Our definition of child health is the parents' assessment of their children's health as reported in the IFLS. We define an individual to be in poor health if he or she chooses somewhat unhealthy or unhealthy. The IFLS also asked questions regarding physical functioning abilities to perform activities of daily living (ADLs); among the ADL options, we chose to employ the

[1] http://www.eiu.com/industry/article/1071418091/indonesia-launches-universal-healthcare/2014-01-13.

metric of a respondent finding it difficult or impossible to walk 5 km as our second marker of poor health.[2]

Table 1 reports the summary statistics of the key variables we use. In the entire sample, self-reported poor health is observed in around 13 percent of respondents. Twenty-six percent of the sample report that they have difficulty walking 5 km. Note that while we have basic demographic data for around 177,000 individuals over the four survey waves, the number of observations available for the different regression models varies greatly depending on the specification. For example, we have 51,479 matched observations where values of spousal health are present and close to 80,000 observations where the mother's health can be matched with the individual. For many regressions, we further restrict by age (e.g., if the dependent variable is child health). Within these restricted samples, more observations may be dropped due to lack of other information of dependent variables or other key control variables. Tables 1–8 and Appendix Tables 1–5 report the number of observations used in each model.

III.B. Econometric specifications

The primary challenge of identifying the impact of health on human capital outcomes is the issue of endogeneity—how to rule out spurious correlation from causality. For example, health of children and their parents may correlate due to unobserved factors that lead parents to engage in health-damaging behaviors (such as smoking), which may result in poor health, which

[2] We also experimented with measuring health using the RAND ADL index. This index comprises the ability of the respondent to do five intermediate activities of daily living, including walking 5 km; bowing, squatting, or kneeling; carrying a heavy load for 20 meters; sweeping house/floor/yard; and drawing a pail of water from a well. The ADL index is then normalized to 100 using the following formula: [Max Score − Sum(Score)]/(Max Score − Min Score) × 100. In the case of the IFLS, responses can take a value of 1if the respondent can achieve the task easily, 3 if he or she can do it with difficulty, and 5 if he or she cannot do it at all. Hence the max score is 25 (if the respondent cannot do any of the activities) and the minimum score is 5 (if the respondent can do all five tasks easily). When translated into the ADL index, a score of 100 would imply the individual can complete all tasks easily, and a score of 0 would mean the individual cannot carry out any of the tasks. Results are qualitatively similar and are available upon request.

may further result in the parent investing less in their children's health and human capital. Because the IFLS follows individuals and families over time, we can employ individual fixed effects, which relies on variation in the health status of an individual child's parent, to identify the impact of parental health.

More formally, we use the following regression models to examine the effects of parental health. When we examine the impact of own health, the regression model is simply:

$$(1)\ \ S_{it} = \beta_0 + \beta_1 PoorHealth_{it} + \boldsymbol{M'}_{it}\boldsymbol{\theta}_1 + \boldsymbol{F'}_{it}\boldsymbol{\theta}_2 + \boldsymbol{H'}_{it}\boldsymbol{\theta}_3 + \rho_i + \gamma_t + \varepsilon_{it}$$

where S_{it} is the outcome of interest of either the father or mother in year *t*. In these regressions, the outcomes include the parent's own labor force participation, hours worked, and earnings, and $PoorHealth_{it}$ measures whether the parent was in self-reported poor health in year *t*.

When we examine the impact of parental health on other members of the family, the regression model becomes:

$$(2)\ \ S_{it} = \beta_0 + \beta_1 Spouse\_PoorHealth_{it} + \boldsymbol{M'}_{it}\boldsymbol{\theta}_1 + \boldsymbol{F'}_{it}\boldsymbol{\theta}_2 + \boldsymbol{H'}_{it}\boldsymbol{\theta}_3 + \rho_i + \gamma_t + \varepsilon_{it}$$

where S_{it} is the outcome of interest of either the father or mother in year *t*. In these regressions, the outcomes include the parent's labor force participation, hours worked, earnings, and whether the parent was in poor health. $Spouse\_PoorHealth_{it}$ captures whether the spouse was in self-reported poor health in year *t*.

When we investigate the cross-generational effects of parental health, the regression model is represented as follow:

$$(3)\ \ S_{it} = \beta_0 + \beta_1 Mother\_PoorHealth_{it} + \beta_2 Father\_PoorHealth_{it} + \boldsymbol{M'}_{it}\boldsymbol{\theta}_1 + \boldsymbol{F'}_{it}\boldsymbol{\theta}_2 + \boldsymbol{H'}_{it}\boldsymbol{\theta}_3 + \rho_i + \gamma_t + \varepsilon_{it}$$

where the outcomes of interest include child schooling, cognitive scores, and health measures. $Parent\_Health_{it}$ represents the mother and father's self-reported health in year *t*.

In all three models, we also include vectors of maternal ($\boldsymbol{M'_{it}\theta_1}$), paternal ($\boldsymbol{F'_{it}\theta_1}$), and household ($\boldsymbol{H'_{it}\theta_1}$) characteristics. γ_t represents survey year fixed effects, which help absorb any overall changes in such outcomes over time; for example, overall child health may have improved in Indonesia between 1993 and 2007 due to nationwide improvement in health care, or the 1997 Indonesian economic crisis could have led to disruptions in household income across the country. ρ_i represents individual fixed effects. Hence, any time-invariant factors, such as child genetic endowments or parental attitudes to health, are accounted for in our fixed effects estimation.[3] ε_{it} represents the idiosyncratic error term.

To examine longer-run effects, we enter lagged parental health in Equation 3. Since own health and human capital outcomes may have persistent effects extending to subsequent waves (independent of parental health), we also control for the lagged outcome. However, since the lagged outcomes may also be endogenous to the fixed effects in the error term, using fixed effects models without accounting for such dynamic effects may also lead to biased and inconsistent estimates. We hence use the Arellano-Bond estimator to allow for the potential lagged effects of own health and schooling, while taking into account individual fixed effects (Arellano and Bond 1990, Blundell and Bond 1998).[4]

IV. Results

Our analysis aims to investigate how much a person's health matters for him- or herself, and for his or her family. To answer this question, we begin by investigating the impact of own health. Next, we examine the impact of spousal health. We then explore how parental health affects their children's health and schooling and delve into how paternal and maternal health

[3] Because our fixed effects model exploits changes in health status, it precludes examining the impact of long-term chronic illnesses.
[4] We use the user-written Stata routine xtabond2 by Roodman (2003) to perform these estimations.

differ in their impact. Finally, we examine the long-run effects of parents' health on their children's educational attainment.

IV.A.   Effects of own health

We start the analysis by investigating the impacts of own health. In Table 2 and all following tables, the odd-numbered columns report the results from OLS (ordinary least squares) regressions and the even-numbered columns report the results from fixed effects (FE) models. Table 2, column 1 shows that self-reported health status strongly correlates with whether the respondent worked last week. Reporting poor health is associated with an almost 9 percent reduction in the probability of working last week (Panel A, column 1). The estimate is smaller at 6.3 percent, but still highly significant when using fixed effects (Panel A, column 2), suggesting that unobserved factors that cannot be captured led to a higher likelihood of both poor health and of not working. In other words, the omitted variable biased the estimate downward (or increased the absolute magnitude of the effect). In our preferred FE specification, poor health is associated with an 8.7 percent reduction in the likelihood of being at work last week for men (Panel B, column 2). Given that the mean rate of reporting working last week is 76 percent among men in this cohort, this roughly translates into an 11 percent reduction. For women, poor health leads to a 4.5 percent cohort, or 10 percent realized, reduction in the likelihood of working last week (Panel C, column 2).

Poor health is also associated with fewer hours of work for those who reported working last week. In our preferred FE model, poor health is associated with working around four fewer hours in a week, and the effect is statistically significant at 1 percent. The effects for men and women are similar: working hours drop by four hours for men and five hours for women (Table 2, column 4).

Indeed, the reductions in labor force participation and hours worked translate into lower earnings. Men's wages primarily drive this effect (columns 5 and 6). For women, the coefficient on poor health is negative but not statistically discernible from zero. This may, however, be driven by selection, as fewer women participate in the formal labor market.[5]

These results demonstrate that health matters for labor force participation on both intensive and extensive margins, which in turn affects earnings. These findings are consistent with the existing economic literature that health indeed is causally linked to labor market outcomes in both developed and developing countries (Coile 2004; Gertler and Gruber 2002; Thirumurthy et al. 2008).

IV.B. Effects of spousal health

We next examine the spillover impact of spousal health on own health and labor force status. Phrased differently, how does one's health affect the human capital outcomes of one's spouse? Table 3 reports the results. The dependent variables are the same as in Table 2, while the main independent variable is whether the spouse self-reports being in poor health. Overall, spousal health appears not to have a discernible impact on the probability of working last week (Panel A, columns 1 and 2). However, when we examine by gender, poor spousal health negatively impacts men's labor force participation by around 1.6 percent (Panel B, column 2). Hours worked last week are also reduced by 1.3 hours (Panel B, column 4). Interestingly, for women, the effect goes in the opposite direction: they are more likely to have worked last week if their spouse is sick—although the estimate is not statistically significant. These women are presumably drawn into the workforce to make up for lost spousal earnings, i.e., the so-called

[5] Reverse causality may be of concern here, i.e., being out of work leads to lower income and poorer health. However, when we examine whether lagged values of work status affect future health, we find that that is not the case. These results are available upon request.

“added worker” effect. Overall, earnings are negatively affected as well (columns 5 and 6). Our results on spousal health and labor market responses are mostly in line with the existing literature. Using data from the Netherlands, García-Gómez et al. (2013) find that a negative health shock reduces men’s labor force participation by 1.5 percent, but similarly to our findings do not find strong evidence of the “added worker” effect. Charles (1999) and Coile (2004) use data from the Health and Retirement Survey for the US and document similar findings.

Health between spouses correlates very strongly, both cross-sectionally and when employing fixed effects (columns 7 and 8). Hence, not only time use (taking time off to care for the sick spouse) may affect labor productivity, but the spouse’s health may also have a direct impact on own health. Several studies note the concordance of spousal health, although the precise reasons are not clear (Wilson 2002; Clark and Etilé 2005). A few potential explanations for the phenomenon have been put forth. The first is assortative matching—i.e., people with similar health statuses match with each other in the marriage market. Clark and Etilé (2005) argue that assortative matching is the key reason for concordance in health in their study. The second possible explanation is that couples may undergo similar lifestyle changes that affect their health in similar ways. For example, couples may quit smoking or begin to exercise more at the same time. Finally, couples may experience the same health shocks (for example, couples may catch the same illnesses), so that health between spouses moves together.

To better understand the relationship of health between spouses, we utilize the 2007 IFLS wave, in which respondents were asked whether they were in an accident that limits or hinders their daily activities. We first show that being in an accident significantly increases the likelihood that the respondent reports being in poor health or having difficulty walking 5 km. Then we instrument spousal health by being in an accident to examine the impact of the spouse’s poor health on own health. We restrict the sample to those who were *not* in an accident together, i.e., we exclude respondents who were in the same accident (such as a car accident) as their spouse. In other words, these couples did not experience the same health shock. For the instrumental variable strategy to be valid, we need to satisfy both the requirement of a strong first stage and the exclusion restriction. As Table 4, Panel A demonstrates, our instrument―being in an accident that hinders or limits activity―has considerable explanatory power, with F-statistics generally well above 10. Given the nature of accidents, we argue that this type of health shock can be viewed as exogenous. By excluding couples who were both in accidents in the same year, we further argue that the accident affects own health by worsening the spouse's health, hence satisfying the exclusion restriction. Doyle (2005) and Mohanan (2013) employ a similar strategy of using accidents to instrument for health shocks. The OLS results echo the strong interspousal health correlations observed in Table 3, Panel C. However, our reduced form (Panel B) and IV estimates (Panels D and E) in Table 4 are not statistically significant, which precludes our ability to make any claims about whether spousal health is causally linked to own health. The lack of clear results suggests that spousal health may be linked for other reasons, such as correlated health shocks or concordant changes in health behaviors.

IV.C. Effects of parental health on the schooling and health of young children

We next focus on how parental health matters for their children's human capital outcomes. During our sample period in Indonesia, elementary schooling and three years of secondary schooling were compulsory. We hence divide our sample into children between ages 6 and 15, to represent the compulsory period, and youth between ages 16 and 25. Among the sample of children, poor parental health is strongly correlated with the child not being enrolled in school (Table 5, column 1). However, when we include child fixed effects, the negative effect is no longer statistically significant, suggesting that omitted variable biases or selection may be responsible for the OLS results. In our fixed effects models, poor paternal health appears to negatively affect girls' school enrollment by 4 percent, but not that of boys (column 2, Panels B and C). This could potentially be a consequence of son preference: when household income falls due to the household head being ill, daughters are typically pulled out of school before sons. (Björkman-Nyqvist 2013).

While school attendance is not much affected, parental health appears to be closely linked to child health. Interestingly, while the health of both parents is closely correlated with child health when we look at the OLS model (column 3), the coefficient on paternal health is no longer statistically significant when we use individual fixed effects, whereas the maternal health coefficient remains similar and highly significant (column 4). Poor maternal health increases the likelihood of poor child health by 5–6 percent. Both parents in poor health also increases the probability of poor child health by 9 percent when we use fixed effects (column 4). The difference between the OLS and FE models suggest that unobserved characteristics indeed influence both parental health and child health. However, maternal health matters more for child health in the short run.

We look at two other human capital metrics: height for age (z-score) and cognitive score. OLS results show strong correlations between paternal health and height for age, and the relationship largely still holds when looking at fixed effects (column 5). For this metric, paternal health appears to matter more—overall, poor paternal health reduces height for age by 0.09 standard deviations. Because an important determinant of height is nutrition, a negative health shock to the father may reduce household income and in turn lower food consumption and nutrition levels. We will return to this hypothesis shortly.

Parental health also strongly correlates with their children's cognitive scores (column 7). Beginning in the second wave of IFLS, respondents between the ages of 7 and 24 were administered cognitive tests to assess their general cognitive level and skills in mathematics. Having a parent in poor health is associated with around a 6 percent lower cognitive score for both girls and boys. However, both the magnitude and statistical significance of the estimates fall when using fixed effects (column 8), suggesting again that uncaptured factors lead to poor health in parents and lower cognitive scores in their children. That said, the coefficient on maternal health remains negative and statistically significant for girls (Panel C, column 8).

IV.D. Effects of parental health on the schooling and health of youth

We then move on to examine the impact of parental health on youth between the ages of 16 and 25. For older children who are beyond the age of compulsory schooling, the impact on school enrollment appears to occur when both parents are in poor health (Table 6, column 2). The youth's own health is strongly linked to maternal health and having both parents in poor health compounds the effect (column 4). Parental health does not significantly affect height for age in this cohort (column 6). One of the largest observed effects of our analyses involves girls' cognitive scores, which are substantially more affected by parental (especially paternal) health. A negative health shock to the father leads to a 14 percent decrease in the daughter's cognitive score, and when both parents experience a negative health shock, the effect increases to 26 percent. These results compare to just a 1.3 percent decrease (ill father) and 0.3 percent decrease (both parents) for boys. This startling disparity suggests that parental health profoundly affects the quality and the quantity of girls' education (column 8).

Looking at the short-run effects of parental health, the most salient result is the effect of maternal health on overall child health, which persists from early childhood to young adulthood.

For the younger cohort, a child was much more likely to be in poor health if the mother was in poor health (5.8 percent) as opposed to the father (2.5 percent; Table 5, column 4). This finding is true for the older cohort, as a youth was much more likely to be in poor health if the mother was in poor health (3.8 percent) as opposed to the father (0.9 percent; Table 6, column 4). Paternal health matters significantly as well, resulting in lower height-for-age among daughters. Another striking result is that girls' cognitive scores, which we interpret as reflective of the quality of their education, seem to be more affected by parental health. Paternal health appears to matter for children's height (nutrition) and schooling for girls when they are young. For youth, the impact of parental health is significant only when both parents are in poor health, but that effect is large.

Our schooling results contrast with those of Bratti and Mendola (2014), who find that poor maternal health is a more important causal determinant of school enrollment than paternal health when examining youth between ages 15 and 24, but are consistent with Alam (2015), who demonstrate that paternal health shocks decrease children's school attendance. In a related vein, Case and Ardington (2006) use longitudinal data from South Africa and Kenya to show that maternal orphans are less likely to be enrolled in school and complete fewer years of school compared with paternal orphans. However, using the IFLS, Gertler et al. (2004) find that the death of both parents matters for child schooling outcomes. They find that maternal death is more significantly linked to child health measures, which is consistent with our results from table 5 that maternal health is more important for short run child health. Our results on maternal health are also in line with Coneus and Spiess (2012), whose findings using data from the German Socio-Economic Panel (SOEP) suggest that parental health tends to be transmitted to the child via the mother.

IV.E. Potential mechanisms

What are the channels through which parents' health influences their children's health and schooling? One possibility is that parents and children share similar genetic endowments. Another is that because parents and children live in the same environment, they experience the same household shocks or undergo behavior changes concurrently. Child fixed effects help ameliorate the first issue, because demeaning "subtracts" any time-invariant factors such as genetic endowments. The fact that we find stronger associations between maternal health and child health than paternal health suggests that the channel is through maternal care rather than correlated household health shocks.

Another potential channel is that medical expenditures divert funds from other household resources, such as consumption or education expenditures. We explore this hypothesis further in an ad hoc analysis of how parental health affects various household expenditures, including expenditures on food, nonfood (including medical expenditures), education, and vice goods such as cigarettes and alcohol (Table 7). Since the unit of variation is now at the household level, we employ household fixed effects in the FE models, and standard errors are clustered at the household level.

We find that food expenditures are not significantly affected when only one of the parents is in poor health. However, expenditures on food fall by 11 percent when both parents are in poor health (Column 2). At the same time, nonfood expenditures, which include medical expenditures, increase 12–14 percent if either parent is sick. Education expenditures per household member fall almost 16 percent when the father is sick, but not the mother (Column 6). Interestingly, when the father is sick, spending on vice goods (cigarettes, alcohol, and betel nuts) goes down by 25 percent, but goes up when the mother experiences a health shock, suggesting that when maternal bargaining power is reduced (which it presumably is when she is in poor health), spending may be diverted to non-child related goods (Column 8). Overall, parental health shocks, and especially health shocks to the father, may indeed negatively impact household food and education expenditures, which could lead to the observed effects on child schooling and health.

IV.F. Longer term effects of parental health

Finally, we assess the longer-term impacts of parental health. To do this, we examine the relationship between lagged parental health and human capital outcomes. Because the first wave of the IFLS was in 1993 and the most recent wave in 2007, the maximum number of years between the waves is 14, meaning that a 13-year-old child in 1993 would be 27 in 2007. We provide suggestive evidence of the longer-term impacts of parental health. Having both parents in poor health in the previous survey wave leads to a 2.3 percentage point reduction in the likelihood of being in school. Educational attainment is similarly negatively affected by parental health. Children with both parents in poor health in the previous wave achieve 0.19 fewer years of schooling (column 4). For high school completion, paternal health matters independently, and the impact is magnified when both parents are in poor health (column 6). Finally, the effects of parental health can be far reaching: lagged maternal and paternal health – independently and jointly – affect own health even after controlling for lagged own health (column 8). Having either parent in poor health during the last wave increases the likelihood of poor health by approximately 3 percentage points. Having both parents in poor health doubles the likelihood of poor health by an increase of 6 percentage points.[6]

[6] Results restricting the sample to those who are 18 or above and below 50 at the time of their last appearance in the panel show similar results.

V. Using alternative health measures as a robustness check

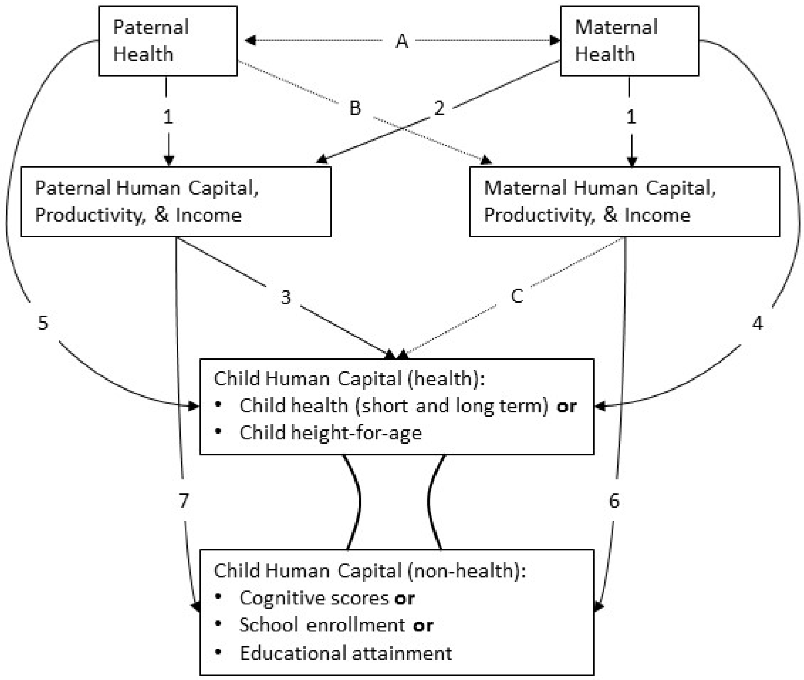
As a robustness check, we use alternative health measures instead of self-reported health—specifically, the ability to perform activities of daily living (ADLs). Using self-reported health status can be problematic because of its subjective nature, which may lead to measurement error. In that case, attenuation bias affects both the OLS and the fixed effects estimators, leading to a lower-bound estimate of the parental health shock. While ADL measures are still self-reported, they are generally considered more reliable measures of health due to their specific and more objective nature and have been used in several economic studies (e.g., Gertler and Gruber 2002; Strauss et al. 1997). However, because observations with ADL indicators are fewer, we rely on self-reported health in the main analysis. Following the literature, we chose the ability to walk 5 km as the main ADL metric. Appendix Tables 1–5 report these findings. Consistent with our main results, we find that poor parental health is strongly linked to poor child health. As before, paternal health is more significantly linked to schooling outcomes, whereas maternal health is more linked to child health.

VI. Conclusion

In this paper, we explore how parental health affects the family. Our findings suggest that the economic returns to parental health are high, and the intrafamilial health relationship is complex. Figure 1 recapitulates the myriad results and highlights the various pathways through which parental health affects the household. The numbered captions below the figure describe the result that supports the associated numbered arrow in the figure. Solid lines represent causal pathways for which the paper provides evidence. Dotted lines represent theoretical causal pathways that are not evidenced by these analyses and are described by the corresponding alphabetized captions.

The results of this paper further support the importance of investments in parental health and, in particular, maternal health in developing countries where underinvestment in, and discrimination against, mothers and daughters is systemic. The school enrollment of young girls—but not boys—is impacted by poor paternal health, which could be a reflection of son preference. Furthermore, a negative health shock to the father leads to a dramatic decrease in the daughter's cognitive score, a deficit for girls that nearly doubles when both parents experience a health shock. As the main income earner, a father's health largely determines the household budget constraint and resources, which in turn affect the children's schooling and some health outcomes. Paternal health shocks destabilize household spending: expenditures on medicine and medical care go up, while expenditures on food and education go down. These outcomes are reflected in our height for age and schooling results, including a dramatic drop in education spending per household member when the father is ill. Vice goods spending goes down when the father is sick but goes up when the mother is sick, which is consistent with a family structure wherein the onus is on the mother to ensure child health is a priority.

Figure 1: Causal Pathways from Parental Health to the Productivity of Children in Adulthood



1. Self-reported poor health decreases the probability of having worked, number of hours worked, and income earned in the last week (see: Section IV.A. and Table 2).
2. For men, poor spousal health reduces labor force participation and hours worked (see: Section IV.B and Table 3).
3. Poor paternal health reflects diminished paternal human capital and is associated with lower height-for-age (see: Section IV.C and Table 5).
4. Poor maternal health increases the likelihood of children being in poor health, in both short and long term (see: Section IV.C/IV.D/IV.F, and Table 5/6/8).
5. Lagged poor paternal health leads to poor child health, both independently and jointly with maternal health (see: Section IV.F and Table 8).
6. Negative shocks to maternal health have a negative impact on the cognitive scores of female children (see: Section IV.C and Table 5). Lagged poor maternal health is associated with a reduction in likelihood of completing high school and years of education. (see: Section IV.E and table 8).
7. Having a father in poor health negatively impacts girls' school enrollment but may not significantly impact boys' school enrollment (see: Section IV.C and Table 5). Cognitive scores of female youth are positively associated with paternal health in fixed effects (FE) models (see: Section IV.D and Table 6). Household expenditures on education are reduced when the father in the household is sick (Table 7). Lagged poor paternal health is associated with reduced educational attainment (Table 8).

A. Health among spouses is very strongly correlated, both cross-sectionally and when employing fixed effects (see: Section IV.B and Table 2). However, reduced form and instrumental variable estimates fail to show a statistically significant impact of spousal health on individual health, precluding the ability to make a statement about the causal nature of this relationship (see: Section IV.B and Table 4).

B. FE regressions show that women’s labor force participation increases in response to their spouse experiencing a negative health shock, but this result is not statistically significant (see: Section IV.B and Table 3).
C. Poor maternal health reflects diminished maternal human capital but is not shown to result in a statistically significant decrease in height-for-age (see: Section IV.C and Table 5).

And indeed, despite the relationship of paternal health and child capital outcomes, we found maternal health to be the predominant factor, in terms of short run child health. As the primary caregiver of the family, the mother’s health matters contemporaneously for child health through young adulthood. Our results demonstrate that poor maternal health increases the likelihood of poor child health. Further, the health of both parents matters greatly throughout their children’s life trajectories in complementary ways. The negative effects are compounded when both parents are in poor health. Additionally, the consequences of poor parental health are persistent. Longer-run effects of poor parental health manifest in a lower likelihood of high school completion, fewer years of schooling, and poorer health. Although we did not measure it in this paper, there is growing evidence documenting the relationship between child human capital (both health and non-health) and productivity and income of children in adulthood, so the impacts of parental health could be even more extensive. Our paper highlights the need for more research on understanding the interplay of intrafamilial health and the mechanisms through which parental health matters, as the data suggests there are unobserved factors at play that have yet to be captured. Further cost-benefit analyses of health interventions should take into account the spillover effects of individual health on other household members.

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Table 1 – Summary statistics of key variables

Variable	Mean	Std. Dev.	Min	Max	# of Obs.
Age	27.92	19.32	0	99	177,204
Male (%)	0.49	0.50	0	1	178,987
Hindu (%)	0.04	0.20	0	1	176,063
Worked last week (%)	0.60	0.49	0	1	82,755
Hours worked last week	38.72	23.23	0	168	56,283
Salary last month (rupees)	526.95	1781.57	0	182000	25,565
Attends school (age 6 to 15) (%)	0.83	0.38	0	1	25,347
Attends school (age 16 to 25) (%)	0.25	0.43	0	1	39,421
Poor health (age 6 to 15) (%)	0.09	0.28	0	1	35,524
Poor health (age 15 to 65) (%)	0.12	0.32	0	1	81,701
Difficulty in walking 5 km (%)	0.26	0.44	0	1	69,150
ADL index (out of 100)	93.28	14.66	0	100	69,138
Urban (%)	0.50	0.50	0	1	161,848
Household size	6.41	2.98	1	39	161,856
Age of spouse	41.98	14.00	0	99	60,804
Spouse completed high school (%)	0.13	0.34	0	1	51,479
Spouse ADL index (out of 100)	0.94	0.13	0	1	45,703
Age of mother	42.48	12.89	0	99	92,971
Mother completed high school (%)	0.17	0.38	0	1	92,421
Mother in poor health (%)	0.15	0.36	0	1	79,865
ADL index of mother (out of 100)	91.69	14.64	0	100	68,736
Age of father	46.17	12.50	15	99	79,283
Father completed high school (%)	0.20	0.40	0	1	79,572
Father in poor health (%)	0.13	0.34	0	1	65,353
ADL index of father (out of 100)	95.86	12.15	0	100	58,476
Cognitive Score	56.11	24.36	0	100	32,303
Height z-score	-0.05	1.00	-19.8	11.1	101,015

Notes: Summary statistics of parental variables are calculated for individuals under age 25. Summary statistics for labor force participation variables are calculated for individuals between ages 15 and 65. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Table 2 – Effects of own health on labor force participation and wages

	(1)	(2)	(3)	(4)	(5)	(6)
	Worked last week		Hours worked last week		Earnings last month, logged	
Panel A: All	OLS	FE	OLS	FE	OLS	FE
Poor Health	-0.088***	-0.063***	-3.0495***	-4.3896***	-0.1482***	-0.0905*
	(0.008)	(0.013)	(0.4569)	(0.6046)	(0.0458)	(0.0522)
# of Obs.	30098	30098	30713	30713	12633	12633
Panel B: Males						
Poor Health	-0.111***	-0.087***	-3.281***	-3.9575***	-0.1806***	-0.1067*
	(0.008)	(0.010)	(0.5276)	(0.7483)	(0.0485)	(0.0640)
# of Obs.	16018	16018	19740	19740	9263	9263
Panel C: Females						
Poor Health	-0.055***	-0.045**	-2.8169***	-5.0347***	-0.1057	-0.0377
	(0.012)	(0.02)	(0.7252)	(1.0298)	(0.0770)	(0.0886)
# of Obs.	14080	14080	10973	10973	3370	3370

* significant at 10% ** significant at 5% *** significant at 1%
Notes: Each cell represents a separate regression. Sample includes individuals between ages 15 and 65. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, household size, urban, highest education completed, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Table 3 – Effects of spousal health on labor force participation, wages, and health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Worked last week		Hours worked last week		Earnings last month, logged		Poor Health	
Panel A: All	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Spouse in poor health	0.0038	-0.0016	-0.2640	-0.7661*	-0.0514	-0.0819*	0.1087***	0.0776***
	(0.0064)	(0.0073)	(0.4016)	(0.5509)	(0.0428)	(0.0463)	(0.0062)	(0.0064)
# of obs.	43887	43887	20274	20274	12891	12891	43220	43220
Panel B: Males								
Spouse in poor health	-0.0143**	-0.0164**	-0.6546	-1.3232***	-0.0210	-0.0709	0.1036***	0.0709***
	(0.0059)	(0.0077)	(0.5808)	(0.6677)	(0.0464)	(0.0522)	(0.0065)	(0.0085)
# of obs.	21438	21438	15576	15576	9162	9162	20946	20946
Panel C: Females								
Spouse in poor health	0.0203**	0.0155	-0.8186	1.0568	-0.1351	-0.1193	0.1149***	0.0848***
	(0.0102)	(0.0124)	(0.8167)	(0.9665)	(0.0881)	(0.0989)	(0.0069)	(0.0096)
# of obs.	22449	22449	10542	10542	3729	3729	22274	22274

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Each cell represents a separate regression. Sample includes individuals between ages 15 and 65. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, spouse's age, spouse's age squared, spouse's religion, spouse's highest completed schooling level, household size, urban, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Table 4 – Is spousal health causally linked to own health?

	(1)	(2)	(3)	(4)	(5)	(6)
	Spouse is in poor health			Spouse has difficulty walking 5 km		
Panel A: First Stage	All	Males	Females	All	Males	Females
Spouse was in an accident	0.0700***	0.0700***	0.0698***	0.3454***	0.3363***	0.1477***
	(0.0208)	(0.0208)	(0.0225)	(0.0798)	(0.1103)	(0.0454)
	In Poor Health			Difficulty in walking 5 km		
Panel B: Reduced Form						
Spouse was in an accident	0.0171	-0.0509	0.0030	0.0875	0.0789	0.0413
	(0.0216)	(0.0571)	(0.0234)	(0.0832)	(0.1088)	(0.0520)
Panel C: OLS						
Spouse in poor health	0.0839***	0.0742***	0.0945***	0.2052***	0.1880***	0.2277***
	(0.0110)	(0.0150)	(0.0160)	(0.0134)	(0.0173)	(0.0209)
Panel D: 2SLS						
Spouse In Poor Health	0.2439	-0.1777	0.2272			
	(0.3127)	(0.2280)	(0.2980)			
Panel E: 2SLS						
Spouse has difficulty in walking 5 km				0.2837	0.2845	0.2529
				(0.2528)	(0.3300)	(0.3570)
# of obs.	11443	5357	6086	5764	2757	3007

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Each cell represents a separate regression. Sample includes individuals between ages 15 and 65. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, spouse's age, spouse's age squared, spouse's religion, spouse's highest completed schooling level, household size, urban, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Table 5 – Effects of parental health on child schooling and health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	School enrollment		Child in poor health		Height for age (z-score)		Ln(cognitive score)	
Panel A: All	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Only father in poor health	-0.0171**	-0.0136	0.0259***	0.0208	-0.0549**	-0.0905*	-0.0572***	-0.0463
	(0.0072)	(0.0130)	(0.0076)	(0.0155)	(0.0279)	(0.0549)	(0.0143)	(0.0349)
Only mother in poor health	-0.0133**	-0.0129	0.0580***	0.0554***	-0.0354	0.0052	-0.0589***	-0.0189
	(0.0064)	(0.0119)	(0.0084)	(0.0139)	(0.0248)	(0.0460)	(0.0134)	(0.0306)
Both parents in poor health	-0.0414***	-0.0147	0.1114***	0.0906***	0.0017	-0.0346	-0.0823***	0.0357
	(0.0143)	(0.0232)	(0.0194)	(0.0274)	(0.0529)	(0.0948)	(0.0247)	(0.0617)
# of obs.	20814	20814	14645	14645	14628	14628	13160	13160
Panel B: Males								
Only father in poor health	-0.0050	0.0117	0.0249**	0.0182	-0.0708*	-0.0913	-0.0528***	-0.0601
	(0.0094)	(0.0179)	(0.0097)	(0.0206)	(0.0416)	(0.0736)	(0.0197)	(0.0493)
Only mother in poor health	-0.0189**	-0.0226	0.0519***	0.0619***	-0.0569	0.0413	-0.0543***	0.0425
	(0.0086)	(0.0168)	(0.0089)	(0.0190)	(0.0371)	(0.0622)	(0.0182)	(0.0441)
Both parents in poor health	-0.0232	-0.0171	0.1098***	0.0515	0.0711	-0.0727	-0.0506	-0.0344
	(0.0169)	(0.0313)	(0.0177)	(0.0368)	(0.0754)	(0.1226)	(0.0370)	(0.0842)
# of obs.	10681	10681	7579	7579	7520	7520	6755	6755
Panel C: Females								
Only father in poor health	-0.0303***	-0.0446**	0.0280***	0.0272	-0.0397	-0.0966	-0.0622***	-0.0374
	(0.0097)	(0.0190)	(0.0101)	(0.0236)	(0.0404)	(0.0827)	(0.0204)	(0.0495)
Only mother in poor health	-0.0081	-0.0026	0.0650***	0.0494**	-0.0098	-0.0235	-0.0641***	-0.0866**
	(0.0090)	(0.0168)	(0.0096)	(0.0204)	(0.0368)	(0.0689)	(0.0192)	(0.0426)
Both parents in poor health	-0.0590***	-0.0072	0.1152***	0.1321***	-0.0649	0.0000	-0.1133***	0.1272
	(0.0171)	(0.0346)	(0.0184)	(0.0409)	(0.0686)	(0.1489)	(0.0369)	(0.0907)
# of obs.	10133	10133	7066	7066	7108	7108	6405	6405

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Every column in each panel represents a separate regression. Sample includes children between ages 6 and 15. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, household size, urban, father's age, father's age squared, father's religion, father's highest completed schooling level, mother's age, mother's age squared, mother's religion, mother's highest completed schooling level, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Table 6 – Effects of parental health on youth schooling and health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	School enrollment		Poor health		Height for age (z-score)		Ln(cognitive score)	
Panel A: All	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Only father in poor health	-0.0415***	0.0010	0.0333***	0.0099	-0.0642*	0.1583	-0.0922***	-0.0823
	(0.0138)	(0.0349)	(0.0106)	(0.0199)	(0.0387)	(0.4791)	(0.0253)	(0.0505)
Only mother in poor health	-0.0261*	-0.0493	0.0585***	0.0384**	-0.0311	0.3608	-0.0620***	-0.0172
	(0.0136)	(0.0344)	(0.0112)	(0.0174)	(0.0310)	(0.4612)	(0.0229)	(0.0433)
Both parents in poor health	-0.0502**	-0.1669***	0.0867***	0.1063***	0.0231	-0.3484	-0.0845*	-0.1252
	(0.0218)	(0.0601)	(0.0238)	(0.0339)	(0.0802)	(0.8078)	(0.0448)	(0.0901)
# of obs.	8465	8465	7798	7798	4628	4628	9135	9135
Panel B: Males								
Only father in poor health	-0.0460**	0.0066	0.0335***	0.0040	-0.0427	1.0868	-0.0992***	-0.0134
	(0.0198)	(0.0484)	(0.0127)	(0.0270)	(0.0516)	(0.6745)	(0.0308)	(0.0736)
Only mother in poor health	-0.0253	-0.0547	0.0488***	0.0655***	-0.0104	0.0715	-0.0592**	-0.0268
	(0.0196)	(0.0500)	(0.0122)	(0.0238)	(0.0507)	(0.8833)	(0.0296)	(0.0618)
Both parents in poor health	-0.0407	-0.1843**	0.0713***	0.0684	0.1423	0.2398	-0.0201	-0.0034
	(0.0332)	(0.0841)	(0.0222)	(0.0430)	(0.0888)	(0.9407)	(0.0540)	(0.1264)
# of obs.	4438	4438	3957	3957	2329	2329	4656	4656
Panel C: Females								
Only father in poor health	-0.0380*	-0.0033	0.0333**	0.0132	-0.0859	-0.8938	-0.0855**	-0.1439**
	(0.0209)	(0.0512)	(0.0141)	(0.0293)	(0.0543)	(0.9130)	(0.0347)	(0.0696)
Only mother in poor health	-0.0282	-0.0482	0.0699***	0.0144	-0.0526	0.7612	-0.0608*	0.0051
	(0.0203)	(0.0475)	(0.0139)	(0.0256)	(0.0509)	(0.6386)	(0.0335)	(0.0612)
Both parents in poor health	-0.0604*	-0.1446	0.1069***	0.1653***	-0.1050	-0.0145	-0.1609**	-0.2634**
	(0.0336)	(0.0879)	(0.0264)	(0.0542)	(0.0918)	(2.5367)	(0.0658)	(0.1292)
# of obs.	4027	4027	3841	3841	2299	2299	4479	4479

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Every column in each panel represents a separate regression. Sample includes individuals between ages 16 and 25. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, household size, urban, father's age, father's age squared, father's religion, father's highest completed schooling level, mother's age, mother's age squared, mother's religion, mother's highest completed schooling level, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Table 7 – Effects of parental health on household consumption

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Ln(Food expenditures per capita)		Ln(Non-food expenditures per capita)		Ln(Education expenditures per capita)		Ln(Vice goods expenditures per capita)	
	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Only father in poor health	-0.0412**	-0.0056	-0.0367	0.1446***	-0.2222**	-0.1588**	-0.2636***	-0.2454***
	(0.0188)	(0.0091)	(0.0360)	(0.0198)	(0.1069)	(0.0698)	(0.1021)	(0.0479)
Only mother in poor health	0.0176	0.0092	0.0386	0.1202***	0.0262	0.0301	0.4000***	0.2089***
	(0.0170)	(0.0088)	(0.0349)	(0.0191)	(0.0990)	(0.0671)	(0.0897)	(0.0461)
Both parents in poor health	-0.1230***	-0.1100***	-0.2400***	-0.0499	-0.3422*	-0.1483	0.0508	-0.0765
	(0.0380)	(0.0155)	(0.0903)	(0.0338)	(0.1982)	(0.1192)	(0.1512)	(0.0818)
# of obs.	52399	52399	52410	52410	52035	52035	52399	52399

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Every column represents a separate regression. Standard errors are clustered by household. Fixed effects are at the household level. Controls include gender, age, age squared, religion, household size, urban, father's age, father's age squared, father's religion, father's highest completed schooling level, mother's age, mother's age squared, mother's religion, mother's highest completed schooling level, and year dummies. Vice goods include alcohol, betel nuts, and cigarettes. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Table 8 – Longer run effects of parental health on human capital outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	In school		Years of schooling		Complete HS		Poor Health	
	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
Only father in poor health in last survey wave	-0.011*	-0.008	0.089	0.068	-0.015**	-0.037***	0.028**	0.030**
	(0.006)	(0.006)	(0.057)	(0.058)	(0.006)	(0.009)	(0.012)	(0.012)
Only mother in poor health in last survey wave	-0.009	-0.009	-0.052	-0.061	-0.011**	-0.0063	0.025**	0.028**
	(0.006)	(0.006)	(0.058)	(0.059)	(0.006)	(0.009)	(0.011)	(0.011)
Both parents in poor health in last survey wave	-0.027**	-0.024**	-0.136	-0.191*	-0.049***	-0.082***	0.057***	0.061***
	(0.011)	(0.011)	(0.098)	(0.099)	(0.010)	(0.015)	(0.021)	(0.022)
# of obs.	29500		27939		38280		8273	

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Every column in each panel represents a separate regression. Standard errors are clustered by person. Fixed effects are at the person level. GMM models are estimated using the Arellano-Bond (1991) dynamic panel estimator (p-values of AB-GMM models testing the null hypothesis that there is no second order autocorrelation can all be rejected). Controls include the lagged dependent variable, gender, age, age squared, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Appendix Table 1 – Using alternative health measures: effect of own health

	(1)	(2)	(3)	(4)	(5)	(6)
	Worked Last Week		Hours Worked Last Week		Ln(Salary Last Year)	
Panel A: All	OLS	FE	OLS	FE	OLS	FE
Difficulty walking 5 km	-0.0609***	-0.0351***	-1.2585***	-1.2251***	-0.0682*	-0.0060
	(0.0063)	(0.0079)	(0.3566)	(0.4294)	(0.0353)	(0.0400)
# of Obs.	37170	37170	37389	37389	15092	15092
Panel B: Males						
Difficulty walking 5 km	-0.0985***	-0.0931***	-2.9980***	-1.9032***	-0.0712	0.0965
	(0.0075)	(0.0105)	(0.4688)	(0.6167)	(0.0460)	(0.0581)
# of Obs.	19652	19652	23707	23707	10898	10898
Panel C: Females						
Difficulty walking 5 km	-0.0480***	-0.0195*	-0.0862	-0.9508	-0.1094**	-0.1134**
	(0.0081)	(0.0115)	(0.4689)	(0.6131)	(0.0472)	(0.0527)
# of Obs.	17518	17518	13682	13682	4194	4194

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Each cell represents a separate regression. Sample includes individuals from ages 15 to 65. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, household size, urban, highest education completed, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Appendix Table 2 – Using alternative health measures: effects of spousal health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Worked Last Week		Hours Worked Last		Ln(Salary)		Difficulty walking 5km	
Panel A: All	OLS	FE	OLS	FE	OLS	FE		
Spouse has difficulty walking 5 km	-0.0094*	-0.0001	-0.4946	-0.9907*	0.0529	-0.0359	0.1387***	0.1089***
	(0.0053)	(0.0065)	(0.4171)	(0.5276)	(0.0369)	(0.0387)	(0.0056)	(0.0069)
# of obs.	38361	38361	21801	21801	10224	10224	36685	36685
Panel B: Males								
Spouse has difficulty walking 5 km	-0.0118**	-0.0011	-0.5019	-0.7947	0.0841**	0.0116	0.1075***	0.0883***
	(0.0049)	(0.0063)	(0.4669)	(0.5920)	(0.0367)	(0.0421)	(0.0052)	(0.0070)
# of obs.	18234	18234	12521	12521	7204	7204	17677	17677
Panel C: Females								
Spouse has difficulty walking 5 km	-0.0048	0.0128	-0.0232	-1.0599	-0.0796	-0.3470***	0.2097***	0.1637***
	(0.0104)	(0.0123)	(0.8994)	(1.1135)	(0.0951)	(0.1026)	(0.0097)	(0.0129)
# of obs.	20127	20127	9280	9280	3020	3020	19008	19008

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Each cell represents a separate regression. Sample includes individuals between ages 15 and 65. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, spouse's age, spouse's age squared, spouse's religion, spouse's highest completed schooling level, household size, urban, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Appendix Table 3 – Using alternative health measures: effects of parental health on child schooling and health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	School enrollment		Child in poor health		Height for age (z-score)		Ln(cognitive score)	
Panel A: All	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Only father has difficulty walking 5 km	-0.0037	-0.0170	-0.0018	-0.0141	-0.1076**	-0.1243**	-0.0264	0.0034
	(0.0103)	(0.0164)	(0.0088)	(0.0160)	(0.0481)	(0.0630)	(0.0211)	(0.0442)
Only mother has difficulty walking 5 km	-0.0049	-0.0047	0.0165***	0.0198**	0.0120	-0.0091	-0.0136	0.0334
	(0.0052)	(0.0088)	(0.0050)	(0.0081)	(0.0184)	(0.0347)	(0.0119)	(0.0237)
Both parents have difficulty walking 5 km	-0.0257**	-0.0253	0.0339***	0.0316**	0.0358	-0.0040	-0.0228	0.0351
	(0.0116)	(0.0166)	(0.0108)	(0.0159)	(0.0293)	(0.0656)	(0.0197)	(0.0428)
# of obs.	17078	17078	10831	10831	10703	10703	9865	9865
Panel B: Males								
Only father has difficulty walking 5 km	0.0050	-0.0058	-0.0009	-0.0269	-0.0219	-0.0456	-0.0223	0.0041
	(0.0138)	(0.0235)	(0.0130)	(0.0220)	(0.0555)	(0.0893)	(0.0305)	(0.0627)
Only mother has difficulty walking 5 km	0.0008	-0.0106	0.0129**	0.0187*	0.0271	0.0043	-0.0094	0.0467
	(0.0074)	(0.0122)	(0.0065)	(0.0111)	(0.0288)	(0.0490)	(0.0163)	(0.0343)
Both parents have difficulty walking 5 km	-0.0133	-0.0214	0.0319**	0.0449**	0.0264	-0.0755	0.0008	0.0098
	(0.0142)	(0.0231)	(0.0129)	(0.0216)	(0.0569)	(0.0918)	(0.0289)	(0.0593)
# of obs.	8771	8771	5610	5610	8170	8170	5060	5060
Panel C: Females								
Only father has difficulty walking 5 km	-0.0131	-0.0266	-0.0020	-0.0005	-0.1929***	-0.2053**	-0.0322	0.0168
	(0.0138)	(0.0231)	(0.0138)	(0.0234)	(0.0512)	(0.0885)	(0.0317)	(0.0629)
Only mother has difficulty walking 5 km	-0.0111	0.0022	0.0203***	0.0210*	-0.0023	-0.0180	-0.0180	0.0236
	(0.0077)	(0.0126)	(0.0070)	(0.0119)	(0.0278)	(0.0490)	(0.0170)	(0.0330)
Both parents have difficulty walking 5 km	-0.0384***	-0.0294	0.0358**	0.0187	0.0475	0.0679	-0.0489	0.0602
	(0.0147)	(0.0239)	(0.0141)	(0.0237)	(0.0570)	(0.0934)	(0.0307)	(0.0623)
# of obs.	8307	8307	5221	5221	5206	5206	4805	4805

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Every column in each panel represents a separate regression. Sample includes children between ages 6 and 15. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, household size, urban, father's age, father's age squared, father's religion, father's highest completed schooling level, mother's age, mother's age squared, mother's religion, mother's highest completed schooling level, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Appendix Table 4 – Using alternative health measures: effects of parental health on youth schooling and health

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	School enrollment		Difficulty walking 5 km		Height for age (z-score)		Ln(cognitive score)	
Panel A: All	OLS	FE	OLS	FE	OLS	FE	OLS	FE
Only father has difficulty walking 5 km	-0.0199*	-0.0568***	0.0565***	0.0690**	-0.0114	-0.0472	-0.0204	0.0197
	(0.0106)	(0.0174)	(0.0168)	(0.0315)	(0.0417)	(0.1138)	(0.0208)	(0.0593)
Only mother has difficulty walking 5 km	0.0073	-0.0118	0.0948***	0.0996***	0.0100	0.0991	0.0096	0.0155
	(0.0074)	(0.0109)	(0.0101)	(0.0190)	(0.0236)	(0.0732)	(0.0127)	(0.0345)
Both parents have difficulty walking 5 km	-0.0266***	-0.0355**	0.1151***	0.1336***	-0.0475	-0.0876	-0.0435**	-0.0084
	(0.0095)	(0.0163)	(0.0154)	(0.0296)	(0.0379)	(0.1047)	(0.0189)	(0.0554)
# of obs.	17143	17143	7797	7797	8244	8244	8384	8384
Panel B: Males								
Only father has difficulty walking 5 km	-0.0302*	-0.0366	0.0509***	0.0268	-0.0414	-0.2414	-0.0178	0.1050
	(0.0157)	(0.0241)	(0.0162)	(0.0321)	(0.0507)	(0.1468)	(0.0284)	(0.0847)
Only mother has difficulty walking 5 km	0.0077	-0.0062	0.0382***	0.0176	0.0211	0.0959	0.0401**	0.0502
	(0.0101)	(0.0152)	(0.0095)	(0.0193)	(0.0326)	(0.0966)	(0.0170)	(0.0496)
Both parents have difficulty walking 5 km	-0.0390***	-0.0562**	0.0350**	0.0283	0.0252	-0.1124	0.0121	-0.0057
	(0.0146)	(0.0233)	(0.0146)	(0.0303)	(0.0457)	(0.1376)	(0.0250)	(0.0816)
# of obs.	8923	8923	3956	3956	4165	4165	4278	4278
Panel C: Females								
Only father has difficulty walking 5 km	-0.0088	-0.0716***	0.0631**	0.1130**	0.0152	0.1536	-0.0234	-0.0599
	(0.0155)	(0.0250)	(0.0276)	(0.0542)	(0.0581)	(0.1782)	(0.0304)	(0.0836)
Only mother has difficulty walking 5 km	0.0069	-0.0165	0.1528***	0.1808***	0.0005	0.1094	-0.0191	-0.0221
	(0.0102)	(0.0154)	(0.0165)	(0.0327)	(0.0382)	(0.1117)	(0.0191)	(0.0485)
Both parents have difficulty walking 5 km	-0.0151	-0.0138	0.1937***	0.2317***	-0.1169**	-0.0804	-0.0994***	-0.0313
	(0.0143)	(0.0228)	(0.0245)	(0.0508)	(0.0531)	(0.1614)	(0.0281)	(0.0756)
# of obs.	8220	8220	3841	3841	4079	4079	4106	4106

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Every column in each panel represents a separate regression. Sample includes individuals between ages 15 to 25. Standard errors are clustered by person. Fixed effects are at the person level. Controls include gender, age, age squared, religion, household size, urban, father's age, father's age squared, father's religion, father's highest completed schooling level, mother's age, mother's age squared, mother's religion, mother's highest completed schooling level, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.

Appendix Table 5 – Using alternative health measures: long-run effects of parental health on adult human capital outcomes

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	In school		Years of schooling		Complete HS		Difficulty walking 5K	
Panel A: Lagged parental health	OLS	GMM	OLS	GMM	OLS	GMM	OLS	GMM
Only father has difficulty walking 5K in last survey wave	-0.014	-0.008	-0.188*	-0.229**	-0.037***	-0.040***	0.002	0.026
	(0.012)	(0.013)	(0.099)	(0.101)	(0.011)	(0.011)	(0.012)	(0.025)
Only mother has difficulty walking 5K in last survey wave	-0.006	-0.005	-0.073	-0.080	-0.012*	-0.011*	0.017**	0.052***
	(0.007)	(0.007)	(0.066)	(0.066)	(0.006)	(0.006)	(0.008)	(0.017)
Both parents have difficulty walking 5K in last survey wave	0.003	0.008	-0.045	-0.080	-0.047***	-0.053***	-0.013	0.015
	(0.017)	(0.018)	(0.138)	(0.143)	(0.018)	(0.018)	(0.009)	(0.021)
# of obs.	29502		27940		32296		3873	

* significant at 10% ** significant at 5% *** significant at 1%

Notes: Every column in each panel represents a separate regression. Standard errors are clustered by person. Fixed effects are at the person level. GMM models are estimated using the Arellano-Bond (1991) dynamic panel estimator (p-values of AB-GMM models testing the null hypothesis that there is no second order autocorrelation can all be rejected). Controls include the lagged dependent variable, gender, age, age squared, and year dummies. Underlying data are from the Indonesia Family Life Survey 1993, 1997, 2000, and 2007 waves.