OVERCOMING POVERTY TRAP: THE CASE OF WATER & SANITATION IN INDONESIA

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Abstract: Overcoming Poverty Trap : The Case of Water & Sanitation in Indonesia. Poverty trap is a cycle in which poor individuals exhibit low health quality due to malnutrition and limited access to health related facilities. Poor health causes low productivity which eventually cycles back to low income. Indonesia significantly reduced poverty from 15.6% in 1990 to 3.3% in 2010. However, this achievement is not conveyed equally across regions. Using data form RAND Corporation, estimations showed that access to sanitation and clean water play a crucial role in improving one's health quality.

Keywords: poverty trap, productivity, income, health facility.

Abstrak: Penanggulangan Perangkap Kemiskinan: Kasus Air dan Kesehatan di Indonesia. Perangkap kemiskinan adalah sebuah siklus di mana individu miskin menunjukkan kualitas kesehatan rendah karena kekurangan gizi dan terbatasnya akses terhadap fasilitas kesehatan yang terkait. Kesehatan yang buruk menyebabkan rendahnya produktivitas yang akhirnya kembali ke siklus berpenghasilan rendah. Indonesia secara signifikan mengurangi kemiskinan dari 15,6% pada tahun 1990 menjadi 3,3% pada tahun 2010. Namun, prestasi ini tidak disampaikan sama di seluruh daerah. Menggunakan form data RAND Corporation, estimasi menunjukkan bahwa akses terhadap sanitasi dan air bersih memainkan peran penting dalam meningkatkan kualitas kesehatan seseorang

Kata kunci: perangkap kemiskinan, produktivitas, pendapatan, fasilitas kesehatan

INTRODUCTION

Poverty is a disadvantage to societies. It constrains people's spending ability (Attanasio and Szèkely, 2004), lowers market potential which makes investment unprofitable (Cheng and Kwan, 2000), and lowers government's tax revenue (Auriol and Warlters, 2005). Moreover, it limits individuals' ability to attain a minimum acceptable way of life which includes proper housing, education, and health (Huston, 2011). Societies with rampant poverty are more prone to malnutrition and poor sanitation (Pakpahan et.al, 1995; Sudaryanto and Rusastra, 2006 ; Ahmed et.al 2007).

Poor individuals or individuals born into poor households are more likely to exhibit malnutrition. It was found that chronic energy deficiency among mothers adversely affects their children (Radhakrishna et al. 2004). Undernourished children will intuitively grow up to be relatively less healthy than the well-nourished ones. When these previously undernourished children enter the workforce as adults they are less productive and consequently earn less.

Knowles and Owen (1995) found a robust relationship between health and income per capita. Healthier workers have fewer days of illness-related absence from work and have less limitation due to health problem (Meerding, 2005). In turn, poor health quality cycles back, trapping impoverished households in low income (Ezeala-Harrison, 1996; World Health Organization 1998, 2001; Farmer, 2001; and Jong-Wook, 2003). This process is known as the vicious cycle of poverty, represented in the diagram below:

Figure 1.
The Vicious Cycle of Poverty

Indonesia is an example of a country that significantly reduced poverty ($1.25 per day) from 15.6% in 1990 to 6% in 2002 and 3.3% in 2010 (World Bank, 2012). However, despite its

considerable achievements in cutting the percentage of population living below poverty line by more than half from 17.40% in 1993 to 7.80% in 2002 (Ferreira and Ravallion, 2008) the success does not seem to transfer equally into a more micro level. It is marked by the noticeable inequality inhousehold socioeconomic conditions as shown in Table 1. Richer provinces tend to perform better in education and health, which again resembles the phenomenon of the vicious cycle of poverty.

Table 1.
Human Development Index Indicators of Selected Indonesian Provinces in 2007

	N Sumatra	Jakarta	S Kalimantan	W Sulawesi	S Sulawesi
GRDP	20	63	4	0.7	7.7
Illiteracy	3.27	1.24	5.95	13.60	13.76
People in Poverty	13.90	4.61	7.01	19.03	14.11
Clean water	49.85	49.27	54.87	41.02	47.12

GRDP is Gross Regional Domestic Product, measured in billions of dollars; Illiteracy is measured by percentage of population aged 15 or above who are illiterate; Poverty is measured by percentage of population living under the $1.25 line; Clean Water is measured by percentage of household having access to clean water

Source: Statistics Indonesia (www.bps.go.id)

Government intervention is needed to break the cycle of poverty. Without one it is extremely difficult, if not impossible, for impoverished individuals to get out of poverty. This also applies for the context of health. Government needs to assist impoverished individuals attain better health quality in order to increase their productivity and eventually, income. However, like any economic agent the government also faces a budget constraint. Hence, it is necessary to allocate the resource efficiently into projects which will increase health substantially.

The main purpose of this study is to investigate a type of investment the government needs to make in order to increase individual's health, given the regional income disparity faced by the Indonesian economy. Specifically, this study aims to investigate: (1) the bidirectional relationship between income and health quality for Indonesia's household; (2) whether Indonesia's regional income disparity has any implication on household health quality; and (3) whether public spending increased Indonesia's household health quality. This study is importance because it focuses on household level income instead of aggregate. It also consistently tracks the same individuals across time in order to have better description of their personal economic progress. It tries to explain the inter-household income variation for parents (cohort 0), its relationship to next children's (cohort 1) health quality, and eventually how this relationship potentially affects children's (cohort 1) income.

The remaining of this article will be organized as follows. The second section provides a literature review regarding the relationship between personal income, health quality, and family characteristics. The third section provides the methodology that will be used in order to answer the study objectives. The fourth section reports and discusses the results found in the models employed in attempts to shed light on the relationships between personal income and health quality. The last section concludes and provides the study limitations and suggestion for future studies. Data used in this study comes from three waves of Indonesian Family Life Survey (IFLS) conducted by The RAND Corporation in 1997, 2000, and 2007. The survey involves individuals from 13 Indonesian provinces.

LITERATURE REVIEW

Meer et al. (2003) reported their study research on the wealth-health nexus in the US. Using data from the Panel Study of Income Dynamics from 1984, 1989 and 1994, they found that a change in wealth over a 5 year period by a million dollars made the event of being in good health at the end of the period 1.05 times more likely to happen. After accounting for the endogeneity, initial level of wealth also plays a significant role in determining one's health status. An increase in initial wealth makes the event of a person being in a good health 1.6 times more likely to happen.

McDonough et al.'s (1997) study was aimed at examining the association between individuals' household income trajectories and mortality. Data came from a PSID interview from 1968 to 1989 of individuals aged 45 or older in the middle of the 10-year period. The income level was then categorized into (1) persistent low income (less than $20,000 for 4-5 years and never more than 70,000); (2) transitory low income (less than $20,000 for 1-3 years and never more than 70,000); (3) transitory high income (more than $70,000 for 1-3 years and never less than 20,000); (4) persistent high income (more than $70,000 for 4-5 years and never less than $20,000); and (5) all others.

It was found income has a strong inverse relationship with mortality.

When investigating the new pattern of relationship between income and health, Ettner (1996) employed both ordinary and Instrumental Variable estimates. Using data from National Survey of Families and Households as health status measurements, it was found that income has a strong positive association with self-assessed health status and a strong negative association with depressive symptoms, work limitations, functional limitations, and bed days. An increase of income by $2,843-$5,030 (one standard deviation away) would reduce number of bed days by 0.26. Based on the IV estimates, increasing monthly income by one standard deviation would cause the event of functional limitations to be 0.49 times less likely to happen. It would reduce the quarterly bed days by 0.75 bed day per quarter, and reduce weekly depressive symptom-days by 3.82 days per week during the previous four months.

Adriana Lleras-Muney's (2005) study which was aimed explaining the relationship between education and mortality rate hypothesized that education increases health because it makes people better decision makers and/or more educated people have better information about health. It was found that compulsory education significantly increased years of schooling by at least 30%. Eventually, education law was found to lead to lower mortality rate by 0.017% but was not statistically significant when calculated using NHEFS data. However, when calculated using US Census data, compulsory schooling led to 0.037% decrease in the mortality rate of children aged 10 or less and was statistically significant at 5% level.

Elo and Preston (1996) examined the magnitude of educational mortality along with a broader set of demographic and socioeconomic variables within a multivariate framework using data from the United States' National Longitudinal Mortality Survey from 1979-1985. Summary statistics showed that in all cases, college graduates have lower mortality rates than high school graduates, though there was an exception in that high school graduates, who have higher mortality rates than those who did not complete high school. The ratio among older males was also higher than older females (1.46 times compared to 1.38 times).

The next step was a multivariate analysis by estimating mortality rates using a log-linear function of relative probability of dying as a function of age, region, race, and educational attainment. For both males and females, those with at least 16 years of education (college graduates) are less likely to die between the ages of 25-64. For males, the event of college graduates to die between the ages of 25-64 is 0.76 times less likely to happen than the event of non-college graduates to die within the same age range. The event of college graduate males dying between the ages of 65-89 is 0.8 times less likely to happen than the event of non-college graduate males dying in that age range; both were significant at the 1% level. For females, education did not have a significant impact for younger individuals. For older individuals, the event of college graduate females to die between the ages of 65-89 is 0.83 times less likely to happen than the event of females who are not college graduates to die within that age range. Also as expected, richer individuals tend to live longer for both males and females in all cases at 1% significance level. The event of richer males dying between the ages of 25-64 is 0.73 times less likely to happen than the event of poorer males dying within that age range. The event of richer males dying between the ages of 65-89 is 0.88 times less likely to happen than the event of poorer males dying within that age range. The event of richer females dying between the ages of 25-64 is 0.96 times less likely to happen than the event of poorer females dying within those ages.

Flores et al. (1999) studied the relationship between ethnicity, family income and parental education on children's health status prompted by the realization of the lack of studies dedicated to explaining the interrelationship between those variables. Using data from National Health Interview Survey (NHIS) of specific individuals from their birth to 17 years of age, it was found that non-White individuals are roughly 50% more likely to be in a suboptimal health condition category with 5% significance level. As expected, suboptimal health quality status was directly associated with lower income and parental education.

Contoyannis et al. (2004) studied the dynamics of health in the British household to explore the consequences of the health-related attrition, using data from British Household Panel Survey from 1991-1999. For men, education level also was found to be positively correlated with health quality status. Men who have at least a university degree were found to be significantly healthier than those who do not. For women, more educated women were also found to be more likely to have better health quality status with coefficients ranging between 0.084 to 0.180; all being statistically significant at 5% levels. This means that the event of a woman with a college degree to have a high quality of health is approximately 1.09 times

more likely to happen than the event of a woman without a college degree to have a high quality of health.

An article by Case et al. (2004) attempted to explain the relationship between childhood health and circumstances and their adult health and economic status. Overall, the findings suggested that individuals born into poorer families experienced poorer health (even experiencing poor uterine environments) and lower education attainment and eventually led to lower income as they grew. They found that a poor health condition at age 7 is associated with 0.3 fewer exams passed by age 16.

A poor condition at age 16 reduced academic performance by 0.2 number of exams passed by the time the child reaches the age of 16. A poor health condition at age 7 reduced health quality until age 42, but a poor health condition at age 16 reduced health quality throughout the person's life and was significant for individuals age 23 to 42. Family income at age 16 became a larger and more significant predictor of health status in adulthood.

Kruk and Freedman (2008) conducted a literature study on health system performance in developing countries based on indicators currently used to measure performance using online medical and public health databases. Specifically, it measured health quality based on effectiveness, equity and efficiency. Broadly speaking, effectiveness captures concepts of access to care and quality of care, which should lead to health status improvement and patient satisfaction. Some indicators necessary for this measurement are availability of physicians, nurses and hospitals per 1,000 people and basic comprehensive emergency obstetric care facilities per 500,000 people. "Equity" includes access for disadvantaged groups, equality for disadvantaged groups and participation/accountability, all of which should lead to health status improvement for disadvantaged groups, fair financing, and risk protection. Measurement indicators include mortality rates for the lowest income quintile, proportion of government health financing that reaches the poorest income quintile, and utilization of essential health services by disadvantaged groups. Efficiency captures the adequacy of funding, cost and productivity, and administrative efficiency which should lead to maximizing the value of resources. Measurement indicators include per capita health care spending, costs per case treated, average length of stay, and health worker attrition rates.

Das et al.'s study (2008) was a descriptive report of their assessment of the quality of medical advice in low income countries. Specifically, they used survey results from Tanzania, India, Indonesia, and Paraguay. In Tanzania, Paraguay, and Indonesia the samples include health professionals who practice in Western-style health facilities. The study discovered how doctors treat their patients using a vignette approach and direct observations. A vignette approach is basically undergone by providing doctors with hypothetical cases and assessing their responses. By looking at these responses, they were able to figure out that (1) the quality of care in low-income countries was very low, (2) low competence was compounded due to low effort from doctors which led to doctors providing lower standards of care for their patients, (3) the poor are particularly disadvantaged, and (4) efforts of training doctors were unlikely to succeed since doctors often exerted little effort.

RESEARCH METHODOLOGY

In this study, the year 1997 is treated as the base period andindividuals are grouped into two age cohorts:cohorts 0 (parents) and cohorts 1(children). Individuals categorized as parents are included in the estimation of income for the base year, 1997. All the socioeconomic characteristics such as education level and health quality for this category will be treated as exogenous variables and are considered as given. Individuals aged 5-15 in 1997 are categorized as children and are consistently tracked in 2000 and 2007, to monitor the progress of their health statuses over time. To avoid the simultaneity and misspecification problems, individuals in the children cohorts are limited to those who are not earning income.

Parents education attainment and health status are treated as exogenous since there are no data available on the parents socioeconomic condition as children. Following Solon's indexing, y_{0i} represents income of parents, Age_{0i} represents the age of parents, $Education_{0i}$ represents the education attainment of parents, and $Health_{0i}$ represents health status index of parents. The variable Age is used as a representation of an individual's experience in order to avoid further endogeneity problems (Bedi and Gaston, 1999). Intuitively, older individuals will be more experienced than younger ones.

According to Greene (2008) fixed effects arise from the assumption that Corr(c_i,$\boldsymbol{X}_{it}$) '" 0. In this article, provinces are a priori considered as potentially being a fixed effect because provinces are time invariant. Moreover, referring to Greene's definition of fixed effects, it is believed that province is correlated with the other

regressors such as education and health quality. In order to avoid losing too many degrees of freedom, fixed effect are presented in regions instead of provinces. The term region will not be used in a geographical sense but economical instead. Jakarta will be used as a base to investigate whether households' income in each province is significantly different from Jakarta. It was found that some provinces have significantly higher household income than Jakarta, some provinces are approximately similar to Jakarta, and some provinces are significantly lower than Jakarta. The same estimation is conducted for children's cohortin 2007. Included observations will be those aged 15-25 and are working at the time of the survey. Consequently, income estimation for parents' cohort is hypothesized to be represented by the following equation:

$$y_{0i} = \alpha_0 + \alpha_1 Age_{0i} + \alpha_2 Age_{0i}^2 + \sum_{s=3}^{6} \alpha_s \, Education_{0i} + \sum_{h=7}^{14} \alpha_h \, Health_{0i} + \alpha_{15} DUrban_{0i} + \sum_{r=16}^{17} \alpha_r \, DRegion_{0i} + \varepsilon_{0i} \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

Due to the age range of working children, it is presumed that income will not exhibit diminishing returns as age increases. It is supported by the scatter diagram of income on age below:

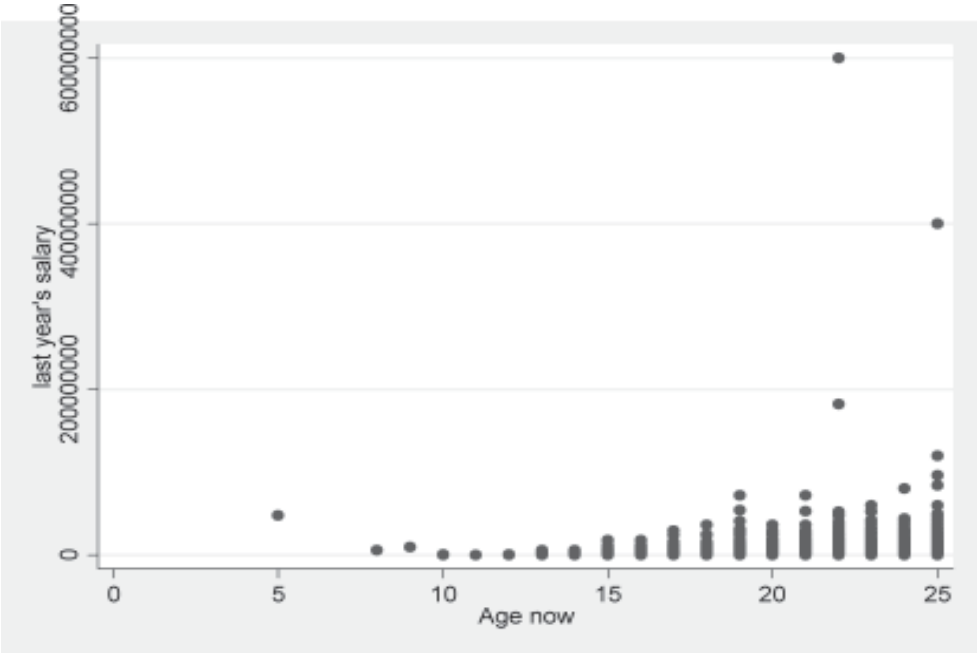

Figure 2:
Scatter diagram of personal income on age

Hence, the income estimation for children is represented by the following equation:

$$y_{1i} = \beta_0 + \beta_1 Age_{1i} + \sum_{s=2}^{5} \beta_s \, Education_{1i} + \sum_{h=6}^{13} \beta_h \, Health_{1i} + \beta_{14} DUrban_{1i} + \sum_{r=15}^{16} \beta_r \, DRegion_{1i} + \mu_{1i} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

Health quality is not commonly cited as a choice variable, since it is rather innate to each individual to some degree. However, what one can do to maintain or even improve health quality is a choice variable. The household allocation of healthcare facilities and/ or treatment can therefore be considered a consumption that will increase one's utility but that is constrained by spending ability. It implies that the optimal consumption of healthcare will depend on relative prices between consumption goods and healthcare as well as the shadow price of income constraint.

Motivated by findings from Rivera and Currais (1999) on the economic growth and health relationship; World Bank's report in 1993 regarding health contribution to promote income growth; Kiuila and Mieszkowski (2007) report regarding the relationship between mortality, education, and income; Llears-Muney (2005) research that was aimed at determining the existence of causal relationship between education and mortality; and Das et.al (2008) who took into account outpatient healthcare facilities availability, health estimation will be represented as:

$$P(HH_{1i} = 1) = \alpha_0 + \alpha_1 Y_{0i} + \alpha_2 Age_{1i} + \alpha_3 Smoke_{1i} + \alpha_4 DUrban_{1i} + \sum_{s=5}^{6} \alpha_s Sanitation_{1i} + \sum_{e=7}^{8} \alpha_e Education_{1i} + \alpha_9 Hospital_{1i} + \varepsilon_{1i} \quad (3)$$

where:

$Health_{1i}$ = Health quality of the i^{th} child;
Y_{0i} = annual parent income of the i^{th} child;
Age_{1i} = Age of the i^{th} child;
$Smoki_{1i}$ = Smoking habits of the i^{th} child;
$DUrban_{1i}$ = Indicator variable of whether the i^{th} childlives in an urban area;
$Sanitation_{1i}$ = Sanitation facilities available for the i^{th} child;
$Education_{1i}$ = education attainment of the i^{th} child;
$Hospital_{1i}$ = time the child must spend to get to the i^{th} nearest hospital in minutes;

The health quality is measured in Likert scale as indicated by the interviewer.Table 2 provides detailed information describing the investigated variables and their definitions.

RESULT AND DISSCUSSION

Results for income estimation are presented in Table 3.In 1997, the estimation result shows a 0.2479 model fit and almost every explanatory variable came out to be statistically significant.Older individuals will typically earn higher income (perhaps due to better experience) and it is significant at 5% level. This finding is consistent with what was found by Bedi and Gaston (1999). A negative sign on the quadratic term suggests that the impact of experience on income exhibits diminishing returns.

Higher education shows a positive relationship with individual's higher income and is statistically significant. A typical individual with Junior High School education is expected to earn $52.80 more annually compared to those with Elementary School education. Those with High School education are expected to earn $292.36 more annually compared to those with Elementary School education. Those with an Associate Degree and a University degree are expected to earn $480.23 and $819.21, respectively,more annually compared to those with only Elementary School education. This is consistent with Benhabib and Spiegel's finding (1994) that a one-percentage-point increase in human capital as measured by years of schooling is associated with 12.8% higher income. It is also consistent with findings by Meng and Wu (1998) that an additional year in years of education is associated with approximately 0.06% higher average household income and was statistically significant.

Healthier individuals are also expected to earn more annually which is represented by positive and significant coefficients of health quality. Individuals with health index = 2 are, on average, earning $10.35 more annually than those with health index = 1. Except for health index = 9, all the health indices show positive coefficients and all are significant at 5% level. This is consistent with findings by Rivera and Currais (1999) and by Kiuila and Mieszkowski (2007). In addition, individuals living in the urban areas are expected to earn $13.96 more annually than those living in the rural areas, but the coefficient is not statistically significant. Individuals living in region 3 are expected to earn $100.89 more annually than those living in region 2.

Table 2.
List of Investigated Variables

Variable Name	Definition
Income	Individual's annual salary (in Indonesian Rupiah)
Age	Individual's age at the time of the survey
Education	Educational attainment of household member (level of schooling) • Elementary School • Junior High School (General & Vocational) • High School (General & Vocational) • Associate Degree • Bachelors Degree • Graduate School (only available in 2000 & 2007 surveys)
Health	Health quality assessed by the interviewer (in 1-9 Likert Scale)
Distance to Hospital	Time required to reach the nearest modern approach health facility
Cigarette consumption	Number of cigarettes consumed daily
Age smoking	The age one started to pick up a smoking habit
Medium water quality	Water source for an individual is of medium quality, e.g. boiled tap water
High water quality	Water source for an individual is of high quality, e.g. bottled mineral water
Medium sanitation	Sanitation for an individual is of medium quality, e.g. public toilet, out house
High sanitation	Sanitation for an individual is of high quality, e.g. private toilet in the house
Urban	Indicator variable whether an individual lives in an urban area
Region 1	Region composed of provinces with significantly lower household income than Jakarta. Namely, South Sumatera, West Nusa Tenggara, South Kalimantan, and Makassar.
Region2	Region composed of provinces with insignificantly different household income than Jakarta. Namely, West Sumatra, Lampung, Jakarta, West Java, and Central Java.
Region 3	Region composed of provinces with significantly higher household income than Jakarta. Namely South Sumatra, Yogyakarta, East Java, and Bali.

The next estimation is the income estimation in 2007 which only includes individuals who were categorized as non-income earning children in 1997 but now are aged 15-25 years old. The estimation coefficients are reported on the second column of table 2. The model fit is 0.1544 and again, almost all explanatory variables came out to be statistically significant.

Among these young adults who are working, their income is positively related with experience and education. An individual who is a year older will earn $49.20 more annually and it was statistically significant. Those with Elementary Education earn approximately $469.50 annually. A typical individual with Junior High School education is expected to earn $ 638.40. A typical high school graduate is expected to earn $818.98. An individual with associate degree education earns $668.37 annually. An individual with Bachelor's education or Graduate School education is expected to earn $790.50 and $1,160.09 respectively.

Individuals with better health earn higher income. The least healthy individuals earn $569.63 annually. Level 3 individuals earn $768.72, level 4 earn $715.66, and level 5 earn $890.85. Individuals with health quality of level 6 earn $858.47, level 7 earn 1,018.42 and those with the highest level of health earn $903.47. Results from this section show that human capital significantly explains individual income. Higher education and better health led to higher income for both parents in 1997 and children in 2007.

The estimation for health quality was conducted for individuals who are categorized as children in 1997 in order to investigate how their health evolves over time and eventually alters their income as grownups in 2007. The health estimation was conducted as a standard logit with dependent variable high health. High health variable represents the health quality status of higher than 5 in the Likert scale. The estimation result is presented in Table 4.

For the year 1997, the model fit is 0.1627 with seven out of thirteen explanatory variables being statistically significant.Higher family income results in 1.02 relative odds ratio. It means that an increase in parents' income will make the event of a typical

Table 3.
Explanatory Variables of Individual Income Estimation

	Coefficients	
Variables	Cohort 0 in 1997	Cohort 1 in 2007
Age	16.83**	49.20**
Age Squared	-0.17**	-
Junior High School	52.80**	168.90**
High School	292.36**	349.48**
Associate Degree	480.23**	198.87**
Bachelor's Degree	819.21**	321**
Graduate Degree	-	690.59**
Health index 2	10.35	-
Health index 3	171.73**	199.09**
Health index 4	135.62**	146.03
Health index 5	176.47**	321.22**
Health index 6	155.25**	288.84**
Health index 7	148.26**	448..79**
Health index 8	204.71**	333.84**
Health index 9	1,222.22	-
Urban setting	13.09	231.74**
Region 1	-4.05	-40.54
Region 3	100.89**	32.40
Cohort 0 Income 1997	-	2.42e-5
Cohort 0 Income 2000	-	4.04e-6
*** significant at 5%	R^2 = 0.2479	R^2 = 0.1544

child being in high quality health 1.02 times more likely to happen. Those with high school education are 2.37 times more likely to report a high health quality. Compared to region 2, children in region 1 are 3.1 times more likely to have high quality health. Region 3 children are 38% as likely to have high quality health, since exp(-0.9563) = 0.38. Though seems counterintuitive, the explanation for this phenomenon is actually quite straight forward. Region 1 is mostly dominated by agricultural sectors. On the contrary, region 3 is dominated by mining which is more likely to expose children to higher water and air pollution.

The coefficient on smoking habit means that higher cigarette consumption is associated with a 1.03 times higher probability of attaining high quality health. The partial effect of smoking habit on an individual child's health might potentially be confounded by other explanatory variables. For example, children from wealthier family might have a better access to health care and that way having better health despite developing a smoking habit relatively early.

The better the water quality in a particular home is, the higher the probability for children to be in a high quality health category. A medium water quality is associated with nine times higher probability of a child attaining high quality health. High water quality is associated with a coefficient of 1.2123 which is to be added to the coefficient of medium level water quality, 2.1975. This means that if a home have a good water quality, then the event of a child to be in a high quality health status is 27.63 times more likely to happen. Only good sanitation resulted in a statistically significant coefficient and it will increase the probability of attaining high health quality by 2.27 times.

In year 2000, the same estimation equation was run and the result is reported in the second column of table 3. The model fit was 0.1585 with six out of thirteen explanatory variables being statistically significant. Parental income variable results inexp (0.338) = 1.40 relative odds ratio.This means that the event of a typical child in year 2000 to attain a high health quality is 1.40 more likely to happen as parents' income increases.

Educational attainment improves health quality only beyond junior high school level. Children with high school education are 4.48 times more likely to be in the high quality health. Smoking habit variables show the expected coefficients. The more cigarettes consumed, the lower the probability of having high health quality since exp(-0.0756) = 0.93. However, children who started smoking at an older age are 1.05 times more likely to have high quality health.

In 2007,the model fit was 0.2126 which was higher than the 2000 estimation. However, only four out of thirteen explanatory variables were statistically significant. Unlike the year 2000 estimation, lagged parents' income variables are not statistically significant. This is probably due to the fact that most individuals involved in this estimation were grownups. The impact of parents' income was captured in the health stock already attained previously as children or adolescent.

The impact of improved sanitation facility is also inconclusive. The signs of water quality are

Table 4.
Children's Health Quality

Variables	Coefficients		
	Cohort 1 in 1997	Cohort 1 in 2000	Cohort 1 in 2007
Age	-0.0492	-0.0396	-0.1456
Cohort 0 Income 1997	1.59e-7**	-	4.18e-7
Cohort 0 Income 2000	-	3.36e-8**	1.73e-8
Junior High School	-0.2529	0.0103	0.6531
High School	0.8611**	1.4993**	0.5926
Associate&Bachelor Education	-	-	0.0763
Urban Area	0.4140	-0.3363	-1.0367
Region 1	1.131**	-0.5364	0.6559
Region 3	-0.9563**	0.8000	-2.4243**
Cigarette consumption	0.0288**	-0.0756**	0.0807**
Age smoking	-0.0208	0.0451**	0.0743
Medium water quality	2.1975**	-	-13.5590**
High water quality	1.2123**	-0.7029**	-14.0126**
Medium sanitation	-0.1158	-	-0.8086
High sanitation	0.8198**	1.2790**	-0.7827
Distance to hospital	-0.0044	0.0016	0.0052
** significant at 5%	$R^2 = 0.1627$	$R^2 = 0.1585$	$R^2 = 0.2126$

inconsistent with the previous year's report. It suggests that health quality is better predicted using lagged compared to contemporaneous variables, as suggested by Radhakrishna et.al (2004). Health quality is a human capital which is accumulated over time. Hence, predicting it using a contemporaneous variable overlooks the dynamic process accrue to it.

CONCLUSION

Contemporaneously, income is explained by education and health. In the absence of government intervention, individuals born in wealthy families will be more likely to attain a better health quality. These findings imply that children from wealthier families will end up earning even more money as grownups. Unless somehow addressed, it will be a recurring process which feeds on itself and eventually create a larger and larger gap between those with wealth and those without.

Data used in this study did not support the notion of a regional implication of health quality. Regional variables in health quality estimations reported a mixed result which made it difficult to conclude or infer the relevance of regional disparity in explaining individual's health.

The need for government investment in public hospitals is not empirically supported by data used in the current study. However, given the dynamic process of health accumulation it is necessary to ensure children to have good health quality in order to allow them to grow up as healthy and productive individuals. The contribution of health facilities such as water and sanitation played a substantial role in predicting a child's health quality. In doing so, it can be inferred that those healthier children will grow up to be healthier and more productive individuals which allows them to earn more. The process can be depicted in the diagram below.

Figure 3.
Health Accumulation Process and Individual Income Improvement

The discontinuous and uneven interval of the surveys might cause some imperfections in the study's estimation process. The fact that health quality is measured by an interviewer's assessment likely causes some subjectivity. To some degree, this might explain why health variable estimation does not give a conclusive result. Data using actual medical records might help improve the estimation of health quality. For example, data regarding blood pressure, daily calorie intake, or body mass indices could be used as a representation of health quality in lieu of a Likert Scale based on an interviewer's assessment.

Like education, health is human capital which is accumulated over time. People's health quality at any given time, is a function of their previous health status. Hence, it is important to study how one's health quality as a child affects his/her health as grownups. In the context of the current study, it is important to better validate the importance of public facilities such as water and sanitation in order to improve one's health. Eventually, this public investment will also validate its importance in increasing long term productivity and increase income.

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