Published in final edited form as:
Future Child. 2012 ; 22(1): 43–63.

Childhood Health: Trends and Consequences over the Life-course

Liam Delaney and

University College Dublin and Visiting Fellow, Center for Health and Well-Being

James P. Smith

Chair in Labor Markets and Demographic Studies, RAND Corporation

Abstract

This paper documents evidence on the changing prevalence of physical and mental health conditions through the course of economic development, focusing in particular on the development of childhood health conditions in the United States. We review the evidence on the persistence of poor childhood health throughout life and the effects of early childhood physical and mental health on later-life health and economic outcomes. Finally, we examine existing evidence on the efficacy of mental health interventions in terms of promoting positive long-run life outcomes.

1. Introduction

The extent to which childhood health problems have important consequences for adult health and economic outcomes is a central science and policy question, with recent evidence indicating that childhood health expansively defined has persistent effects on lifetime health and SES outcomes.^{1,2} This paper examines changing prevalence of childhood physical and mental health conditions particularly in the US, estimated life-time economic costs of childhood health problems, and reviews the recent literature on costs and consequences of childhood interventions.

Recent work emphasized the shift from early acute health shocks in developed countries to remediating specific childhood chronic illnesses and providing a foundation for good child mental health. At a population level, the growing importance of childhood mental health is emphasized in several recent papers.^{3,4} We argue that long-term costs to individuals and society of poor and un-remediated childhood mental health problems are large.

There are approximately seventy-five million children living in the US, about twenty-five million in each of the three age intervals between zero and five, six and eleven, twelve and seventeen. How they are provided with the best possible conditions for good mental and physical health will impact their well-being now and have implications for America's transition to an increasingly graying society over the next thirty years given complementarities in childhood and adult health. As well as having one of the largest shares of private expenditure on healthcare of any country in the world, the US spends over a trillion dollars each year through federal, state and locally funded healthcare agencies, and funds educational initiatives related to healthcare.

This paper is structured as follows. Section 2 presents evidence on changing prevalence of physical and mental health problems for American children and raises issues about the reliability of evidence about these trends. Section 3 examines evidence on possible lifetime economic consequences of childhood ill-health, with an emphasis on distinguishing between childhood physical and mental health. Section 4 discusses potential routes to improve

outcomes for children with mental health disorders, particularly childhood depression and attention deficit disorders. Section 5 concludes with suggestions for research and policy.

2. Changing Prevalence of Childhood Health Problems

2.1 Global Trends

Across a long sweep of history, Robert Fogel documents shifts in patterns of health across centuries through three periods; a first where infant mortality is high and life expectancy is low largely due to shortages of food; a second where, although improved from the first stage, infant mortality is high and life expectancy low due to infectious illnesses; and a third where infant mortality decreases substantially and life expectancy increases dramatically due to conquering of major infectious illnesses through the development of sanitation systems, vaccinations, adequate nutrition and related positive health advantages.⁵

The pattern of poor sanitation and nutrition affecting child health outcomes is still very prevalent among the poorest countries, with an estimated 7.8 percent of deaths in low-income countries due to childhood underweight and 6.1 percent due to poor water conditions.⁶ Globally, the main causes of child death are pneumonia (17 percent), diarrhea (17 percent), other infections (12 percent), severe neonatal infections (11 percent), prematurity (11 percent), birth asphyxia and trauma (8 percent) and malaria (7 percent). The main factors implicated in child deaths in developing countries include zinc, iron and iodine deficiencies, poor sanitation, suboptimal breastfeeding patterns and poor nutrition more generally. Worldwide mortality in children younger than 5 years dropped from 11.9 million deaths in 1990 to 7.7 million deaths in 2010, with almost half occurring in Sub-Saharan African, 33 percent in South Asia and less than 1 percent occurring in high-income countries.

Recent work has demonstrated a shift in childhood illness patterns away from acute health problems and toward chronic conditions. Furthermore, several recent papers have even argued that contrary to the evidence of improving child health suggested by the mortality data, the extent of childhood chronic physical illnesses is increasing in the US.⁷ In this paper we document changing health conditions of American children by first examining trends in infant mortality and then childhood chronic diseases.

2.2 Changing Patterns of Child Health in the US

The pattern of child mortality and health in the US reflects the same patterns described by Robert Fogel and Dora Costa.⁸ As outlined by David Cutler and Ellen Meara, the trajectory of life expectancy was driven by substantial decreases in infant mortality related to sanitation investment and improved nutrition through the first half of the 20th century, and then by increases in later life expectancy.⁹ While substantial medical advances occurred throughout the late 20th century in treatments of illnesses affecting infants, these rates were so low as a fraction of total mortality that they had only small effects on overall life expectancy.

Figure 1 plots trends in infant mortality by gender in the US since the mid-1930s. For boys and girls, there was a rapid seven-fold decline in infant mortality rates with current rates reaching less than one percent. As pointed out by David Cutler, Angus Deaton, and Adriana Lleras-Muney, the bulk of increases in human life expectancy through the first half of the 20th century were attributable to declines in infant mortality.¹⁰ Using variation in timing and location of technology roll-outs, David Cutler and Grant Miller estimate that almost half of the overall mortality reduction in the first third of the 20th century in the US was due to improvements in water purification, with almost three quarters of infant mortality reduction due to water purification.¹¹ From the 1960s onwards, Cutler and Meara (see note 9) attribute

the continuing decline in infant mortality to improvements in treatment (neo-natal medical care) for low birth-weight babies.

Figure 2 compares secular trends over the same period of time in infant mortality rates in the US and in a population weighted average aggregate of countries in Western Europe which have comparable data and consistent geographical boundaries.¹² In the 1930s and up to 1945, infant mortality rates were higher in these Western countries compared to the US. During these years, the gap between Western Europe and America actually widened as the Western European rate stalled most likely due to the impacts of the depression and the Second World War. After the war, European infant mortality rates fell rapidly and had converged to the U.S. by the mid-1970s, after which the two rates moved in lockstep.

2.3 Childhood Chronic Conditions

Figure 1 documents a marked improvement in health of American children when infant mortality is the yardstick. Through the last half-century, emphasis shifted in developed countries from acute fatal health problems toward chronic health problems as the infant mortality rate declined. As well as increasing in relative importance, it is claimed that chronic childhood physical illnesses are increasing in absolute importance. Given that shift in emphasis, we next turn to secular trends in American chronic childhood diseases.

Table 1 uses the Smith childhood retrospective module that was placed into the 2007 wave of the Panel Study of Income Dynamics.¹³ Using calendar life history methods, the initial set of questions asked of respondents in the Smith PSID module was whether or not they had in the years up to and including age 16 a list of important childhood illnesses. This list included asthma, diabetes, respiratory disorders (such as bronchitis, wheezing, hay fever, shortness of breath, or sinus infection), speech impairment, allergic condition, heart trouble, chronic ear problems or infections, epilepsy/seizures, severe headaches or migraines, stomach problems, high blood pressure, difficulty seeing with eyeglasses, depression, drug or alcohol problems, mumps, measles and chicken pox.

Table 1 organizes reported prevalence rates of these childhood diseases by birth cohort of PSID respondents. Taking the data at face value, the following patterns of secular changes emerge. Precisely coincident with development of effective vaccines, common childhood infectious diseases have almost disappeared—first measles and mumps, and more recently chicken pox where the vaccine was developed in 1995.¹⁴ Very rare childhood diseases—type 1 diabetes, hypertension, and epilepsy or seizures—have remained very rare so it is difficult to read conclusive evidence on the direction of secular trends. For relatively common childhood diseases, Table 1 suggests that this sub-set of childhood diseases are becoming more prevalent over time. This is especially the case for respiratory diseases (asthma and respiratory illness), allergies, and depression.

There are reasons why the data should not be taken at face value. Since they are based on recall, memory biases may play a role. Memory typically declines with time from the event, although salient events may suffer less from this memory decay and memory of childhood happenings appear to be superior than for other times of life. The second problem is the difficulty in separating true prevalence and incidence from improved detection. For most childhood diseases, there is likely improved diagnosis and detection over time. For some diseases, including mental illness, there may be some effect of lowering thresholds for diagnosis. Finally, at very old ages mortality selection effects may be operative since those with a childhood disease may have lower life expectancy.

How serious are these sources of bias? Mortality selection cannot be playing much of a role for birth cohorts less than sixty years old. For younger birth cohorts, trends in childhood

chronic disease still appear to be growing over time. One way of assessing how central recall bias could be is to use contemporaneously reported data on childhood chronic conditions. Even there, one difficulty is that American National Health Statistics are not like American National Economic Statistics in the importance that has been placed on reporting series consistently over time. Definitions of what is included within a disease category change periodically in both long-term suppliers of American National Health Statistics—NHANES and NHIS (see Dana Goldman and James Smith).¹⁵ Using sub-sets of children diseases that can be defined more or less consistently over time, Figures 3 and 4 (see note 13) examine trends in asthma, bronchitis and hay fever. Similar to the trends from recall data, all three childhood chronic diseases exhibit sharply rising secular trends. The similarity between the periodic contemporaneous record and PSID recall data indicates that recall bias is unlikely to be the primary driver of secular trends.

Moreover, a range of other studies using contemporaneously reported statistics also report increased rates of chronic illnesses among American. Perrin and others (see note 7) documented substantial increases in a range of childhood chronic illnesses such as obesity, asthma, and ADHD in the United States. Jeanne Van Cleave and others using data from three NLSY cohorts aged between two and eight, report end-study prevalence of any chronic health condition of 12.8 percent for the 1994 cohort, 25.1 percent for the 2000 cohort, and 26.6 percent for the 2006 cohort.¹⁶ Using data from the Center for Disease Control from 1980 to 2007, Lara J. Akinbami and others showed an increase in prevalence of childhood asthma from approximately 3.6 percent prevalence in 1980 to approximately 9.7 percent prevalence in 2007.¹⁷ Some 13.1 percent (9.6 million children) are reported as either currently having or having once been diagnosed with asthma during their lifetime based on the 2007 National Health Interview Survey.

A world in which infant mortality rates are rapidly declining while prevalences of childhood chronic diseases are rising has significant hurdles before it becomes conventional wisdom. Most indicators of adult health have been improving over this period and to the extent childhood health contributes to adult health this would raise some questions. Secondly, some major factors thought to contribute to better childhood health have been getting better rather than worse. Table 2 shows that the fraction of children who grew up in a home where neither parent smoked has been rising. Similarly, the fraction of PSID respondents who thought that they grew up in a poor family has been declining over time. While childhood obesity rates were rising rapidly in recent years, Figure 5 demonstrates that most of that rise in childhood obesity would only affect the youngest cohorts in Table 1. Figure 6 indicates that there has been only a small rise in low birth weight babies over time. Finally, Table 3 shows that the fraction of babies born underweight or severely underweight only rose slightly across the last thirty years. At this point, we conclude that statements about rapidly rising rates of childhood chronic physical health conditions over time are premature at best, especially concerning the magnitude of trends until a better job is done on separating out the impacts of improved detection and diagnosis.

The Smith PSID childhood retrospective can display trends by childhood SES. Tables 3 and 4 document trends for those who lived in a childhood household with above (Table 3) or below (Table 4) median family income. Historically, reported prevalence of the three childhood infectious diseases were more common among better-off American families, but the effectiveness of vaccines for measles and mumps was greater in above-average family income group. The pattern of rising rates of childhood disease prevalence over time is true both above and below the median income, but with only a few exceptions (respiratory illnesses, allergies, ear problems) in the most recent birth cohorts prevalence rates are higher for children who grew up in below-average income families.

Our findings are consistent with a large body of research that documented that children from low-income families experienced higher prevalence rates for the main childhood conditions. For example, Akinbami and others' review demonstrates racial differences in asthma prevalence, with Asian-American children having lower prevalence than Whites, Black children having 1.6 times the prevalence rate of asthma compared to Whites, and Puerto Rican children having 2.4 times the prevalence rate compared to Whites (see note 17).

3. Long-Term Economic Consequences of Childhood Health Problems

3.1.a Childhood Physical Illness and Adult Outcomes

We investigate next longer-term economic consequences of childhood physical and mental health issues. We organize this section as follows: a review of the relevant literature including those based on 'natural experiments' and those population based. We then present new estimates of effects of poor childhood mental and physical health on later-life outcomes including adult health, education, work, and income.

3.1.b Effects of Childhood Health—Literature Review— Natural Experiments

Some of the recent literature has examined the effect of environmental shocks such as famines and toxins in affecting early childhood and intrauterine environments and subsequently conditioning the path of development and adult health. A large literature (reviewed by Tessa Roseboom and others¹⁸) examined effects of growing up during the Dutch famine on later patterns of heart disease; Douglas Almond and others used a one percent sample of the 2000 Chinese census, and finds effects of exposure to the Chinese Famine on a range of adverse economic outcomes¹⁹ The main advantage of these types of designs as argued by their proponents is that they provide an opportunity to isolate 'causal' effects of early life conditions as they are examining factors that affect health limited in time duration and outside the control of parents.

The main advantage of natural experiments is the potential to overcome confounding problems associated with most regression methodologies. However, the extent to which the shock used (such as influence or famine) can be seen as representative of other types of shocks to child health is very much an open question (see Angus Deaton²⁰). Furthermore, it is important to examine the extent to which the shocks may generate unintended selection effects, such as differential fertility and differential mortality that change the average health of surviving babies. Given the rapid decline in infant mortality in America over the 20th century, selection effects due to unhealthy children dying in early childhood are less of an issue in understanding effects of early childhood circumstances.

Much of the recent natural experiments literature relating to impacts of early-life childhood conditions stems from the Barker hypothesis which maintains that foundations for later chronic illness are laid in the in-utero environment. Barker argues that stress to the fetus during pregnancy leads to the diversion of resources to protect the brain at the expense of other organs, which can weaken these organs, predisposing the fetus to later patterns of disease.²¹ In line with this, several studies have found predictive effects of birth-weight on a range of later-life outcomes²². In this literature, birth weight is often taken as a summary statistic for the in-uterine environment. Supporting the results of Anne Case and others,²³ Sandra Black, Paul Devereux and Kjell Salvanes find significant effects of birth weight on a range of adult outcomes, using instrumental variable estimates on large register data from Norway.²⁴ The Black, Devereux, and Salvanes result is based on a large amount of data and the presence of birth weight interventions, which acted as an external factor influencing the birth weight of a sub-set of the population (see note 24).

Caleb Finch and Eileen Crimmins argue that much of the health improvements in adulthood over the centuries arose due to decreased exposure to early-life inflammation.²⁵ They provide evidence that mortality declines in Sweden among infants predict mortality declines among adults in the same cohort, a fact they attribute to lower risk of gastroenteritis among infants leading to lower risk of inflammation in later life.

3.1.c Effects of Childhood Health—Literature Review on Population Studies

Population studies have also examined whether early physical health adversity impacts later economic outcomes (see notes 1 and 21). This research follows individuals from childhood to adulthood or supplements existing panels with parts of the data that are missing. The two mainstays of this research are the British cohort studies that follow individuals from the week of their birth or the long-term panels in the US.

Using data from the PSID, Smith finds effects of childhood health outcomes on a wide range of adult economic variables including levels and trajectories of family income, household wealth, individual earnings, and labor supply that are robust to controlling for observed and unobserved family effects (see note 2). Similarly, Anne Case, Darren Lubotsky, and Christina Paxson find that respondents to the UK National Child Development study (NCDS) who had low birth weight and poor childhood health experienced a range of negative life outcomes including lower school attainment and occupational attainment. Case and Paxson indicate that childhood health (proxied by height) is associated with a wide range of positive life outcomes, only some of which are mediated by education. More recently, Anne Case and Christina Paxson find strong effects of early health on occupational attainment among the Whitehall Civil Service sample.²⁶

One problem with examining effects of childhood illnesses on subsequent health and economic outcomes in America is the paucity of data sets of a mature adult population that tracked respondents from early life. The use of life histories in panel studies has become a useful tool in examining effects of early conditions on later health (see note 13). Life history studies ask respondents to recall important information about their early life, including general childhood health patterns, patterns of healthcare utilization, and onset and duration of childhood illnesses. Visual and verbal memory aids are used to prompt respondents to remember information from the time period.

Several major studies have employed life reconstruction data including the Health and Retirement Study (HRS), the English Longitudinal Study of Ageing (ELSA), and the Survey of Health, Aging and Retirement in Europe (SHARE). This enables researchers to elicit information from current large-scale panel studies that did not interview respondents as children. Using data from the HRS and PSID, Smith finds that patterns of recalled childhood illnesses match closely known information about childhood illness patterns during the respondent's childhood, as measured in contemporaneously collected American National Health Surveys. These recalled measures of childhood illness also act as important predictors of later patterns of illness using these samples (see note 13). On the physical health side, several studies examined associations between childhood asthma and a wide range of negative contemporaneous and future life outcomes. To illustrate, Katayoun Bahadori and others reviewed the evidence (68 studies) pointing to associations with asthma and poorer schooling outcomes and lower future earnings.²⁷

3.1.d Life Time Effects of Childhood Mental Illness

Given the increasing relative importance of mental health problems among young children, the role of childhood mental illness in determining future population wellbeing is viewed as increasingly important. Currie and others find significant effects of childhood mental health

problems (see note 4). They use data based on public health insurance records of 50,000 children born between 1979 and 1987 in Manitoba Canada. Their design allows them to compare children with non-congenital health problems with their siblings. One of their findings is that childhood physical health problems affect later life outcomes largely through an effect on future health problems, but that childhood mental health problems have effects that are large and independent of future health problems.

Smith and Smith use retrospective PSID health data and find substantial effects on retrospectively recalled childhood depression on future economic well-being (see note 3). Their estimations show substantial reductions in income largely caused by large reductions in the amount of weeks worked per year. Respondents who reported childhood mental problems also had lower educational attainment although this effect was low relative to the impacts on income. The authors estimate a discounted net value of family income lost of approximately 300 thousand dollars per affected individual, giving a total lifetime cost over the current American population of 2.1 trillion dollars.

ADHD is one of the most common form of mental illness among young children. Janet Currie and Mark Stabile using Canadian data find negative human capital consequences of ADHD, controlling for a range of possible confounding factors.²⁸ They report reductions in future reading and mathematical test scores and enhanced probability of future grade repetition and use of remedial services.

3.1.e Effects of Childhood Health—New Estimates

We present next new estimates of impacts of childhood health on later life economic outcomes using the Smith retrospective PSID childhood health module. Our analyses examine the association of both dimensions of childhood health—physical and mental—with the most salient adult outcomes—health, education, work and income.

Table 5 sets the format for presentation with the adult outcome being whether your self-reported adult health in 2007 was excellent or very good. All full age range models include dummy variables for age groups 21–40 and 41–60 with post age 60 the excluded group. In this and the following tables, we include models that first summarize estimated impacts of all childhood physical health (with the exception of common childhood infectious diseases—measles, mumps, and chicken pox) and childhood mental health components into two variables—any childhood physical health problem and any childhood mental health problem. In the adjacent column, the physical health component is separated into its component parts although some sub-components are aggregated due to low prevalence or commonality of estimated effects. The two models on the right hand side of Table 5 and subsequent tables are estimated over the full sample of original PSID children and the two models on the right hand side are within sibling fixed effects estimates.

These models indicate that childhood mental health problems have larger impacts on self-reported adult health than do childhood physical health problems although the two are close in within sibling models.

Table 6 lists our estimates for adult years of schooling completed—probably the most common adult SES outcome examined in the literature. OLS estimates strongly suggest that the damage done in adult life is much larger for mental health problems (0.8 of a year of schooling) than for physical health problems (the estimate is actually positive). The sibling fixed effect estimate hints at the reason for this odd result. For many childhood physical health problems, there apparently are strong selection effects whereby children in better off families are more likely to get the disease. A good case in point is the common infectious diseases where the OLS estimate is a statistically significant and an implausible seven tenths

of a year decrement. In contrast, within sibling estimate is small and statistically insignificant. As suggested by a comparison of Tables 3 and 4, children in better off families are more likely to be susceptible to these common infectious disease, a selection effect being transmitted to coefficients estimated in the OLS models. These results suggest some caution in interpreting OLS models in the literature. In the sibling fixed effect models, the impact of childhood mental health problems remains statistically significant—a reduction in about half of year of schooling.

Table 6 contains our estimates for the number of weeks worked in 2006. The estimated impact of childhood mental illness is much larger (about three times larger) than childhood physical health. The preferred sibling effects model indicates almost seven fewer weeks worked associated with a childhood mental health problem. The physical health diseases associated with a larger reduction in weeks worked are asthma, epilepsy, headaches, and hypertension.

Table 6 lists estimates when ln adult labor market earnings are the SES outcome.²⁹ Once again, estimated impacts are much larger for childhood mental health problems. Hypertension and epilepsy (two very low prevalent childhood diseases) and to a lesser extent asthma indicate negative effects on earnings although statistical significance is elusive, most likely due to low disease prevalence. In contrast, large negative impacts on childhood mental health on ln earnings are statistically significant in all model specifications.

Our preferred and most general SES economic outcome is Ln Family Income contained in Table 6. Using fixed effects models, the estimated negative impact of children's mental health problems suggests a 37 percent lower family income, three times larger than the estimated impact of a childhood physical health problem. Within physical health problems, estimated effects are largest for hypertension, speech problems, and asthma.

An important issue not addressed by the previous set of tables concerns how these estimated effects vary by age. Using the within sibling fixed effects estimates, Table 7 provides separate estimates for two age groups—those ages 21–40 and those ages 41–60.

Given that these are estimates for a single calendar year (2007), these estimates could be read either as life course aging effects or as cohort effects, and there is no way to identify separate cohort or aging effects. Whichever interpretation is preferred, the estimates for these SES outcomes indicate that estimated effects of childhood mental problems are smaller in the older age group for all SES outcomes while the childhood physical health outcomes are slightly larger in the older age group.³⁰

Our results suggest that while both childhood mental and physical health outcomes are important—that evaluated in terms of their future adult economic effects—that childhood mental health problems are far the more important of the two (see note 3). This is due to larger estimated impacts on key adult SES outcomes, and in part to earlier imprints of childhood mental problems in adulthood.

4. Effect of Interventions in Influencing Life Course Health Trajectories

Given the relative importance of childhood mental health, we review evidence on whether widely used and recommended interventions appear to be effective treatments of the two of the most important childhood mental health problems—ADHD and depression.

Given the prevalence and long-run effects of ADHD and childhood depression, the importance of remediation is apparent. Effective interventions could potentially remediate

not only the psychological and economic costs experienced by children and their families when the child is young, but also reduce the high costs associated with life-long trajectories of psychological problems. Recent studies examining the lifetime trajectory of individuals who have experienced childhood psychological problems indicate lifetime costs in terms of earnings alone that could exceed \$500,000 over the lifetime (see note 3 and Alissa Goodman, Robert Joyce and James Smith³¹). Such estimates are underestimates of total effects as they do not include many spillover costs onto family members. A large literature exists attempting to examine the most effective pharmacological, behavioral and psychological treatments for each of these problems.

ADHD

Treatment for ADHD generally takes the form of pharmacological or behavioral interventions. Several studies have examined effects of stimulant and non-stimulant medication either solely or in combination with other forms of treatment.³² This literature has documented the efficacy of stimulant medications for treatment of ADHD (see R. H. Weisler³³). There is currently an ongoing literature examining the optimal combination of pharmacological and behavioral interventions, and the effectiveness of different types of behavioral interventions and pharmacological treatments.

One of the largest recent studies examining the effectiveness of treatments for ADHD is the NIMH Multi-modal study of the treatment of ADHD. This study contained four conditions: children who were treated with intensive medication management alone; children who were treated with intensive behavioral treatment alone; children who received a combination of both; and a control group of children who received routine community care. The 14 month follow-up of over 600 children revealed superior outcomes for both the medication and the combined conditions relative to community care.³⁴ Effects, while diminished, were also shown ten months later at the 24 month follow-up stage.³⁵

While the literature provides strong evidence that appropriately applied stimulant treatment perhaps in combination with behavioral interventions can alleviate at least some symptoms of ADHD, there is no way yet of knowing whether these treatments break the link between childhood ADHD onset and the potential adverse effects throughout life over the long term.

Childhood Depression

For childhood depression, the literature has evaluated the effectiveness of various pharmacological interventions and behavioral and psychological interventions. For the latter, the use of Cognitive Behavioral Therapy (CBT) has been particularly widely studied. In general, this literature has suggested that CBT is effective in the treatment of both anxiety and depression. A 2005 Cochrane Review of CBT for the treatment of anxiety in children finds a 50 percent success rate for CBT, higher than in the control cases.³⁶ A number of experiments and reviews found that CBT is effective in the treatment of child and adolescent depression (for example, N. Watanabe and others³⁷).

For pharmacological interventions, the use of selective serotonin reuptake inhibitors (SSRIs) to treat childhood depression was examined in several studies. There remains uncertainty about the efficacy of SSRIs in treating childhood depression. Almost all reviews stress the incompleteness of the literature in terms of drawing conclusions on efficacy. The Cochrane review of S. E. Hetrick and others³⁸ reviews 12 trials examining the use of SSRIs in children and concludes that there is little evidence for their effectiveness. However, several papers and reviews demonstrated the effectiveness of the SSRI fluoxetine for treatment of childhood depression (for example, Craig J. Whittington and others;³⁹). It is currently FDA-

approved as a treatment, unlike other SSRI medications, though with an ongoing debate about potential for increase risk of suicide attempts (for example, Neal D. Ryan⁴⁰).

There is much still to learn about the optimal combination of treatments in terms of promoting child mental health, with almost unanimous opinion among reviewers that the existing evidence base is too focused on short-term and small-scale trials, making conclusions about overall efficacy difficult. Given the evidence on life-long effects of childhood psychological problems and the growing number of trials that have tested the efficacy of different treatments, it should be a priority to conduct longer-term follow-up studies to examine effectiveness of these treatments in breaking the link between childhood psychological problems and adult outcomes. There are also complex issues regarding how the results from clinical trials might be scaled up to the affected population. While CBT has been demonstrated to be effective in treating childhood depression in many trials now, the task of rolling out this and other effective treatments to wider and more heterogeneous populations is obviously a much more difficult one than demonstrating effectiveness in single trials.

5. Conclusions

Our results suggest that while both childhood mental and physical health outcomes are important, that—evaluated in terms of their future economic effects throughout the adult years—childhood mental health problems are far the more important of the two. In part, this is due to larger estimated impacts on key adult SES outcomes, and in part this is due to the earlier imprints of childhood mental problems in adulthood. Finally, much more research is needed on the long-run efficacy of childhood interventions. Clinical trials have been far too short to evaluate the long term impacts of mediation and the impacts are definitively long term.

Acknowledgments

This research was supported by grants from NIA to The RAND Corporation. Paper presented at a conference on the Future of Children at the Center for Well-Being at Princeton University in April 2011.

Endnotes

1. Currie, Janet. Healthy, Wealthy, and Wise: Socioeconomic Status, Poor Health in Childhood, and Human Capital Development. *Journal of Economic Literature*. 2009; 47(no. 1):87–122.
2. Smith, James P. The Impact of Childhood Health on Adult Labor Market Outcomes. *The Review of Economics and Statistics*. 2009; 91(no. 3):478–89. [PubMed: 23585697]
3. Smith, James P.; Smith, Gillian C. Long-term Economic Costs of Psychological Problems during Childhood. *Social Science and Medicine*. 2010; 71(no. 1):110–15. [PubMed: 20427110]
4. Currie, Janet. Child Health and Young Adult Outcomes. *Journal of Human Resources*. 2010; 45(no. 3):517–48. others.
5. Fogel, Robert W. Changes in the Physiology of Aging during the Twentieth Century. National Bureau of Economic Research; Cambridge, Mass.: 2005. Working Paper 11233
6. World Health Organization. Global Health Risks: Mortality and Burden of Disease Attributable to Selected Major Risks. Geneva: 2009.
7. Perrin JM, Bloom SR, Gortmaker SL. The Increase of Childhood Chronic Conditions in the United States. *JAMA*. 2007; 297(no. 24):2755–59. [PubMed: 17595277]
8. Fogel, Robert W.; Costa, Dora L. A Theory of Technophysio Evolution, with Some Implications for Forecasting Population Health, Health Care Costs, and Pensions Costs. *Demography*. Feb; 1997 34(no. 1):49–66. 1997. [PubMed: 9074831]

9. Cutler, David M.; Meara, Ellen. Changes in the Age Distribution of Mortality over the Twentieth Century. In: Wise, David A., editor. Chapter 10 in Perspectives on the Economics of Aging. University of Chicago Press; 2004. p. 333-66.
10. Cutler, David M. The Determinants of Mortality. *Journal of Economic Perspectives*. 2006; 20(no. 3):97-120. others.
11. Cutler, David M.; Miller, Grant. The Role of Public Health Improvements in Health Advances: The Twentieth-Century United States. *Demography*. 2005; 42(no. 1):1-22. [PubMed: 15782893]
12. The Western European rate is for any given year the sum of deaths of people under the age of 1 divided by the sum of the population of people under the age of 1 for France, Britain, Spain, Italy, Belgium, Netherlands, and Denmark.
13. Smith, James P. Re-constructing Childhood Health Histories. *Demography*. 2009; 46(no. 2):387-403. [PubMed: 21305399]
14. See Smith (note 13) for a more complete treatment.
15. Goldman, Dana P.; Smith, James P. The Increasing Value of Education to Health. *Social Science and Medicine*. 2011 forthcoming.
16. Van Cleave, Jeanne; Gortmaker, Steven L.; Perrin, James M. Dynamics of Obesity and Chronic Health Conditions Among Children and Youth. *JAMA*. 2010; 303(no. 7):623-30. [PubMed: 20159870]
17. Akinbami, Lara J. Status of Childhood Asthma in the United States, 1980- 2007. *Pediatrics*. 2009; 123:S131-S145. others. [PubMed: 19221156]
18. Roseboom, Tessa J. Effects of Prenatal Exposure to the Dutch Famine on Adult Disease in Later Life: A n Overview. *Molecular and Cellular Endocrinology*. 2001; 185(nos. 1-2):93-8. others. [PubMed: 11738798]
19. Almond, Douglas. Long-Term Effects of the 1959-1961 China Famine: Mainland China and Hong Kong. National Bureau of Economic Research; Cambridge, MA: 2007. others Working Paper. W13384
20. Deaton, Angus. Instruments, Randomization, and Learning about Development. *Journal of Economic Literature*. 2010; 48(no. 2):424-55.
21. Smith, James P. Healthy Bodies and Thick Wallets: The Dual Relation Between Health and Economic Status. *Journal of Economic Perspectives*. 1999; 13(no. 2):145-66.
22. Whincup, Peter H. Birth Weight and Risk of Type 2 Diabetes: A Systematic Review. *JAMA*. 2008; 300(no. 24):2886-97. others. [PubMed: 19109117]
23. Case, Anne. The Lasting Impact of Childhood Health and Circumstance. *Journal of Health Economics*. 2005; 24(no. 2):365-89. others. [PubMed: 15721050]
24. Black, Sandra E. From the Cradle to the Labor Market? The Effect of Birth Weight on Adult Outcomes. *The Quarterly Journal of Economics*. 2007; 122(no. 1):409-39. others.
25. Finch, Caleb; Crimmins, Eileen. Inflammatory Exposure and Historical Changes in Human Life-spans. *Science*. 2004; 305:1736-39. [PubMed: 15375259]
26. Case, Anne; Paxson, Christina. Causes and Consequences of Early Life Health. *Demography*. 2010; 47(Supplement):S65-S85. [PubMed: 21302429]
27. Bahadori, Katayoun. Economic Burden of Asthma: A Systematic Review. *BMC Pulmonary Medicine*. 2009; 9:24. others. [PubMed: 19454036]
28. Currie, Janet. Child Health and Young Adult Outcomes. *Journal of Human Resources*. 2010; 45(no. 3):517-48. others.
29. This outcome is estimated over a sample of workers.
30. One possibility is measurement error is larger in the older age group due to increasing distance from the event to be remembered which would also indicate an attenuation of effects in the older age group. This could not explain the increasing effect with age for the childhood physical health indicator.
31. Goodman, Alissa; Joyce, Robert; Smith, James P. The Long Shadow Cast by Physical and Mental Problems on Adult Life. *PNAS; Proceedings of National Academy of Sciences*. 2011; 108(no. 15): 6032-37.

32. A recent meta-review of Cochrane reviews of non-pharmacological interventions for ADHD argues that the literature to date is too inconsistent to provide a judgment of the efficacy of these treatments. (See Foisy M, Williams K. The Cochrane Library and Non-Pharmacological Treatments for Attention Deficit Hyperactivity Disorder in Children and Adolescents: An Overview of Reviews. *Evidence-Based Child Health: A Cochrane Review Journal*. 2011; 6:283–97.
33. Weisler RH. Review of Long-Acting Stimulants in the Treatment of Attention Deficit Hyperactivity Disorder. *Expert Opinion on Pharmacotherapy*. 2007; 8:745–58. [PubMed: 17425471]
34. MTA Cooperative Group. A 14-Month Randomized Clinical Trial of Treatment Strategies for Attention-Deficit/Hyperactivity Disorder (ADHD). *Archives of General Psychiatry*. 1999; 56:1073–86. [PubMed: 10591283]
35. MTA Cooperative Group. National Institute of Mental Health Multimodal Treatment Study of ADHD Follow-up: 24-Month Outcomes of Treatment Strategies for Attention-deficit/hyperactivity Disorder. *Pediatrics*. 2004; 113:754–61. [PubMed: 15060224]
36. James AACJ, Soler A, Weatherall RRW. Cognitive Behavioural Therapy for Anxiety Disorders in Children and Adolescents. *Cochrane Database of Systematic Reviews*. 2005; (Issue 4) Article CD004690.
37. Watanabe N. Psychotherapy for Depression among Children and Adolescents: A Systematic Review. *Acta Psychiatrica Scandinavica*. 2007; 116:84–95. others. [PubMed: 17650269]
38. Hetrick SE. Selective Serotonin Reuptake Inhibitors (SSRIs) for Depressive Disorders in Children and Adolescents. *Cochrane Database of Systematic Reviews*. 2007; (Issue 3) others. Article CD004851.
39. Whittington, Craig J. Selective Serotonin Reuptake Inhibitors in Childhood Depression: Systematic Review of Published versus Unpublished Data. *The Lancet*. Apr 24; 2004 363(no. 9418):1341–45. others.
40. Ryan, Neal D. Treatment of Depression in Children and Adolescents. *The Lancet*. Sep 10; Sep 10; 2005 366(no. 9489):933–40. 2005.

Figure 1.
Infant mortality rate by year in US—Berkeley World Mortality Tables

Figure 2.
Infant Mortality rate in US and Western Europe

Figure3. Asthma—Actual Prevalence by Year (0-18years old)
Source: Akinbami, L. J. et al., 2009, *Pediatrics* 123:S131-S145.

Figure 4. Prevalence rates of selected childhood diseases among 12-17 year olds

Source: Ogden, Cynthia, and Margaret Carroll, Prevalence of Obesity among Children and Adolescents: United States, Trends 1963-1965 through 2007-2008, National Center for Health Statistics, June 2010, available at http://www.cdc.gov/nchs/data/hestat/obesity_child_07_08/obesity_child_07_08.pdf

Figure 5.
Trends in obesity among children and adolescents: United States, 1963-2008

Figure 6. Low birth weight and very low birth weight rates by year, United States, 1980-2000, all races

Note: * <2,500 grams. + <1,500 grams.

Source: National Center for Health Statistics. Birth weight data based on birth certificate data.

Table 1

PSID Responses to Child Health History by Age

Year of birth	1986-1977	1976-1967	1966-1957	1956-1947	1946-1937	<1936
				Vaccine 1963 ↓		
			Measles			
	7.6	15.5	49.8	81.8	85.2	86.7
			Mumps			
Vaccine 1995 ↓	4.3	12.7	43.4	68.1	67.3	68.6
			Chicken Pox			
	83.0	79.1	75.9	83.0	79.6	72.3
			Asthma			
	12.9	9.0	5.5	5.6	4.1	2.8
			Respiratory Illness			
	14.3	12.6	9.5	10.8	7.2	7.2
			Speech Impediment			
	3.3	2.4	2.7	2.6	1.6	1.0
			Allergies			
	12.3	11.6	8.9	9.4	6.9	5.0
			Heart Trouble			
	1.8	1.7	1.6	1.3	2.8	1.0
			Ear Problem			
	8.6	7.8	5.4	6.2	7.9	7.2
			Headaches or Migraines			
	11.9	9.0	6.6	6.7	5.5	5.8
			Stomach Problem			
	5.5	4.0	3.7	3.4	2.8	2.6
			Depression			
	7.3	4.6	3.1	3.0	1.2	1.0
			Diabetes			
	0.8	0.5	0.1	0.2	0.2	0.2
			Epilepsy or Seizures			
	1.2	1.2	1.3	0.6	0.5	0.0
			Hypertension			
	1.1	0.4	0.3	0.1	0.4	0.9
N	1,813	1,531	1,715	1,375	553	557

Source: Smith (2009b).

Table 2

PSID Responses to Child Health History by Age

Year of birth	<1936	1937-1946	1947-1956	1957-1966	1967-1976	1977-1986
A. Fraction where Neither Parent Smoked When Respondent was <17						
	43.0	32.3	34.9	39.2	41.1	51.3
B. Fraction Where Parents were Poor When Child						
	55.9	49.9	41.7	34.8	31.4	26.9

Table 3

PSID Responses to Child Health History by Age—Above Median Family Income

Year of birth	1986-1977	1976-1967	1966-1957	1956-1947
Vaccine 1995 ↓			Vaccine ↓	
		Measles		
	4.6	9.7	45.9	85.6
			Vaccine 1963 ↓	
		Mumps		
	2.2	7.4	42.9	76.9
		Chicken Pox		
	91.1	86.2	82.2	90.9
		Asthma		
	10.8	7.8	6.0	4.5
		Respiratory Illness		
	16.4	14.2	11.6	12.4
		Speech Impediment		
	4.0	2.7	3.8	1.7
		Allergies		
	15.1	14.9	10.9	9.6
		Heart Trouble		
	1.4	1.1	1.5	0.6
		Ear Problem		
	10.2	8.9	6.8	7.3
		Headaches or Migraines		
	10.8	8.9	5.5	6.8
		Stomach Problem		
	5.7	3.1	3.2	1.7
		Depression		
	6.7	3.8	2.7	3.4
		Diabetes		
	0.8	0.4	0.3	0.0
		Epilepsy or Seizures		
	1.1	0.6	0.9	0.6
		Hypertension		
	0.3	0.2	0.5	0.0
N	1,813	1,531	1,715	1,375

Table 4

PSID Responses to Child Health History by Age—Below Median Family Income

Year of birth	1986-1977	1976-1967	1966-1957	1956-1947
				Vaccine ↓
				Measles
	11.6	18.7	52.8	79.7
				Vaccine 1963 ↓
				Mumps
Vaccine 1995 ↓	8.1	15.5	48.2	66.2
				Chicken Pox
	78.1	74.8	72.8	80.3
				Asthma
	14.5	10.4	5.7	6.4
				Respiratory Illness
	11.5	11.4	7.7	11.5
				Speech Impediment
	4.4	2.0	2.6	1.9
				Allergies
	9.7	10.2	7.7	7.1
				Heart Trouble
	3.0	1.9	1.4	1.9
				Ear Problem
	7.7	7.5	4.9	7.7
				Headaches or Migraines
	12.1	8.7	7.3	9.0
				Stomach Problem
	6.2	4.4	3.8	4.5
				Depression
	9.8	5.4	3.3	4.5
				Diabetes
	1.5	0.7	0.0	0.0
				Epilepsy or Seizures
	1.2	2.4	1.4	0.0
				Hypertension
	1.8	0.9	0.2	0.0
N	1,813	1,531	1,715	1,375

Table 5
Estimated Impacts of Childhood Health on Adult Health

(probit for self reported adult health being either Excellent or Very Good)

Variables	OLS				Sibling Fixed Effect			
	DF/DX.	't'	DF/DX	't'	Coeff.	't'	Coeff.	't'
Childhood diseases								
Mental health	-0.172	7.15	-0.156	6.17	-0.103	2.41	-0.093	2.18
Physical health	-0.062	5.10	X	X	-0.091	4.16	X	X
Infectious			0.044	2.60			0.007	0.25
Sight problems			-0.116	3.83			-0.120	2.40
Asthma			-0.069	3.05			-0.081	2.19
Diabetes + Heart			-0.179	4.27			-0.104	1.33
Respiratory + Allergies			X	X			X	X
+ Ear + Stomach			-0.026	1.76			-0.012	0.45
Speech problems			-0.009	0.24			-0.020	0.38
Epilepsy			-0.027	0.45			-0.131	0.16
Headaches			-0.063	2.91			-0.087	2.34
Hypertension			-0.293	3.43			-0.253	1.62

Note: Models also include age controls. Physical health does not include the common childhood infectious diseases.

Table 6

Estimated Impacts of Childhood Health on Adult Education

Variables	OLS				Sibling Fixed Effect			
	Coeff.	't'	Coeff.	't'	Coeff.	't'	Coeff.	't'
Childhood diseases								
Mental health	−0.775	6.85	−0.685	5.86	−0.446	2.83	−0.461	2.91
Physical health	0.294	5.16	X	X	0.108	1.59	X	X
Infectious			0.712	9.06			0.173	1.81
Sight problems			−0.486	3.47			0.042	0.24
Asthma			−0.181	1.74			0.025	0.22
Diabetes + Heart			−0.057	0.29			0.215	1.05
Respiratory + Allergies			X	X			X	X
+ Ear + Stomach			0.458	6.77			0.078	0.93
Speech problems			0.002	0.01			0.071	0.34
Epilepsy			−0.027	0.10			−0.071	0.24
Headaches			−0.104	1.04			0.253	2.07
Hypertension			−1.110	2.98			−1.125	3.26

Note: Models also include age controls. Physical health does not include common childhood infectious diseases.

Table 7

Estimated Impacts of Childhood Health on Adult Weeks Worked

Variables	OLS				Sibling Fixed Effect			
	Coeff.	't'	Coeff.	't'	Coeff.	't'	Coeff.	't'
Childhood diseases								
Mental health	−6.14	6.97	−5.10	5.60	−7.06	4.19	−6.51	3.87
Physical health	−2.25	5.11	X	X	−2.20	2.79	X	X
Infectious			2.26	3.71			0.10	0.10
Sight problems			−4.06	3.75			−1.11	0.56
Asthma			−0.55	0.67			−3.00	1.99
Diabetes + Heart			−2.58	1.73			2.72	1.02
Respiratory + Allergies			X	X			X	X
+ Ear + Stomach			−0.159	0.30			−0.59	0.62
Speech problems			−2.16	1.61			−1.86	0.93
Epilepsy			−4.00	1.88			−4.18	1.27
Headaches			−4.06	5.22			−3.90	2.87
Hypertension			−7.36	19.5			−3.74	0.74

Table 8

Estimated Impacts of Childhood Health on Adult ln Earnings

Variables	OLS				Sibling Fixed Effect			
	Coeff.	't'	Coeff.	't'	Coeff.	't'	Coeff.	't'
Childhood diseases								
Mental health	−0.376	7.69	−0.344	6.85	−0.476	4.09	−0.473	4.05
Physical health	−0.018	0.73	X	X	−0.062	1.26	X	X
Infectious			0.153	4.59			0.025	0.37
Sight problems			−0.142	2.29			0.002	0.02
Asthma			−0.023	0.53			−0.054	0.63
Diabetes + Heart			0.045	0.52			0.169	1.42
Respiratory + Allergies			X	X			X	X
+ Ear + Stomach			0.063	2.19			−0.049	0.79
Speech problems			−0.064	0.89			−0.011	0.08
Epilepsy			−0.135	1.10			−0.145	1.14
Headaches			−0.158	3.61			−0.008	0.10
Hypertension			−0.748	4.25			−0.851	1.81

Table 9

Estimated Impacts of Childhood Health on In Family Income

Variables	OLS				Sibling Fixed Effect			
	Coeff.	't'	Coeff.	't'	Coeff.	't'	Coeff.	't'
Childhood diseases								
Mental health	−0.330	7.70	−0.287	6.53	−0.365	2.66	−0.348	2.53
Physical health	0.021	0.96	X	X	−0.126	2.31	X	X
Infectious			0.259	8.81			−0.027	0.39
Sight problems			−0.223	4.26			0.078	0.57
Asthma			−0.064	1.64			−0.148	1.61
Diabetes + Heart			0.088	1.21			0.017	0.08
Respiratory + Allergies			X	X			X	X
+ Ear + Stomach			0.126	4.94			−0.102	1.50
Speech problems			−0.157	2.46			−0.280	1.38
Epilepsy			−0.216	2.11			−0.014	0.08
Headaches			−0.100	2.65			−0.042	0.49
Hypertension			−0.839	6.09			−0.437	0.74

Table 10

Estimated Impacts of Childhood Health on Adult Outcomes by Age Group (Fixed Effect within Sibling Estimates)

Variables	Age 21-40		Age 41-60	
	Coeff.	't'	Coeff.	't'
Adult Health				
Mental health	-0.135	2.69	-0.047	0.61
Physical health	-0.081	2.81	-0.108	3.34
Education				
Mental health	-0.486	2.92	-0.288	0.91
Physical health	0.127	1.49	0.043	0.42
Weeks Worked				
Mental health	-8.39	4.47	-4.54	1.45
Physical health	-1.87	1.84	-2.64	2.23
Ln Earnings				
Mental health	-0.530	4.49	-0.259	1.07
Physical health	-0.054	0.86	-0.086	1.16
Ln Family Income				
Mental health	-0.398	3.00	-0.257	0.92
Physical health	-0.104	1.55	-0.145	1.70