Lifetime individual and population consequences of early-life access to health insurance

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Abstract

Gaining access to health insurance in childhood has been associated with improved childhood health and educational attainment. Expansions in health insurance access have steadily lowered the rates of uninsured children and may have long term consequences for adult health and wellbeing. This paper analyzes the lifetime impact of gaining health insurance in childhood on health and economic outcomes during adulthood using dynamic microsimulation. We find disease prevalence at age 65 falls for most chronic conditions, with the exception of cancer. We also find increased access to health insurance in childhood results in 11 additional months of life expectancy and 16 additional months lived free of disability. While there is no change in total lifetime medical spending, both Medicaid and Medicare expenditures fall. Lifetime earnings increase by about 8% for individuals who gain the benefits of childhood health insurance, and the receipt of Disability Insurance falls throughout the entire lifecycle.

Keywords: Health Insurance; Microsimulation

JEL Classification: I13, I180, J24, E27

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1. Introduction

There are multiple channels through which health insurance may affect an individual's health and economic status. For example, health insurance may increase use of preventive care, leading to better disease prevention and better health. Individuals with disease may rely on health insurance to obtain and finance critically needed curative care thereby improving their health. Further, being healthy may lead to increased educational attainment and ultimately to higher rates of employment, and higher wages. In addition, health insurance may raise economic status directly by decreasing the cost of health care. Health insurance may affect individuals in myriad ways and having access to health insurance early in life may improve the likelihood of its having long term beneficial effects.

In a recent literature review, we documented the large body of work studying the effects of health insurance on health and economic outcomes (Gaudette et al. (2016)). Several studies have examined the impact of access to childhood health insurance on outcomes. Some evidence from studies on childhood health expansions (e.g. Medicaid) have shown a positive impact on health outcomes (Currie and Gruber (1996a); Bronchetti (2014); Boudreaux et al. (2016); Miller and Wherry (2015)) including reductions in avoidable hospitalizations and child mortality, while other studies show no impact on health (Newhouse et al. (1993), De la Mata (2012)). In addition, there is evidence that improved health among children who gain access to health insurance through Medicaid or other state programs translates into educational gains (Cohodes et al. (2016); Brown et al. (2015)). If access to childhood health insurance improves childhood health and educational attainment, there is also the potential for positive impact on adult health, productivity and economic well-being.

We analyze the lifecycle impacts of having health insurance as a child on adult health and economic outcomes using the Future Americans Model (FAM), an economic-demographic microsimulation model that follows Americans aged 25 and older and projects their lifetime health and economic outcomes. This methodological approach allows estimation of health insurance's impact on competing risk factors of disease as well as economic outcomes. This also allows us to build on prior literature by projecting health and economic outcomes across the entire lifecycle. We quantify the effects of childhood health insurance on medical spending, health outcomes such as chronic disease and mortality, labor market outcomes such as full or part-time labor supply and earnings, and government program participation, such as the receipt of Disability Insurance.

We compare simulated outcomes in the intervention scenario, in which all uninsured children gain health insurance, to outcomes under the status quo. We identify individuals who were most likely to have been uninsured during childhood among a nationally representative cohort of young Americans and in simulations of the intervention scenario, assume that these individuals gained the benefits of childhood health insurance found in the literature. Because having health insurance in childhood is not random, we utilize empirical estimates of the effects of childhood health insurance on outcomes based on studies of health insurance that employs methodology that yields causal findings. We model two pathways in which access to health insurance in childhood may impact long term health and economic outcomes: one, through increases in high school graduation rates and college completion; and two through improvements in health through a decrease in the likelihood of having high blood pressure in adulthood.

We found that there would be substantial changes to both health and economic outcomes if every child had health insurance. For the subset of individuals who under the scenario of newly acquired access to childhood health insurance, there were reductions of incidence of stroke, cardiovascular disease, and diabetes at age 65. Over their lifetimes, these gains translated into 11 additional months of life expectancy and an expected 16 additional months lived free of disability. We found that both the education and improved chronic conditions components of the intervention were important contributors of these gains. Our simulations showed that there would be no change in total medical spending: the increase in additional spending due to increased longevity was offset by reductions in health spending due to avoided chronic conditions. However, both Medicare and Medicaid spending declined while private consumption of health care increased. In addition, there was an 8% increase in lifetime earnings. We also find that the likelihood of claiming Disability Insurance fell throughout the entire working lifecycle. The percent of uninsured children is small relative to the population, thus the impact of the intervention was modest for the nationally representative cohort as a whole.

The remainder of the article is organized as follows. First, we briefly describe the related literature on health insurance. Second, we describe our methodology based on the dynamic micro simulation model, the FAM, and the scenarios implemented in our simulations. Third, we present simulation results. Finally, we discuss the policy implications of our results and additional research needed on health insurance reform.

2. Previous Literature

This paper extends the literature that studies lasting consequences of childhood circumstances. More specifically, we focus on the lasting effects of access to health insurance during childhood. This literature studies two main types of outcomes: health and economic, and we contribute to both by simulating long-run effects of access to health insurance during childhood based on robust findings from prior literature. Using a simulation approach allows us to both study a wide range of outcomes and toe evaluate outcomes that occur much later in life than previous studies. This may be particularly important for health spending for example, which occurs rapidly at older ages.

There is a growing literature that considers how health insurance during childhood affects health outcomes. In a series of seminal papers, Currie & Gruber (1996a, 1996b) used Medicaid expansions as exogenous variation to show that Medicaid eligibility decreased infant and child mortality. Following this, Howell et al. (2010) found that Medicaid and SCHIP eligibility was associated with a reduction in external-cause mortality but not internal-cause mortality. Both Wherry & Meyer (2016) and Brown et al. (2015) found that access to health insurance earlier in life affects mortality during adolescence and young-adulthood. Beyond mortality, findings are more mixed. For example, both Currie, Decker, & Lin (2008) as well as Miller & Wherry (2015) find that eligibility at certain ages but not others may improve self-reported health later in life. In addition, Miller & Wherry (2015), Boudreaux et al. (2016), and Bronchetti (2014) find that access to health insurance during childhood improves chronic conditions later in life.

There is also a recent line of literature that studies the effects of health insurance during childhood on economic outcomes. Using IRS tax return data, Brown et al. (2015) found that eligibility during childhood increased cumulative tax payments at age 18 as well as earnings at ages 19-28. These findings were concentrated on females. Miller & Wherry (2015) also found that prenatal Medicaid eligibility caused increased earnings later in life. A related finding from Brown et al. (2015) is that individuals who were eligible for Medicaid during childhood receive lower cumulative EITC payments by age 27. One channel that could explain this is the effect of childhood health insurance on educational outcomes. Cohodes et al. (2016) found that having access to Medicaid during childhood decreased the high school drop-out rate by 4% as well as increased the probability of obtaining a 4-year college degree by 2.5%. This is somewhat in line with Brown et al. (2015), who found that female eligibles were more likely to have ever attended college. Exploiting the same set of expansions to Medicaid that Brown et al. and Cohodes et al. use, Miller & Wherry (2015) also find an increase in high school graduation rates due to prenatal eligibility.

In addition to the literature that studies the effects of childhood health insurance on later in life outcomes, this study is related to two other distinct literature branches. The first is the economic literature that uses structural modeling to evaluate the impact of health insurance reform. This branch focuses on the economic and distributional impact of increasing access to public health insurance, and typically does not consider health as an outcome. Examples include Pashchenko and Porapakkarm (2013), which develops and calibrates an overlapping generations model to evaluate the impact of the recent health insurance reform on welfare. In this study, spending on health has no impact on future health, length of life, or other individual characteristics. Similarly, Pohl (2014) builds a partial equilibrium model in which health insurance only enters the utility function, and does not enter the health transition model. Recently, Jung and Tran (2016) incorporated a Grossman (1972) health capital demand in a general equilibrium model to study the Affordable Care Act. However, health is assumed to have no impact on mortality and productivity. The study focused on the crowding-out of private health insurance, output, and distributional impact of the reform. Since we rely on microsimulation methods, this research differs from this literature by producing granular health and economic outcomes of increased health insurance at the individual level that allows for rich heterogeneity in inputs and outputs. The microsimulation approach we use however, does not account for general equilibrium effects accounted for by some of the structural literature.

The second branch uses a state-transition approach to estimate the impact of health insurance on health. For instance, Li, Bruen, Lantz, and Mendez (2015) relied on two distinct pieces of empirical evidence to find the likely health impact of insurance expansions for hypertensive individuals. The first is the empirical evidence on the impact of insurance coverage on the use of antihypertensive medication; the second on the impact of antihypertensive medication on cardiovascular events and mortality. By joining these two pieces together, they estimate the impact of increased health insurance on heart diseases, stroke, and cardiovascular-related deaths. Snider et al. (2016) used a similar approach to evaluate the budget and welfare impact of restraining eligibility for AIDS drug assistance programs. More broadly, a chapter of a 2009 report by the Institute of Medicine used a thorough literature review to evaluate the likely impact of insurance via its increased access to timely diagnosis of conditions, preventive services, health care, and medication (Institute of Medicine, 2009). This literature is informative of likely mechanisms through which health insurance can improve health, but relies on the assumption that newly insured individuals will derive the same health benefits as the populations studied when evaluating the effectiveness of drugs and medical services. By only relying on the causal estimates of health insurance on health and economic outcomes identified by our literature review, we avoid making such an assumption.

By building on findings from the literature and utilizing the estimates of the effects of childhood health insurance on completed education and chronic conditions into our microsimulation model, we extend the literature in several ways. First, we estimate a counterfactual and study the effects of policies that have not actually been implemented. This helps inform future policy decisions. Second, by using dynamic microsimulation, we predict outcomes much later in life than previous literature has been able to observe. Finally, we quantify changes in health as well as health spending & economic outcomes throughout the life course.

3. Methods

In this section, we describe the Future Americans Model, which we use to simulate outcomes under the status quo, as well as under the intervention scenario where every child has health insurance. We also describe the simulation as well as each of these scenarios.

3.1 The Future Americans Model

We conduct simulations using the Future Americans Model (FAM), a dynamic microsimulation model designed to follow Americans aged 25 years and older and project their health, medical spending, and economic outcomes over time. Conceptually, the FAM is quite similar to its predecessor, the Future Elderly Model (FEM), a microsimulation model developed by Goldman et al. to forecast the implications of different medical technology scenarios on elderly health and health care spending (Goldman et al. (2004)). The FEM uses the Health and Retirement Study as its core data source and model how a nationally representative of Americans over age 50 age; how their health and economic status over their remaining life. The FEM has been utilized in approximately 55 peer-reviewed manuscripts, including two special issues of Health Affairs.

The FAM expands upon its predecessor (FEM) and produces estimates on the health and economic outcomes of individuals beginning at age 25. For each individual, the model takes into account demographic characteristics and health conditions to project health and disease, health behaviors, disability status, program participation, and medical spending. We use data from the Panel Study of Income Dynamics (PSID), the Medical Expenditure Panel Survey (MEPS) and the Medicare Current Beneficiary Survey (MCBS). We describe the model and methods briefly here; a description of how education and chronic conditions, which are intervened on, enter the model can be found in the attached appendix; a complete technical appendix containing details on the modeling is available online.[1]

The FAM is a dynamic microsimulation model that follows the evolution of individual-level health trajectories and economic outcomes, rather than the average or aggregate characteristics of a cohort. The FAM has three core modules (see Figure 1). The first, shown at the top of the figure, is the Replenishing Cohorts module, which predicts economic and health outcomes of new cohorts of 25 year-olds with data from the PSID, and incorporates trends in demography, disease, body-mass index, smoking, and pensions based on data from external sources, such as National Health Interview Survey and the American Community Survey. This module generates cohorts as the simulation proceeds, so that we can measure outcomes for the age 25+ population in any given year.

The second component is the Health Transition module, which uses the longitudinal structure of the PSID to calculate transition probabilities across various health states, including chronic conditions, functional status, body-mass index and mortality, using linear and nonlinear

[1] See https://healthpolicy.box.com/v/FAMTechdoc

multivariate regression models. These transition probabilities depend on a battery of predictors: age, sex, education, race, ethnicity, smoking behavior, marital status, employment and health conditions. Baseline factors such as parental education and childhood health are also controlled for using a series of initial health variables measured at age 25. FAM transitions produce a large set of simulated outcomes.

Health conditions are derived from PSID survey questions and include diabetes, high blood pressure, heart disease, cancer (except skin cancer), stroke or transient ischemic attack, and lung disease (either or both chronic bronchitis and emphysema). The concept of chronic conditions used in the simulations corresponds to having ever been diagnosed with a condition. We thus treat chronic conditions as absorbing: once individuals receive a diagnosis, they are henceforth considered to have that condition. The body-mass index variable is based on the self-reported height and weight of PSID respondents, and its evolution is projected with the estimates of a log-linear model. Functional status is measured by limitations in instrumental activities of daily living or activities of daily living. The instrumental activities of daily living limitations indicator is based on questions about difficulty using the phone, managing money, and taking medications. The activities of daily living limitations indicator is based on respondents' assessment of their ability to conduct basic tasks, such as dressing, eating, and bathing. For the purpose of this study, we consider individuals free of disability if they reported no limitations, and as disabled if they reported at least one limitation. Unlike health conditions, we allow for transitions in and out of functional states.

Finally, the Policy Outcomes module combines individual-level outcomes into aggregate outcomes, such as medical care costs (Medicare, Medicaid and Private), Disability Insurance benefits, and Social Security expenditures and contributions. To calculate a value for both disability and social security claiming, we use average monthly benefit amounts by age and gender for 2014 and apply them to each year forecasted. We assume no growth in either disability or social security benefits and so this is likely an underestimate in the true changes in these benefits. Individual health spending is predicted with regard to health status (chronic conditions and functional status), demographics (age, sex, race, ethnicity and education), nursing home status and mortality. Health spending estimates are based on spending data from the MEPS for individuals aged 64 and younger and the Medicare Current Beneficiary Survey for individuals aged 65 and older, who constitute the bulk of the Medicare population. Our definition of medical spending includes medical provider visits, hospital events, inpatient stays, outpatient visits, emergency department visits, dental care, home health care, optometry, other medical equipment and services, prescribed medicines, and nursing home stay. Our estimates are based on spending data from the 2007-2010 MEPS and the 2007-2010 MCBS. The estimates are based on pooled least squares regressions of each type of spending on risk factors, self-reported conditions, and functional status, with spending inflated to current dollars using the medical component of the consumer price index.

An example of how the three modules interact is as follows. For year 2009, the model begins with the population of Americans aged 25 and older based on nationally representative data from the PSID. Individual-level health and economic outcomes for the next two years are predicted using the Policy Outcomes module. The cohort is then aged two years using the Health Transition Module. Aggregate health and functional status outcomes for those years are then calculated. At that point, a new cohort of 25-year-olds is introduced into the 2011 population using the Replenishing Cohort module, and they join those who survived from 2009 to 2011. This forms the age 25+ population for 2016. The transition model is then applied to this population. The same process is repeated until reaching the last year of the simulation.

3.2 Simulations

In this study, we report results from a cohort simulation, in which we follow a single cohort of Americans until death under alternative health insurance scenarios. These simulations focus on a representative cohort of Americans aged 25 to 26 in 2009; this cohort was born between 1983 and 1984. In each period, the Policy Outcomes module predicts medical expenditure based on an individual's current health and economic outcomes. Then, the Health and Economic Transitions module predicts survival, health transitions, functional status, quality-adjusted life-years, labor force participation, earnings, and program participation for the next period, using estimated probabilities from multivariate regression models. The same process is repeated at each time step until everyone in the cohort has died. These simulations are used to compare expected lifetime outcomes across scenarios, such as the probability of onset of disease by a given age, life expectancy, and lifetime medical spending.

3.3 Scenarios

We compare two scenarios. The first is the status quo, where we transition outcomes with no changes. The second is the counterfactual intervention scenario where every child was insured during childhood. We use the FAM to investigate what would have happened if every American had health insurance during childhood based on the empirical estimates from Cohodes et al. (2016) on the impact of childhood health insurance on high school graduation rates and college completion. In the hypertension intervention, we decrease the probability of having high blood pressure, as found by Boudreaux et al. (2016). Table 1 shows the estimates that we integrate in to our model. We then compare our intervention scenario to outcomes under the status quo, which are baseline FAM projections. There are two main steps to implement the health insurance scenarios. First, we identify the population that was likely to have been uninsured during childhood. This is the population that we intervene on. Second, we modify characteristics of this population using findings from the literature detailed above.

One of the keys is determining who was not insured during childhood. The PSID data do not contain information about childhood health insurance status of all respondents. Thus, we take two steps to identify individuals who were likely uninsured during childhood. First, we use the Current Population Survey Annual Social and Economic March Supplement (CPS ASEC) to identify historical characteristics of the population who do not have health insurance during childhood. Second, we assign individuals from the PSID as being uninsured to match this distribution of observed characteristics. Specifically, we use the 1988-2002 CPS to identify the race and maximum parental education of children who were uninsured during this time period. We examine the cohort that was 25-26 in 2009, as this is the cohort that we use for simulations.[2] It is important to note that the population of children who were uninsured during childhood are different from a nationally representative sample, and therefor randomly assigning individuals as being uninsured is not an ideal approach. For example, uninsured children were more likely to be racial and ethnic minorities and from low education and income groups.

[2] This corresponds to ages 4-18 for our initial cohort. The CPS measured the status of health insurance for children differently prior to this period, and so for consistency reasons we restrict our timeframe. Since uninsurance rates have been steadily declining in the last decades, we may be underestimating the percent of children uninsured, which would make our findings a lower bound.

We divide the population of uninsured children in this cohort into 12 categories and match this distribution across three racial groups and four education groups: Hispanic; Black, Non-Hispanic; and White or other race, Non-Hispanic; less than high school; high school graduates; some college; and a four year college degree or higher. In addition to matching these characteristics identified using the CPS ASEC, we exclude individuals in the PSID who report growing up wealthy, since these individuals were more likely to be insured during childhood. We match the distribution from the CPS using the PSID, Table 2 shows the results. About 53% of the population that we assign as uninsured during childhood is white, non-Hispanic; 20% is Black, non-Hispanic; and 27% is Hispanic. Across all races, children who have at least one parent who has obtained a Bachelor's degree or higher are less likely to be uninsured.

For the population that we identified as likely to be uninsured during childhood, we estimate what would have happened had they been insured. Based on results from the literature cited in the previous section, we implement our intervention scenario based on two components: education and chronic conditions, namely hypertension. We increase both high school graduation and college completion, following the findings in Cohodes et al. (2016) as well as decrease the probability of having high blood pressure, as found in Boudreaux et al. (2016). We forecast outcomes under three main scenarios. First, we assume that providing health insurance improves both education and chronic conditions. We then consider outcomes under an increase in education and a decrease in chronic conditions independently. This allows us to see which intervention is driving our results as well as to study the interaction of the combined intervention.

Due to the endogeneity of health insurance coverage, previous literature has largely estimated the effects of being eligible for insurance, particularly Medicaid. In order to calculate what the effect of actually taking up insurance, or the treatment on the treated, as opposed to the average treatment effect, we follow Cohodes et al. (2016) and assume a take-up rate of Medicaid of 71.4% for ages 0-18. This means that in all scenarios, we divide the findings in Table 1 by this take up rate.

For each educational outcome, college completion and high school graduation, we intervene on individuals who were identified as being uninsured during childhood in the first step and who were most likely to complete this level of schooling, but did not. For example, we estimate college completion for individuals using a rich set of individual characteristics as controls, including race, parental education, whether the individual grew up in a low-income household, and self-reported child health. Denote the predicted probability of college completion as $\hat{C}$. We then add a random normal draw, u with mean 0 and standard deviation equal to the root mean square error of the model to this predicted value. We rank individuals by $\hat{C} + u$. Individuals with the highest values are reassigned education to be college graduates until the amount reassigned is equivalent to an increase of 9.66 percentage points for the population identified as being uninsured during childhood. We follow the same steps for high school, reassigning high school drop outs to graduates until the reassignment is equivalent to an increase of 5.32 percentage points for the population uninsured during childhood. We reassign college before high school to avoid reassigning individuals from high school drop outs to college graduates.

The second intervention is a reduction of high blood pressure prevalence. We use the findings of Boudreaux et al. (2016), who found that the roll-out of Medicaid significantly reduced likelihood of high blood pressure later in life for children who had health insurance. Specifically, we reduce the probability of hypertension incidence in the simulations by a multiplier such that there is a 12 percentage point decrease in the probability of having high blood pressure at age 54.[3]

4. Results

The simulation results show what would have happened had every child in the cohort aged 25-26 in 2009 had health insurance during childhood. In each case, we show findings for the group of individuals who were marked as being uninsured during childhood as well as findings for the nationally representative cohort. The uninsured group shows the impact on those receiving the treatment (treatment on the treated), and the nationally representative cohort is informative about the scale of the intervention for the population as a whole (average treatment effect). For the uninsured group, we also report results separately for both components of the intervention: educational increase and hypertension reduction.

[3] This prevalence reduction corresponds to the lower bound estimate of Boudreaux et al. and is used to provide a conservative estimate for the impact of health insurance. The incidence multiplier is obtained by conducting a grid search over potential multipliers and conducting cohort simulations until obtaining a 12 percentage point reduction relative to the status quo for the population we intervene on at age 54.

4.1 Health Outcomes

To compare health outcomes, we show disease prevalence per 1000 at age 45 and 65, as well as lifetime incidence of disease. We also show life expectancy and disability free life years for both the entire cohort of 25-26 year olds in 2009, including individuals who were uninsured and insured during childhood, as well as the group that was uninsured during childhood and received the intervention. We show results for the status quo scenario (no intervention) and for the scenario of childhood health insurance for those without for both samples. Under the status quo, the uninsured group has a higher prevalence of cardiovascular disease, stroke, high blood pressure, diabetes, and lung disease at age 45 and at age 65, with the exception of prevalence of cancer, as shown in Table 3. The group that was uninsured during childhood and received the intervnetion also have about half a year less life expectancy at age 25 and almost a full year less of disability free life years.

In the intervention scenario, individuals who receive the benefits of health insurance have significant health improvements, which also marginally improve health outcomes for the nationally representative cohort. We find that lifetime incidence of nearly all major diseases decreases comparing the status quo to the intervention for both the treated group (column 6) and the entire cohort (column 3). The exception is an increase in cancer, largely due to the increased life expectancy. Excluding cancer, we find improvements in all major chronic conditions throughout the life span, as shown in Table 3. Intervening on the uninsured group results in a reduction of lifetime cardiovascular disease by 2.3%; stroke by 4.9%; diabetes by 1.8%; and lung disease by 1.2%. Figure 2 shows the change in health outcomes throughout the lifecycle. By age 45, the prevalence of each disease fell. The change continues to grow over the course of the lifecycle.

In addition to preventing disease, we estimate that the increased health insurance in childhood would lead to longer, healthier lives. Panel B of Table 3 shows that the treated group has an increase in life expectancy of 0.9 years (column 6). The increase in disability-free life years is even larger, 1.3 years. Improvements in functional status are found both in terms of activities of daily living (ADLs) limitations as well as instrumental activities of daily living (IADLs) limitations. At every age, individuals in the uninsured group would be less likely to need help with 3 or more ADLs, as shown in Figure 3. In addition they are less likely to need help with two or more IADLs, as shown in Figure 4.

We investigate how much of the change in health is driving by an increase in educational attainment and how much is driven by a reduction in high blood pressure and report results in Table 4. With respect to cardiovascular disease we found a reduction in prevalence at age 65 of about 7% relative to the status quo (Table 1). About three-quarters of the reduction is driven by a reduction in the probability of having high blood pressure (Table 4). With respect to diabetes, the 3% reduction is almost entirely driven by increases in educational attainment. Both health and education play important roles in increasing life expectancy as well as disability-free life years.

4.2 Economic Outcomes

We analyze the impact of childhood health insurance on both lifetime medical spending, government transfers, and labor force participation. Table 5 shows that under the status quo, projected lifetime medical spending is similar for the nationally representative cohort and the cohort of individuals without childhood health insurance (Column 1 and 4). However, the uninsured group has larger expected lifetime disability benefits, about 14%, and about 11% lower earnings than the cohort that includes both insured and uninsured.

Comparing the status quo to the intervention scenario, we only small changes in total medical spending (Column 6). However, spending for Medicaid and Medicare is projected to fall by about 5% and 1.1% respectively. Increases in lifetime health care spending due to increased life expectancy is off-set by decreases in spending due to a reduction in disease. Figure 5 shows that the intervention reduces eligibility for Medicaid later in life.

We also find that economic outcomes improve for the uninsured group with childhood health insurance. Similar to Medicaid eligibility, we find that at every age, individuals in the uninsured group would be less likely to claim Disability Insurance (DI) if they were insured, as shown in Figure 6. We also find that childhood health insurance increases the likelihood of full time work relative to the status quo (Figure 7). This increase in the likelihood of working full-time translates into an increase of 0.9 full-time work years, or 3.6% more full-time work years.

The increased earnings capacity as well as the increased time spent working translates into an increase in lifetime earnings of $109,000 (in $2015) or about 8.5%.

The education component of the intervention has a direct impact on economic outcomes, while the hypertension reduction affects outcomes through its dynamic impact on disability, health, and longevity. For example, the results displayed in Table 6 show that the educational intervention leads to higher spending, since higher educational achievement is associated with higher medical spending. On the other hand, preventing hypertension is expected to lower lifetime medical spending. Overall, these two interventions almost exactly offset each other in their effect on medical spending. Further, the expected decrease in Medicare spending is driven entirely by the reduction in hypertension, while the decrease in Medicaid spending is driven by the increase in education. Looking at the government outlays and other economic outcomes, we find the education intervention has larger effects than the hypertension intervention. For example, the effect of improved hypertension on disability claiming is just under half of the effect of increased educational attainment, while the effect on earnings is about 40%.

5. Discussion and Conclusions

Our findings support the interconnection between education, health, and economic outcomes (Smith (1999)). By improving both health and education, insurance during childhood has lasting effects. Our results are consistent with results from the prior work on the effects of increased education on health and mortality. For example, in a seminal paper, Lleras Muney (2005) found that an additional year of schooling lowers the probability of dying in the next 10 years by 3-6 percentage points. We find that increased educational attainment as a results of childhood health insurance increases life expectancy by about one-half year.

Intervening with health insurance in childhood may improve adult outcomes more than some mid and later life health interventions. For example, Gaudette et al. (2015) find that increasing statin use among older adults increase life expectancy by 1.4 years for healthy 51 year olds. However, they find that this is mainly an increase in unhealthy years. In contrast, we find that childhood health insurance increase disability free life years by more than the increase in life expectancy.

Although our analysis considers what could have happened in the past, it also speaks to policies moving forward. Given the gains in both health and economic outcomes from insuring children that we find, health insurance is a potential tool for improving later in life outcomes. The nature of health and human capital imply that interventions made in childhood may be particularly important (See Heckman and Masterov (2007)). Further, children enrolled in Medicaid account for a relatively small portion of overall Medicaid spending (Kaiser Family Foundation (2011)). Since the Medicaid expansions of the 1980s, the uninsured rate of children has gradually fallen. More recently, it has continued to fall, due in part to the Affordable Care Act. However, the future of health insurance in the United States is still being decided. This paper speaks to policies that would encourage childhood insurance, including automatic enrollment of children or universal coverage for children, as well as the extension of the Children's Health Insurance Program (CHIP). Further, there are still gains to be made in many areas. For example, the uninsured rate varies across states and was as high as 13% in Arizona in 2015. Further, there are large disparities of insurance by race and ethnicity. As of 2014, the uninsured rate for Hispanic children remains nearly double that of white, non-Hispanic children (9.6% vs 4.9%). Insuring all children may be one way to close the gap in health and economic outcomes for minority populations.

References

Boudreaux, M. H., Golberstein, E., & McAlpine, D. D. (2016). The Long-term Impacts of Medicaid Exposure in Early Childhood: Evidence from the Program's Origin. *Journal of Health Economics, 45*(January 2016), 161-175.

Bronchetti, E. T. (2014). Public Insurance Expansions and the Health of Immigrant and Native Children. *Journal of Public Economics, 120*(December 2014), 205-219.

Brown, D. W., Kowalski, A. E., & Lurie, I. Z. (2015). *Medicaid as an Investment in Children: What is the Long-Term Impact on Tax Receipts?* Retrieved from

Cohodes, S. R., Grossman, D. S., Kleiner, S. A., & Lovenheim, M. F. (2016). The Effect of Child Health Insurance Access on Schooling: Evidence from Public Insurance Expansions. *Journal of Human Resources, 51*(3), 727-759.

Currie, J., Decker, S., & Lin, W. (2008). Has Public Health Insurance for Older Children Reduced Disparities in Access to Care and Health Outcomes? *Journal of Health Economics, 27*(6), 1567-1581.

Currie, J., & Gruber, J. (1996a). Health Insurance Eligibility, Utilization of Medical Care, and Child Health. *Quarterly Journal of Economics, 111*(2), 431-466.

Currie, J., & Gruber, J. (1996b). Saving Babies: The Efficacy and Cost of Recent Changes in the Medicaid Eligibility of Pregnant Women. *Journal of Political Economy, 104*(6), 1263-1296.

De La Mata, D. (2012). The effect of Medicaid eligibility on coverage, utilization, and children's health. *Health Econ, 21*(9), 1061-1079.

Gaudette, É., Goldman, D. P., Messali, A., & Sood, N. (2015). Do Statins Reduce the Health and Health Care Costs of Obesity? *PharmacoEconomics, 33*(7), 723-734.

Gaudette, É., Pauley, G. C., & Zissimopoulos, J. M. (2016). *Lifetime Consequences of Early and Midlife Access to Health Insurance: A Review*.

Goldman, D. P., Shekelle, P. G., Bhattacharya, J., Hurd, M., & Joyce, G. F. (2004). *Health status and medical treatment of the future elderly*. Retrieved from

Grossman, M. (1972). On the concept of health capital and the demand for health. *Journal of Political Economy, 80*(2), 223-255.

Heckman, J. J., & Masterov, D. V. (2007). The Productivity Argument for Investing in Young Children. *Applied Economic Perspectives and Policy, 29*(3), 446-493.

Howell, E., Decker, S., Hogan, S., Yemane, A., & Foster, J. (2010). Declining Child Mortality and Continuing Racial Disparities in the Era of the Medicaid and SCHIP Insurance Coverage Expansions. *American Journal of Public Health, 100*(12), 2500-2506.

Institute of Medicine. (2009). *America's Uninsured Crisis: Consequences for Health and Health Care*. Washington, DC: The National Academies Press.

Jung, J., & Tran, C. (2016). Market inefficiency, insurance mandate and welfare: US health care reform 2010. *Review of Economic Dynamics, 20*, 132-159.

Li, S., Bruen, B. K., Lantz, P. M., & Mendez, D. (2015). Impact of Health Insurance Expansions on Nonelderly Adults With Hypertension. *Prev Chronic Dis, 12*, E105.

Lleras-Muney, A. (2005). The Relationship Between Education and Adult Mortality in the United States. *The Review of Economic Studies, 72*(1), 189-221.

Medicaid Spending per Enrollee (Full or Partial Benefit). (2011). Retrieved from http://kff.org/medicaid/state-indicator/medicaid-spending-per-enrollee:

Miller, S., & Wherry, L. R. (2015). *The Long-Term Effects of Early Life Medicaid Coverage*. Available at SSRN 2466691.

Newhouse, J. P., & Group, R. C. I. E. (1993). *Free for all?: Lessons from the RAND Health Insurance Experiment*. Cambridge, Massachusetts, London, England: Harvard University Press.

Pashchenko, S., & Porapakkarm, P. (2013). Quantitative analysis of health insurance reform: Separating regulation from redistribution. *Review of Economic Dynamics, 16*(3), 383-404.

Pohl, V. (2014). Medicaid and the Labor Supply of Single Mothers: Implications for Health Care Reform. *Available at SSRN 2566757*.

Smith, J. P. (1999). Healthy Bodies and Thick Wallets: The Dual Relation Between Health and Economic Status. *The Journal of Economic Perspectives, 13*(2), 144.

Snider, J. T., Goldman, D. P., Rosenblatt, L., Seekins, D., Juday, T., Sanchez, Y., . . . Romley, J. A. (2016). The Impact of State AIDS Drug Assistance Policies on Clinical and Economic Outcomes of People With HIV. *Med Care Res Rev, 73*(3), 329-348.

Wherry, L. R., & Meyer, B. D. (2016). Saving Teens: Using a Policy Discontinuity to Estimate the Effects of Medicaid Eligibility. *Journal of Human Resources, 51*(3), 556-588.

Tables and Figures

Table 1: Findings Brought into the FAM

Education	
Cohodes et al. (2016)	• 10 percentage point increase in average Medicaid eligibility between 0-17 decreased the high school dropout rate by .38 percentage point (standard deviation of .015).
	• 10 percentage point increase in average Medicaid eligibility between 0-17 increased college completion by .69 percentage point (standard deviation of .032).
Chronic conditions	
Boudreaux et al. (2016)	• Moving from no to full exposure to Medicaid during early childhood (age 0-5) decreased the probability of hypertension in adulthood by 22 percentage points (standard deviation of 0.10) for low-income individuals (<150% of the federal poverty line).

Table 2: Population Uninsured during Childhood

	CPS	Intervention Group in FAM
Hispanic, LT HS	0.124	0.124
Hispanic, HS	0.084	0.081
Hispanic, Some College	0.042	0.043
Hispanic, BA+	0.018	0.018
White, Non-Hispanic, LT HS	0.060	0.060
White, Non-Hispanic, HS	0.221	0.221
White, Non-Hispanic, Some College	0.159	0.160
White, Non-Hispanic, BA+	0.095	0.096
Black, Non-Hispanic, LT HS	0.036	0.036
Black, Non-Hispanic, HS	0.087	0.088
Black, Non-Hispanic, Some College	0.053	0.053
Black, Non-Hispanic, BA+	0.020	0.020
Total Hispanic	0.269	0.266
Total Black, Non-Hispanic	0.196	0.197
Total White, Non-Hispanic	0.535	0.537

The first column shows summary statistics for uninsured children from the March supplement of the Current Population Survey 1988-2002. Cells are broken down by child's race and the maximum education obtained by a member of the household: less than high school (LT HS), high school degree (HS), some college, and Bachelor's degree or higher (BA+). The second column shows these summary statistics for the group that is marked as uninsured during childhood in the simulations.

Table 3: Health Outcomes

	Nationally Representative Cohort			Uninsured Individuals		
	Status Quo	Increased Health Insurance		Status Quo	Increased Health Insurance	
	Level	Level	Difference	Level	Level	Difference
Panel A. Disease Prevalence (per 1000)						
At Age 45						
Cardiovascular Disease	104	103	-1.07	106	99	-7.41
Stroke	23	23	-0.35	28	25	-2.46
Cancer	43	43	0.17	42	44	1.18
High Blood Pressure	338	324	-13.68	361	266	-94.9
Diabetes	110	109	-0.64	124	120	-4.43
Lung Disease	78	77	-0.44	83	80	-3.06
At Age 65						
Cardiovascular Disease	322	319	-3.36	326	303	-23.32
Stroke	107	105	-1.92	110	96	-13.28
Cancer	176	177	0.76	166	171	5.42
High Blood Pressure	734	715	-19.35	758	624	-134.14
Diabetes	328	327	-1.58	366	355	-11.47
Lung Disease	179	178	-0.64	188	184	-4.55
Panel A2. Lifetime Incidence of Diseases						
Cardiovascular Disease	642	640	-2.17	641	626	-15.02
Stroke	358	355	-2.48	350	332	-17.18
Cancer	386	388	2.84	358	377	19.68
High Blood Pressure	872	860	-12.35	882	797	-85.63
Diabetes	472	471	-1.35	516	507	-9.38
Lung Disease	324	324	-0.59	338	334	-4.11
Panel B. Expected Lifetime Outcomes at Age 25						
Life Expectancy (years)	54.98	55.11	0.13	54.41	55.32	0.91
Disability-free Life-years	41.35	41.54	0.19	40.43	41.77	1.34

Table 4: Health Outcomes by Intervention

	Status Quo	Difference with Status Quo		
		Increased Health Insurance	Educational Benefits Only	Hypertension Benefits Only
Panel A. Disease Prevalence (per 1000)				
At Age 45				
Cardiovascular Disease	106	-7.41	-3.34	-4.17
Stroke	28	-2.46	-1.37	-1.12
Cancer	42	1.18	1.17	0
High Blood Pressure	361	-94.9	-0.53	-94.34
Diabetes	124	-4.43	-4.44	0
Lung Disease	83	-3.06	-3.16	0.09
At Age 65				
Cardiovascular Disease	326	-23.32	-5.39	-17.96
Stroke	110	-13.28	-5.64	-8.09
Cancer	166	5.42	5.13	0.38
High Blood Pressure	758	-134.14	-1.9	-131.52
Diabetes	366	-11.47	-12.59	1.14
Lung Disease	188	-4.55	-5.53	1.06
Panel A2. Lifetime Incidence of Diseases				
Cardiovascular Disease	641	-15.02	-0.27	-15.04
Stroke	350	-17.18	-5.43	-11.73
Cancer	358	19.68	14.65	5.31
High Blood Pressure	882	-85.63	1.43	-86.82
Diabetes	516	-9.38	-12.56	3.27
Lung Disease	338	-4.11	-7.32	3.23
Panel B. Expected Lifetime Outcomes at Age 25				
Life Expectancy (years)	54.41	0.91	0.51	0.4
Disability-free Life-years	40.43	1.34	0.74	0.59

Table 5: Economic Outcomes

	Nationally Representative Cohort			Uninsured Individuals		
	Status Quo	Increased Health Insurance		Status Quo	Increased Health Insurance	
	Level	Level	Difference	Level	Level	Difference
Panel A. Lifetime Medical Spending at Age 25 ($1000s)						
Total	439.84	439.76	-0.09	437.3	436.7	-0.6
Medicare	152.79	152.54	-0.25	157.11	155.37	-1.74
Medicaid	73.15	72.59	-0.57	79.55	75.62	-3.94
Panel B. Economic Outcomes & Government Outlays						
Lifetime DI Benefits	6438.23	6270.6	-167.63	7520.06	6352.09	-1167.96
Lifetime SS Benefits ($1000s)	129.89	129.87	-0.01	130.11	130.07	-0.05
Lifetime Earnings ($1000s)	1446.72	1462.37	15.65	1282	1390.51	108.51
Full-time Years	25.08	25.21	0.13	24.34	25.22	0.88

All amounts are presented in present values at age 25, calculated with a 3% interest rate. DI refers to disability insurance and SS refers to social security. Full-time years are the number of years that the individual is working full-time.

Table 6: Economic Outcomes by Intervention

	Status Quo	Difference with Status Quo		
		Increased Health Insurance	Educational Benefits Only	Hypertension Benefits Only
Panel A. Lifetime Medical Spending ($1000s)				
Total	437.3	-0.6	5.16	-5.76
Medicare	157.11	-1.74	0.53	-2.31
Medicaid	79.55	-3.94	-4.56	0.63
Panel B. Economic Outcomes & Government Outlays				
Lifetime DI Benefits	7520.06	-1167.96	-827.36	-375.46
Lifetime SS Benefits ($1000s)	130.11	-0.05	-0.02	-0.02
Lifetime Earnings ($1000s)	1282	108.51	93.08	14.33
Full-time Years	24.34	0.88	0.62	0.26

All amounts are presented in present values at age 25, calculated with a 3% interest rate. DI refers to disability insurance and SS refers to social security. Full-time years are the number of years that the individual is working full-time.

Figure 1: Core Modules of the Future Americans Model

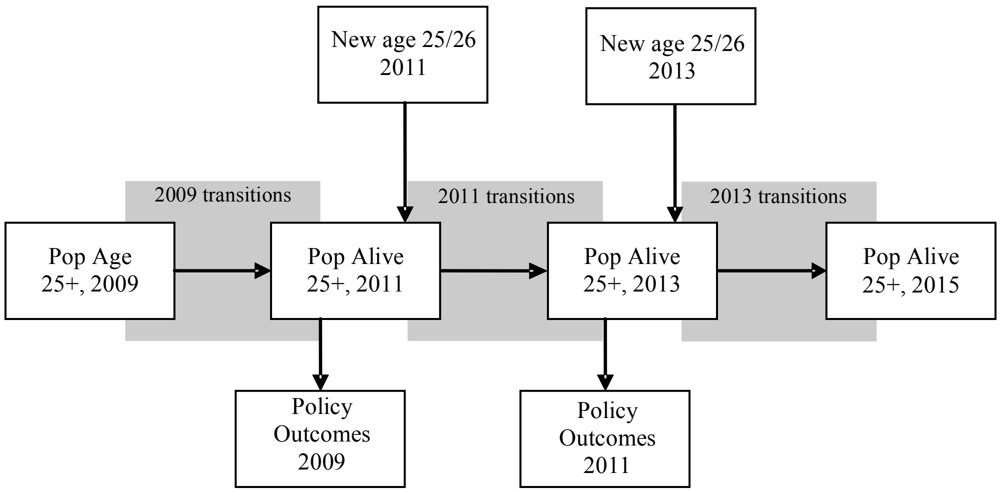
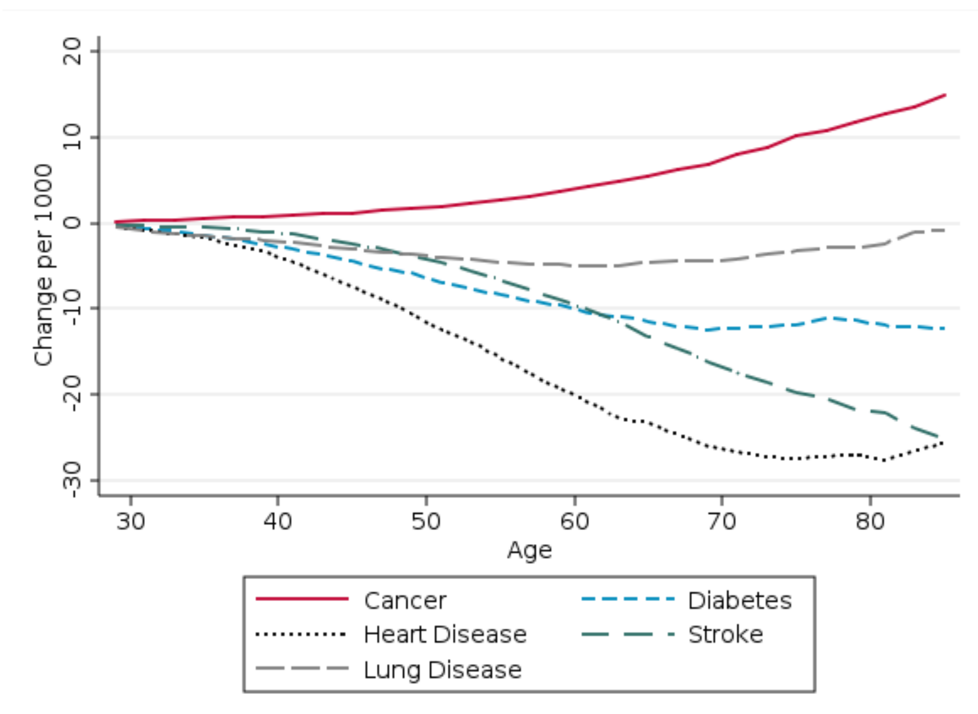
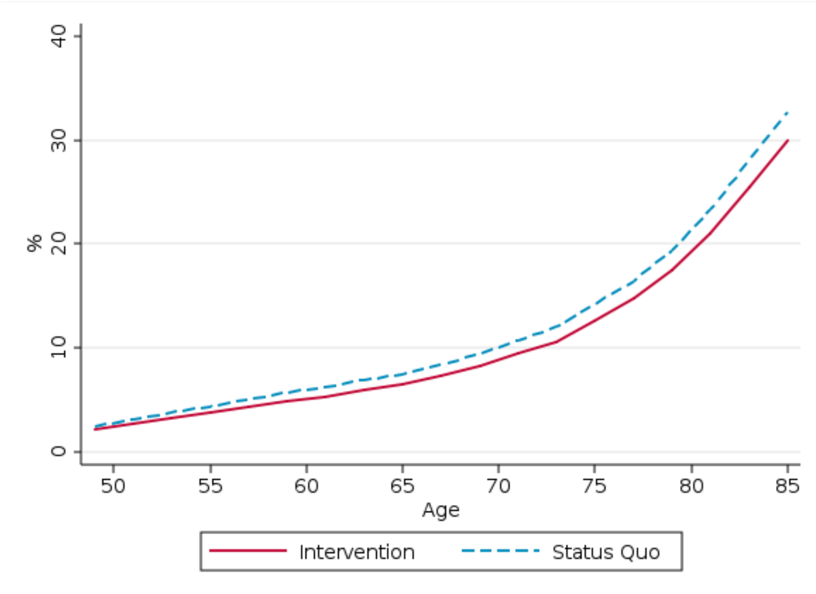


Figure 2: Change in Chronic Conditions in Intervention Scenario Relative to the Status Quo



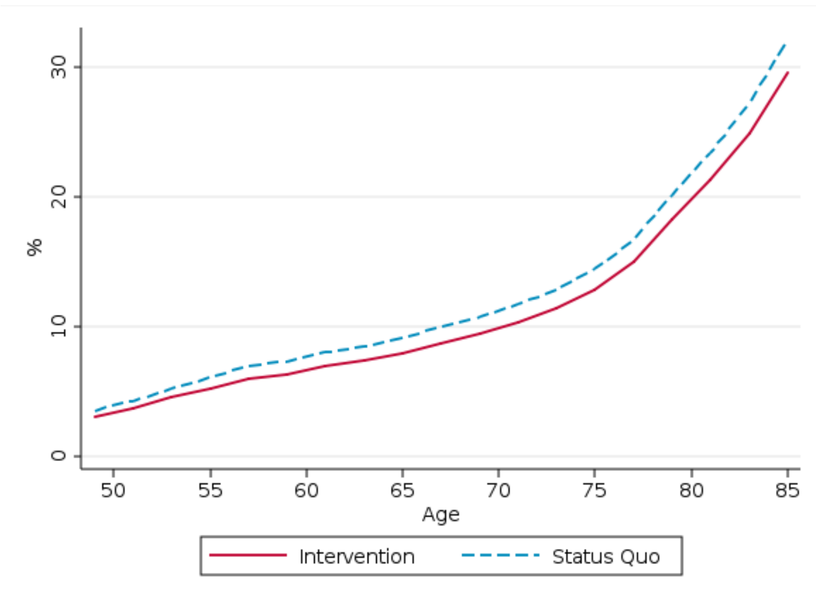
The intervention outcome corresponds to the uninsured group gaining the benefits of insurance during childhood, including both improved educational outcomes and a decrease in the likelihood of becoming hypertensive.

Figure 3: Likelihood of Needing Assistance with 3 or More Activities of Daily Living



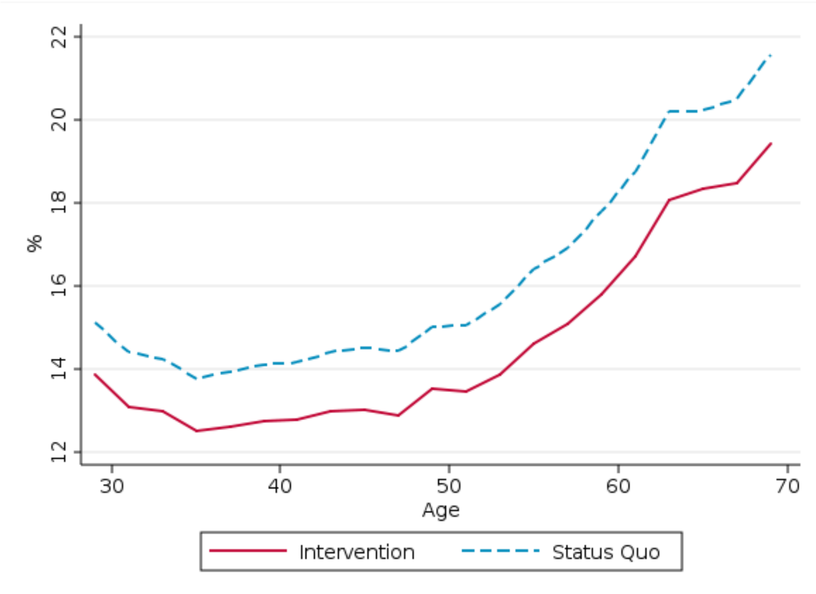
The intervention outcome corresponds to the uninsured group gaining the benefits of insurance during childhood, including both improved educational outcomes and a decrease in the likelihood of becoming hypertensive.

Figure 4: Likelihood of Needing Assistance with 2 or More Instrumental Activities of Daily Living



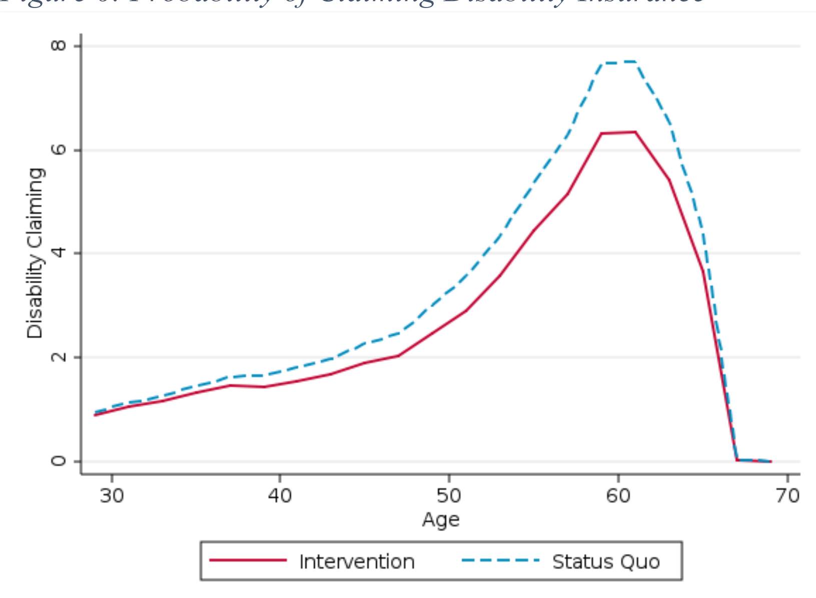
The intervention outcome corresponds to the uninsured group gaining the benefits of insurance during childhood, including both improved educational outcomes and a decrease in the likelihood of becoming hypertensive.

Figure 5: Percent of Cohort Eligible for Medicaid



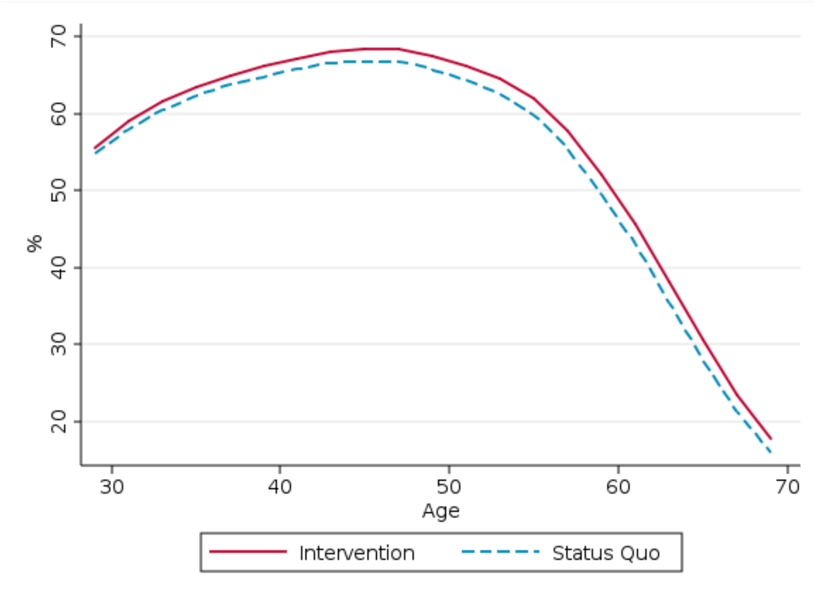
The intervention outcome corresponds to the uninsured group gaining the benefits of insurance during childhood, including both improved educational outcomes and a decrease in the likelihood of becoming hypertensive.

Figure 6: Probability of Claiming Disability Insurance



The intervention outcome corresponds to the uninsured group gaining the benefits of insurance during childhood, including both improved educational outcomes and a decrease in the likelihood of becoming hypertensive.

Figure 7: Probability of Working Full-time



The intervention outcome corresponds to the uninsured group gaining the benefits of insurance during childhood, including both improved educational outcomes and a decrease in the likelihood of becoming hypertensive.

Appendix: The Role of Education and Hypertension

This section describes how education and hypertension enter the FAM. Each of these is important as they are what is intervened on when determining the effects of health insurance during childhood.

A.1 Education

Education does not transition in the FAM; rather it is fixed at age 25. We model education as a series of outcomes: less than high school completion, high school/GED/some college/AA, college graduate, or more than college. However, education does affect the transition probability of many different outcomes. Education is a predictor of the following outcomes: medical costs, health outcomes: ADLS, cancer, diabetes, heart disease, high blood pressure, IADLs, insurance category, BMI, lung disease, stroke; and economic outcomes: earnings, DI claiming, labor force participation, smoking status, self-reported health, SS claiming, SSI claiming, wealth; and demographic outcomes: number of births, marital status.

A.2 Hypertension

Hypertension both transitions in the FAM and enters other transition probabilities. However, having high blood pressure is an absorbing state. Let h_{i,j_i} be a vector denoting outcomes, with $h_{i,j_i,bp} = 1$ being a component of the vector and denoting individual *i* being hypertensive at age j_i. Let ji_0 be the first age that individual i is observed. We assume that the individual-specific component of the hazard of hypertension can be decomposed as a time invariant and variant component. The time invariant component is composted of the effect of observed characteristics that are constant over the entire life course, including education, race and ethnicity, gender, child self-reported health, growing up rich or poor, and interactions between race and education and race and gender, x_i, and initial conditions, $h_{i,j_0,-bp}$. The time variant component is the effect of previously diagnosed outcomes, excluding blood pressure, $h_{i,j_i-1,-bp}$. These outcomes include an interaction between age and sex, whether or not the individual was ever a smoker or never a smoker, whether or not the individual exercises, BMI, and diabetes. Importantly, heart disease is not included, which prevents feedbacks in the model. We assume an index of the form $z_{bp,j_i} = x_i\beta_{bp} + h_{i,j_i-1,-bp}\gamma_{bp} + h_{i,j_0,-bp}\psi_{bp} + a_{bp,j_i} + \varepsilon_{i,j_i,bp}$.

We approximate a_{bp,j_i} as an age spline with knots at 35, 45, 55, 65, and 75. We assume that ε is a time-varying shock specific to age j and uncorrelated across diseases. Then, the latent component of the hazard model for having high blood pressure is modeled as follows:

$$h^*_{i,j_i,bp} = x_i\beta_{bp} + h_{i,j_i-1,-bp}\gamma_{bp} + h_{i,j_0,-bp}\psi_{bp} + a_{m,j_i} + \varepsilon_{i,j_i,bp}$$

We then defined the absorbing state of having high blood pressure as follows:

$$h_{i,j_i,bp} = \max\{I\left(h^*_{i,j_i,bp} > 0\right), h_{i,j_i-1,bp}\}$$

An individual having high blood pressure at age $j-1$ enters as a predictor for the following outcomes at age j: heart disease, stroke, mortality, disability, smoking status, BMI, having any health insurance, claiming Disability Insurance, Social Security, SSI, or DB, being in a nursing home, working, earnings, having positive wealth, and the amount of wealth.