

Health Insurance and Ex Ante Moral Hazard: Evidence from Medicare

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Basic economic theory suggests that health insurance coverage may cause a reduction in prevention activities, but empirical studies have yet to provide much evidence to support this prediction. However, in other insurance contexts that involve adverse health events, evidence of ex ante moral hazard is more consistent. In this paper, we extend the analysis of the effect of health insurance on health behaviors by allowing for the possibility that health insurance has a direct (ex ante moral hazard) and indirect effect on health behaviors. The indirect effect works through changes in health promotion information and the probability of illness that may be a byproduct of insurance-induced greater contact with medical professionals. We identify these two effects and in doing so identify the pure ex ante moral hazard effect. This study exploits the plausibly exogenous variation in health insurance as a result of obtaining Medicare coverage at age 65. We find evidence that obtaining health insurance reduces prevention and increases unhealthy behaviors among elderly men. We also find evidence that physician counseling is successful in changing health behaviors.

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Ms. Brooks said they dropped their health coverage in July after the family premium jumped to \$989 a month from \$489 a month. Business was slow, and their previous income of \$60,000 a year had fallen in half. The effect was immediate. Mr. Brooks, 50, has stopped taking Lipitor to control high cholesterol and has started taking over-the-counter herbal supplements. Ms. Brooks no longer takes Singulair for asthma and has adopted an exercise program intended to regulate her breathing. Ms. Brooks estimates they are saving \$150 a month by not using prescription drugs. “We changed our diets a lot to help the effectiveness of the supplements, and maybe that’s a good thing,” she said.¹

This vignette from the New York Times is a perfect illustration of *ex ante* moral hazard—in this case, the loss of health insurance resulted in changes in health behavior that reduced the risk or severity of illness. While *ex ante* moral hazard is nearly always mentioned as a potential consequence of health insurance, it is equally as often noted that *ex ante* moral hazard is unlikely to be a significant problem.

“The extent of moral hazard in terms of actions that affect health may not be large for health insurance in most instances, since the uncompensated loss of health itself is so consequential.” (Cutler and Zeckhauser 2000, p. 577)

“In the context of health insurance, the *ex ante* moral hazard problem may be small because common forms of health insurance in fact offer very incomplete coverage. Even if the consumer has generous coverage for the monetary components of the loss (medical expenditures and foregone earnings), he will be uninsured for the utility loss.” (Kenkel, 2000, p.1687)

While limited, empirical evidence on the extent of *ex ante* moral hazard in the health insurance context is mostly consistent with these predictions about its importance (Kenkel 2000; Zweifel and Manning 2000). Findings from the Rand Health Insurance Experiment (RHIE) showed that less generous health insurance had no significant or practical effect on health behaviors such as smoking, drinking, and exercise (Newhouse 1993). Less generous insurance was associated with decreased use of preventive medical services (secondary prevention), which contradicts the simple intuition that less insurance should cause an increase in prevention (Lillard

¹ Broder, John. “Problem of Lost Health Benefits is Reaching into the Middle Class.” New York Times November 25, 2002.

et al. 1986). However, this finding is not conclusive because the consumer may engage in more primary prevention activities (self-protection) in response to an increase in the price of preventive medical care. Moreover, it is likely that the less generous (i.e., more cost-sharing) insurance plans in the RHIE increased the cost of preventive care relative to curative care due to the cap on out-of-pocket expenditures, and because these types of care are substitutes, consumers may have substituted toward curative care.

More direct evidence also offers mixed support for the *ex ante* moral hazard hypothesis. Courbage and Coulon (2004) found no evidence that private health insurance coverage reduced prevention (smoking and exercise) activities among British Households. In contrast, Klick and Stratman (2007) found that state mandated health insurance coverage for the treatment of diabetes, which is linked to obesity, was associated with higher body mass index among diabetics.

Empirical evidence in other insurance contexts is more supportive of the existence of a substantial amount of *ex ante* moral hazard. In the case of automobile insurance, there appears to be a significant reduction in prevention and an increase in accidents when the generosity of insurance is increased (Chiappori 2000). Indeed, Cohen and Dehejia (2004) examined the effect of compulsory auto insurance laws and found that having auto insurance was associated with an increase in auto fatalities. Similarly, in the workers' compensation (WC) case, increases in benefits (insurance generosity) are associated with more workplace injuries (Ruser 1985; 1991; Fortin and Lanoie 2000). The positive association between WC benefits and injuries is evidence that the worker moral hazard effect—less precaution because of more generous insurance—outweighs the countervailing incentive for firms to increase safety investments to offset higher

benefit (insurance) costs. Kaestner and Carroll (1997) empirically identify these two separate effects and reported a significant worker (*ex ante*) moral hazard effect.

It is interesting to note that the same rationale for why *ex ante* moral hazard may not be important in the health insurance context—that it is not possible to insure health—fails to explain findings in two other contexts that also involve adverse health effects. The consequences of reduced prevention in driving (automobile insurance) and at work (workers' compensation insurance) result in immediate and sometimes quite severe adverse health events. In comparison, a poor diet and smoking will not adversely affect health for many years, which lowers the cost of these behaviors (i.e., lowers the benefit of prevention). Furthermore, the costs of future adverse health events are low because all elderly persons are covered by Medicare.²

In sum, there are theoretical reasons to believe that health insurance coverage may cause a reduction in prevention activities, but empirical studies have yet to provide sufficient evidence to support this prediction. One explanation for the lack of empirical evidence is that it is more difficult to detect *ex ante* moral hazard in the health insurance context than in others because of the non-random nature of health insurance. Besides the RHIE, there have been relatively few exogenous sources of variation in health insurance that could be used to identify an *ex ante* moral hazard effect. Similar problems have plagued the study of the effect of health insurance coverage on other outcomes such as health and use of health care services (Brown et al. 1998; Levy and Meltzer 2004).

One source of plausibly exogenous variation in health insurance coverage is the introduction and expansion of public health insurance. The introduction of Medicaid and

² Kenkel (2000) suggests that another impediment to reducing prevention is that prevention decisions depend on having health insurance coverage at the time of the health loss and that movement in and out of insurance reduces the incentive to alter prevention activities. But this argument ignores the fact that in the US all persons age 65 and older are insured and this is the likely time of health loss from reduced prevention activities when younger.

Medicare and the expansion of Medicaid have been used to study the effect of insurance on health care utilization and health (Decker 2005; Currie and Gruber 1996; Kaestner et al. 2000, 2001). However, this source of variation has been used only sparingly to study the effect of health insurance on prevention and health behaviors. Card et al. (2005) study the effect of obtaining Medicare at age 65 on several health behaviors and the use of preventive services. They find that obtaining insurance is not associated with changes in smoking, exercise and weight, nor is it strongly associated with use of preventive services (mammogram). In contrast, McWilliams et al. (2003) and Decker et al. (2006) find that obtaining Medicare at age 65 significantly increases rates of mammography, prostate and cholesterol screening. All of these results are evidence inconsistent with a strong, *ex ante* moral hazard effect.

In this paper, we extend the analysis of the effect of health insurance on health behaviors by examining the effect of Medicare on health behaviors of the elderly. Focusing on the elderly is useful because of the exogeneity of Medicare, but also because the benefits of prevention are more immediate among the elderly and prevention, particularly better health behaviors, may be more salient. The National Institute of Aging (NIA) reports that quitting smoking has immediate and important health benefits including a significantly lower risk of heart attack, stroke, other circulatory diseases and lung cancer.³ NIA also reports that staying physically active and exercising regularly can help prevent or delay many diseases and disabilities among the elderly.

We extend the literature on *ex ante* moral hazard by allowing for the possibility that health insurance, in this case Medicare, has a direct (*ex ante* moral hazard) and indirect effect on health behaviors. The indirect effect works through changes in health promotion information and the probability of illness that may be a byproduct of insurance-induced greater contact with medical professionals. There is significant evidence that physician counseling is successful in

³ See <http://www.niapublications.org/agepages/smoking.asp>.

changing health behaviors (Kenkel 2000; US Preventive Services Task Force 2003, 2004; Viscusi 1995). Thus, obtaining insurance coverage at age 65 has two potentially offsetting effects on prevention. On the one hand, obtaining health insurance should reduce prevention because it lowers the cost of medical care (*ex ante* moral hazard). However, increased contact with physicians may alter information about the benefits of prevention and the probability of illness, which may increase prevention. We identify these two effects and in doing so identify the pure *ex ante* moral hazard effect. In contrast to most previous analyses, we find that obtaining health insurance does reduce prevention and increase unhealthy behaviors among elderly men. However, this finding is only apparent once we control for contact with medical professionals.

Health Insurance, Information and Prevention

The theoretical motivation for our study is a straightforward application of the Ehrlich and Becker (1972) model of the demand for self-protection (prevention). Following directly from Becker and Ehrlich (1972), the consumer's expected utility depends on income (I) in the healthy (1) and sick (0) state:

$$(1) \quad EU = [1 - \pi(r)]U(I_1 - r) + \pi(r)U(I_0 - r),$$

where r is the amount of money spent to reduce the probability of becoming sick (i.e., prevention). Maximizing consumer utility with respect to r yields the first order condition

[FOC(r):

$$(2) \quad \begin{aligned} FOC(r) &= -\frac{\partial \pi}{\partial r}U_1 - [1 - \pi(r)]U'_1 + \frac{\partial \pi}{\partial r}U_0 - \pi(r)U'_0 = 0 \\ &-\frac{\partial \pi}{\partial r}(U_1 - U_0) = U'_1 + \pi(U'_0 - U'_1) \end{aligned}$$

Equation (2) is the usual marginal benefit equal to marginal cost equilibrium condition. The benefit of prevention is the increase in utility resulting from the decline in the probability of becoming ill; income in the healthy state is higher than income in the sick state so a decrease in

the probability of becoming sick increases utility. The cost of prevention is the reduction in utility as a result of expenditures on prevention.

We now introduce health insurance into the analysis, but in a way that is intended to illustrate the effect of Medicare on behaviors. Specifically, we assume that there is no insurance prior to age 65 and at age 65 the consumer is given health insurance (q) that is free (i.e., Medicare). Thus, health insurance coverage depends only on age and it is exogenous. For an elderly (age > 64) consumer, Medicare changes expected utility as follows:

$$(3) EU = [1 - \pi(r)]U(I_1 - r) + \pi(r)U(I_0 - r + q).$$

Maximizing (3) with respect to prevention (r) also yields equation (2). *Ex ante* moral hazard arises because health insurance reduces the income difference between the healthy and sick states and therefore reduces the benefits of investment in prevention. A consumer who is fully insured ($q=I_1-I_0$) would receive no benefits from prevention and therefore not invest in prevention.⁴

As equation (2) indicates, consumer prevention efforts depend on the productivity of prevention ($\frac{\partial \pi}{\partial r}$) and the probability of illness (π). Insurance may affect both of these determinants. Specifically, insurance is associated with an increase in physician visits and this increase in physician contact may influence prevention activities. Numerous studies have shown that physician advice and interventions are successful in influencing patient behaviors (US

⁴ If health insurance premiums reflected the reduced level of risk caused by prevention, then even a consumer who is fully insured would invest in prevention (Ehrlich and Becker 1972). If the consumer is less than fully insured, increases in insurance may not necessarily reduce prevention, as insurance reduces both the marginal benefits and marginal costs of prevention (Ehrlich and Becker 1972). *Ceteris paribus*, insurance reduces prevention if the individual is sufficiently risk tolerant or if the marginal product of prevention efforts is sufficiently large.

Preventive Services Task Force 2003, 2004). These studies have analyzed several lifestyle changes relating to problem drinking, smoking cessation, diet, and exercise.⁵

The evidence on the effects of physician counseling suggests that physicians alter the productivity of prevention because the physician may suggest more effective prevention strategies or provide better information about the benefits of a given prevention strategy. Similarly, contact with a physician may change the perception of illness; for example, physician contact may uncover a previously unknown illness. We can incorporate these ideas into the analysis by making the marginal product of prevention effort and the probability of illness a function of physician contacts (m), which itself is a function of insurance (q):

$$m = m(q)$$

$$(4) \pi = \pi[r, m(q)]$$

$$\frac{\partial \pi}{\partial r} = \frac{\partial \pi}{\partial r}[m(q)]$$

Equation (2) then becomes:

$$(5) FOC(r) = -\frac{\partial \pi}{\partial r}[m(q)](U_1 - U_0) - \{1 - \pi[r, m(q)]\}U'_1 - \pi[r, m(q)]U'_0 = 0.$$

The effect of (exogenous) insurance (q) on prevention (r) is given by:

$$(6) \frac{dr}{dq} = -\frac{\partial FOC(r)}{\partial q} / SOC(r),$$

⁵ Mundt et al. (2005) test the effectiveness of brief physician advice on reducing alcohol use among adults age 65 or older. The results of this clinical trial show that this physician intervention significantly reduced alcohol use and frequency of excessive drinking of the treatment group relative to the control group. Whitlock et al. (2004) review several intervention studies and conclude that brief intervention counseling or advice in a primary care setting can reduce weekly drinking by 13-34 percent. Other experimental (clinical trials) studies show that physician advice also positively affects diet and exercise patterns of adults and elderly persons (Elley et al. 2003; Bull et al. 1998). The literature on physician counseling also finds strong effects on smoking behaviors (Doescher and Saver 2000; Young and Ward 1998; Frank et al. 1991). Lancaster and Stead (2004) review 39 trials conducted between 1972 and 2003, to assess the effectiveness of physician-based advice related to smoking cessation. They conclude that even brief advice leads to a significant increase in the odds of quitting (odds ratio 1.69), with more intensive advice raising the likelihood of quitting even further.

where $SOC(r)$ is the second order condition with respect to r , which is negative by assumption.

Thus, the sign of the effect of insurance on prevention is the same as the sign of $\frac{\partial FOC(r)}{\partial q}$ in

equation (6), which is:

$$(7) \quad \frac{\partial FOC(r)}{\partial q} = -\frac{(\partial\pi)^2}{\partial r \partial m} \frac{\partial m}{\partial q} (U_1 - U_0) + \frac{\partial\pi}{\partial r} [U'_0] - \frac{\partial\pi}{\partial m} \frac{\partial m}{\partial q} (U'_0 - U'_1) - \pi[r, m(q)] U''_0.$$

We assume that physicians raise the marginal product of prevention $[\frac{(\partial\pi)^2}{\partial r \partial m} < 0]$ and that

physicians' effect on the probability (perception) of illness is ambiguous ($\frac{\partial\pi}{\partial m} \leq 0$). Thus, the

first term on the right hand side of equation (7) is positive, which indicates that insurance increases prevention because physician contacts improve the productivity of investments in prevention. The second term is negative and is the pure *ex ante* moral hazard effect—insurance reduces the value of investments in prevention because it raises income in the sick state. The third term may be positive or negative and depends on whether physician visits reveal that a person is healthier or sicker than expected. The last term is positive—prevention is increased because insurance lowers the marginal cost of prevention by providing more income in the sick state.

To summarize, empirical analyses of the effect of health insurance on health behaviors (*ex ante* moral hazard) need to account for changes in a person's information set that may occur as a result of insurance, most notably changes in information that are likely to occur because of greater receipt of medical services. It is well known that health insurance increases use of medical services (Newhouse 1993). Similarly, there is significant evidence that physicians are successful at changing lifestyle behaviors. So, insurance may reduce prevention because of traditional arguments related to *ex ante* moral hazard, but investigations of this effect may not

uncover this behavior because of potentially offsetting effects caused by greater interaction with the medical system. Here, we separate out these two effects in the context of elderly persons who obtain insurance through Medicare.

Methods

Our objective is to identify the effect of Medicare on health behaviors. To accomplish this goal we used longitudinal data from the Health and Retirement Study (HRS) that allows us to observe persons before and after age 65. We compare pre- to post-age 65 (Medicare) changes in behaviors (Y) of those who were uninsured before age 65 to pre- to post-age 65 changes in behaviors of those who were insured prior to age 65. This is the approach used by McWilliams et al. (2003) and Decker et al. (2006). Specifically, we estimate the following regression model:

$$\begin{aligned}
 Y_{it} &= \alpha_i + \sum_{k=60}^{69} \beta_k AGE_{kit} + \delta MARITAL_{it} + \omega X_{it} + \sum_{t=1992}^{2006} \gamma_t YEAR_t + \lambda_1 (UNIN_i * POST65_{kt}) \\
 (8) \quad &+ \lambda_2 (UNIN_i * AGE63_64_{kt}) + e_{it} \\
 &i = 1, \dots, N \\
 &t = 1992, \dots, 2006
 \end{aligned}$$

where Y is a measure of some health behavior, for example cigarette use, of person i in year t; AGE is a series of dummy variables indicating single years of age (60 to 69); MARITAL is a dummy variable indicating that the person is married; X represents a vector of other time-varying individual characteristics and YEAR is a series of year dummy variables (1992 to 2006).

Importantly, equation (8) includes individual fixed effects (α_i) that control for time-invariant characteristics of individuals that may be correlated with health behaviors and health insurance coverage prior to age 65. While receipt of Medicare at age 65 is exogenous, having health insurance prior to age 65 is a choice. Here we assume that this choice depends solely on a fixed, personal characteristic, conditional on other observed time-varying factors such as employment, and that once we control for this factor, insurance status prior to age 65 is exogenous.

The key independent variable in equation (8) is the interaction term between a dummy variable indicating that the person was uninsured prior to age 65 (UNIN) and a dummy variable indicating that the person is over age 65 (POST65). The coefficient on this variable measures the effect of Medicare on health behaviors and this effect is identified in a difference-in-differences (DD) framework; the “treatment” group is persons who were uninsured prior to age 65 and the “comparison” group is persons who were insured prior to age 65. Identification of the effect of Medicare comes from the assumption that, conditional on measured covariates, pre- and post-age 65 changes in health behaviors would be the same for the treatment and comparison groups in the absence of Medicare.

To assess the validity of this identification assumption, we also include an interaction between the uninsured dummy variable and a dummy variable for ages 63 to 64. Ideally, the coefficient on this term would be zero—there would be no pre-age 65 differences in the time (age) pattern of outcomes between the insured and uninsured. In fact, we find this to be the case in most analyses. The coefficient of this interaction (λ_2) is generally insignificant and close to zero, which supports the above identification assumption of similar trends between the two groups prior to age 65.⁶ However, we also calculate (and present) the difference between λ_1 and λ_2 . This is the difference-in-difference-in-differences (DDD) estimate and it is an alternative estimate of the *ex ante* moral hazard effect. It would be preferred to the difference-in-difference estimate if the interaction between the uninsured dummy variable and a dummy variable for ages 63 to 64 controlled for any differential trends between individuals who are insured versus uninsured.

⁶ If there are anticipatory effects of Medicare, then including the interaction between uninsured and age 63 to 64 dummy would not be a good test of the identification assumption. Generally, we do not find any significant effects, which is consistent with no anticipatory changes. Card et al. (2008) also do not find evidence of significant anticipatory behavior.

We have raised the possibility that Medicare coverage will also affect health behaviors indirectly because of greater contact with medical professionals. Indeed, it is well known that insurance increases physician visits and use of other medical services. It is also known that physician visits affect health behaviors. To incorporate these ideas, we modify equation (8) to include physician visits:

$$\begin{aligned}
 (9) \quad Y_{it} = & \alpha_i + \sum_{k=60}^{69} \beta_k AGE_{kit} + \delta MARITAL_t + \sum_{k=1}^K \omega_k X_{kit} + \sum_{t=1992}^{2006} \gamma_t YEAR_t + \lambda_1 (UNIN_i * POST65_{it}) \\
 & + \lambda_2 (UNIN_i * AGE63_64_{it}) + \rho_1 DOCTOR_{it} + \rho_2 (DOCTOR_{it} * POST65_{it}) \\
 & + \rho_3 (UNIN_i * DOCTOR_{it}) + \rho_4 (UNIN_i * DOCTOR_{it} * POST65_{it}) + e_{it}
 \end{aligned}$$

where all variables are defined as before with the exception of DOCTOR, which measures whether person i had a physician visit at time t . We allow the effects of physician visits on health behaviors to differ by whether or not a person had health insurance coverage prior to age 65 and whether the visit was pre- or post-Medicare.

We allow for heterogeneous effects of physician visits on health behaviors because there is a missing variable, health status, which is likely correlated with both doctor visits and health behaviors. Therefore, estimates of the effect of doctor visits are likely to be biased, particularly for doctor visits pre-Medicare for those without insurance because poor health is likely to be the motivating force behind the decision to seek care. As a result, the coefficients ρ_1, ρ_2 , and ρ_4 will be better measures of the effect of physician visits on health behaviors than ρ_3 .

Identification of the *ex ante* moral hazard effect comes from two assumptions: that health status is uncorrelated with the interaction between uninsured and the post-age 65 dummy (conditional on individual fixed effects and observed covariates), and that the *ex ante* moral hazard effect of Medicare is the same for those who did not visit the doctor pre- and post-Medicare and those that did visit the doctor.

Data

The empirical analysis is based on the first eight waves of the Health and Retirement Study (HRS). The HRS is an ongoing longitudinal study conducted by the Institute for Social Research at the University of Michigan, which began in 1992 and is repeated biennially. We used surveys through 2006. Prior to 1998, the HRS cohort included individuals born between 1931 and 1941 and their spouses regardless of the spouse's age, and a separate Study of Assets and Health Dynamics among the Oldest Old (AHEAD) included individuals born before 1924. Since 1998, AHEAD respondents have been contacted as part of a joint data collection effort with the HRS, and the sample frame was also expanded by including cohorts born between 1924 and 1930 and those born between 1942 and 1947. The analysis sample is limited to individuals who are between the ages of 60 and 69, in order to provide a tighter comparison pre- and post-Medicare age eligibility. Disabled persons and those on Medicare prior to age 65 are excluded from the analysis. The sample is further restricted to adults who have not completed high school because of the relatively high rate of uninsured persons in this group. About 24 percent of individuals between the ages of 60 and 64 with less than a high school education are uninsured whereas 8.7 percent of those with at least a high school degree are uninsured. This low-educated group also has a higher participation in unhealthy behaviors such as smoking and physical inactivity relative to the general population. Thus, the question of how health insurance affects health behaviors among the low-educated is relevant to informing policies that seek to reduce the number of uninsured.⁷ The final sample size across eight waves comprises of 9,782 person-wave observations for 3,396 persons.⁸

⁷ We have also estimated all models using persons of all education levels and the results were basically unchanged.

⁸ This is the maximum sample size in the analyses. For some variables, the actual sample size is less due to missing information.

The HRS is administered for the specific purpose of studying life-cycle changes in health and economic resources, and includes detailed information on demographics (e.g., age, marital status, education, race), health insurance status, health care utilization, and health behaviors. The respondent's health insurance status is determined from a series of questions about the type of coverage. For each wave, a coverage indicator is defined for whether the individual reports being covered by health insurance under any governmental program including Medicare or Medicaid, under his own current or previous employer, under his spouse's current or previous employer, or under any other supplemental insurance. Two measures of uninsured are employed in the analysis. The first captures those individuals who have been continuously uninsured during all waves prior to age 65, and the second measure captures those individuals who have been uninsured more than half the time prior to age 65. About 11 percent of the analysis sample between the ages of 60-64 is uninsured in all waves, and 21 percent is uninsured more than half the time over the sample period.

Dichotomous indicators are defined for various dimensions of health care utilization. These measure whether the respondent reported any overnight hospital stay and any physician visit, since the prior wave. A continuous measure of the number of physician visits is also defined. To ensure a more precise classification of health care utilization pre- and post-age 65, these variables are assigned to the respondent's mean age between the prior and the current wave. Thus, for a respondent who is currently 65 and reports a physician visit since the prior wave, the health care usage is appropriately treated as a pre-age 65 observation.

Three health behaviors are considered: exercise, smoking and alcohol use. Questions related to physical activity are somewhat limited. We measure exercise by a dichotomous indicator for whether the respondent reports participating in "vigorous physical activity or

sports—such as heavy housework, aerobics, running, swimming, or bicycling—three or more times a week.”⁹ Three measures of cigarette consumption are constructed: number of cigarettes smoked daily, dichotomous indicator of daily smoking, and a dichotomous indicator for whether the person quit smoking. The number of cigarettes smoked daily is taken directly from a survey question that asks respondents to report on the number of cigarettes or packs (20 cigarettes per pack) that they smoke each day. If a respondent reports a positive number, we consider them a daily smoker. While the number of days per week of smoking is not asked in the HRS, data from the Behavioral Risk Factor Surveillance System (BRFSS) show that the vast majority of current smokers (over 85 percent) smoke daily. As a consistency check, among adults ages 60-64 with less than a high school education, the prevalence of daily smoking is highly similar across the HRS (26.4 percent) and the BRFSS (24.0 percent). Finally, we define an indicator for whether the respondent has quit smoking, which is equal to one if a person had smoked in the past, but currently doesn’t smoke.

Alcohol use is measured as a dichotomous indicator for whether the respondent currently drinks. From waves 3-8, the HRS also asks respondents to report on the number of days that they consume alcohol during an average week. An indicator for daily drinking is defined based on this measure of frequency.

Table 1 provides descriptive statistics for respondents by insurance status (consistently uninsured in all waves). Samples are limited to respondents less than 65 years of age because we wanted to show pre-Medicare differences. Table 1 also provides information about the demographic variables used in the analysis: gender, age, race, marital status, and education.

Figures in Table 1 show that the insured visit the doctor more frequently and are more likely to

⁹ Due to an inconsistency in the survey questions in waves seven and eight, models of physical activity are estimated for the first six waves of the HRS.

have a hospital visit than the uninsured. The insured also smoke less than the uninsured. There are no significant differences in exercise or alcohol use between the insured and uninsured.

Results

We begin by presenting estimates of the effect of Medicare on physician visits and hospital stays. Our intention here is to establish that Medicare is associated with a significant increase in visits to medical providers and that our results are similar to those of previous studies. Table 2 reports estimates of the effect of Medicare on whether a low-educated person had any doctor visits in the last two years, the number of doctor visits in the past two years and whether a person had a hospital stay in the past two years. We discuss the difference-in-difference-in-differences estimates (DDD), but these are very similar to the simpler difference-in-differences estimates (DD). For low-educated males who were always uninsured prior to age 65, receipt of Medicare:

- significantly increased the probability of seeing a doctor by 7.6 percentage points, which represents a 12.4 percent increase from the pre-age 65 mean of the uninsured;
- significantly increased the number of doctor visits by 30.9 percent;¹⁰
- and increased the probability of having a hospital stay by 4.8 percentage points (32.2 percent), although this effect is not statistically significant.

For low-educated females who were always uninsured prior to age 65, receipt of Medicare:

- increased the probability of seeing a doctor by an insignificant 2.7 percentage points (3.4 percent);

¹⁰ We use fixed effects Poisson regression to estimate models for count outcomes: number of doctor visits and number of cigarettes consumed daily (reported later). The Poisson model does not suffer from the “incidental parameters” problem and can accommodate fixed effects well; both the conditional and unconditional likelihood maximization yield consistent and identical parameter estimates. The standard errors are adjusted for over-dispersion as described in Wooldridge (2001). For all other dichotomous outcomes, OLS is used for estimation. Results are not sensitive to the use of logit/probit for these outcomes.

- significantly increased the number of doctor visits by 38.8 percent;
- and increased the probability of having a hospital stay by an insignificant 3.2 percentage points (21.3 percent).

As can be seen in Table 2, results are similar if we focus on persons who were uninsured more than half the time prior to age 65 instead of those always uninsured. These results are also similar to those reported in recent studies. Estimates in Card et al. (2005) suggest that gaining Medicare coverage was associated with a 24 percentage point increase in the probability of visiting a doctor among white, non-Hispanic high-school drop outs (males and females), and a 23 percentage point increase among high-school drop outs from other race/ethnic groups.¹¹ In the case of any hospital visit, estimates in Card et al. (2005) suggest that gaining Medicare was associated with a 12.3 percentage point increase in the probability of experiencing a hospital stay among non-Hispanic white drop outs, and Medicare was not associated with a hospital stay for drop outs of other race/ethnic groups. Decker et al. (2006), who use a similar methodology and the same data as us, found that receipt of Medicare increased the probability of a doctor visit by five percentage points among previously uninsured persons (males and females), and increased the probability of a hospital stay by 3.3 percentage points.¹² Overall, the results we report and those in previous studies demonstrate that receipt of Medicare clearly increases contact with medical providers. It is this contact that we believe is an important confounding influence when trying to identify the *ex ante* moral hazard effect of insurance.

¹¹ These effects sizes were calculated by inflating the regression discontinuity (RD) estimates for doctor visits using the regression discontinuity estimates for any insurance coverage. For example, the RD estimate indicated that among non-Hispanic, white drop outs, the pre- to post-age 65 change in the probability of visiting a doctor was 3.1 percentage points. The RD estimate related to any insurance coverage was 13 percentage points. So the implied effect of Medicare was 23.9 percentage points (0.031/0.13). It is important to note that estimates rescaled in this way can differ dramatically with relatively small changes in the underlying estimates.

¹² One reason our estimates are larger than those in Decker et al. (2006) is that we estimate separate models for males and females. In addition, we limit the sample to low-educated persons and do not restrict the sample to those individuals only observed in wave 1. Decker et al. (2006) also only utilize the first six waves of the HRS.

Next, we examine the effect of receipt of Medicare on health behaviors: exercise, smoking and drinking. Table 3 reports estimates for the male sample. Here we focus on those who were always uninsured and Appendix Table 1 presents estimates for an alternative group—those uninsured more than 50 percent of the time, which includes the always uninsured. Results in Appendix Table 1 are similar to those in Table 3. For each outcome, we report estimates from two models: one that does not control for doctor visits and one that does. Again, we discuss the DDD estimates only, but DD estimates are similar. More importantly, estimates indicate no statistically significant pre-age 65 trends, which supports the identification assumption underlying the analysis.

For exercise, receipt of Medicare is associated with a 9.1 percentage point (24 percent) decrease in the probability of engaging in vigorous physical activity. However, this estimate includes both the *ex ante* moral hazard effect and the effect of increased contact with physicians and other medical professionals. When we control for doctor visits, the main effect of Medicare receipt on exercise becomes larger (-15.1 percentage points or 40 percent). By main effect of Medicare, we refer to the effect of Medicare receipt for a previously uninsured person who did not visit the doctor pre- or post-Medicare receipt. This is the *ex ante* moral hazard effect, or $(\lambda_1 - \lambda_2)$ of equation (9). Note that none of the coefficients on doctor visits are statistically significant or large. Similar results are reported in Appendix Table 1, which pertains to those uninsured at least half the time prior to age 65. Finally, we note that results (not reported) do not differ qualitatively if we use an alternative measure of exercise. The absence of a substantial effect of physician visits on exercise is consistent with evidence reviewed by the US Preventive Services

Task Force (2002), which reported mixed evidence as to the effect of physician counseling on exercise and physical activity.¹³

The next outcome is cigarette consumption. In the absence of controls for doctor visits, receipt of Medicare is associated with a small (1.3 percent) and statistically insignificant decrease in the number of cigarettes smoked daily. When we control for doctor visits, receipt of Medicare is associated with a 22.7 percent increase in daily cigarette consumption among those who never visit a physician, and visits to the doctor have large effects on smoking. However, most of these estimates of physician effects, while large, are not statistically significant. Among the always insured group, a visit to the doctor is associated with an insignificant 10 percent decrease in daily cigarette consumption, and for those who were uninsured prior to age 65, a visit to the doctor post-age 65 when they have Medicare is associated with a 42.1 percent decrease in daily cigarette consumption. These results are consistent with the simple theoretical model and empirical evidence about the effectiveness of physician visits in changing health behaviors. They reveal that Medicare is associated with an increase in unhealthy behavior (i.e., *ex ante* moral hazard) once we control for the effect of Medicare on doctor visits and that doctor visits are health promoting.

Similar results are found when we analyze whether a person quit smoking and whether they are a daily smoker. Among those who do not visit the doctor pre- or post-Medicare, Medicare receipt is associated with an 8.1 percentage point, or 18 percent, lower probability of quitting smoking and a 6.7 percentage point, or 15.8 percent, higher prevalence of daily smoking

¹³ In contrast, Card et al. (2008), using data from the BRFSS find that Medicare is associated with a 36.1 percentage point (72 percent) increase in strenuous exercise among white, high school dropouts, and a 19.7 percentage point (22 percent) increase among non-white drop outs. Effect size was calculated as in footnote 11: dividing the RD estimate for exercise by the RD estimate for insurance coverage.

once we adjust for the effect of contact with the medical profession.¹⁴ These are estimates of the *ex ante* moral hazard effect of Medicare. Physician visits are associated with a significant increase in the probability of quitting smoking and a significant decrease in daily cigarette consumption among the always insured, and a substantial, but not statistically significant increase in the probability of quitting smoking and decrease in daily cigarette consumption among those who gain Medicare. Similar estimates are reported in Appendix Table 1.

The last behavior we analyze is alcohol consumption, which we measure in two ways: dichotomous indicators for any alcohol use and daily consumption. Controlling for doctor visits, receipt of Medicare among the previously uninsured group is associated with an 11.6 percentage point (31.8 percent) increase in the probability of any alcohol consumption and a 2.0 percentage point (14.8 percent) increase in daily alcohol consumption. Neither estimate is statistically significant. However, consistent with our hypothesis, once we control for doctor visits, estimates of *ex ante* moral hazard are more consistent with theory—insurance causes an increase in unhealthy behaviors. Doctor visits tend to decrease alcohol use, especially among those who were uninsured prior to age 65. Estimates in Appendix Table 1 show a much smaller *ex ante* moral hazard effect and are generally less consistent with our hypotheses.

One challenge with our analysis is the evident lack of statistical power. In several cases, we found relatively large effects of obtaining Medicare on health behaviors, but these effects were not statistically significant. To address this issue, we did the following. First, we redefined the dichotomous dependent variables so that all of them represent unhealthy behaviors (i.e., no vigorous exercise, daily cigarette use, did not quit smoking, alcohol user, and daily alcohol use),

¹⁴ Card et al. (2005) find a decrease in daily smoking among white, non-Hispanic dropouts and an increase in daily smoking among non-white high-school dropouts. Neither effect is statistically significant. However, given that few persons in either group are likely to be affected by Medicare (i.e., already insured), the implied effect sizes are quite large.

and we transformed these dependent variables into standard normal deviates $[(Y-\text{mean})/\text{std. dev.}]$. Transforming the dependent variables in this way allows us to obtain estimates of the effect of obtaining insurance on behaviors using a seemingly unrelated regression framework, and in turn allows us to test joint hypotheses across equations. All effects are measured as changes in standard normal deviations of the dependent variables and we test whether the average effect across models is statistically different from zero.

Table 4 presents these results. Here too, we focus on DDD estimates and all models include doctor visits. In each column, we present an estimate of the average effect of Medicare receipt on three unhealthy behaviors: no vigorous exercise, smoking, and alcohol use. The p-value associated with the estimate is shown in brackets. We alternate the measures of smoking and alcohol use that are used in the regressions and these are indicated in the column headings. In all cases, we find that, after accounting with physician contact, on average Medicare increased unhealthy behaviors, consistent with ex ante moral hazard. For instance, the estimate in the first column indicates that receipt of Medicare is associated with a 0.234 of a standard deviation increase in unhealthy behaviors and this effect is statistically significant at the 0.01 level. In column two, we replace daily cigarette consumption with not quitting cigarette use, and the estimate is similar; receipt of Medicare is associated with a 0.241 of a standard deviation increase in unhealthy behaviors and this effect is statistically significant at the 0.01 level. In column three, we replace alcohol participation with daily alcohol use. The estimate indicates that receipt of Medicare is associated with a 0.178 of a standard deviation increase in unhealthy behaviors and this effect is statistically significant at the 0.14 level. Finally, in column four the three behaviors we used were: no vigorous exercise, not quit smoking, and daily alcohol use. The estimate in this column indicates that the receipt of Medicare is associated with a 0.184 of a

standard deviation increase in unhealthy behaviors and this effect is statistically significant at the 0.13 level. We view the estimates in Table 4 as confirmatory of the general findings of Table 3 and as further evidence that Medicare is associated with an increase in unhealthy behaviors (net of doctor visits). Simultaneous estimation of all three outcomes improves the precision of estimates and allows us to draw more definitive inferences.

Table 5 presents estimates of the effect of Medicare on the health behaviors of elderly women. Here too, we present estimates of the effect of Medicare for those who were always uninsured prior to age 65. Estimates using an alternative definition of uninsured, more than half the time, are presented in Appendix Table 2 and are consistent with those discussed in the text. Before beginning, we note that Medicare receipt was not associated with large changes in contact with the medical profession for uninsured women (see Table 2). Thus, we do not expect physician visits to be a particularly important confounding factor for the relationship between receipt of health insurance and health behaviors.

In the case of exercise, Medicare is associated with a decrease in the probability of engaging in vigorous exercise, and after controlling for visits to the doctor, the main (i.e., *ex ante* moral hazard) effect increases in magnitude and is quite large. Receipt of Medicare for those with no pre- or post-age 65 doctor visits is associated with a 12.8 percentage point (43 percent) decrease in the probability of engaging in vigorous exercise, and among those uninsured prior to age 65, a doctor visit post-Medicare receipt is associated with an 11.9 percentage point increase in engaging in vigorous physical activity. However, both of these estimates are not statistically significant. Overall, Medicare appears to be associated with a decrease in physical activity, which is consistent with an *ex ante* moral hazard effect.

Among elderly women, Medicare receipt is not associated with a strong *ex ante* moral hazard effect on smoking. In fact, Medicare receipt is associated with a large decrease (30.9 percent) in the number of cigarettes smoked per day. With respect to daily cigarette participation and quitting smoking, a small *ex ante* moral hazard effect emerges after controlling for physician contact. Among women who do not visit the doctor pre- or post-Medicare, Medicare receipt is associated with an 4.3 percentage point, or 7.7 percent, lower probability of quitting smoking and a 2.2 percentage point, or 9.6 percent, higher prevalence of daily smoking. Estimates in Table 5 and Appendix Table 2 provide some evidence that physicians have a beneficial effect on elderly female tobacco use. A visit to the doctor for someone who was always insured is associated with a statistically significant 8.8 percentage point (16 percent) increase in the probability of quitting smoking, and for a previously uninsured person, visiting the doctor post-receipt of Medicare is associated with a 10.3 percentage point (18 percent) increase in quitting. Estimates of the effects of physician visits of similar magnitude are found for daily cigarette consumption. The last set of estimates in Table 5 pertains to alcohol use. Here we find that receipt of Medicare is associated with a decrease in alcohol participation and an increase in daily alcohol consumption. Estimates are small in absolute value, but large in relative terms and estimates are not statistically significant.

In Table 6, we present estimates of the effect of obtaining insurance on behaviors using a seemingly unrelated regression framework. As noted, all effects are measured as changes in standard normal deviations of the dependent variables and we test whether the average effect across models is statistically different from zero. DDD estimates indicate that receipt of Medicare is associated with an increase in unhealthy behaviors on average. However, none of the estimates are statistically significant.

Sensitivity Analyses

We conducted several additional analyses to assess the robustness of the previous findings. While all estimates were obtained controlling for time-invariant individual heterogeneity, the possibility of unobserved time-varying factors remains. Theory would suggest that health is one of the most important time-varying characteristic that may be driving an individual's health behaviors and doctor visits. To assess this possibility, we performed three analyses. First, we re-estimated all models including direct controls for health status. Specifically, equation (9) was estimated by explicitly controlling for self-reported health status, functional difficulties, and difficulties in activities of daily living. Second, we exploited the longitudinal nature of the data to control for lagged doctor visits from the prior wave in the models. Finally, we included leading health indicators. The results from these analyses remain almost unchanged from previous estimates.

While all models control for employment indicators, we acknowledge that this may be potentially endogenous. Therefore, we also estimated models with and without employment and the results are not substantially affected with respect to significance or effect magnitudes. Finally, we also estimated models which constrain the effects of doctor visits to be the same pre- and post-age 65 for those who are always insured, as there is no a priori reason why these effects should likely differ. We found that we were unable to reject this restriction as expected, and the results are not affected in comparison with those reported.

Conclusions

Economic theory suggests that health insurance may reduce prevention because it lowers the cost of medical care and thereby reduces the financial and health consequences of illness. This implies that receipt of insurance will result in an increase in unhealthy behaviors like

smoking and drinking. This is often referred to as *ex ante* moral hazard. However, previous research in the context of health insurance has not found much evidence of an *ex ante* moral hazard effect, which is surprising because in similar contexts, workers compensation insurance and automobile insurance, evidence of an *ex ante* moral hazard effect has been found.

We hypothesize that one possible explanation for this is that health insurance not only changes incentives related to prevention and health behavior, but also changes use of medical services and contact with medical professionals. These effects may be offsetting and the net effect of insurance on health behaviors may be positive or negative. More importantly, previous empirical research has not separated the direct (*ex ante* moral hazard) effect from the indirect effect (physician visits) of insurance on health behaviors. Here we do so.

We study the effects of receipt of Medicare on the health behavior of elderly persons. We used longitudinal data and difference-in-differences (and DDD) research design to obtain estimates of the effects of Medicare. Specifically, we compare changes in health behavior pre- and post-age 65 of those who are uninsured and those who are insured prior to age 65. We expect the change in health behaviors of those who are uninsured prior to age 65 to differ from those who are insured, and we assume that this difference is the effect of Medicare. To identify the *ex ante* moral hazard effect, we estimate models that control for physician visits.

The pattern of results shows consistent evidence of an *ex ante* moral hazard effect for males. Among elderly men, the *ex ante* moral hazard effects associated with receipt of Medicare are as follows:

- a 39.7 percent decrease in the probability of engaging in vigorous physical exercise;
- a 18.0 percent lower probability of quitting cigarette use;
- a 15.8 percent higher prevalence of daily smoking;

- a 22.7 percent higher cigarette consumption;
- a 14.8 percent increase in the probability of daily alcohol consumption;
- and a 31.8 percent increase in the probability of current alcohol use.

We did not find consistent evidence of an *ex ante* moral hazard effect for females, although estimates generally indicated that Medicare was associated with an increase in unhealthy behaviors.

These estimates provide evidence that Medicare (health insurance) is associated with less prevention as manifested by an increase in unhealthy behaviors among elderly males. The effect sizes appear to be large enough to adversely affect health. But evidence also suggests that Medicare was associated with an increase in visits to the doctor and that doctor visits are associated with significant improvements in health behaviors. Often these two effects associated with Medicare are sufficient to yield a combined effect that is small and usually not statistically different from zero. One policy implication of our findings is that Medicare should be designed to encourage visits to the doctor, particularly among those who were previously uninsured. This could be accomplished by removing co-payments and annual deductibles, and covering routine doctor visits, perhaps for low-income adults only. Greater community outreach would also expand contact between individuals in vulnerable populations (low SES and more likely to be uninsured) and medical professionals.

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Table 1
Descriptive Statistics for Respondents Prior to Age 65
Health and Retirement Study: Waves 1-8

Variable Name	Definition	Insured	Uninsured
Age	Age in year	61.807	61.926
Male	Dichotomous indicator for whether respondent is male	0.454	0.412
White	Dichotomous indicator for whether respondent is white	0.772	0.752
Black	Dichotomous indicator for whether respondent is black	0.167*	0.138
Other Race	Dichotomous indicator for whether respondent is of some other race	0.061***	0.110
Hispanic	Dichotomous indicator for whether respondent is Hispanic	0.192***	0.404
Married	Dichotomous indicator for whether respondent is married	0.685***	0.571
Divorced	Dichotomous indicator for whether respondent is divorced	0.139	0.131
Full-time Employment	Dichotomous indicator for whether respondent works full-time	0.332	0.321
Part-time Employment	Dichotomous indicator for whether respondent works part-time	0.080*	0.115
Retirement	Dichotomous indicator for whether respondent if fully retired	0.345***	0.220
Partial Retirement	Dichotomous indicator for whether respondent if partially retired	0.073**	0.049
Unemployed	Dichotomous indicator for whether respondent is unemployed and looking for work	0.012***	0.033
Household Size	Number of adults ages 18 and over who reside in the household	2.530***	2.878
Parents alive	Number of parents who are currently alive	0.276	0.290
Assets	Net household wealth in 1982-1984 dollars	100909.800***	57803.510
Any Doctor Visit	Dichotomous indicator for whether respondent visited a doctor, emergency room or clinic since the last wave or in the past two years	0.857***	0.663
Number of Doctor Visits	Number of visits to the doctor since the last wave or in the past two years	7.793***	4.414
Any Hospital Stay	Dichotomous indicator for whether respondent had any overnight hospital stay since the last wave or in the past two years	0.200***	0.097
Engaged in Vigorous Physical Activity	Dichotomous indicator for whether respondent participated in vigorous physical activity or sports three or more times a week	0.355	0.386
Daily Cigarette Consumption	Dichotomous indicator for whether respondent smokes everyday	0.272*	0.323
Number of Cigarettes	Average number of cigarettes smoked daily (Ever Smokers)	7.032***	12.008
Quit Cigarettes	Dichotomous indicator for whether respondent has quit smoking (Ever Smokers)	0.585***	0.474
Daily Alcohol Consumption	Dichotomous indicator for whether respondent consumed alcohol everyday in the past 3 months	0.060	0.077
Alcohol Participation	Dichotomous indicator for whether respondent consumed alcohol in the past month	0.276	0.237
Number of Observations		4,166	470

Notes: Means are reported for the pre-age 65 sample. The HRS sample is 60-64 years of age with less than a high school education. The uninsured sample represents individuals who are consistently uninsured in all eight waves. All means are weighted by the sampling weight. Stars denote that the difference in the means across the insured and uninsured groups is significant as follows: * indicates $0.05 < p\text{-value} \leq 0.10$, ** indicates $p\text{-value} \leq 0.05$. The number of observations represents the maximum sample size for the pre-age 65 group with non-missing information on doctor visits. For some variables, the sample size is less due to further missing observations (see text).

Table 2
 Estimates of the Effect of Receipt of Medicare at Age 65 on Doctor Visits and Hospital Stay
 Longitudinal Analysis Using Data from the Health and Retirement Study

	Any Doctor Visit	Males Number of Doctor Visits	Any Hospital Stay	Any Doctor Visit	Females Number of Doctor Visits	Any Hospital Stay
DD:						
Uninsured*Post 65 (Always Uninsured)	0.080* (0.045)	0.532*** (0.169)	0.075 (0.055)	-0.015 (0.033)	0.315** (0.118)	0.059 (0.046)
Uninsured*Age 63-64	0.004 (0.046)	0.223 (0.181)	0.027 (0.055)	-0.043 (0.033)	-0.073 (0.119)	0.026 (0.046)
DDD:						
Uninsured*Post65 - Uninsured*Age 63-64	0.076* (0.042)	0.309** (0.137)	0.048 (0.051)	0.027 (0.031)	0.388*** (0.105)	0.032 (0.043)
DD:						
Uninsured*Post 65 (Uninsured >50% of Time)	0.084** (0.036)	0.552*** (0.130)	0.037 (0.043)	0.055** (0.025)	0.276*** (0.087)	0.010 (0.035)
Uninsured*Age 63-64	0.010 (0.035)	0.238* (0.131)	-0.007 (0.042)	0.006 (0.025)	0.002 (0.088)	0.011 (0.034)
DDD:						
Uninsured*Post65 - Uninsured*Age 63-64	0.073** (0.035)	0.314*** (0.111)	0.045 (0.042)	0.049** (0.024)	0.274*** (0.081)	-0.001 (0.034)
Mean of Dep. Variable for Previously Uninsured Always	0.615	5.013	0.149	0.787	7.308	0.150
Mean of Dep. Variable for Previously Uninsured >50% of Time	0.601	4.414	0.128	0.796	7.564	0.140

Notes: OLS is used to obtain parameter estimates when dependent variable is any doctor or any hospital visit. For number of doctor visits, Poisson regression method is used. All models include controls for person-specific fixed effect, age (single year age dummy variables), marital status (two dummy variables: married and divorced), employment (indicators for full-time, part-time, full retirement, partial retirement, unemployed), household size, number of living parents, assets, total years worked and year dummy variables. * indicates $0.05 < p\text{-value} \leq 0.10$, ** indicates $p\text{-value} \leq 0.05$

Table 3
 Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
 Longitudinal Analysis Using Data from the Health and Retirement Study
 Male Sample

	Engaged in Vigorous Physical Activity		Number of Cigarettes Daily		Daily Cigarette Consumption (Yes/No)		Quit Cigarettes (Limited to Ever Smokers)		Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
DD:												
Uninsured*Post 65 (Always Uninsured)	-0.067 (0.071)	-0.123 (0.132)	0.007 (0.150)	0.290 (0.223)	-0.035 (0.028)	0.028 (0.048)	0.047 (0.036)	-0.028 (0.062)	0.014 (0.047)	0.087 (0.082)	-0.053 (0.040)	-0.037 (0.066)
Uninsured*Age 63-64	0.024 (0.068)	0.028 (0.069)	0.020 (0.150)	0.063 (0.159)	-0.047* (0.028)	-0.039 (0.029)	0.064* (0.036)	0.053 (0.037)	-0.026 (0.048)	-0.029 (0.048)	-0.055 (0.039)	-0.058 (0.040)
DDD:												
Uninsured*Post65 - Uninsured*Age 63-64	-0.091 (0.065)	-0.151 (0.132)	-0.013 (0.148)	0.227 (0.239)	0.012 (0.026)	0.067 (0.049)	-0.017 (0.033)	-0.081 (0.062)	0.040 (0.044)	0.116 (0.083)	0.003 (0.033)	0.020 (0.061)
Doctor Visit		0.002 (0.037)		-0.100 (0.082)		-0.032** (0.014)		0.031* (0.018)		-0.068*** (0.024)		0.006 (0.018)
Doctor*Uninsured		0.079 (0.095)		0.011 (0.210)		0.025 (0.040)		-0.037 (0.050)		0.140** (0.067)		-0.055 (0.058)
Doctor*Post 65		-0.045 (0.060)		0.037 (0.136)		0.022 (0.023)		-0.017 (0.030)		0.030 (0.039)		-0.004 (0.029)
Doctor*Uninsured*Post 65		0.041 (0.147)		-0.421 (0.277)		-0.084 (0.055)		0.106 (0.070)		-0.113 (0.093)		-0.017 (0.071)
Mean of Dep. Variable for Previously Uninsured	0.380	0.380	13.346	13.346	0.425	0.425	0.451	0.451	0.365	0.365	0.135	0.135

Notes: For number of cigarettes, Poisson regression method is used. For all other outcomes, OLS is used to obtain parameter estimates. All models include controls for person-specific fixed effect, age (single year age dummy variables), marital status (two dummy variables: married and divorced), employment (indicators for full-time, part-time, full retirement, partial retirement, unemployed), household size, number of living parents, assets, total years worked and year dummy variables. * indicates $0.05 < p\text{-value} \leq 0.10$, ** indicates $p\text{-value} \leq 0.05$

Table 4
 Cross-Equation Estimates of the Average Effect of Receipt of Medicare at Age 65 on Unhealthy Behaviors
 Seemingly Unrelated Regression
 Male Sample

Outcomes	No Vigorous Physical Activity Daily Cigarette Consumption Alcohol Participation	No Vigorous Physical Activity Did Not Quit Cigarettes Alcohol Participation	No Vigorous Physical Activity Daily Cigarette Consumption Daily Alcohol Consumption	No Vigorous Physical Activity Did Not Quit Cigarettes Daily Alcohol Consumption
DDD:	0.234**	0.241**	0.178	0.184
Uninsured*Post65 -	(0.095)	(0.095)	(0.120)	(0.121)
Uninsured*Age 63-64	[0.01]	[0.01]	[0.14]	[0.13]

Notes: Models are jointly estimated using a seemingly unrelated regression framework, and control for doctor visits, as specified in equation (9). All outcomes are redefined as unhealthy behaviors and transformed into standard normal deviates (see text). Estimates of the average effect of Medicare receipt on the three unhealthy behaviors are presented. Standard errors are reported in parentheses, and associated p-values are reported in brackets. * indicates $0.05 < p\text{-value} \leq 0.10$, ** indicates $p\text{-value} \leq 0.05$

Table 5
 Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
 Longitudinal Analysis Using Data from the Health and Retirement Study
 Female Sample

	Engaged in Vigorous Physical Activity		Number of Cigarettes Daily		Daily Cigarette Consumption (Yes/No)		Quit Cigarettes (Limited to Ever Smokers)		Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
DD:												
Uninsured*Post 65 (Always Uninsured)	-0.132** (0.064)	-0.219 (0.166)	-0.025 (0.160)	-0.224 (0.376)	-0.010 (0.024)	0.025 (0.059)	0.044 (0.044)	-0.030 (0.117)	-0.0001 (0.031)	-0.042 (0.076)	-0.017 (0.017)	0.007 (0.036)
Uninsured*Age 63-64	-0.104* (0.057)	-0.091 (0.059)	0.089 (0.154)	0.085 (0.155)	0.006 (0.024)	0.003 (0.024)	0.005 (0.045)	0.013 (0.046)	-0.003 (0.031)	-0.003 (0.032)	-0.015 (0.016)	-0.013 (0.016)
DDD:												
Uninsured*Post65 - Uninsured*Age 63-64	-0.029 (0.060)	-0.128 (0.165)	-0.114 (0.168)	-0.309 (0.385)	-0.016 (0.023)	0.022 (0.059)	0.039 (0.042)	-0.043 (0.117)	0.003 (0.029)	-0.039 (0.076)	-0.003 (0.014)	0.021 (0.035)
Doctor Visit		0.076* (0.041)		0.045 (0.110)		-0.044*** (0.017)		0.088*** (0.028)		-0.036* (0.021)		0.008 (0.011)
Doctor*Uninsured		-0.160* (0.089)		-0.033 (0.235)		0.044 (0.038)		-0.095 (0.074)		0.012 (0.049)		0.020 (0.025)
Doctor*Post 65		-0.058 (0.083)		-0.268 (0.189)		-0.019 (0.029)		0.042 (0.051)		0.002 (0.038)		-0.001 (0.018)
Doctor*Uninsured*Post 65		0.119 (0.177)		0.214 (0.409)		-0.049 (0.064)		0.103 (0.124)		0.052 (0.081)		-0.033 (0.038)
Mean of Dep. Variable for Previously Uninsured	0.297	0.297	8.008	8.008	0.230	0.230	0.561	0.561	0.104	0.104	0.026	0.026

See notes to Table 3.

Table 6
 Cross-Equation Estimates of the Average Effect of Receipt of Medicare at Age 65 on Unhealthy Behaviors
 Seemingly Unrelated Regression
 Female Sample

Outcomes	No Vigorous Physical Activity Daily Cigarette Consumption Alcohol Participation	No Vigorous Physical Activity Did Not Quit Cigarettes Alcohol Participation	No Vigorous Physical Activity Daily Cigarette Consumption Daily Alcohol Consumption	No Vigorous Physical Activity Did Not Quit Cigarettes Daily Alcohol Consumption
DDD:	0.073	0.084	0.154	0.165
Uninsured*Post65 -	(0.145)	(0.156)	(0.131)	(0.140)
Uninsured*Age 63-64	[0.62]	[0.59]	[0.24]	[0.238]

Notes: Models are jointly estimated using a seemingly unrelated regression framework, and control for doctor visits, as specified in equation (9). All outcomes are redefined as unhealthy behaviors and transformed into standard normal deviates (see text). Estimates of the average effect of Medicare receipt on the three unhealthy behaviors are presented. Standard errors are reported in parentheses, and associated p-values are reported in brackets. * indicates $0.05 < p\text{-value} \leq 0.10$, ** indicates $p\text{-value} \leq 0.05$

Appendix Table 1
 Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
 Male Sample from the Health and Retirement Study, Partially Uninsured Prior to Age 65

	Engaged in Vigorous Physical Activity		Number of Cigarettes Daily		Daily Cigarette Consumption (Yes/No)		Quit Cigarettes (Limited to Ever Smokers)		Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
DD:												
Uninsured*Post 65	0.008	-0.077	0.009	0.283	-0.052**	-0.027	0.080***	0.051	-0.005	-0.0004	-0.041	-0.034
(Uninsured >50% of Time)	(0.059)	(0.111)	(0.128)	(0.209)	(0.022)	(0.041)	(0.029)	(0.053)	(0.037)	(0.070)	(0.030)	(0.054)
Uninsured*Age 63-64	0.027	0.027	-0.022	-0.012	-0.056**	-0.050**	0.077***	0.069**	-0.017	-0.015	-0.013	-0.013
	(0.055)	(0.056)	(0.118)	0.121	(0.022)	(0.022)	(0.028)	(0.028)	(0.037)	(0.037)	(0.028)	(0.028)
DDD:												
Uninsured*Post65-	-0.019	-0.104	0.030	0.294	0.004	0.023	0.003	-0.019	0.012	0.015	-0.028	-0.021
Uninsured*Age 63-64	(0.056)	(0.112)	(0.127)	(0.215)	(0.021)	(0.042)	(0.028)	(0.053)	(0.036)	(0.071)	(0.026)	(0.052)
Doctor Visit		0.013		-0.138		-0.026*		0.024		-0.055**		0.019
		(0.040)		(0.091)		(0.015)		(0.020)		(0.026)		(0.020)
Doctor*Uninsured		-0.021		0.135		0.001		-0.016		0.027		-0.054
		(0.077)		(0.165)		(0.030)		(0.038)		(0.051)		(0.040)
Doctor*Post 65		-0.060		0.107		0.011		-0.0003		0.009		-0.014
		(0.066)		(0.155)		(0.025)		(0.032)		(0.042)		(0.033)
Doctor*Uninsured*Post 65		0.108		-0.474*		-0.031		0.045		-0.006		-0.010
		(0.125)		(0.250)		(0.046)		(0.060)		(0.079)		(0.058)
Mean of Dep. Variable for Previously Uninsured	0.422	0.422	11.584	11.584	0.402	0.402	0.487	0.487	0.406	0.406	0.137	0.137

See notes to Table 3.

Appendix Table 2
 Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
 Female Sample from the Health and Retirement Study, Partially Uninsured Prior to Age 65

	Engaged in Vigorous Physical Activity		Number of Cigarettes Daily		Daily Cigarette Consumption (Yes/No)		Quit Cigarettes (Limited to Ever Smokers)		Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
DD:												
Uninsured*Post 65 (Uninsured >50% of Time)	-0.112** (0.051)	-0.348** (0.145)	0.050 (0.132)	-0.274 (0.333)	-0.010 (0.019)	0.044 (0.051)	0.023 (0.034)	-0.092 (0.093)	0.004 (0.024)	-0.051 (0.065)	-0.015 (0.012)	0.005 (0.031)
Uninsured*Age 63-64	-0.054 (0.045)	-0.042 (0.046)	-0.008 (0.127)	-0.009 (0.129)	-0.014 (0.018)	-0.017 (0.018)	0.027 (0.033)	0.031 (0.033)	0.008 (0.024)	0.010 (0.024)	-0.005 (0.012)	-0.005 (0.012)
DDD:												
Uninsured*Post65 - Uninsured*Age 63-64	-0.058 (0.050)	-0.306** (0.146)	0.058 (0.138)	-0.265 (0.341)	0.004 (0.018)	0.061 (0.051)	-0.004 (0.033)	-0.124 (0.093)	-0.004 (0.023)	-0.061 (0.066)	-0.009 (0.011)	0.010 (0.031)
Doctor Visit		0.079* (0.048)		0.053 (0.126)		-0.056*** (0.020)		0.119*** (0.033)		-0.004 (0.025)		0.011 (0.013)
Doctor*Uninsured		-0.083 (0.074)		-0.062 (0.202)		0.050 (0.031)		-0.119** (0.053)		-0.074* (0.040)		0.006 (0.019)
Doctor*Post 65		-0.142 (0.091)		-0.324 (0.205)		-0.002 (0.032)		0.006 (0.057)		-0.013 (0.042)		-0.00002 (0.021)
Doctor*Uninsured*Post 65		0.272* (0.154)		0.364 (0.361)		-0.067 (0.054)		0.143 (0.099)		0.071 (0.070)		-0.027 (0.033)
Mean of Dep. Variable for Previously Uninsured	0.309	0.309	6.365	6.365	0.228	0.228	0.576	0.576	0.132	0.132	0.015	0.015

See notes to Table 3.