Medicare and 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 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

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

simple intuition that less insurance should cause an increase in prevention (Lillard 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 little support for the *ex ante* moral hazard hypothesis. Courbage and Coulon (2004) find no evidence that private health insurance coverage reduced prevention (smoking and exercise) activities among British Households. Similarly, Klick and Stratman (2004) find that mandated health insurance coverage for the treatment of diabetes, which is linked to obesity, is associated with lower body mass index among diabetics.

In contrast, empirical evidence in other insurance contexts is more supportive of the existence of a significant 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). 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 find 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. Indeed, the consequences of reduced prevention in driving (automobile insurance) and at work (workers' compensation insurance) result in more 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 (raises the cost of prevention). Moreover, 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 evidence to support this prediction. However, in other insurance contexts that also involve adverse health events, evidence of *ex ante* moral hazard is more consistent. One explanation of the conflicting findings is that it has been 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 Medicare and the expansion of Medicaid have been used to study the effect of insurance on

[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.

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, and prostrate 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 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 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 significantly reduce prevention and

increase unhealthy behaviors among elderly persons. 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 Erhlich (1972), the consumer's expected utility depends on income (I) in the healthy (1) and sick (0) state:

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

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

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

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 reduction in utility as a result of expenditures on prevention.

To this point, we have ignored the possibility that the consumer has access to insurance. We now introduce health insurance into the analysis, but in a limited 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 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.[3]

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

[3] 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 do not necessarily reduce prevention, as insurance reduces both the marginal benefits and marginal costs of prevention (Ehrlich and Becker 1972). A sufficient condition for insurance to reduce prevention is U'' equal to zero, in which case insurance has no effect on the marginal cost of prevention.

Some of the reviewed studies suggest that females might not be as responsive to brief counseling as males, though there are no significant differences in effectiveness across age groups. 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. Physicians are generally more likely to offer advice regarding smoking cessation to older males who currently smoke intensively (Doescher and Saver, 2000; Young and Ward, 1998; Frank et al., 1991). Goldstein et al. (1998), in a survey of a representative sample of primary-care physicians, report that 67 percent ask and 74 percent advise their patients about smoking. A recent survey of older smokers (ages 50 and up) finds that over 80 percent of those who were advised to quit said that the advice influenced their quitting decision "extremely" or "quite a lot" and that it increased their confidence in quitting (Ossip-Klein et al., 2000). 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.

The effectiveness of physician intervention in changing health behaviors is consistent with several behavioral models (Kreuter et al., 2000). For instance, under a priming effect, advice from a physician concerning lifestyle changes may cause patients to become more aware of and respond to health information and programs that they may encounter outside the office. Other models suggest that patients advised by their physicians to adopt lifestyle changes may view the information as personally relevant, which according to the psychology literature, tends to be retained for a longer period of time and is more likely to lead to permanent behavioral

change. Physician advice may also serve as a catalyst for patients thinking about adopting lifestyle changes, motivating them to finally take action. In light of its effectiveness, national guidelines and health strategies regularly call on physicians to take advantage of the opportunity afforded by the patient's visit. Health practitioners are urged to routinely advise patients to modify risky behaviors such as physical inactivity, smoking, excessive drinking, and unhealthy diets (Healthy People 2010).

In terms of equation (2), the above discussion of the effects of physician contact on health behaviors 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):

$$(3)\quad \begin{array}{l} m = m(q) \\ \pi = \pi[r, m(q)] \\ \dfrac{\partial \pi}{\partial r} = \dfrac{\partial \pi}{\partial r}[m(q)] \end{array} .$$

Equation (2) then becomes:

$$(4)\quad FOC(r) = -\frac{\partial \pi}{\partial r}[m(q)](U_1 - U_0) - \{1 - \pi[r, m(q)]\}U'_1 - \pi[r, m(q)]U'_0 = 0 .$$

We assume that insurance is not a choice, which is consistent with the fact that Medicare covers virtually the entire elderly population, thus the effect of insurance (q) on prevention (r) is given by:

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

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 (5), which is:

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

To see how insurance may affect prevention through physician visits, we first assume that its only effect is to raise the productivity of prevention efforts ($\frac{(\partial \pi)^2}{\partial r \partial m} < 0$). In this case ($\frac{\partial \pi}{\partial m} = 0$), and we have:

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

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 on the right hand side 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 last term is positive—prevention is increased because insurance lowers the marginal cost of prevention by providing more income in sick state. The upshot of this discussion is that the effect of insurance on physician visits may increase prevention and offset any pure *ex ante* moral hazard effects that may be present.

If we assume that insurance and the increase in physician visits has no effect on the productivity of prevention efforts ($\frac{(\partial\pi)^2}{\partial r \partial m} = 0$), then the effect of insurance on prevention depends solely on whether physician visits affect the probability of illness. If, as suggested earlier, physician visits uncover illnesses that were previously unknown ($\frac{\partial\pi}{\partial m} > 0$), then equation (6) becomes:

(8) $$\frac{\partial FOC(r)}{\partial q} = \frac{\partial\pi}{\partial r}[U'_0] - \frac{\partial\pi}{\partial m}\frac{\partial m}{\partial q}(U'_0 - U'_1) - \pi[r, m(q)]U''_0 .$$

Here, the first term on the right hand side is the pure *ex ante* moral hazard effect. The second term is negative; prevention efforts are decreased by insurance because of the effect of physician visits on the probability of illness. An increase in the probability of illness raises the (expected) marginal cost of investment in prevention. Alternatively, if physician visits reveal that a person is healthier than expected, then this would cause an increase in prevention.

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 use two complementary approaches. The first approach uses longitudinal data from the Health and Retirement Study (HRS) that allows us to observe persons before and after age 65. Among this group, 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:

$$(1)\ Y_{it} = \alpha_i + \sum_{k=56}^{74} \beta_k AGE_{kit} + \delta MARITAL_{it} + \omega X_{it} + \sum_{t=1992}^{2004} \gamma_t YEAR_t + \lambda(UNIN_i * POST65_{kt}) + e_{it},$$

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 (56 to 74); MARITAL is a dummy variable indicating person is married; X represents a vector or other time-varying individual characteristics and YEAR is a series of year dummy variables (1992 to 2004). Importantly, equation (1) includes individual intercepts 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 (1) 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. The coefficient on this variable measures the effect of

Medicare on health behaviors and this effect is identified in a difference-in-differences 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.

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 (1) to include physician visits:

$$Y_{it} = \alpha_i + \sum_{k=56}^{74} \beta_k AGE_{kit} + \delta MARITAL_{it} + \sum_{k=1}^{K} \omega_k X_{kit} + \sum_{t=1992}^{2004} \gamma_t YEAR_t + \lambda(UNIN_i * POST65_t) + \rho_1 DOCTOR_{it} + \rho_2 (DOCTOR_{it} * POST65) + \rho_3 (UNIN_i * DOCTOR_{it}) + \rho_4 (UNIN_i * DOCTOR_{it} * POST65_t) + e_{it} \quad (3)$$

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 $\rho_1, \rho_2,$ and ρ_4

will be better measures of the effect of physician visits on health behaviors than ρ_3.[4] Identification of the *ex ante* moral hazard effect (λ) 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.

The second approach we use to obtain estimates of the effect of Medicare on health behaviors uses cross-sectional data on a sample of individuals aged 60 to 69 from the Behavioral Risk Factor Surveillance System (BRFSS). In this case, we exploit the fact that, among the elderly, some demographic groups are much more likely to be uninsured prior to age 65 than others. To simplify the exposition, we will refer to two groups: the uninsured, which are persons from demographic groups likely to be uninsured, and the insured, which are persons from demographic groups likely to have health insurance. Identification of the effect of Medicare comes from an analogous comparison to that used in the longitudinal analysis. Basically, we compare the pre- to post-age 65 changes in health behaviors of a group likely to be uninsured to the pre- to post-age 65 changes in health behaviors of a group likely to be insured. The assumption underlying this research design is that in the absence of Medicare, changes pre- and post-age 65 in health behaviors would be the same for uninsured and insured persons. Thus, if we observe a change in the pre- and post-age 65 differences, we assume that it is due to Medicare.

The regression model to obtain the cross-sectional estimates of the effect of Medicare on health behaviors is given by:

[4] Equation (3) was also estimated by explicitly controlling for self-reported health status. The results remain robust, suggesting that the specification in (3) controls for heterogeneous effects of physician contact due to differences in health status.

$$Y_{it} = \alpha + \sum_{k=1}^{K} \beta_k X_{kit} + \sum_{k=1}^{K} \eta_k Z_{kit} + \sum_{t=1994}^{2005} \gamma_t YEAR_t + \lambda(\hat{UNIN}_i * POST65_t) +$$
$$\rho_1 DOCTOR_{it} + \rho_2 (DOCTOR * POST65) + \rho_3 (\hat{UNIN}_i * DOCTOR_{it}) +$$
$$(5) \qquad \rho_4 (\hat{UNIN}_i * DOCTOR_{it} * POST65_t) + e_{it} \qquad .$$
$$i = 1,...,N$$
$$t = 1994,...,2005$$

In equation (5), all variables are defined as before except the following: X represents several demographic characteristics such as age, race, marital status and education that were subsumed by the individual fixed effects in the longitudinal analysis, interactions between these factors, and indicators for state of residence; Z represents other characteristics likely to vary over time for an individual, such as employment and household size; and $\hat{UNIN}$ is a dummy variable indicating that the person has a relatively high probability of being uninsured prior to age 65. Specifically, to construct the $\hat{UNIN}$ dummy variable, we first predict the probability that a person aged 60 to 64 is without health insurance using the following regression model:

$$(6) \quad UNIN_{it} = \tau + \sum_{k=1}^{K} \phi_k X_{kit} + \sum_{t=1994}^{2005} \sigma_t YEAR_t + u_{it} .$$

Next, we assign persons to the uninsured and insured categories using the following rule:

$$\hat{UNIN} = 1 \quad if \quad (\hat{\tau} + \sum_{k=1}^{K} \hat{\phi}_k X_{kit}) > \mu$$
$$(7)$$
$$\hat{UNIN} = 0 \quad if \quad (\hat{\tau} + \sum_{k=1}^{K} \hat{\phi}_k X_{kit}) \leq \mu \quad ,$$

where the symbol ^ is used to indicate a predicted value and μ is either the 50th or the 75th percentile of the propensity score; we assign someone to the uninsured category if they have a predicted probability (propensity score) of being uninsured that is greater than at the 50th or 75th percentiles alternately. Equation (7) is simply a way to classify persons as more or less likely to be insured.

One advantage of the cross-sectional approach is that $\hat{UNIN}$ is clearly exogenous; it is simply a linear combination of pre-determined variables. However, the disadvantage is that $\hat{UNIN}$ is an imperfect way to identify persons who were uninsured prior to age 65. Thus, some people we assign to the uninsured category will actually have health insurance prior to age 65 and some who we assign to the insured category will not have insurance prior to age 65. For example, using the 0.75 (75^{th} percentile) cutoff, we find that only 20 percent of males ages of 60 and 64 assigned to the uninsured category were actually uninsured, and eight percent of males ages 60 to 64 assigned to the insured category were uninsured. This measurement error will result in attenuated (biased toward zero) estimates of the effect of uninsured (treatment on treated); the magnitude of the attenuation will be substantial, as the estimated effect will be approximately 12 percent (1/8) the magnitude of the treatment on treated effect. The extent of attenuation is very similar using the alternative threshold of 0.5 (50^{th} percentile). Fortunately, the BRFSS has relatively large samples that will mitigate the importance of this bias.

Data

The empirical analysis uses information from two sources: the Health and Retirement Study (HRS) and the Behavioral Risk Factor Surveillance System (BRFSS). The HRS is used to conduct the longitudinal analysis and the BRFSS is used in the cross-sectional analysis.

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. The HRS cohort includes individuals born between 1931 and 1941 and their spouses regardless of the spouse's age. The analysis sample is limited to individuals who are between the ages of 56 and 75. 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. Over 20 percent of individuals between the ages of 56 and 64 with less than a high school education are uninsured whereas less than eight 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. The final sample size across six waves comprises of 19,599 person-wave observations for 5,511 persons.

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.

Dichotomous indicators are defined for various dimensions of health care utilization. These measure whether the respondent reported any overnight hospital stay, any physician visit, and regular use of prescription drugs, since the prior wave or in the past two years. 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.

Four health behaviors are considered: exercise, weight, 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." The respondent's body mass index (BMI) is defined using self-reported height and weight. 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 BRFSS show that the vast majority of current smokers (85 percent of males, and 81 percent of females) smoke daily. 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.

Drinking is measured as a dichotomous indicator for whether the respondent currently drinks. From waves 3-7, 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 also defined based on this measure of frequency.

The cross-sectional analysis is based on data from the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a state-based system of health surveys coordinated by the Centers for Disease Control and Prevention to collect uniform information on risky behaviors, preventive practices, and health care access and usage. The interviews are of adults 18 years of age and older, and are based on a multi-stage stratified random sampling of telephone numbers. By 1994 all states and the District of Columbia were participating in the BRFSS. The present analysis thus utilizes data from the years 1994 through 2005, excluding 2002 and 2003 for which information on physician visits is not available. One advantage of the BRFSS is its large sample size. There are 356,112 adults interviewed in 2005, for instance. The empirical models are restricted to adults between the ages of 60 and 69 in order to provide a tighter comparison of individuals before and after reaching Medicare age eligibility. Individuals with a college education or above are further excluded from the analysis because this demographic group has a very low probability of being uninsured prior to age 65. For instance, the rate of uninsured for college-graduated adults (between the ages of 60 and 64) is 4.5 percent, compared to 12.0 percent for those who did not finish college. The final sample size is 129,904.

Like the HRS, the BRFSS has information on health insurance coverage, doctor visits and health behaviors. An indicator for being uninsured is defined if the respondent reports not having health insurance coverage from any public, private or other sources. The respondent is also asked "how long it has been since they last visited a doctor for a routine check-up." A dichotomous indicator for any doctor visit within the past 12 months is defined.

We focus on the same behaviors as in the HRS: exercise, weight, smoking and drinking. We try to create a consistent set of measures across the two surveys. For exercise, we define an indicator for whether the respondent participates in vigorous exercise or physical activity. In the BRFSS, this is a survey-coded variable based on a series of questions probing participation in several activities and their frequency. This indicator refers to participation in any activity or activities that require rhythmic contraction of large muscle groups at 50 percent of functional capacity for 20 or more minutes, three or more times a week. This measure is chosen due to its consistency across the years in order to maximize sample size. Other measures have more missing observations, though the results are not qualitatively affected. This measure of vigorous exercise is also more specifically defined relative to the measure available in the HRS, reflected in a lower prevalence for both males and females in the BRFSS. Body mass index is defined based on reported height and weight.

For cigarette use, the BRFSS does not consistently ask about the number of cigarettes consumed or frequency of use. As a result, we create a dichotomous indicator for whether the respondent currently smokes everyday, which combines both current smoking participation and a measure of frequency. An indicator is also defined for whether the respondent quit smoking in the past year. Drinking is measured by a continuous variable for the average number of drinks consumed daily. This variable is based on a consistent set of questions that ask the respondents how many days they consumed alcohol in the past month and the number of drinks that they consumed on such days. In addition, the number of days that alcohol was consumed in the past month, which captures drinking frequency, and the number of drinks consumed on occasion are also employed as separate outcome variables in the specifications. These measures are chosen in

the BRFSS to ensure consistency and comparison with the HRS estimates. Other measures of exercise, dieting, alcohol consumption, and smoking yielded similar results qualitatively.

Table 1 provides descriptive statistics for respondents in each data set by insurance status. Samples are limited to respondents less than 65 years of age because we wanted to show pre-Medicare differences. For the BRFSS, the indicator of insurance status is the predicted insurance status, not the actual status, based on the 75^{th} percentile. 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 have a hospital visit than the uninsured. The insured also smoke less than the uninsured. In regard to BMI, exercise and alcohol use, the evidence is more mixed. In the HRS, insured persons are less likely to exercise, but in the BRFSS, they report greater exercise than uninsured. In the HRS, insured persons report drinking less alcohol than the uninsured, but in the BRFSS, insured persons report greater alcohol consumption than the uninsured. For overweight status, the difference between the uninsured and insured is not statistically significant in the HRS, but the BRFSS suggests a greater probability of being overweight for the uninsured.

Results

Longitudinal Analysis of HRS Data

The first set of results we present are those obtained using longitudinal data from the HRS. 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. For low-educated males who were always uninsured prior to age 65, receipt of Medicare:

- increased the probability of seeing a doctor by 11.6 percentage points, which represents a 18 percent increase from the pre-age 65 mean of the uninsured;
- increased the number of doctor visits by 44.1 percent;
- and increased the probability of having a hospital stay by 4.9 percentage points (29 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 3.0 percentage points (4 percent);
- increased the number of doctor visits by 11.7 percent;
- and increased the probability of having a hospital stay by 3.6 percentage points (26 percent).

None of the estimates for females were statistically significant. As can be seen in Table 2, results are similar if we focus on persons who were uninsured at least 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.[5] In the case of any hospital visit, estimates

[5] 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.

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.[6] 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.

Next, we examine the effect of receipt of Medicare on health behaviors: exercise, weight, 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 at least 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.

For exercise, receipt of Medicare is associated with a significant 9.0 percentage point (25 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 is reduced (-3.9 percentage points or 11 percent) and no longer statistically significant. By main effect of Medicare, we refer to the effect of Medicare receipt

[6] 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.

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 (λ) of equation (3). 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, results do not differ qualitatively if we use an alternative measure of exercise.

There are also no statistically significant estimates related to body mass (BMI), and all estimates of the effect of Medicare on BMI are numerically small relative to the mean. Similar results were found for a measure indicating being overweight (results not shown). Overall, these estimates suggest that Medicare and doctor visits have relatively little impact on exercise and weight of elderly men, although exercise does appear to decrease moderately after receipt of Medicare suggesting some amount of *ex ante* moral hazard. Moreover, because physician visits are basically uncorrelated with exercise for men, it does not matter whether we control for physician visits and the *ex ante* moral hazard effect is apparent in both specifications. The absence of an 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. In contrast, Card et al. (2005), 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.[7] The former effect appears to be implausibly large and may be due to the imprecision of the estimates (see footnote 4).

The next outcome is cigarette consumption. Receipt of Medicare is associated with a small (3.3 percent) and statistically insignificant increase in the number of cigarettes smoked

[7] Effect size was calculated as in footnote 4: dividing the RD estimate for exercise by the RD estimate for insurance coverage.

daily. When we control for doctor visits, receipt of Medicare is associated with a 23.1 percent increase in daily cigarette consumption among those who never visit a physician, and visits to the doctor have large effects on smoking. Among the always insured group, a visit to the doctor is associated with a 12.5 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 35.3 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 doctor visits are health promoting. Similar results are found when we analyze whether a person quit smoking and whether they are a daily smoker, although in these cases, estimates of the *ex ante* moral hazard effect are not statistically significant. Among those who do not visit the doctor pre- or post-Medicare, Medicare receipt is associated with a 3.1 percentage point, or 8.2 percent, lower probability of quitting smoking and a 4.6 percentage point, or 10.8 percent, higher prevalence of daily smoking once we adjust for the effect of contact with the medical profession.[8] 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. Similar estimates are reported in Appendix Table 1.

The last behavior we analyze is alcohol consumption, which we measure in two ways: dichotomous indicator of any alcohol use and a dichotomous indicator of whether a person

Deleted: heavy

Deleted: e—three or more drinks consumed per day—

[8] 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.

drinks daily. Controlling for doctor visits, receipt of Medicare among the no-physician visit group is associated with a 7.1 percentage point, 17.2 percent, increase in the probability of any alcohol consumption and a 1.7 percentage point, or 10.2 percent, increase in daily alcohol consumption. Neither estimate is statistically significant. For both measures of alcohol use, doctor visits tend to decrease use. Once we control for doctor visits, estimates of *ex ante* moral hazard are more consistent with theory—insurance causes an increase in unhealthy behaviors. Estimates in Appendix Table 1 are less supportive of this hypothesis. These estimates are in accordance with the clinical literature on physician counseling and smoking behaviors, which consistently finds strong effects. Grandes et al. (2000), for instance, report that 7.1 percent of smokers in a physician counseling intervention group abstained from smoking at a six-month follow-up relative to the control group. Fleming et al. (1997) conducted a randomized control trial to gauge the efficacy of brief physician advice in reducing alcohol use. They find that the intervention resulted in a 22 percent decline in weekly alcohol consumption among heavy drinkers after 12 months, relative to the control group.

Table 4 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 16.1 percentage point (60 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 a 12.5 percentage point (44 percent) 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. These results for exercise do not carry over to weight. Indeed, receipt of Medicare is associated with a small (3.7 percent) decrease in BMI even though we observe a significant decrease in physical activity.

Estimates related to cigarette consumption reveal that, in general, Medicare receipt is not strongly associated with tobacco use among elderly women. Estimates in Table 4 and Appendix Table 2 are usually small and not statistically significant, although there is 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 12.4 percent decrease in daily cigarette consumption, and for a previously uninsured person, visiting the doctor post-receipt of Medicare is associated with a 32 percent decrease in daily cigarette consumption. Similar effects of physician visits are found for the other measures of cigarette use, particularly for the always insured group.

The last set of estimates in Table 4 pertains to alcohol use. Here we find that receipt of Medicare is associated with an increase 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. Controlling for doctor visits has little effect on estimates and coefficients on doctor visits are not statistically significant. Overall, there is some evidence that Medicare is associated with increased alcohol use, but estimates are too imprecise to place much confidence in them.

Cross Sectional Analysis of BRFSS

We now turn to the results from the alternative research design that uses cross sectional data. In this analysis, we compare changes in health behaviors pre- and post-age 65 for those more and less likely to be uninsured. We classify people into the more- and less-likely to be uninsured groups using demographic characteristics. As described above this results in what we will refer to as misclassification, as a relatively small proportion of persons who we classify as uninsured are in fact uninsured (20 percent) and some who we classify as insured are in fact uninsured (eight percent). This will result in a downward biased estimate of the effect of receipt of Medicare for those who were actually uninsured. We can calculate the implied effect of receipt of Medicare among the uninsured by using the extent of misclassification, which we know, to rescale estimates.

The first outcome is the probability of seeing a physician in the last year and estimates for this analysis are reported in Table 5. For both males and females, estimates indicate that for those likely to be uninsured prior to age 65, there was a relative increase in the probability of visiting a physician post-age 65. For males, estimates indicate that turning age 65 is associated with between a 1.7 and 2.7 percentage point increase in the probability of seeing a physician depending on how we classify persons to the insured and uninsured group (whether we use the 0.5 or 0.75 threshold of propensity score). Misclassification of persons to the insured and

uninsured group imply that estimates of the effect of Medicare are approximately eight times the size of the estimates reported in Table 5. Adjusting for the extent of misclassification suggests that among those actually uninsured, the probability of seeing a physician increased by between 13.6 and 21.6 percentage points, or between 18 and 29 percent. The magnitudes of these estimates are similar to what we found in the longitudinal analysis and provide further documentation that Medicare receipt results in an increase in physician contacts that may affect health behaviors and confound estimates of the *ex ante* moral hazard effect. Similar estimates are found for women.

Table 6 presents the estimates of the effect of turning age 65 on the health behaviors of elderly men from the BRFSS. Among those likely to be uninsured prior to age 65, receipt of Medicare is associated with a 4.5 percentage point decrease in the probability of engaging in vigorous physical activity in past month for those who do not visit the doctor. Going to the doctor post-receipt of Medicare is associated with a 4.9 percentage point increase in the probability of engaging in vigorous physical activity for those who were previously uninsured. These results are similar in sign to the results from the analysis that used longitudinal data. However, adjusting the estimates for the attenuation bias due to misclassification, yields large effect sizes. Estimates imply that among those previously uninsured, receipt of Medicare is associated with 36 percentage point (346 percent) decrease in exercise among those who do not visit the doctor. Estimates in Appendix Table 3, which use an alternative classification of persons to the insured and uninsured groups, are similar in sign to those in Table 7, although smaller in magnitude. It is important to note that estimates rescaled to account for misclassification can differ dramatically with relatively small changes in the underlying

estimates. Estimates, even rescaled estimates, of the effect of Medicare receipt on BMI in Table 6 are small and not statistically significant.

The next outcome examined is cigarettes. Estimates indicate that receipt of Medicare is associated with a 1.3 percentage point decrease in the incidence of daily cigarette consumption before controlling for physician visits. Controlling for physician visits, Medicare is associated with a 1.5 percentage point increase in the incidence of daily cigarette consumption among those who do not visit the doctor, and visits to the doctor are associated with significant decreases in cigarette use. So here we again have evidence of an *ex ante* moral hazard effect. Among the previously uninsured who do not visit the doctor, rescaled estimates suggest that Medicare is associated with a 12 percentage point (55 percent) increase in the probability of being a daily smoker, which is somewhat larger than estimates from the longitudinal analysis presented in Table 3. For those previously uninsured that go to the doctor, Medicare is associated with more beneficial effects, as doctor visits are associated with significant reductions in the prevalence of daily smoking. Similar results are found for the probability of quitting smoking, although the estimate of the *ex ante* moral hazard effect is not statistically significant in this case. The rescaled estimate is large, however, indicating an 8.0 percentage point (160 percent) decrease in the probability of quitting cigarette use among those who never go to the doctor.[9]

We also find evidence of an *ex ante* moral hazard effect for alcohol use. We measure alcohol use three ways: number of days drank in past month; number of drinks on days drank; and number of drinks in the past month (days times drinks per day). In models that do not control for doctor visits, Medicare is associated with a significant decrease in each measure of alcohol consumption. But when we control for doctor visits and identify the *ex ante* moral

[9] Similar estimates are found in Appendix Table 3.

hazard effect from the effect of physicians, we find that Medicare is not significantly associated with alcohol use for those who do not visit the doctor, and that physician visits are associated with decreased alcohol use. None of the estimates of the *ex ante* moral hazard effect are statistically significant and rescaled estimates generally imply small effects, although estimates in Appendix Table 3 suggest larger *ex ante* moral hazard effects.

The last set of results is the cross-sectional estimates for women, which are presented in Table 7. In the case of exercise, estimates indicate that among those likely to be uninsured and who do not visit the doctor, the *ex ante* moral hazard effect of Medicare is a 1.3 percentage point decrease in the probability of vigorous exercise, which when scaled to account for the misclassification of persons into insured and uninsured groups imply that receipt of Medicare is associated with a 10.4 (122 percent) decrease in vigorous exercise. Physician visits also tend to increase exercise. However, the decrease in exercise does not appear to have an impact on reported weight, as estimates of the effect of Medicare on BMI are small and not statistically significant. Similar estimates are reported in Appendix Table 4.

Estimates related to cigarette use indicate that Medicare is associated with a decrease in the probability of being a daily smoker and a decrease in the probability of quitting before controlling for physician visits. However, after controlling for physician visits, Medicare is associated with a statistically significant decrease in probability of quitting smoking and no change in the probability of being a daily smoker. Physician visits tend to reduce cigarette consumption.

As before, we find evidence of an *ex ante* moral hazard effect for alcohol use. Controlling for doctor visits, receipt of Medicare is associated with an increase in the number of days that a woman drank in past month, the number of drinks on days she drank, and the total

number of drinks in the past month. While none of these estimates are statistically significant, they imply large effects given the misclassification bias. For example, monthly alcohol consumption is 9.8 percent higher after receipt of Medicare for those likely to be uninsured prior to age 65, which implies a very large increase in alcohol consumption for those who actually were uninsured. Doctor visits also tend to reduce drinking and the evidence in support of an *ex ante* moral hazard effect is much stronger after we control for doctor visits. Estimates in Appendix Table 4 suggest larger *ex ante* moral hazard effects.

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 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 use both longitudinal and cross-sectional data and a similar 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 (likely) uninsured and those who are (likely) insured prior to age 65. We expect the change in health behaviors of those who are (likely) uninsured prior to age 65 to differ from those who are (likely) 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.

We find consistent evidence of *ex ante* moral hazard effect and consistent evidence that physician visits result in improved health behaviors. In general, similar results are found using longitudinal and cross-sectional data. Because estimates from the longitudinal analysis are more precise, we use these as our preferred estimates. Among elderly men, the *ex ante* moral hazard effects associated with receipt of Medicare are as follows:

- a 11.1 percent decrease in the probability of engaging in vigorous physical exercise;
- a 8.2 percent lower probability of quitting cigarette use;
- a 10.8 percent higher prevalence of daily smoking;
- a 10.2 percent increase in the probability of daily alcohol consumption.
- and a 17 percent increase in the probability of current alcohol use.

Similarly, among elderly women, the *ex ante* moral hazard effects associated with receipt of Medicare are as follows:

- a 60 percent decrease in the probability of engaging in vigorous physical exercise;
- a 2.5 percent lower probability of quitting cigarette use;
- a 14.8 percent higher prevalence of daily smoking;

- and a 22.9 percent higher probability of current drinking.

The similarity and consistency of these findings across genders and analyses (data and methods) are notable. They provide robust evidence that Medicare (health insurance) is associated with less prevention as manifested by an increase in unhealthy behaviors among the elderly. 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 these 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-pays for routine doctor visits, perhaps for low-income adults only, and through greater community outreach. In our sample from the BRFSS, approximately 20 percent of persons between the ages of 65 and 69 had not had a doctor visit in the last year. This is a significant proportion of the sample.

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Table 1
Descriptive Statistics for Respondents Prior to Age 65
Health and Retirement Study and Behavioral Risk Factor Surveillance System

Variable Name	Definition	HRS		BRFSS	
		Insured	Uninsured	Predicted Insured	Predicted Uninsured
Age	Age in years	59.798*	59.726	61.933**	62.020
Male	Dichotomous indicator for whether respondent is male	0.449**	0.410	-	-
Less than High School	Dichotomous indicator for whether respondent has less than a high school education	-	-	0.086**	0.665
High School	Dichotomous indicator for whether respondent has a high school degree or GED	-	-	0.541**	0.255
Some College	Dichotomous indicator for whether respondent attended college but did not graduate	-	-	0.373**	0.079
White	Dichotomous indicator for whether respondent is white	0.742**	0.742	0.909**	0.662
Black	Dichotomous indicator for whether respondent is black	0.191**	0.143	0.064**	0.248
Other Race	Dichotomous indicator for whether respondent is of some other race	0.067**	0.115	0.027**	0.090
Hispanic	Dichotomous indicator for whether respondent is Hispanic	0.188**	0.431	0.024**	0.179
Married	Dichotomous indicator for whether respondent is married	0.651**	0.568	0.795**	0.421
Divorced	Dichotomous indicator for whether respondent is divorced	0.158	0.166	0.077**	0.261
Full-time Employment	HRS: Dichotomous indicator for whether respondent works full-time	0.323	0.334	-	-
Part-time Employment	HRS: Dichotomous indicator for whether respondent works part-time	0.073**	0.143	-	-
Working for Pay	BRFSS: Dichotomous indicator for whether respondent works for pay	-	-	0.331**	0.264
Self-employed	BRFSS: Dichotomous indicator for whether respondent is self-employed	-	-	0.082**	0.059
Retirement	Dichotomous indicator for whether respondent if fully retired	0.291**	0.153	0.389**	0.337
Partial Retirement	HRS: Dichotomous indicator for whether respondent if partially retired	0.042	0.041		
Unemployed	Dichotomous indicator for whether respondent is unemployed and looking for work	0.017**	0.039	0.024**	0.035
Household Size	Number of adults ages 18 and over who reside in the household	2.605**	2.946	2.101**	1.994
Parents alive	HRS: Number of parents who are currently alive	0.336**	0.423	-	-
Assets	HRS: Net household wealth in 1982-1984 dollars	82212.950**	59071.340	-	-
Any Doctor Visit	HRS: Dichotomous indicator for whether respondent visited a doctor, emergency room or clinic since the last wave or in the past two years BRFSS: Dichotomous indicator for whether respondent visited a doctor for a routine check-up in the past year	0.878**	0.680	0.794**	0.751
Number of Doctor Visits	HRS: Number of visits to the doctor since the last wave or in the past two years	9.602**	3.896	-	-
Any Hospital Stay	HRS: Dichotomous indicator for whether respondent had any overnight hospital stay since the last wave or in the past two years	0.231**	0.102	-	-
Engaged in Vigorous Physical Activity	HRS: Dichotomous indicator for whether respondent participated in vigorous physical activity or sports three or more times a week BRFSS: Dichotomous indicator for whether respondent participated in any	0.315**	0.343	0.141**	0.089

	activities that require rhythmic contraction of large muscle groups at 50 percent of functional capacity for 20 or more minutes, three or more times a week.				
Body Mass Index	Weight in meters divided by the square of the height in meters	28.344**	27.656	27.248**	27.790
Overweight	Dichotomous indicator for whether the respondent's BMI is 25 or greater	0.719	0.686	0.659**	0.679
Daily Cigarette Consumption	Dichotomous indicator for whether respondent smokes everyday	0.304	0.318	0.165**	0.220
Number of Cigarettes	HRS: Average number of cigarettes smoked daily (Ever Smokers)	8.046**	11.079	-	-
Quit Cigarettes	HRS: Dichotomous indicator for whether respondent has quit smoking (Ever Smokers) BRFSS: Dichotomous indicator for whether respondent has quit smoking in the past year (Ever Smokers)	0.550**	0.454	0.045**	0.066
Daily Alcohol Consumption	HRS: Dichotomous indicator for whether respondent consumed alcohol everyday in the past 3 months BRFSS: Dichotomous indicator for whether respondent consumed alcohol everyday in the past month	0.048*	0.090	0.055**	0.042
Alcohol Participation	Dichotomous indicator for whether respondent consumed alcohol in the past month	0.269	0.286	0.438**	0.288
Monthly Alcohol Consumption	BRFSS: Number of drinks consumed in past 30 days	-	-	7.779**	6.795
Number of Days Drink	BRFSS: Number of days that respondent drinks in a month	-	-	3.799**	2.441
Average Drinks on Occasion	BRFSS: Average number of drinks consumed on a day that respondent drinks	-	-	0.780**	0.636
Number of Observations		9,212	812	46,042**	15,499

Notes: Means are reported for the pre-age 65 sample. The HRS sample is 56-64 years of age with less than a high school education, and the BRFSS sample is 60-64 years of age with less than a college education. 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 $0.05 < \text{p-value} \leq 0.10$, ** indicates $\text{p-value} \leq 0.05$. In the BRFSS sample, the difference in gender across the two groups is not meaningful (and therefore not reported) as separate gender-specific models are employed to predict uninsured status based on the 75^{th} percentile of the resulting gender-specific propensity score. 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

	Males			Females		
	Any Doctor Visit	Number of Doctor Visits	Any Hospital Stay	Any Doctor Visit	Number of Doctor Visits	Any Hospital Stay
Uninsured*Post 65 (Always Uninsured)	0.116** (0.032)	0.441** (0.155)	0.049 (0.042)	0.030 (0.024)	0.117 (0.095)	0.036 (0.029)
Uninsured*Post 65 (Uninsured >50% of Time)	0.111** (0.026)	0.337** (0.120)	0.027 (0.035)	0.051** (0.020)	0.295** (0.105)	0.036 (0.029)
Mean of Dep. Variable for Previously Uninsured Always	0.645	5.810	0.169	0.783	6.324	0.141
Mean of Dep. Variable for Previously Uninsured >50% of Time	0.626	5.067	0.151	0.786	6.763	0.146

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 $0.05 < \text{p-value} \leq 0.10$, ** indicates $\text{p-value} \leq 0.05$

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		Body Mass Index (BMI)	
Uninsured*Post 65 (Always Uninsured)	-0.090* (0.051)	-0.039 (0.101)	-0.082 (0.198)	0.200 (0.372)
Doctor Visit		0.002 (0.023)		0.035 (0.098)
Doctor*Uninsured		0.015 (0.066)		0.272 (0.276)
Doctor*Post 65		0.045 (0.042)		-0.038 (0.162)
Doctor*Uninsured*Post 65		-0.069 (0.114)		-0.411 (0.429)
Mean of Dep. Variable for Previously Uninsured	0.352	0.352	26.535	26.535

Notes: OLS is used to obtain parameter estimates when dependent variable is physical activity, BMI, and quit cigarette use. For number of cigarettes and number of alcohol drinks, 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 $0.05 < \text{p-value} \leq 0.10$, ** indicates $\text{p-value} \leq 0.05$

	Number of Cigarettes Daily (Ever Smokers)		Quit Cigarettes (Limited to Ever Smokers)		Daily Cigarette Consumption (Yes/No)	
Uninsured*Post 65 (Always Uninsured)	0.033 (0.089)	0.231 (0.142)	0.046 (0.028)	-0.038 (0.053)	-0.045** (0.022)	0.046 (0.042)
Doctor Visit		-0.125** (0.030)		0.045** (0.014)		-0.037** (0.011)
Doctor*Uninsured		0.235** (0.074)		-0.060 (0.040)		0.031 (0.031)
Doctor*Post 65		-0.081 (0.062)		-0.018 (0.023)		0.023 (0.018)
Doctor*Uninsured*Post 65		-0.353** (0.172)		0.122** (0.061)		-0.122** (0.049)
Mean of Dep. Variable for Previously Uninsured	11.631	11.631	0.461	0.461	0.426	0.426

	Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
Uninsured*Post 65 (Always Uninsured)	0.002 (0.034)	0.071 (0.0650	-0.016 (0.029)	0.017 (0.051)
Doctor Visit		-0.040** (0.017)		-0.018 (0.014)
Doctor*Uninsured		0.055 (0.048)		0.057 (0.044)
Doctor*Post 65		-0.022 (0.028)		-0.021 (0.023)
Doctor*Uninsured*Post 65		-0.099 (0.075)		-0.056 (0.058)
Mean of Dep. Variable for Previously Uninsured	0.414	0.414	0.166	0.166

Table 4
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		Body Mass Index (BMI)	
Uninsured*Post 65 (Always Uninsured)	-0.066 (0.046)	-0.161 (0.122)	-0.620** (0.208)	-0.947* (0.535)
Doctor Visit		0.047* (0.025)		-0.066 (0.129)
Doctor*Uninsured		-0.174** (0.061)		0.158 (0.311)
Doctor*Post 65		-0.049 (0.053)		-0.063 (0.224)
Doctor*Uninsured*Post 65		0.125 (0.130)		0.383 (0.581)
Mean of Dep. Variable for Previously Uninsured	0.267	0.267	28.663	28.663

See notes to Table 3.

	Number of Cigarettes Daily (Ever Smokers)		Quit Cigarettes (Limited to Ever Smokers)		Daily Cigarette Consumption (Yes/No)	
Uninsured*Post 65 (Always Uninsured)	-0.042 (0.098)	0.164 (0.150)	-0.001 (0.034)	-0.014 (0.099)	0.009 (0.019)	0.031 (0.048)
Doctor Visit		-0.124** (0.031)		0.085** (0.019)		-0.048** (0.012)
Doctor*Uninsured		0.229** (0.070)		-0.033 (0.056)		0.039 (0.028)
Doctor*Post 65		-0.089 (0.067)		0.033 (0.036)		-0.012 (0.020)
Doctor*Uninsured*Post 65		-0.320* (0.186)		0.021 (0.106)		-0.029 (0.052)
Mean of Dep. Variable for Previously Uninsured	7.766	7.766	0.566	0.566	0.210	0.210

	Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
Uninsured*Post 65 (Always Uninsured)	0.026 (0.024)	0.030 (0.061)	0.007 (0.012)	0.022 (0.028)
Doctor Visit		-0.020 (0.015)		-0.003 (0.008)
Doctor*Uninsured		0.011 (0.036)		0.016 (0.019)
Doctor*Post 65		0.031 (0.026)		0.012 (0.012)
Doctor*Uninsured*Post 65		-0.001 (0.067)		-0.018 (0.030)
Mean of Dep. Variable for Previously Uninsured	0.131	0.131	0.024	0.024

Table 5
Estimates of the Effect of Receipt of Medicare at Age 65 on Doctor Visits
Cross Sectional Analysis Using Data from the Behavioral Risk Factor Surveillance System

	Males	Females
	Any Doctor Visit	Any Doctor Visit
Predicted Uninsured *Post 65 (Prediction Based on 75 Percentile)	0.017* (0.009)	0.022** (0.006)
Predicted Uninsured *Post 65 (Prediction Based on 50 Percentile)	0.027** (0.008)	0.012** (0.006)
Mean of Dep. Variable for Previously Uninsured (Prediction Based on 75 Percentile)	0.741	0.819
Mean of Dep. Variable for Previously Uninsured (Prediction Based on 50 Percentile)	0.766	0.819

Notes: Standard errors are reported in parentheses. All models include controls the propensity score, age (single-year age dummy variables), employment (indicators for working for pay, self-employed, unemployed, homemaker or student, and retired), household size, and year dummy variables. * indicates $0.05 < \text{p-value} \leq 0.10$, ** indicates $\text{p-value} \leq 0.05$

Table 6
Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
Cross Sectional Analysis Using Data from the Behavioral Risk Factor Surveillance System
Predicted Uninsured Based on 75th Percentile of Propensity Score
Male Sample

	Engaged in Vigorous Physical Activity		Body Mass Index (BMI)		Daily Cigarette Consumption (Yes/No)		Current Smoker (Yes/No)		Quit Cigarettes Past Year (Limited to Ever Smokers)	
Predicted Uninsured*Post 65	-0.008	-0.045**	0.184*	0.044	-0.013*	0.015	-0.016*	0.010	-0.004	-0.010
	(0.009)	(0.018)	(0.098)	(0.194)	(0.008)	(0.016)	(0.009)	(0.017)	(0.004)	(0.009)
Doctor Visit		0.014**		1.031**		-0.082**		-0.086**		0.007*
		(0.007)		(0.081)		(0.007)		(0.007)		(0.004)
Doctor*Uninsured		-0.024*		-0.004		-0.008		-0.003		0.003
		(0.014)		(0.155)		(0.013)		(0.014)		(0.007)
Doctor*Post 65		-0.009		-0.272**		0.022**		0.021**		0.000
		(0.011)		(0.119)		(0.010)		(0.011)		(0.006)
Doctor*Uninsured*Post 65		0.049**		0.147		-0.034*		-0.030		0.008
		(0.021)		(0.224)		(0.019)		(0.020)		(0.010)
Mean of Dep. Variable for Previously Uninsured	0.104	0.104	27.252	27.252	0.217	0.217	0.265	0.265	0.050	0.050

Notes: For number of days drink, number of alcohol drinks, monthly alcohol consumption, and daily servings of fruits and vegetables, Poisson regression method is used with robust-corrected standard errors. Otherwise, OLS is used. Standard errors are reported in parentheses. All models include controls for the propensity score, age (single-year age dummy variables), employment (indicators for working for pay, self-employed, unemployed, homemaker or student, and retired), household size, and year dummy variables. * indicates $0.05 < \text{p-value} \leq 0.10$, ** indicates p-value ≤ 0.05

	Number of Days Drink Past Month		Average Drinks on Occasion		Monthly Alcohol Consumption	
Predicted Uninsured*Post 65	-0.095*	0.003	-0.093**	-0.035	-0.087	0.003
	(0.051)	(0.090)	(0.047)	(0.088)	(0.075)	(0.137)
Doctor Visit		-0.153**		-0.132**		-0.264**
		(0.035)		(0.032)		(0.051)
Doctor*Uninsured		-0.172**		-0.158**		-0.251**
		(0.072)		(0.067)		(0.106)
Doctor*Post 65		0.099*		-0.007		0.091
		(0.054)		(0.050)		(0.076)
Doctor*Uninsured*Post 65		-0.109		-0.068		-0.092
		(0.109)		(0.104)		(0.163)
Mean of Dep. Variable for Previously Uninsured	4.224	4.224	1.022	1.022	12.607	12.607

Table 7
Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
Cross Sectional Analysis Using Data from the Behavioral Risk Factor Surveillance System
Predicted Uninsured Based on 75th Percentile of Propensity Score
Female Sample

	Engaged in Vigorous Physical Activity		Body Mass Index (BMI)		Daily Cigarette Consumption (Yes/No)		Current Smoker (Yes/No)		Quit Cigarettes Past Year (Limited to Ever Smokers)	
Predicted Uninsured*Post 65	-0.008	-0.013	0.122	-0.063	-0.018**	-0.003	-0.017**	-0.002	-0.007*	-0.020**
	(0.006)	0.014	(0.091)	(0.207)	(0.006)	(0.013)	(0.006)	(0.014)	(0.004)	(0.010)
Doctor Visit		0.016**		0.940**		-0.085**		-0.091**		0.013**
		0.006		(0.085)		(0.005)		(0.006)		(0.004)
Doctor*Uninsured		-0.015		0.236		-0.017*		-0.013		0.002
		0.011		(0.163)		(0.010)		(0.011)		(0.008)
Doctor*Post 65		-0.005		-0.098		0.026**		0.026**		-0.001
		0.008		(0.124)		(0.008)		(0.008)		(0.006)
Doctor*Uninsured*Post 65		0.007		0.184		-0.015		-0.014		0.015
		0.016		(0.230)		(0.014)		(0.015)		(0.011)
Mean of Dep. Variable for Previously Uninsured	0.085	0.085	27.889	27.889	0.167	0.167	0.204	0.204	0.062	0.062

See notes to Table 7.

	Number of Days Drink Past Month		Average Drinks on Occasion		Monthly Alcohol Consumption	
Predicted Uninsured*Post 65	-0.034	0.005	-0.082*	0.030	-0.015	0.098
	(0.066)	(0.132)	(0.047)	(0.098)	(0.082)	(0.175)
Doctor Visit		-0.080**		-0.044		-0.120**
		(0.041)		(0.029)		(0.051)
Doctor*Uninsured		-0.186*		-0.125		-0.207
		(0.108)		(0.078)		(0.131)
Doctor*Post 65		-0.019		-0.051		-0.021
		(0.061)		(0.043)		(0.074)
Doctor*Uninsured*Post 65		-0.034		-0.138		-0.130
		(0.152)		(0.111)		(0.197)
Mean of Dep. Variable for Previously Uninsured	1.136	1.136	0.304	0.304	2.270	2.270

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		Body Mass Index (BMI)	
Uninsured*Post 65 (Uninsured >50% of Time)	-0.037 (0.043)	-0.008 (0.086)	-0.188 (0.164)	0.118 (0.325)
Doctor Visit		0.014 (0.026)		0.050 (0.106)
Doctor*Uninsured		-0.052 (0.050)		0.099 (0.209)
Doctor*Post 65		0.039 (0.045)		-0.035 (0.171)
Doctor*Uninsured*Post 65		-0.014 (0.096)		-0.352 (0.366)
Mean of Dep. Variable for Previously Uninsured	0.372	0.372	26.792	26.792

See notes to Table 3.

	Number of Cigarettes (Daily)		Quit Cigarettes (Limited to Ever Smokers)		Daily Cigarette Consumption (Yes/No)	
Uninsured*Post 65 (Uninsured >50% of Time)	0.080 (0.078)	0.175 (0.119)	0.042* (0.024)	0.019 (0.046)	-0.030 (0.019)	0.001 (0.036)
Doctor Visit		-0.128** (0.032)		0.049** (0.016)		-0.039** (0.012)
Doctor*Uninsured		0.111* (0.061)		-0.053* (0.030)		0.025 (0.024)
Doctor*Post 65		-0.081 (0.066)		-0.011 (0.025)		0.017 (0.019)
Doctor*Uninsured*Post 65		-0.185 (0.148)		0.047 (0.053)		-0.050 (0.041)
Mean of Dep. Variable for Previously Uninsured	11.129	11.129	0.473	0.473	0.416	0.416

	Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
Uninsured*Post 65 (Uninsured >50% of Time)	-0.0005 (0.029)	0.015 (0.056)	-0.019 (0.023)	-0.019 (0.043)
Doctor Visit		-0.037** (0.019)		-0.008 (0.016)
Doctor*Uninsured		0.017 (0.036)		-0.012 (0.031)
Doctor*Post 65		-0.031 (0.030)		-0.028 (0.025)
Doctor*Uninsured*Post 65		-0.025 (0.064)		-0.009 (0.047)
Mean of Dep. Variable for Previously Uninsured	0.452	0.452	0.147	0.147

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		Body Mass Index (BMI)	
Uninsured*Post 65 (Uninsured >50% of Time)	-0.067* (0.038)	-0.209* (0.107)	-0.420** (0.168)	-1.047** (0.453)
Doctor Visit		0.041 (0.029)		-0.007 (0.147)
Doctor*Uninsured		-0.062 (0.048)		-0.085 (0.243)
Doctor*Post 65		-0.076 (0.056)		-0.182 (0.240)
Doctor*Uninsured*Post 65		0.164 (0.113)		0.727 (0.484)
Mean of Dep. Variable for Previously Uninsured	0.287	0.287	28.277	28.277

See notes to Table 3.

	Number of Cigarettes (Daily)		Quit Cigarettes (Limited to Ever Smokers)		Daily Cigarette Consumption (Yes/No)	
Uninsured*Post 65 (Uninsured >50% of Time)	0.025 (0.086)	0.088 (0.136)	0.003 (0.028)	-0.044 (0.078)	0.001 (0.015	0.036 (0.041)
Doctor Visit		-0.125** (0.035)		0.077** (0.022)		-0.045** (0.013)
Doctor*Uninsured		0.102* (0.058)		0.014 (0.039)		0.009 (0.022)
Doctor*Post 65		-0.099 (0.070)		0.027 (0.038)		-0.007 (0.021)
Doctor*Uninsured*Post 65		-0.120 (0.165)		0.054 (0.083)		-0.040 (0.044)
Mean of Dep. Variable for Previously Uninsured	7.071	7.071	0.535	0.535	0.243	0.243

	Alcohol Participation (Yes/No)		Daily Alcohol Consumption (Yes/No)	
Uninsured*Post 65 (Uninsured >50% of Time)	0.031 (0.019)	0.031 (0.052)	-0.003 (0.009)	0.033 (0.024)
Doctor Visit		-0.007 (0.017)		-0.014 (0.009)
Doctor*Uninsured		-0.034 (0.028)		0.034** (0.014)
Doctor*Post 65		0.027 (0.028)		0.023* (0.014)
Doctor*Uninsured*Post 65		0.006 (0.056)		-0.043* (0.025)
Mean of Dep. Variable for Previously Uninsured	0.142	0.142	0.017	0.017

Appendix Table 3
Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
Cross Sectional Analysis Using Data from the Behavioral Risk Factor Surveillance System
Male Sample, Predicted Uninsured Based on 50th Percentile of Propensity Score

	Engaged in Vigorous Physical Activity		Body Mass Index (BMI)		Daily Cigarette Consumption (Yes/No)		Current Smoker (Yes/No)		Quit Cigarettes Past Year (Limited to Ever Smokers)	
Predicted Uninsured*Post 65	-0.001	-0.024	0.250**	0.103	-0.022**	-0.002	-0.019**	0.0004	-0.004	-0.015*
	(0.008)	(0.016)	(0.085)	(0.177)	(0.007)	(0.015)	(0.008)	(0.016)	(0.004)	(0.008)
Doctor Visit		0.019**		0.984**		-0.079**		-0.085**		0.013**
		(0.009)		(0.100)		(0.008)		(0.009)		(0.005)
Doctor*Uninsured		-0.023*		0.086		-0.009		-0.002		-0.009
		(0.013)		(0.138)		(0.012)		(0.012)		(0.006)
Doctor*Post 65		-0.010		-0.303**		0.023*		0.022*		-0.005
		(0.013)		(0.147)		(0.012)		(0.013)		(0.007)
Doctor*Uninsured*Post 65		0.031*		0.140		-0.022		-0.022		0.015
		(0.018)		(0.202)		(0.017)		(0.018)		(0.009)
Mean of Dep. Variable for Previously Uninsured	0.114	0.114	27.313	27.313	0.207	0.207	0.249	0.249	0.050	0.050

See notes to Table 7.

	Number of Days Drink Past Month		Average Drinks on Occasion		Monthly Alcohol Consumption	
Predicted Uninsured*Post 65	-0.025	0.089	-0.048	0.081	-0.054	0.091
	(0.041)	(0.080)	(0.037)	(0.075)	(0.059)	(0.115)
Doctor Visit		-0.163**		-0.129**		-0.269**
		(0.041)		(0.037)		(0.058)
Doctor*Uninsured		-0.072		-0.090		-0.125
		(0.061)		(0.056)		(0.088)
Doctor*Post 65		0.144**		0.064		0.159*
		(0.064)		(0.056)		(0.088)
Doctor*Uninsured*Post 65		-0.135		-0.161*		-0.170
		(0.093)		(0.086)		(0.134)
Mean of Dep. Variable for Previously Uninsured	4.392	4.392	0.970	0.970	11.452	11.452

Appendix Table 4
Estimates of the Effect of Receipt of Medicare at Age 65 on Health Behaviors
Cross Sectional Analysis Using Data from the Behavioral Risk Factor Surveillance System
Female Sample, Predicted Uninsured Based on 50th Percentile of Propensity Score

	Engaged in Vigorous Physical Activity		Body Mass Index (BMI)		Daily Cigarette Consumption (Yes/No)		Current Smoker (Yes/No)		Quit Cigarettes Past Year (Limited to Ever Smokers)	
Predicted Uninsured*Post 65	0.001	-0.012	0.041	-0.076	-0.018**	-0.003	-0.016*	0.031	-0.001	-0.010
	(0.006)	(0.013)	(0.082)	(0.191)	(0.005)	(0.012)	(0.009)	(0.022)	(0.004)	(0.009)
Doctor Visit		0.021**		0.888**		-0.081**		-0.157**		0.015**
		(0.007)		(0.107)		(0.007)		(0.012)		(0.005)
Doctor*Uninsured		-0.017*		0.229		-0.014		0.018		-0.002
		(0.010)		(0.146)		(0.009)		(0.016)		(0.007)
Doctor*Post 65		-0.013		-0.101		0.030**		0.054**		-0.002
		(0.011)		(0.159)		(0.010)		(0.018)		(0.008)
Doctor*Uninsured*Post 65		0.017		0.114		-0.016		-0.053**		0.010
		(0.014)		(0.211)		(0.013)		(0.024)		(0.010)
Mean of Dep. Variable for Previously Uninsured	0.106	0.106	27.394	27.394	0.164	0.164	0.199	0.199	0.055	0.055

Notes: For number of days drink, number of alcohol drinks, monthly alcohol consumption, and daily servings of fruits and vegetables, Poisson regression method is used. Otherwise, OLS is used. Standard errors are reported in parentheses. All models include controls for the propensity score, age (single-year age dummy variables), employment (indicators for working for pay, self-employed, unemployed, homemaker or student, and retired), household size, and year dummy variables. * indicates $0.05 < \text{p-value} \leq 0.10$, ** indicates $\text{p-value} \leq 0.05$

	Number of Days Drink Past Month		Average Drinks on Occasion		Monthly Alcohol Consumption	
Predicted Uninsured*Post 65	-0.064	0.077	-0.066**	0.122*	-0.085	0.151
	(0.047)	(0.101)	(0.033)	(0.072)	(0.058)	(0.126)
Doctor Visit		-0.119**		-0.062*		-0.148**
		(0.048)		(0.035)		(0.058)
Doctor*Uninsured		0.001		-0.023		-0.030
		(0.078)		(0.056)		(0.098)
Doctor*Post 65		0.044		0.032		0.084
		(0.073)		(0.052)		(0.085)
Doctor*Uninsured*Post 65		-0.176		-0.236**		-0.297**
		(0.114)		(0.081)		(0.141)
Mean of Dep. Variable for Previously Uninsured	1.667	1.667	0.384	0.384	3.078	3.078