

The Effect of Health Insurance Coverage on the Use of Medical Services*

Michael Anderson
UC Berkeley
mlanderson@berkeley.edu

Carlos Dobkin
UC Santa Cruz
cdobkin@ucsc.edu

March 8, 2009

Abstract

Despite considerable policy interest in expanding health insurance coverage, there is still substantial uncertainty about the causal effects of insurance coverage on utilization of care. Most studies of this issue have trouble determining what part of the large differences in healthcare utilization between the insured and the uninsured are due to insurance status as opposed to the other substantial differences between these two populations. In this paper, we leverage a sharp change in insurance coverage rates that occurs when young adults “age out” of their parents’ insurance to estimate the effect of insurance coverage on utilization of outpatient, emergency department (ED), and inpatient services. Using the National Health Interview Survey (NHIS) data, emergency department records from Arizona, California, and New Jersey and hospital admission records from California, New York, and Texas, we find that aging out results in an abrupt 5 to 8 percentage point reduction in the probability of having health insurance. This drop in insurance coverage results in a substantial increase in the number of people that report delaying or forgoing care due to concerns about cost, large reductions in ED visits and very large reductions in hospital admissions. The drop in ED visits and inpatient admissions is due entirely to reductions in the care provided by privately owned hospitals with particularly large reductions at for profit hospitals. These results imply that expanding health insurance coverage will result in a substantial increase in utilization.

* We thank Jan Morgan at California OSHPD for helping us get access to the California Hospital discharge records.

1. INTRODUCTION

One-quarter of nonelderly adults in the United States lacked health insurance at some point during 2007 (Schoen et al. 2008). The health care provided these individuals generates considerable public expenditures – they visit the emergency department (ED) in large numbers and receive \$56 billion of uncompensated care each year (Abelson 2008; Hadley et al. 2008). It is possible that some of the cost of expanding health insurance coverage may be offset by reductions in inappropriate use of emergency department services. Indeed, Massachusetts' experiment with near universal health insurance coverage is funded in part on the assumption that reimbursements for uncompensated care will fall substantially (Gruber 2006). The empirical evidence suggests this may not be the case as uninsured individuals consume less medical care per capita than insured individuals (Hadley et al. 2008). However, since insurance coverage is determined in part by underlying health this may not be a reasonable comparison. Forecasting the effects of expanding health insurance coverage on utilization of care and net government spending requires exogenous variation in health insurance coverage.

A sizable literature examines the impacts of publicly provided health insurance (Medicare) among the elderly (Lichtenberg 2002; Decker and Rapaport 2002; McWilliams et al. 2003; McWilliams et al. 2007; Card, Dobkin, and Maestas 2008). However, health insurance coverage is near universal among the elderly, so expanding health insurance coverage has minimal impact on this population. The beneficiaries of health insurance expansions are instead likely to be young adults (commonly defined as age 19–29). Almost half of all young adults in the United States lacked health insurance coverage in 2007, and they accounted for 37 percent of all uninsured adults (Schoen et al. 2008). Furthermore, because the elderly transition to Medicare from a mixture of private insurance and no insurance, results from Medicare studies cannot accurately predict the effects of insuring a previously uninsured population.

In this paper we leverage a sharp decrease in insurance coverage rates at age 19 to estimate the effect of insurance coverage on self reported access to care, ED visits, and inpatient hospital admissions. Many private health plans cover dependents aged 18 or younger; as a result, some young adults lose insurance coverage on the last day of the month in which they turn 19.¹ Using

¹ An important exception to this rule involves students. Many insurance plans will cover dependents beyond the age of 18 if the dependent is enrolled in school. We therefore expect – and find – stronger effects of turning 19 on insurance coverage rates for segments of the population with less education.

National Health Interview Survey (NHIS) data, emergency department records from Arizona, California and New Jersey and hospital admission records from California, New York, and Texas, we examine the impact of this sharp change in coverage. We find that this drop in insurance coverage results in an increased number of people reporting that cost is a barrier to getting medical care and substantial reductions in reductions in emergency department visits and non-urgent hospital admissions. We find no evidence that young adults “stockpile” health services shortly before turning 19 in anticipation of losing coverage.

The reductions in hospital admissions and ED visits are pronounced for privately owned hospitals (both non-profit and for-profit), but we observe no equivalent reductions for publicly owned hospitals. These results indicate that the newly uninsured do receive a disproportionate fraction of their care at publicly owned hospitals. However, becoming uninsured does not increase an individual’s overall utilization of care at publicly owned hospitals. Expanding health insurance coverage therefore requires substantial net expenditures, since uninsured individuals do not fully substitute uncompensated care and ED visits for standard inpatient and outpatient care.

2. EMPIRICAL FRAMEWORK

We consider a simple reduced-form model of the causal effects of health insurance coverage on a variety of outcomes:

$$(1) \quad Y_{ijka} = \gamma_{0,jk} + \gamma_{1,jk} D_{ija} + \varepsilon_{ijka}$$

In this model, Y_{ijka} represents outcome k (generally some measure of use of care or access to care) for individual i of demographic group j at age a . D_{ija} is an indicator variable equal to unity if individual i has health insurance at age a and zero otherwise, and ε_{ijka} contains all other determinants of the outcome Y_{ijka} . The coefficient $\gamma_{1,jk}$ represents the causal effect of health insurance for group j on outcome k . In principle $\gamma_{1,jk}$ may vary by individual i (heterogeneous effects), but for the moment we assume that effects are homogenous with a given group j . Effects may also vary with age, but in practice we focus on the value of $\gamma_{1,jk}$ at age 19.

It is difficult to obtain consistent estimates of the causal effect of health insurance, $\gamma_{1,jk}$, because health insurance status, D_{ija} , is endogenously determined. An individual’s choice to secure health

insurance is determined in part by his health, and other individual characteristics also affect both insurance coverage and health outcomes. Some of these characteristics are observable in our data, but many are not. Table 1 reports summary statistics by health insurance status for young adults (age 18–19) from the NHIS. Insured individuals are less likely to be minorities, less likely to be male, more likely to have a high school diploma, and more likely to have some college education. Since observable characteristics are correlated with insurance status, it is likely that unobservable characteristics are also correlated with insurance status. To avoid these issues, we identify the causal effect of health insurance using the sharp discontinuity in insurance coverage rates at age 19 as an instrument for insurance status.

Many private health plans cover dependents through the last day of the month in which the dependent turns 19 (Kriss et al 2008). Let Z_{ija} be an indicator variable equal to unity if individual i is observed after the last day of the month in which she turns 19 and zero if she is observed before the last day of the month in which she turns 19; $Z_{ija} = 1\{A_{ij} > \text{age of individual } i \text{ on the last day of the month when she turns 19}\}$. If age were the sole determinant of health insurance coverage, then we would observe $D_{ija} = Z_{ija}$, and we could estimate γ_{1jk} as the difference in mean outcomes between individuals just under 19 and just over 19 (Imbens and Lemieux 2008):

$$(2) \quad \gamma_{1jk}^{SRD} = \lim_{a \uparrow 19} E\left[Y_{ijka} \mid A_{ij} = a\right] - \lim_{a \downarrow 19} E\left[Y_{ijka} \mid A_{ij} = a\right]$$

For γ_{1jk}^{SRD} to equal γ_{1jk} , we need the identifying assumption that $E\left[\varepsilon_{ijka} \mid A_{ij} = a\right]$ is continuous at $a = 19$ (A_{ij} is the age of individual i of group j). This is the standard regression discontinuity (RD) assumption that the conditional expectations of other factors affecting the outcome of interest do not change discontinuously at the threshold. In our context, the assumption requires that other factors affecting health care utilization, such as employment, school attendance, or risky behaviors, do not change discontinuously when individuals turn 19. If this assumption holds, then the RD approximates a randomized controlled trial – individuals just below age 19 are similar, in expectation, to individuals just above age 19 along all dimensions except those affected by health insurance coverage. We present empirical evidence that this assumption holds in Table 1.

Age is not the only determinant of insurance coverage, however, and so the RD design that we implement is the “fuzzy” type. One possible strategy is to estimate the reduced form effect of

turning 19, Z_{ija} , on each outcome of interest Y_{ijka} . This strategy is the analog of an “intention to treat” analysis in a randomized controlled trial with imperfect compliance – in this case Z_{ija} corresponds to the intention to treat indicator. Many of our analyses take this form; in particular, we estimate the effect of turning 19 on health insurance coverage, utilization of outpatient care, utilization of inpatient care, and visits to the ED. Under the assumption that turning 19 affects utilization of care only through its effect on health insurance coverage, however, we can also identify γ_{1jk} , the causal effect of health insurance coverage, D_{ija} , on outcome Y_{ijka} . This parameter is identified by dividing the effect of turning 19 on outcome Y_{ijka} by the effect of turning 19 on health insurance coverage (D_{ija}):

$$(3) \quad \gamma_{1jk} = \frac{\lim_{a \uparrow 19} E[Y_{ijka} | A_{ij} = a] - \lim_{a \downarrow 19} E[Y_{ijka} | A_{ij} = a]}{\lim_{a \uparrow 19} E[D_{ija} | A_{ij} = a] - \lim_{a \downarrow 19} E[D_{ija} | A_{ij} = a]}$$

Intuitively, the numerator identifies the reduced form effect of turning 19 on the outcome of interest, Y_{ijka} . However, the probability of health insurance coverage does not change by 100 percentage points when an individual turns 19. It changes instead by less than 100 percentage points, and the denominator identifies the exact magnitude of the change. To infer the effect of health insurance on Y_{ijka} , we rescale the change in the outcome by the change in the fraction insured. This strategy is analogous to using the age 19 discontinuity as an instrument to identify the causal effect of health insurance (Hahn, Todd, and Van Der Klaauw 2001).

Following the methodology suggested in Imbens and Lemieux (2008), we estimate both the reduced form effect of turning 19, Z_{ija} , and the causal effect of health insurance, D_{ija} , nonparametrically using local linear regressions. To estimate the reduced form effect of turning 19 on outcome Y_{ijka} , we estimate a least squares regression of the form

$$(4) \quad Y_{ijka} = \pi_0 + \pi_1 Z_{ija} + \pi_2 (A_{ij} - 19) + \pi_3 (A_{ij} - 19) Z_{ija} + \eta_{ijka}$$

using only observations corresponding to individuals whose age, A_{ij} , is greater than 18 years and less than 20 years (or, in the case of NHIS data, observations corresponding to individuals whose age, A_{ij} , is greater than 17.25 years and less than 20.75 years). The coefficient $\hat{\pi}_1$ estimates the causal effect of turning 19 on Y_{ijka} . This procedure is equivalent to estimating local linear regressions directly above and directly below the age 19 discontinuity using a rectangular kernel

and a bandwidth of $h = 1$ year (or $h = 1.75$ in the case of NHIS data). Intuitively, the bandwidth h limits how far observations can lie from the discontinuity point and still influence our estimates, while the regressors A_{ij} and $A_{ij}Z_{ija}$ control for any trend in Y_{ijka} with respect to age near the discontinuity point. We also experiment with different values of h to test the sensitivity of our results to bandwidth selection.

To estimate the causal effect of health insurance on outcome Y_{ijka} , we estimate a two stage least squares (2SLS) regression of the form

$$(5) \quad D_{ija} = \alpha_0 + \alpha_1 Z_{ija} + \alpha_2 (A_{ij} - 19) + \alpha_3 (A_{ij} - 19) Z_{ija} + u_{ija}$$

$$(6) \quad Y_{ijka} = \gamma_0 + \gamma_1 \hat{D}_{ija} + \gamma_2 (A_{ij} - 19) + \gamma_3 (A_{ij} - 19) Z_{ija} + v_{ijka}$$

using only observations corresponding to individuals whose age, A_{ij} , is greater than 18 years and less than 20 years (or, in the case of NHIS data, observations corresponding to individuals whose age, A_{ij} , is greater than 17.25 years and less than 20.75 years). The coefficient $\hat{\gamma}_1$ estimates the causal effect of health insurance coverage on Y_{ijka} . Because our system is just identified, the 2SLS estimate of γ_1 is numerically identical to the ratio of the reduced form coefficient from equation 4 divided by the first stage coefficient from equation 5, or $\hat{\pi}_1 / \hat{\alpha}_1$. The 2SLS regression is thus equivalent to separately estimating the reduced form and first stage equations using local linear regressions directly above and directly below the age 19 discontinuity, and then taking the ratio of the estimates from the reduced form and first stage equations, $\hat{\pi}_1 / \hat{\alpha}_1$. The local linear regressions use rectangular kernels and a bandwidth of $h = 1$ year (or $h = 1.75$ years in the case of NHIS data), and we again experiment with different values of h to test the sensitivity of our results to bandwidth selection. In some cases we separately estimate and combine the reduced form and first stage regression coefficients because it is more straightforward than estimating the 2SLS regression.

3. THE EFFECTS OF HEALTH INSURANCE ON UTILIZATION OF OUTPATIENT CARE

We first examine the effects of health insurance on the utilization of outpatient care. To measure these effects, we use survey data from the National Health Interview Survey (NHIS). The NHIS

includes questions on the type of insurance coverage that the respondent has, whether the respondent has lost coverage due to age or leaving school, whether the respondent has seen a health care provider in the past two weeks, whether the respondent has delayed care due to cost, and whether the respondent has forgone care due to cost. We use NHIS data from 1997 to 2007, and in our primary specification we include respondents that are between 17.25 years of age and 20.75 years of age. This trimmed sample includes 42,897 observations.

The bandwidth of $h = 1.75$ years that we use with the NHIS data is wider than the bandwidth of $h = 1$ year that we use with hospital inpatient and ED visit data. We use a wider bandwidth with the NHIS data for two reasons. First, some NHIS respondents that age out of their insurance may not immediately realize that they are no longer covered. Estimating the effect on coverage very close to the age 19 threshold may therefore understate the true loss in coverage that occurs at age 19. Second, two of the NHIS measures of care ask whether a respondent has delayed or forgone treatment in the past 12 months. This fact implies that the full effect of losing insurance coverage at age 19 may take months to become apparent. A respondent cannot delay or forgo care until the first incident requiring care occurs. If, for example, 40 percent of respondents require care within the first two months following their 19th birthday and 70 percent require care within the first four months following their 19th birthday, then roughly 40 percent of the full effect of turning 19 may appear within the first two months and roughly 70 percent of the full effect of turning 19 may appear within the first four months (the exact fraction will depend on the relative effects of turning 19 for the respondents that frequently require care and the respondents that infrequently require care).² Both the 12 month window and the possibility that respondents do not immediately perceive their coverage loss imply that estimating the discontinuity very close to the age 19 threshold will result in both the estimate of the change in insurance and the change in access to care being underestimated. We therefore widen the bandwidth to $h = 1.75$ to allow observations further from the age 19 threshold to influence the estimates. Unlike the estimates from the ED and inpatient data, the NHIS estimates rely heavily on a parametric model specifying a linear trend of the outcome in age on either side of the age 19 threshold.

² The responses to the question asking whether a respondent saw a health care provider in the last two weeks reveal that approximately 10 percent of the sample saw a health care provider in any two week period. As much as 40 percent of the sample may therefore have seen (or wanted to see) a health care provider in the two month period following turning 19. It is likely, however, that some individuals see health care providers very frequently and others see health care providers very infrequently. This would reduce the percentage of the sample that sees (or wants to see) a health care provider in the two month period following turning 19.

Figure 1 plots the distribution of insurance coverage by age at one month intervals for NHIS respondents. All NHIS respondents fall into one of four categories: privately insured, uninsured, covered by Medicaid, or covered by other insurance. The proportion of young adults that are privately insured stands at 70 percent at age 17.25 but drops below 60 percent by age 20.75. The superimposed lines in Figure 1 plot the linear trend for each insurance type before and after age 19 (the regression trend lines are fit on micro data rather than the one month means plotted in the figure). There is evidence of a discrete drop at age 19 in the proportion privately insured (2.8 percentage points, $t = 2.8$), with smaller reductions in the proportion covered by Medicaid (1.4 percentage points, $t = 2.6$) and the proportion covered by other insurance (1.3 percentage points, $t = 2.5$).³ These reductions in coverage are mirrored by a sharp increase in the proportion uninsured at age 19 (5.4 percentage points, $t = 6.7$).

Figure 2 plots the proportion uninsured by age for four demographic groups: low education (high school or less), high education (more than high school), males, and females. For all groups, the proportion uninsured trends upward with age.⁴ The key finding in Figure 2 is that turning 19 induces a much larger loss of coverage among low education respondents than among high education respondents. At any age, low education respondents are more likely to be uninsured than high education respondents. The proportion of low education respondents uninsured for jumps 11.6 percentage points at age 19 ($t = 9.8$), but the proportion of high education respondents uninsured jumps only 2.5 percentage points at the same age ($t = 2.0$). This contrast in effects for low and high education respondents supports the hypothesis that individuals lose coverage at age 19 because they “age out” of their parents insurance. Many private insurance plans cover dependents beyond age 18 if the dependents are enrolled in school; we thus expect larger effects for low education respondents since these individuals are less likely to be students at age 19 than high education respondents. Comparing genders, males are more likely to be uninsured than females, and the proportion uninsured jumps at age 19 by approximately 6.3 percentage points for males ($t = 5.2$) and 4.6 percentage points for females ($t = 4.1$).

The patterns in Figure 3 confirm that the “age out” mechanism generates the observed drop in insurance coverage at age 19. Figure 3 plots, by age, the proportion of respondents that report

³ Some states phase out Medicaid eligibility at age 19.

⁴ Note that the composition of the low education and high education groups changes with age. The number of individuals in the low education group trends downward with age (as most individuals do not begin college until age 17.7 or later), while the number of individuals in the high education group trends upwards with age. There is no evidence, however, of a discrete change in the composition of the low or high education groups at the age 19 threshold.

losing health insurance due to age or leaving school. This proportion is plotted for each of the four demographic groups (low education, high education, males, and females). The proportion of low education respondents who lose coverage due to age or leaving school jumps 8.7 percentage points at age 19 ($t = 10.4$). In contrast, the proportion of high education respondents who lose coverage due to age or leaving school jumps only 1.9 percentage points at the same age ($t = 2.6$). In all four groups, the increase in the proportion losing coverage due to age or leaving school at age 19 closely mirrors the increase in the proportion uninsured at age 19. For example, among the low education group, turning 19 increases the proportion uninsured by 11.6 percentage points and increases the proportion losing coverage due to age or leaving school by 8.7 percentage points. Among females, turning 19 increases the proportion uninsured by 4.6 percentage points and increases the proportion losing coverage due to age or leaving school by 4.3 percentage points.

Table 2 collects the local linear regression estimates for Figures 1 through 3. These estimates come from the regression described in equation 5, and all regressions are estimated using micro data. Each coefficient represents the causal effect of turning 19 on some outcome (we report only $\hat{\alpha}_1$, the coefficient on the age 19 indicator, $Z_{ija} = 1\{A_{ij} > \text{age of individual } i \text{ on the last day of the month when she turns } 19\}$). Each row in Table 2 presents results for a different demographic subgroup (male, female, high school or less, more than high school), and each main column presents results for a different outcome (privately insured, uninsured, Medicaid, other insurance, and lost insurance due to age or leaving school). Within each outcome column, the left sub-column reports results for the specification described in equation 5, and the right sub-column reports results for a modified specification that also includes indicators for Hispanic, black, and male. That the inclusion of additional covariates as controls increases precision but in general has a minimal impact on the point estimates is further evidence that the covariates are not changing discontinuously at the threshold.

Figure 4 presents the effects of turning 19 on several measures of utilization of outpatient care. It plots, by age at two month intervals, the proportion of NHIS respondents that saw a health care provider in the last two weeks, that delayed care due to cost, and that forwent care due to cost. Turning 19 is associated with a small but statistically insignificant drop in the probability of having seen a health care provider in the last two weeks ($t = 0.6$). The probability of delaying care due to cost, however, increases by 1.5 percentage points at age 19 ($t = 2.7$), and the probability of forgoing care due to cost increases by 1.1 percentage points at the same age ($t =$

2.6). The proportion delaying care and the proportion forgoing care both trend upwards after age 19. This upward trend is caused in part by the fact that each question asks the survey respondent if he has delayed care (or forgone care) at any time in the past 12 months. Depending on the frequency of care, it may take months before the event of losing health insurance causes an individual to delay care.

The patterns in Figures 2 and 3 imply that the effects of turning 19 on access to care should be concentrated among specific demographic groups. In particular, the effects should be strongest for the low education group because it had the largest reduction in insurance coverage. Figures 5 through 7 plot, for each measure of outpatient care, the effects of turning 19 by each of the four demographic groups (low education, high education, male, and female). For every measure, the low education group demonstrates the largest effect at age 19.

Figure 5 plots the proportion of NHIS respondents that report delaying care due to cost. The proportion of low education respondents – the group that experienced the largest loss in insurance coverage at age 19 – that delay care due to cost jumps 2.6 percentage points at age 19. This increase is statistically significant ($t = 3.3$). The proportion of males that delay care due to cost also increases significantly at age 19 (1.7 percentage points, $t = 2.3$). However, there is no significant increase at age 19 in the proportion of females or high education respondents that delay care due to cost.

Figure 6 plots the proportion of NHIS respondents that report forgoing care due to cost. The proportion of low education respondents that forgo care due to cost jumps 2.3 percentage points at age 19 ($t = 3.5$). The proportion of females that forgo care due to cost also increases significantly at age 19 (1.3 percentage points, $t = 2.0$). There is no significant increase at age 19, however, in the proportion of males or high education respondents that forgo care due to cost.

Figure 7 plots the proportion of NHIS respondents that report seeing a health care provider in the last two weeks. The proportion of low education respondents that saw a health care provider in the last two weeks drops 2.0 percentage points at age 19 ($t = 2.3$). However, there is no significant decrease at age 19 in the proportion of males, females, or high education respondents that report seeing a health care provider in the last two weeks.

Table 3 summarizes the local linear regression estimates for Figures 5 through 7. Again, each coefficient represents the causal effect of turning 19 on some measure of outpatient care. Each row presents results for a different demographic subgroup, and each main column presents results for a different outcome (delay care due to cost, no care due to cost, see provider in last two weeks). Within each outcome column, the left sub-column reports results for the specification described in equation 4, and the right sub-column reports results for a modified specification that also includes indicators for Hispanic, black, and male. The inclusion of covariates has a negligible impact on the point estimates in all cases.

In Table 4 we combine the first stage estimates from Table 2 (the effect of turning 19 on insurance coverage) with the reduced form estimates from Table 3 (the effect of turning 19 on utilization of outpatient care) to estimate the effect of losing insurance coverage on utilization of outpatient care. Each entry in Table 4 is calculated by taking the corresponding reduced form effect from Table 3 and dividing it by the corresponding first stage effect on the probability of being uninsured from Table 2.⁵ The effects are most precisely estimated for low education respondents.⁶ For these respondents, becoming uninsured increases the probability of delaying care due to cost by 22.1 percentage points ($t = 3.3$), increases the probability of forgoing care due to cost by 19.8 percentage points ($t = 3.5$), and decreases the probability of seeing a provider in during a two week period by 17.0 percentage points ($t = 2.3$). Effects for other demographic groups are generally of similar magnitude but less precisely estimated (often the effects are not statistically significant).

Overall, there is strong evidence that turning 19 reduces health insurance coverage and that this reduction in health insurance coverage results in the delay or postponement of outpatient care. The effects are pronounced and precisely estimated for low education individuals – the group that is most likely to be uninsured (and would gain the most from near universal health coverage). We now consider the effects of health insurance coverage on emergency department care.

4. THE EFFECTS OF HEALTH INSURANCE ON EMERGENCY DEPARTMENT VISITS

⁵ Standard errors come from estimation via 2SLS.

⁶ The high precision for low education respondents is due primarily to the strong first stage effect on insurance coverage for these respondents.

A significant portion of young adults receive at least some of their health care at hospital emergency departments. Approximately 26 percent of 18 and 19 year old respondents in the 2005-2007 NHIS report receiving treatment in an emergency department in the prior 12 months. However, the NHIS has neither the questions nor the sample size needed to generate precise estimates of the age profile of emergency department visits.⁷ As an alternative we examine a near census of emergency department visits from Arizona, California and New Jersey.⁸ The Arizona and California data are available for 2005 and 2006 calendar years and the New Jersey data are available for 2004 to 2006. For the age group that is the focus of our analysis, 18 and 19 year olds, we observe 941,102 emergency department visits. The record for each visit contains basic demographic information including race, ethnicity, gender, type of health insurance and age in months. In addition the dataset includes detailed information on the cause of the admission and the treatment that the person received.

Figure 8 shows the age profile of insurance coverage of people that visit the emergency department.⁹ We plot the proportion with each type of insurance coverage for non overlapping cells of one month of age and superimpose the fitted values from equation 5. The figure reveals that the proportion of individuals with private coverage drops steadily with age, while the proportion that is uninsured increases with age. Furthermore, there are discrete changes in both proportions when people turn 19. Though the age profile of insurance coverage has a similar shape to the general population estimates from the NHIS in Figure 1, some of the levels are notably different. The estimates from the emergency department data show much lower rates of private coverage and higher rates of Medicaid and lack of insurance. Estimates from the NHIS of the insurance coverage of young adults that received treatment in the emergency department in the prior year show a distribution of health care coverage fairly close to the distribution found in the emergency room data.¹⁰

Figure 8 also shows compelling evidence of a discrete reduction in private insurance coverage immediately after people turn 19 with the majority of those losing their private coverage ending

⁷ The question regarding Emergency Department use refers to the past year and is only included in the Sample Adult portion of the survey. This substantially reduces the sample size – in a typical year the NHIS sample adult file has only about 600 18 and 19 year olds.

⁸ Emergency Department visits at hospitals that are not under state oversight such as Veteran Affairs hospitals are not included in these datasets.

⁹ The expected payer is reported on the medical records.

¹⁰ The proportion with private, Medicaid and no coverage in the ED data are (0.42, 0.25, 0.25). In the general population estimates from the NHIS, they are (0.62, 0.10, 0.20). In the NHIS estimates restricted to people with a visit to the emergency department in the past year, they are (0.53, 0.19, 0.18).

up uninsured. However, regression estimates of the discrete increase at age 19 in the proportion uninsured from the age profile in Figure 8 understates the true size of the increase. This is because, as can be seen in Figure 9, there is a discrete decrease at age 19 in the number of people receiving treatment in the emergency department. This discrete decrease is due to people who have lost their insurance forgoing treatment. The estimates in Figure 8 are from the sample analog of the following equation.

$$(7) \quad RD_U = \lim_{a \uparrow 19} E[U_{ija} | A_{ij} = a] - \lim_{a \downarrow 19} E[U_{ija} | A_{ij} = a]$$

where U_{ija} is the proportion uninsured, A_{ij} is age and RD_U is the discrete change in the proportion that are uninsured that occurs at age 19 among people visiting the emergency department. This is a biased estimate of the actual reduction in insurance coverage in this population because $\lim_{a \downarrow 19} E[U_{ija} | A_{ij} = a]$ is estimated from a population where people who have just lost their insurance are substantially less likely to appear. If we make the plausible assumption that the discrete reduction in admissions consists entirely of people who have lost their insurance, we can compute an unbiased estimate of the change in insurance coverage by adjusting for the reduction in admissions. The bias term takes the following form,¹¹

$$(8) \quad bias = \frac{\lim_{a \uparrow 19} E[V_{ija} | A_{ij} = a] - \lim_{a \downarrow 19} E[V_{ija} | A_{ij} = a]}{\lim_{a \uparrow 19} E[V_{ija} | A_{ij} = a]} (1 - \lim_{a \downarrow 19} E[U_{ija} | A_{ij} = a])$$

where V_{ija} is the rate of emergency department visits. We estimate the sample analogs of the various elements of RD_U and the bias term and their variances and covariances by estimating equations 4 and 5 via Seemingly Unrelated Regression. The standard errors are estimated using the Delta Method.

In Table 5 we present the estimates of the discrete change in insurance coverage adjusted for the bias term in equation 8. Adjusting for the bias that results from the 3.4 percentage point reduction in admissions at age 19 increases the effect on the proportion uninsured from about 5 percentage points to about 7.6 percentage points. The estimate of the effect on the proportion uninsured does not increase by the full 3.4 percentage points because adjusting for the missing people effects the size of both the numerator and the denominator of our estimate of the proportion uninsured at the

¹¹ The adjustment for the bias in the estimate of the change in the private insurance, Medicaid and other insurance have a slightly different form as only the denominator of the proportion with the coverage as we approach the discontinuity from the right is incorrect.

threshold as we approach it from the left. Examining the estimates of the changes in other types of coverage reveals that the increase in the proportion uninsured is due largely to the 6.3 percentage point reduction in the number of people with private coverage. The remainder of the increase is due to a 1 percentage point reduction in the proportion of people covered by Medicaid. The table also presents estimates for men and women separately and reveals that men and women have very similar size reductions in insurance coverage.

Figure 9 presents the age profile of the rate of emergency department visits per 10,000 person years. The figure reveals that the rates are increasing throughout this age range for both men and women. The figure also reveals evidence of a discrete reduction in treatment at age 19. In the first column of Table 6 we present the regression estimate of the discrete change in the natural log of admissions at age 19 for the entire population and for men and women separately. The regressions reveal that men experience a 3.6 percent decrease in admissions, and women experience a 3.2 percent decrease in admissions. In Figure 10 we present the age profile of emergency department visits by the type of control of the hospital. The figure shows substantial decreases in the number of people treated in emergency departments in Non Profit Hospitals and For Profit Hospitals but no evidence of any decrease in the number of people treated in Public Hospitals. The corresponding regression estimates are in the second through fourth columns of Table 6. They reveal that the two classes for privately controlled hospitals account for the entire reduction in the number of people treated.¹²

To estimate the impact of losing insurance coverage on the use of emergency department services we divide the estimates of the percent change in admissions from Table 6 by the estimates of the percentage point change in insurance. These elasticities are presented in Table 7. The estimate for the overall population in the first column and first row is 0.443. This implies that people that lose their insurance coverage reduce their emergency department treatments by 44.3 percent. The reduction for men and women are very similar.

5. THE EFFECTS OF HEALTH INSURANCE ON INPATIENT ADMISSIONS

Among young adults approximately 9.1 percent of women and 2.4 percent of men have had a hospitalization in the past year. The gender difference in the hospitalization rates is due entirely to

¹² This is not necessarily evidence of a violation of the Federal Emergency Medical Treatment and Active Labor Act as it might be that people are choosing not to go to the emergency department or declining treatment when they are informed that they lack insurance,

admissions of pregnant women. We analyze men, pregnant women and women that are not pregnant separately. Due to state administered programs intended to provide them health insurance, pregnant women have a very different age profile of insurance coverage than the other two groups. The limitations of the NHIS that prevent us from using it to examine emergency department visits are even more severe when examining hospitalizations. To examine the pattern of hospital admissions we instead use a census of hospital discharges from three large states: California, New York and Texas.¹³ Between the three states we observe a total of 1,819,675 hospital visits among 18 and 19 year olds. These records contain the same limited demographic variables that are available on the emergency department records and very detailed information on the cause of admission and treatment received in the hospital.

In Figure 11 we present the age profile of insurance coverage for all young adults admitted to a hospital. The figure reveals that Medicaid coverage is by far the most common type of coverage for admissions and that the proportion uninsured is far lower than the levels observed in either the general population (as estimated using the NHIS data) and in the population of people that visit the emergency room. The figure also shows compelling evidence of a decline in private coverage and a nearly offsetting increase in Medicaid coverage at exactly age 19. The estimates of the change in the insurance profile at 19 are biased due to a change in composition similar to the one that induced bias in the estimates from the emergency department records. The first row of Table 8 presents estimates of the discrete change in insurance coverage that occurs at age 19 for the overall inpatient population. These estimates reveal that among all admissions, approximately 41 percent of the loss in private coverage at age 19 is offset by increases in Medicaid coverage, so the proportion uninsured increases by only 2.6 percentage points. In the rows below we present the estimates by gender, with the women split into pregnant and non pregnant. These estimates reveal that, for men, aging out of private insurance results in a 6.2 percentage point increase in the proportion that are uninsured. Women that are not pregnant experience an approximately 4.7 percentage point increase in the proportion uninsured, and pregnant women experience almost no change in the proportion uninsured.¹⁴

¹³ The hospital records include discharges between 1990 and 2005 in California, 1992 and 2005 in New York, and 1999 and 2003 in Texas. Discharges from hospitals that are not regulated by the states' departments of health services are not included amongst these records.

¹⁴ This is probably because most hospitals make an effort to enroll the uninsured in Medicaid so that they can recover their costs.

In Figure 12 we present the age profile of hospital admissions for men and women that are not pregnant by the route through which they are admitted to the hospital. The figure reveals only a small decline in admissions through the emergency department after people lose their insurance coverage. Many of these admissions are for emergent medical conditions that are emergent and may be less sensitive to price. We see more substantial drops in admissions directly to the hospital. These admissions are typically planned admissions and may be elective. In Table 9 we present estimates of the change in the log of admissions at age 19, estimated from equation 4. The table reveals that inpatient admissions through the emergency department drop by about 2 percent for both men and women and that planned admissions drop by 6.8 percent for men and 5.7 percent for women. There is no evidence of a statistically significant change in hospital admissions for pregnant women – who also displayed no evidence of a reduction in insurance coverage – by either route. In the bottom three rows of this table we present the estimates of the change in hospital admissions by ownership type. There is a 1.5 percent decrease in admissions to non profit hospitals and a 3.3 decrease in admissions to for profit hospitals. There is no evidence, however, of a reduction in overall admissions to hospitals under public control.

In Table 10 we present the instrumental variables estimates of the impact of insurance coverage on the probability of an inpatient admission. The estimate for men is 0.64 and for women is 0.70. These suggest that insurance coverage is an important determinant of whether people will receive inpatient treatment. These estimates are even larger than the estimates for emergency department visits. When we examine the results by route into the hospital, it is clear that the overall drop in admissions is due largely to the large decline in admissions directly to the hospital, which are typically elective admissions.

6. DISCUSSION

Using NHIS data, ED visit data, and hospital inpatient data, we find that losing health insurance coverage reduces utilization of outpatient care, emergency department care, and inpatient care. Low education individuals experience a particularly high risk of losing insurance coverage at age 19, and they also demonstrate the largest reductions in care at age 19. The reduction in emergency department visits that occurs at age 19 is concentrated among non profit and for profit hospitals; there is no observable drop in emergency department visits at public hospitals. The reduction in hospital inpatient admissions is concentrated among scheduled visits, many of which are elective,

rather than unscheduled visits that begin in the emergency department and result in an inpatient admission.

The net effect of losing health insurance on utilization of care is unambiguously negative. All three types of care – outpatient, ED visits, and inpatient – decrease. The decreases in all three areas clarify several uncertainties about the impacts of insurance coverage on utilization of care. First, losing insurance coverage results in no net increase in emergency department care. This suggests that newly uninsured patients do not substitute emergency department care for other care (or, if they do substitute care towards the emergency department, the substituted care is swamped by a reduction in their normal emergency department visits). Second, any increase in uncompensated charity care is insufficient to offset the decrease in paid care – total outpatient and inpatient care both fall. Finally, losing insurance does increase the proportion of care that individuals receive at public hospitals. However, this increase is solely due to a decrease in care received at for profit and non profit hospitals – the total amount of care at public hospitals does not increase.

These results suggest that expanding health insurance coverage requires substantial net resources. It is possible that expanded coverage might reduce ED visits and uncompensated care, but any such reductions are overwhelmed by increases in paid care. Several issues affect the generalizability of these results, however.

As with all instrumental variables or fuzzy RD designs, the reported estimates represent local average treatment effects. The estimand is the average effect for individuals that lose their insurance at the age 19 threshold. As demonstrated in Figures 2 and 3, these individuals are predominantly those with relatively low levels of education. Young adults with lower educational attainment, however, are much more likely to be uninsured than young adults with higher educational attainment (Kenney and Pelletier 2008). Thus, for policy purposes, the estimated effects pertain to young adults that would be likely to benefit from an expansion in health insurance coverage. The estimated effects are also local in age. Strictly speaking, they pertain to individuals close to the age 19 threshold, but they are likely to generalize to young adults in their late teens or early twenties. The results are less likely to generalize to middle-aged individuals. As noted earlier, however, young adults account for a large fraction of uninsured adults in the United States.

There is also an asymmetry between our results, which are estimated off of individuals that lose health insurance coverage, and the effects of an expansion in health insurance coverage. People who have recently lost health insurance may still be in relatively good health; their price elasticity of health care consumption may therefore be high. As insults to health accumulate, however, care may become more critical, and individuals may become less price sensitive. In that case, our estimates would overstate the increase in care that would ensue from an expansion of health insurance coverage to individuals that have long been uninsured. The fact that the loss in insurance is anticipated also creates a dynamic that may not apply to expansions in health insurance coverage – individuals may “stockpile” health services in anticipation of losing coverage. If this were to occur, our results would again overstate the increase in care that would ensue from an expansion in health insurance coverage. There is no empirical evidence of such stockpiling, however. For example, if individuals were stockpiling, then we would expect an upward spike in seeing a health care provider in the two month period before turning 19. No such spike exists in Figure 7 for low education individuals (the only group that demonstrates a significant effect for this outcome). Likewise, we would expect an upward spike in hospital admissions not through the ED the month before turning 19. No such spike exists in Figure 12.

7. CONCLUSION

We leverage a sharp discontinuity in health insurance coverage that occurs when dependents age out of their parents’ plans at age 19 to estimate the effects of health insurance coverage on utilization of care. We find that losing health insurance coverage reduces utilization of three principal types of care: outpatient care, emergency department care, and inpatient care. Individuals that are at the highest risk of losing insurance coverage demonstrate the largest reductions in utilization of care. The estimated elasticities are large – a 10 percent decrease in the insurance coverage rate among ED patients reduces ED visits by 4.4 percent, and a 10 percent decrease in the insurance coverage rate among hospital patients reduces hospital visits by 6.3 percent. The reduction in hospital visits is stronger for non-urgent admissions, and the reductions in ED and hospital visits are concentrated among for profit and non profit hospitals, as opposed to public hospitals.

Our estimates pertain directly to young adults at high risk of being uninsured and may not generalize to middle-aged individuals. Nevertheless, young adults comprise a large fraction of the uninsured and would be key beneficiaries of any large-scale expansion of health insurance

coverage. These results indicate that substantial public expenditures are necessary to fund such an expansion – reductions in ED visits and uncompensated care are insufficient to offset the increase in care that insurance coverage induces.

REFERENCES

- Abelson, R. (2008). "Uninsured Put a Strain on Hospitals." *The New York Times*, December 9, 2008.
- Card, D., C. Dobkin, and N. Maestas (2008). "The Impact of Nearly Universal Insurance Coverage on Health Care Utilization: Evidence from Medicare." *American Economic Review*, 98(5), 2242-2258.
- Decker, S. and C. Rapaport (2002). "Medicare and Inequalities in Health Outcomes: The Case of Breast Cancer." *Contemporary Economic Policy*, 20(1), 1-11.
- Gruber, J (2006). "The Massachusetts Health Care Revolution: A Local Start for Universal Coverage." *Hastings Center Report*, 36(5), 14-19.
- Hadley, J., T. Coughlin, J. Holahan, and D. Miller (2008). "Covering the Uninsured in 2008: Current Costs, Sources of Payment, and Incremental Costs." *Health Affairs*, 27(5), w399-w415.
- Hahn, J., P. Todd, and W. Van der Klaauw (2001). "Identification and Estimation of Treatment Effects with a Regression-Discontinuity Design." *Econometrica*, 69(1), 201-209.
- Imbens, G. and T. Lemieux (2008). "Regression Discontinuity Designs: A Guide to Practice." *Journal of Econometrics*, 142(2), 615-635.
- Kenney, G. and J. Pelletier (2008). "Spotlight on Low-Income Uninsured Young Adults: Causes and Consequences." *Kaiser Low-Income Coverage and Access Survey*, September 2008.
- Kriss, J.L., S.R. Collins, E. Gould, B. Mahato, and C. Schoen (2008). "Rite of Passage? Why Young Adults Become Uninsured and How New Policies Can Help, 2008 Update." *The Commonwealth Fund*, 1139(38), 1-24.

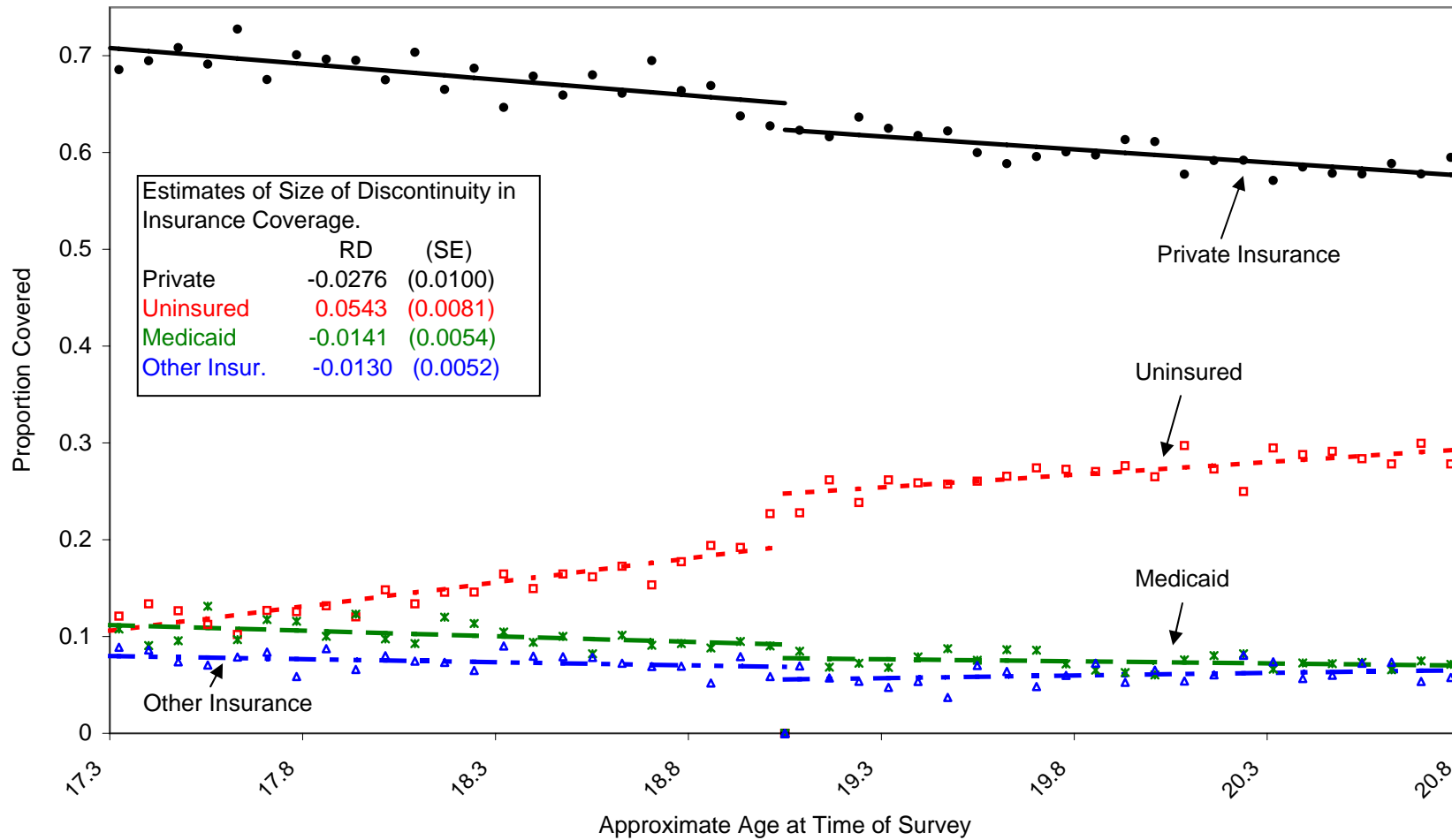
Lichtenberg, F. (2002). "The Effects of Medicare on Health Care Utilization and Outcomes." *Forum for Health Economics & Policy*, Vol. 5 (Frontiers in Health Policy Research): Article 3.

McWilliams, J.M., J.Z. Ayanian, E. Meara, and A.M. Zaslavsky (2007). "Use of Health Services by Previously Uninsured Medicare Beneficiaries." *The New England Journal of Medicine*, 357(2), 143-153.

McWilliams, J. M., A. Zaslavsky, E. Meara, and J. Ayanian (2003). "Impact of Medicare Coverage on Basic Clinical Services for Previously Uninsured Adults." *Journal of the American Medical Association*, 290(6), 757-64.

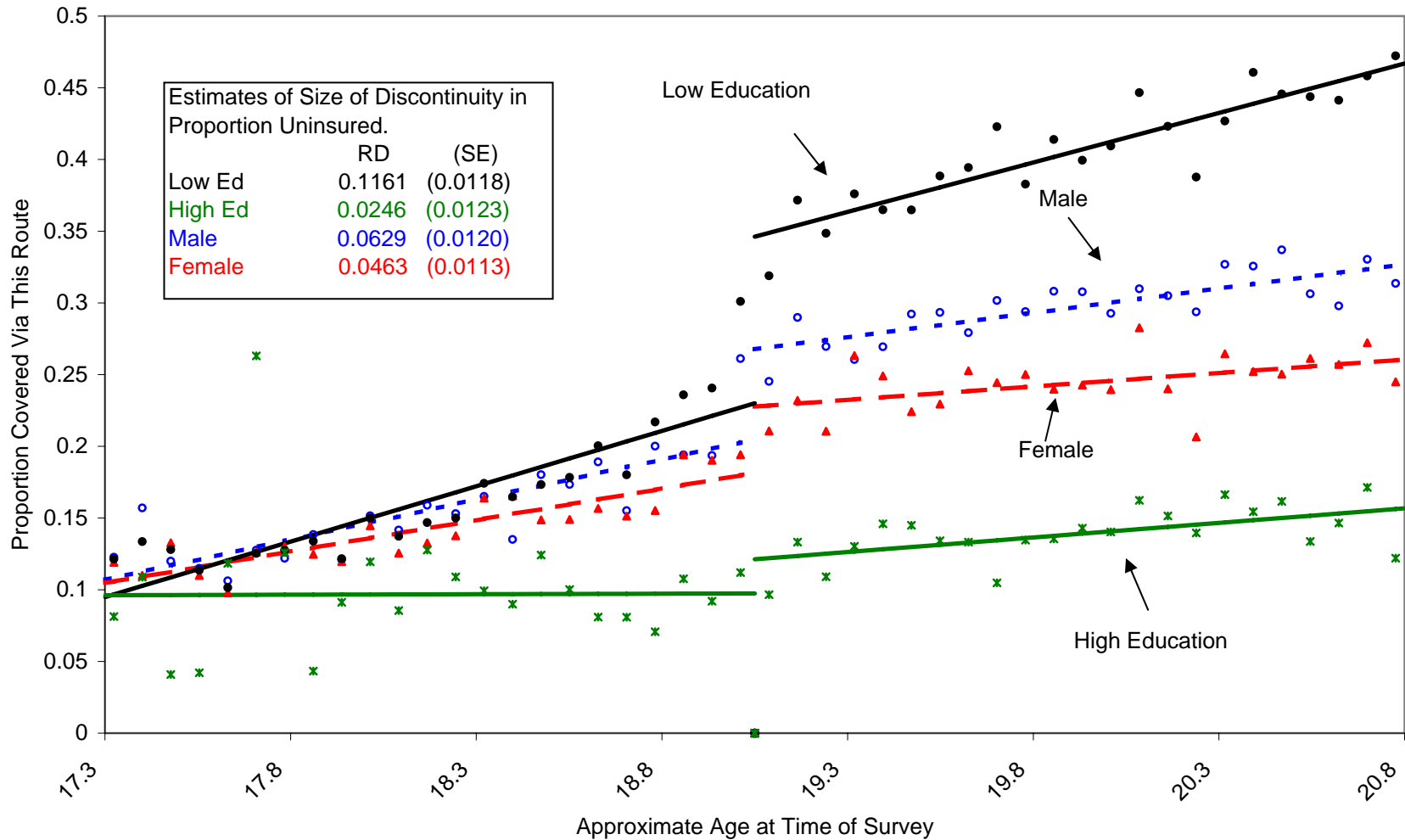
Schoen, C., S.R. Collins, M.M. Doty, J.L., and J.L. Kriss (2008). "How Many are Underinsured? Trends Among U.S. Adults, 2003 and 2007." *Health Affairs*, 27(4), w298-w309.

Figure 1: Age Profile of Health Insurance Coverage in the United States
National Health Interview Survey (1997-2007)



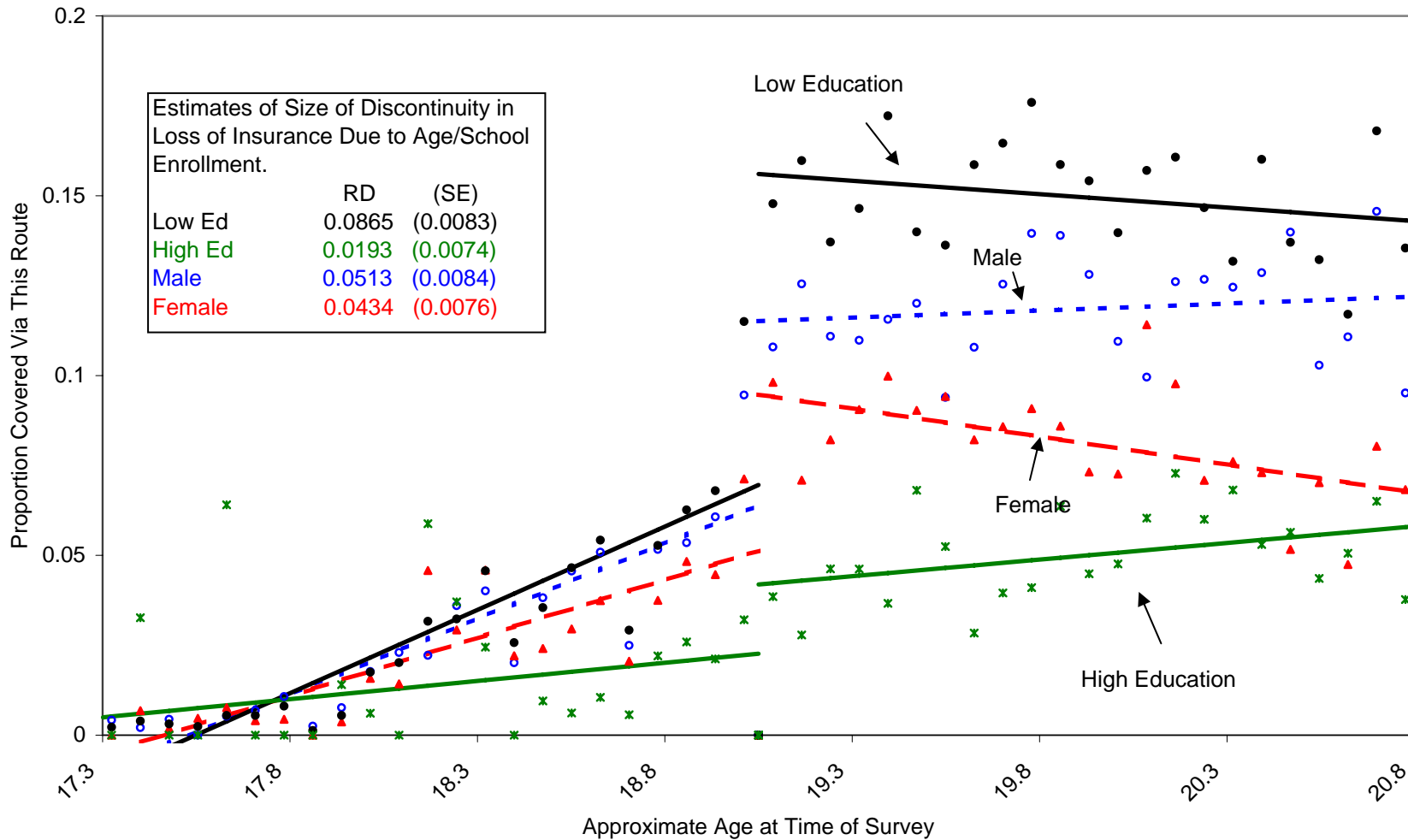
Notes: Regressions and proportions are weighted to take into account the stratified structure of the NHIS. The regression lines superimposed on the proportions are from a linear polynomial in age interacted with a dummy that takes on a value of one for people over 19 and 0 otherwise. This regression is fit on the micro data rather than the means of the bins. The age variable is centered on the last day of the month on which the individual's 19th birthday falls. Individuals with unknown month of birth comprise 11.6 percent of the surveyed population that are 18 or 19 at the time of the survey and they have been dropped from the analysis. The age profiles above include 42,897 individuals from the NHIS person files.

Figure 2: Age Profile of Proportion Uninsured by Subgroup
National Health Interview Survey (1997-2007)



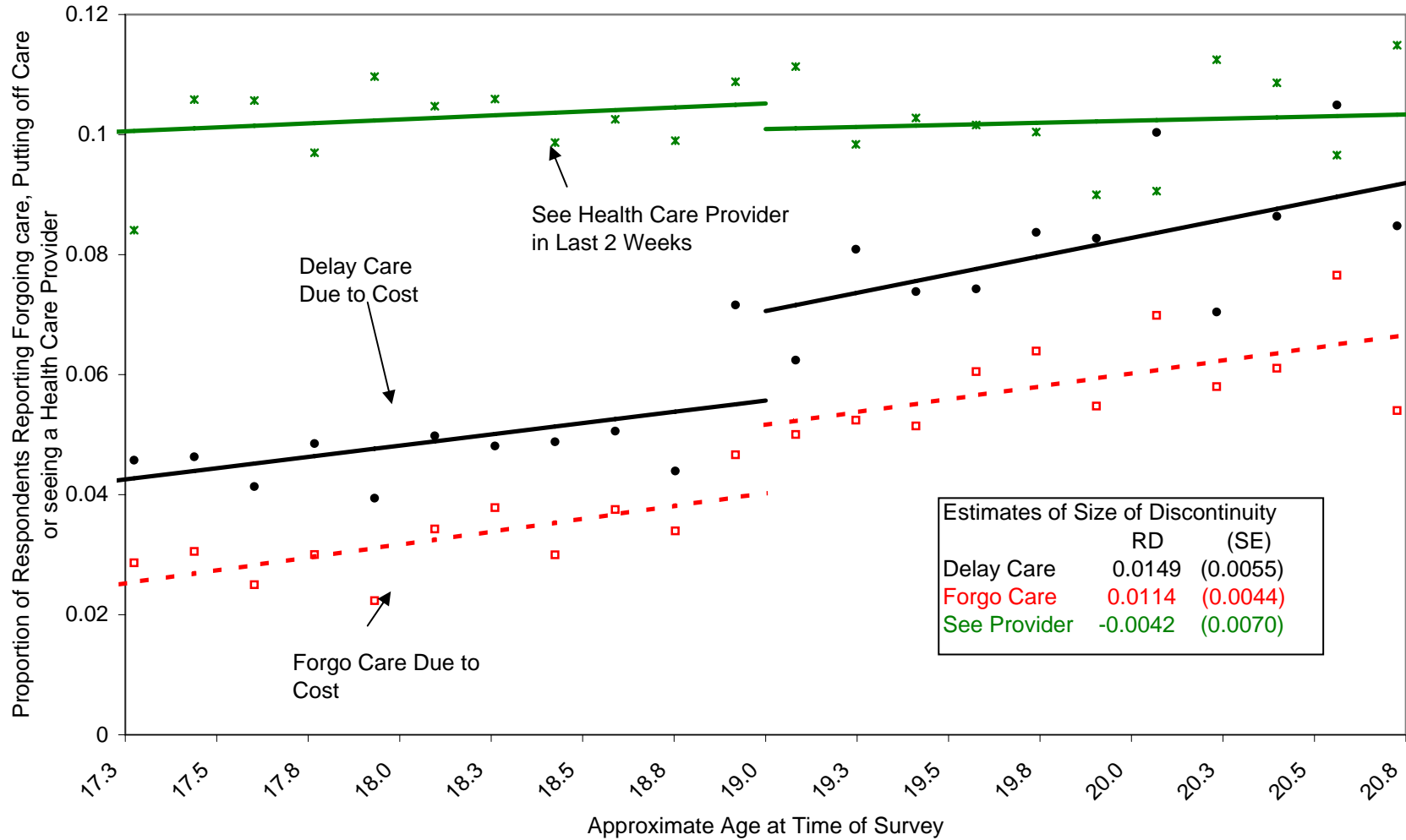
Notes: See notes from Figure 1. "Low Education" is defined as High School or less at the time of survey or education unknown. "High Education" is defined as has more than High School. As can be inferred from how the proportions vary around the fitted lines the "Low Education" group is shrinking with age and the "High Education" group is growing however there is no discrete change at age 19 in the mix of these groups.

Figure 3: Age Profile of Cause of Loss of Insurance Due to Age or Leaving School by Subgroup
National Health Interview Survey (1997-2007)



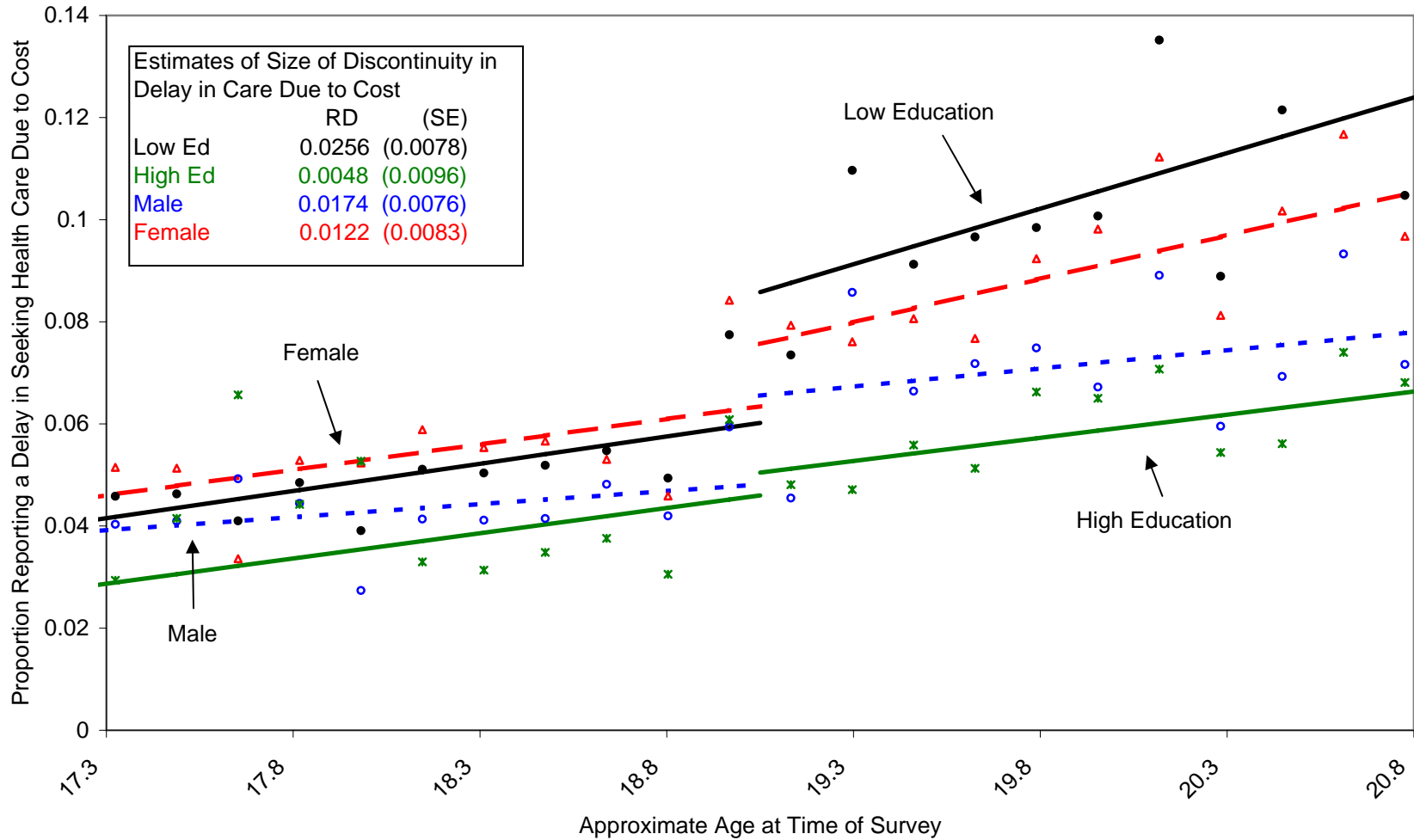
Notes: See notes from Figure 2. In the National Health Interview Survey the respondent is asked the following question regarding all household members that are currently without health insurance. "Which of these are reasons (you/subject name) stopped being covered or do not have health insurance?" One possible answer they can choose from is "Ineligible because of age/left school".

Figure 4: Age Profile of Barriers to Access to Care in the United States
National Health Interview Survey (1997-2007)



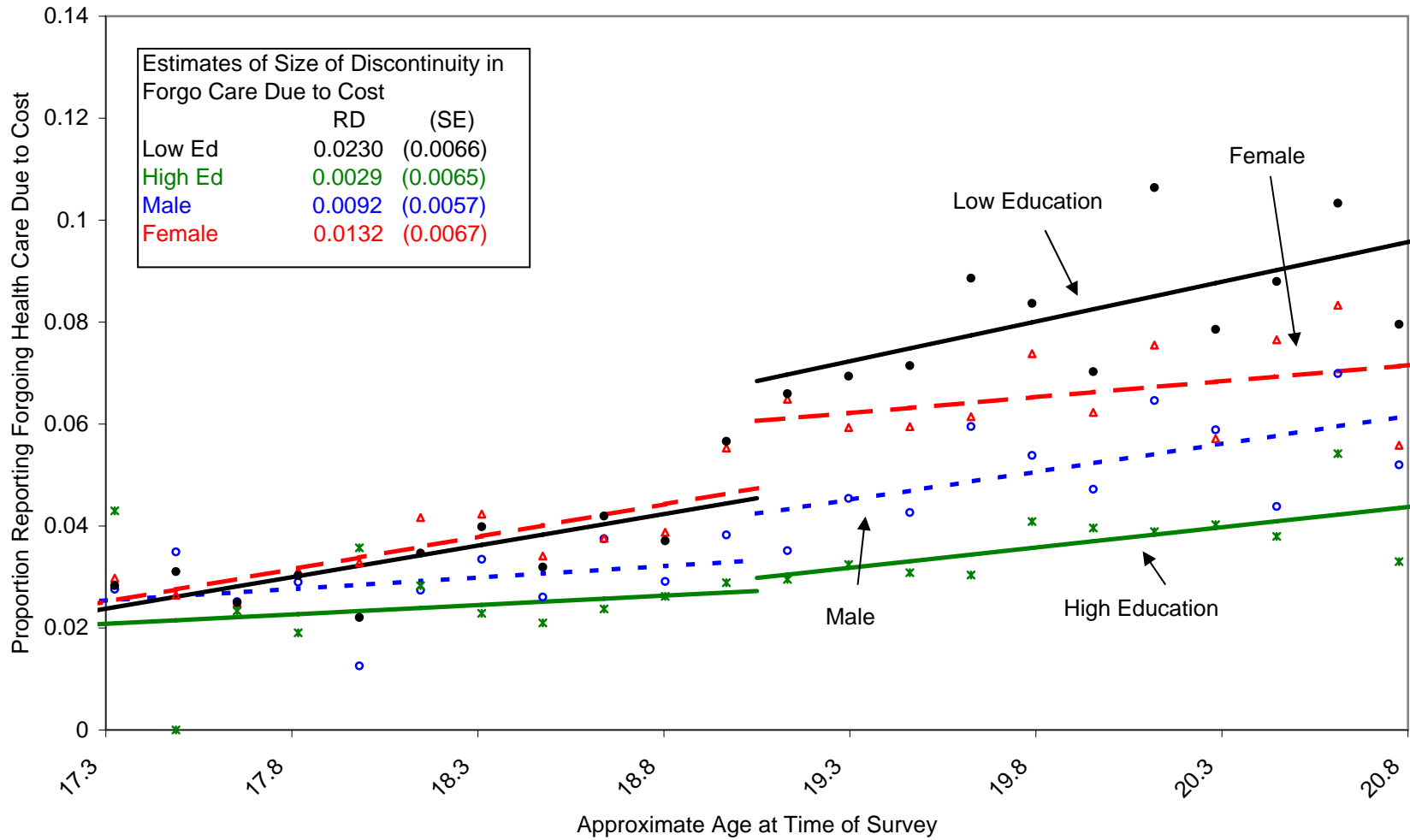
Notes: See notes for Figure 1. The questions regarding delay of medical care and forgoing medical care due to cost both refer to the prior 12 months. Seeing a health care provider means that the person has seen either a doctor or other health care professional in any setting other than an inpatient stay in the hospital. The exact questions are provided in the notes for Figures 5 and 6.

Figure 5: Age Profile of Delay in Care Due to Cost
National Health Interview Survey (1997-2007)



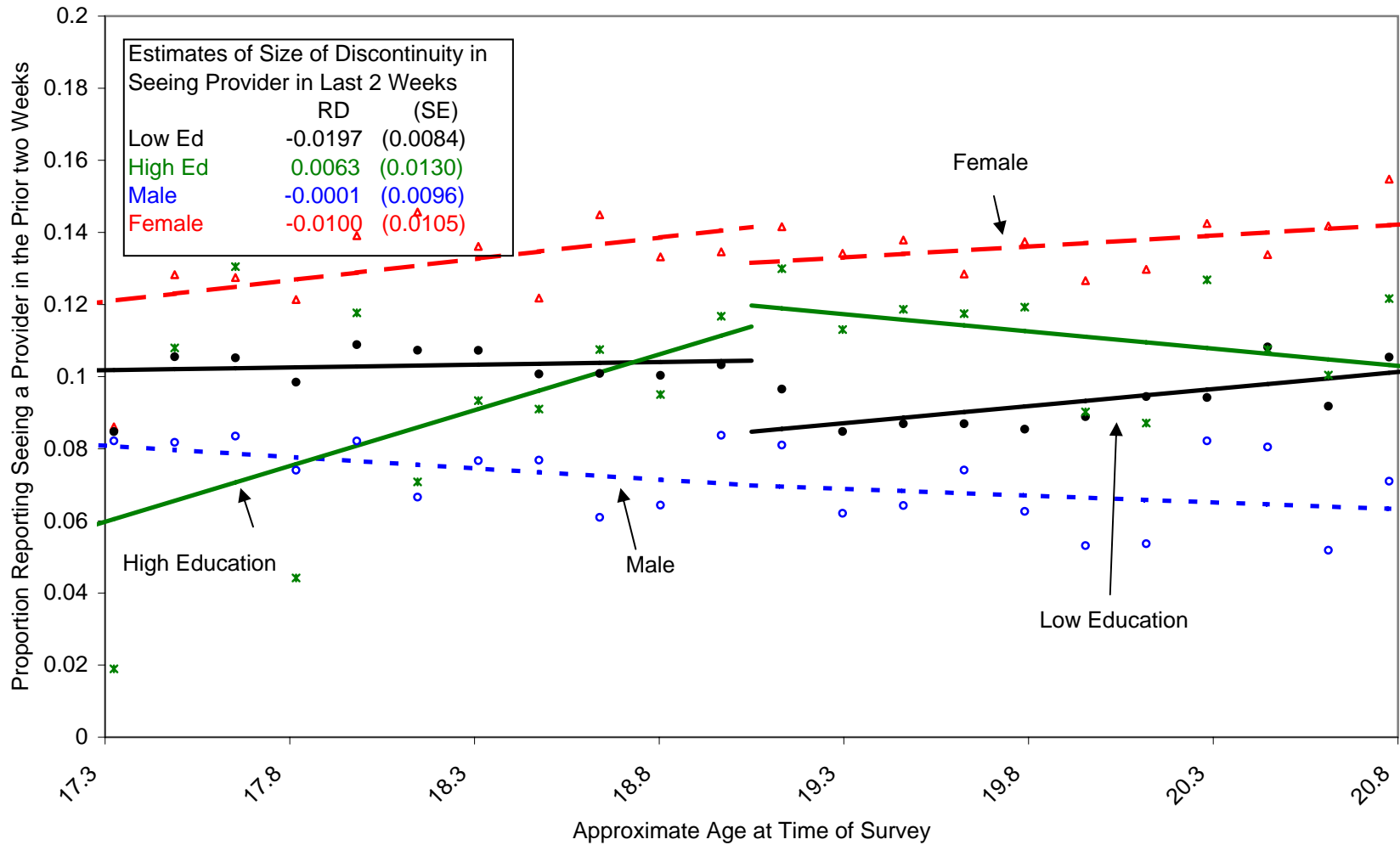
Notes: See notes from Figure 4. The question used to construct the age profiles in this figure reads as follows. "During the past 12 months, has medical care been delayed for {person} because of worry about the cost? (Do not include dental care)."

Figure 6: Age Profile of Forgoing Care Due to Cost
National Health Interview Survey (1997-2007)



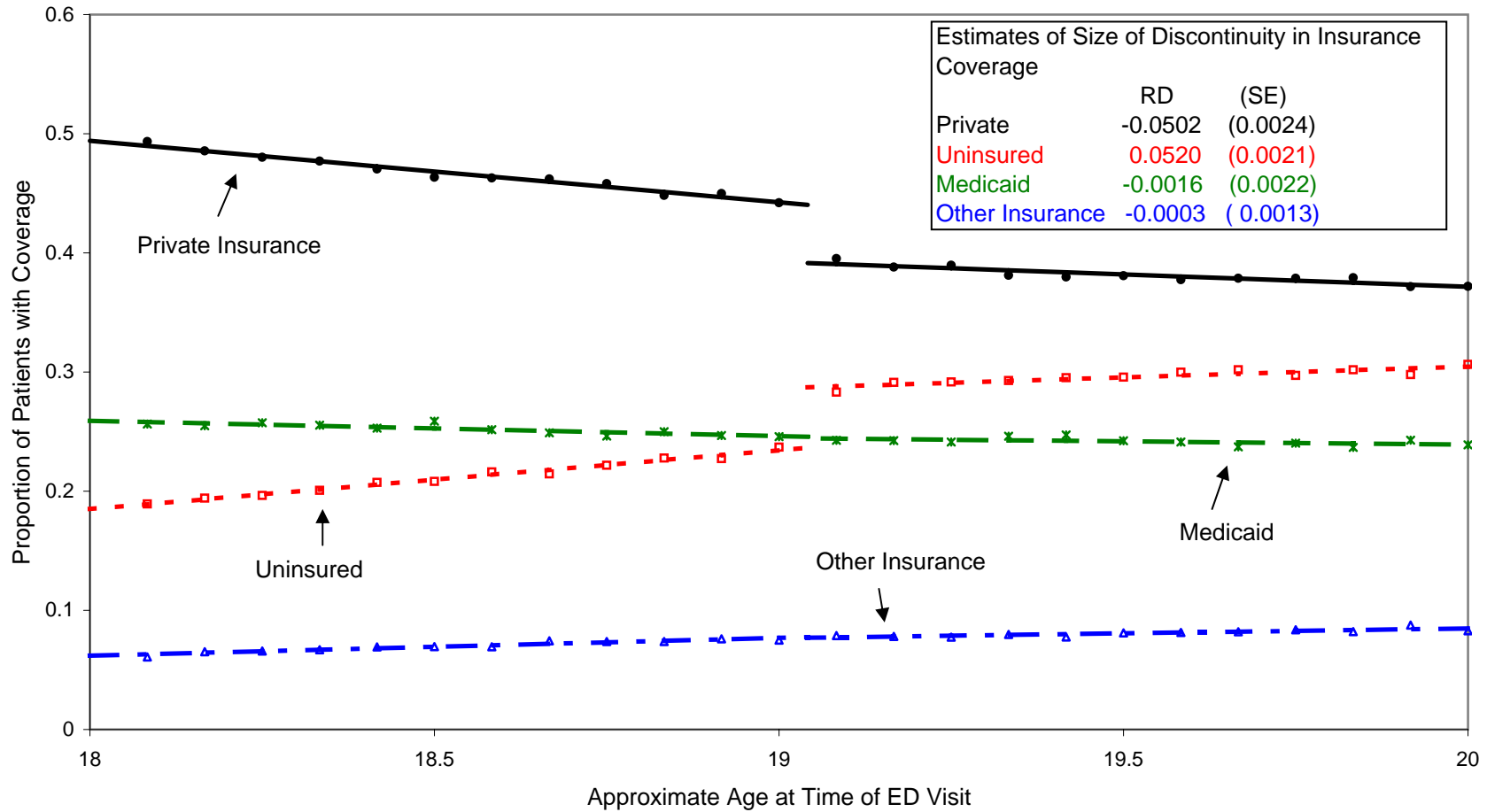
Notes: See notes from Figure 4. The question used to construct the age profiles in this figure reads as follows. "During the past 12 months, was there any time when {person} needed medical care, but did not get it because {person} couldn't afford it?"

Figure 7: Age Profile of See Provider in Last Two Weeks
National Health Interview Survey (1997-2007)



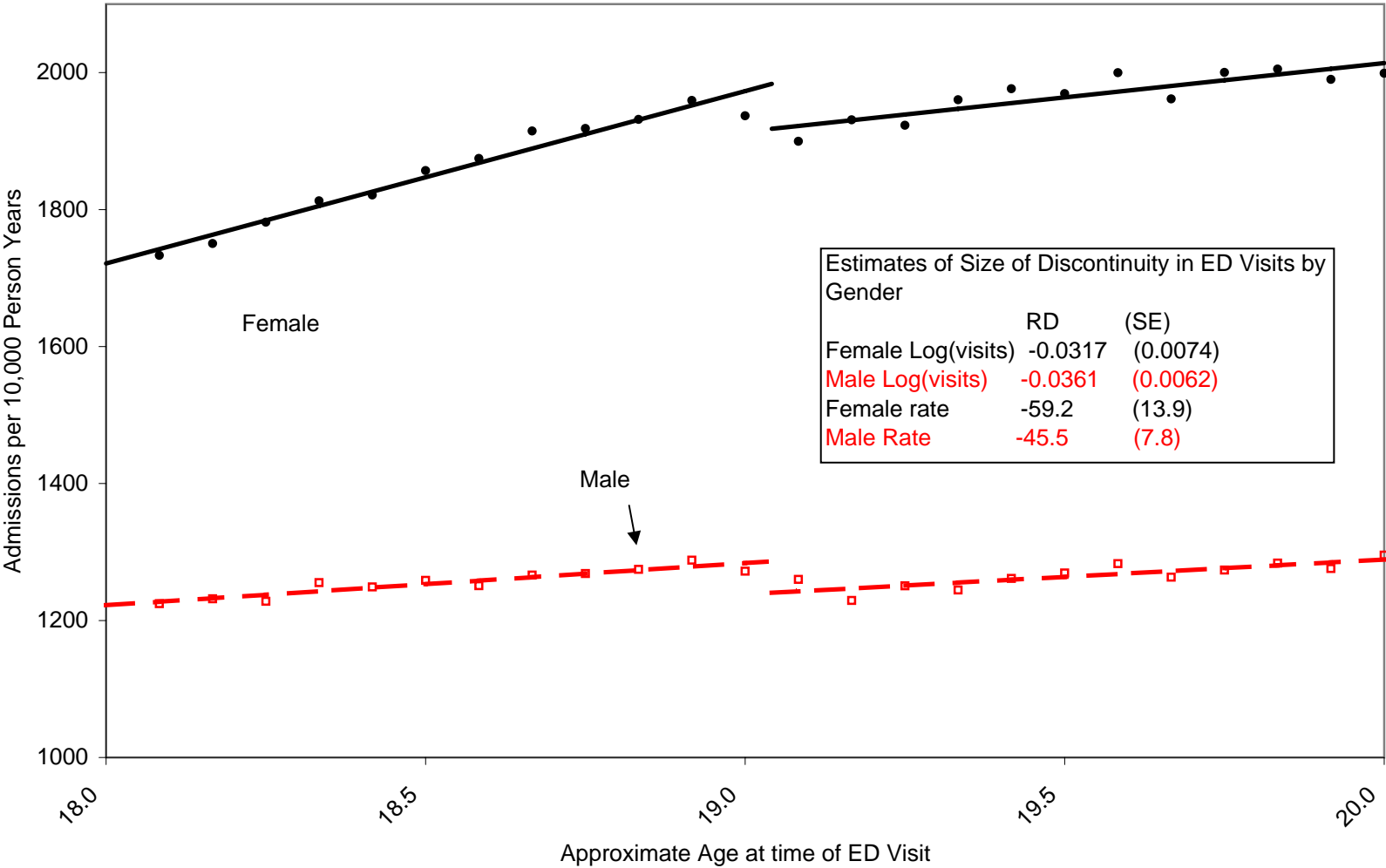
Notes: See notes from Figure 4. The question used to construct the age profiles in this figure reads as follows. "During those 2 weeks, did {person} see a doctor or other health care professional at a doctor's office, a clinic, an emergency room, or some other place? (do not include times during an overnight hospital stay)"

Figure 8: Age Profile of Insurance Coverage for People Entering the Emergency Department
 Arizona (2005-2006), California (2005-2006), and New Jersey (2004-2006)



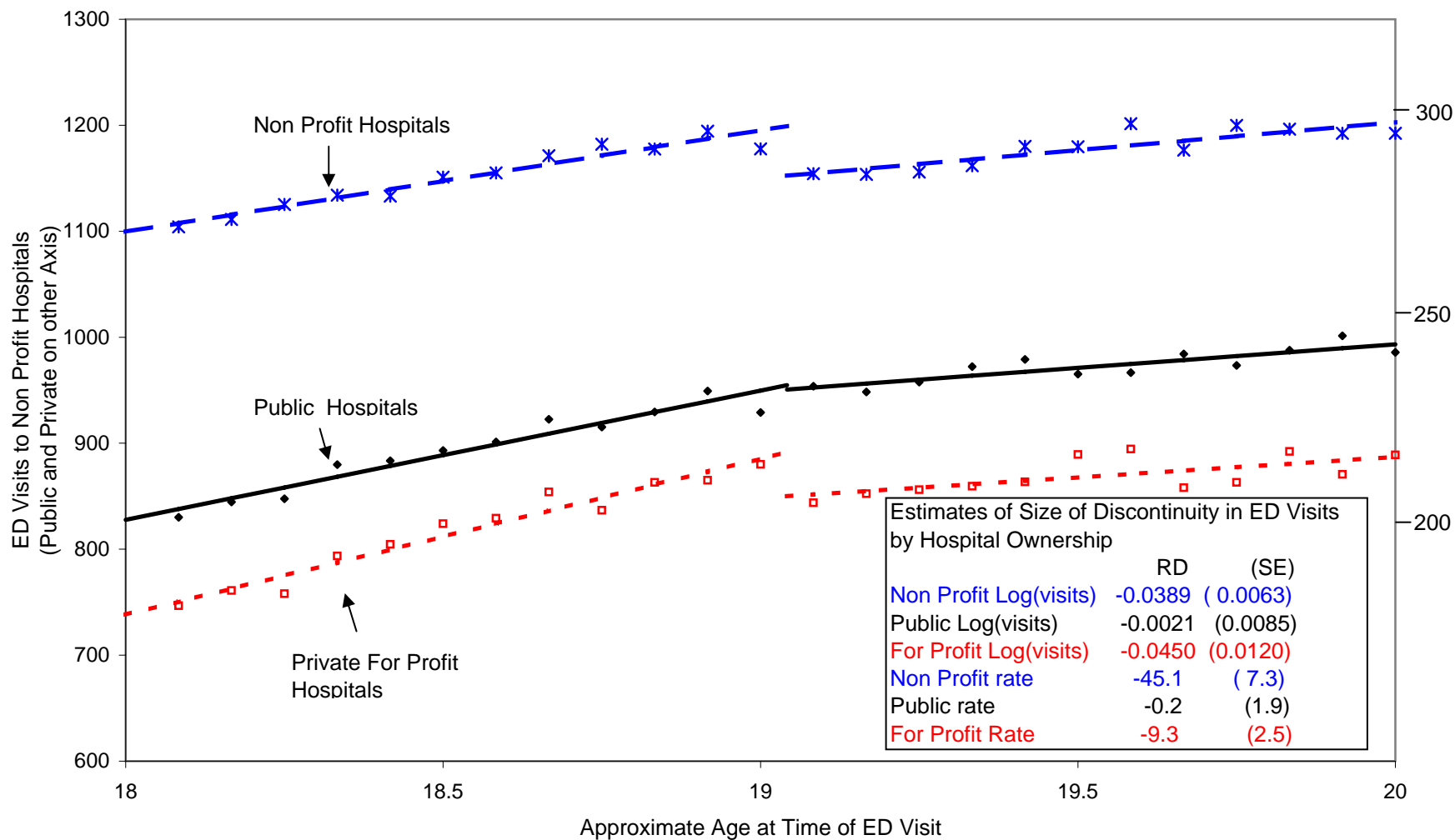
Notes: The Emergency Department datasets used to make the age profiles above are a near census of ED visits in each state. Only hospitals that are not under state oversight do not contribute data. The regression estimates of the change in insurance coverage have not been adjusted for the discrete reduction in visits that occurs at age 19. Patients that are admitted to the hospital are not included in the Emergency Department datasets. This is not a substantial problem as in this age group only about 7 percent of ED visits result in admission to the hospital and the inpatient records show a similar age profile in insurance coverage.

Figure 9: Age Profile of Emergency Department Visits by Gender
 Arizona (2005-2006), California (2005-2006), and New Jersey (2004-2006)



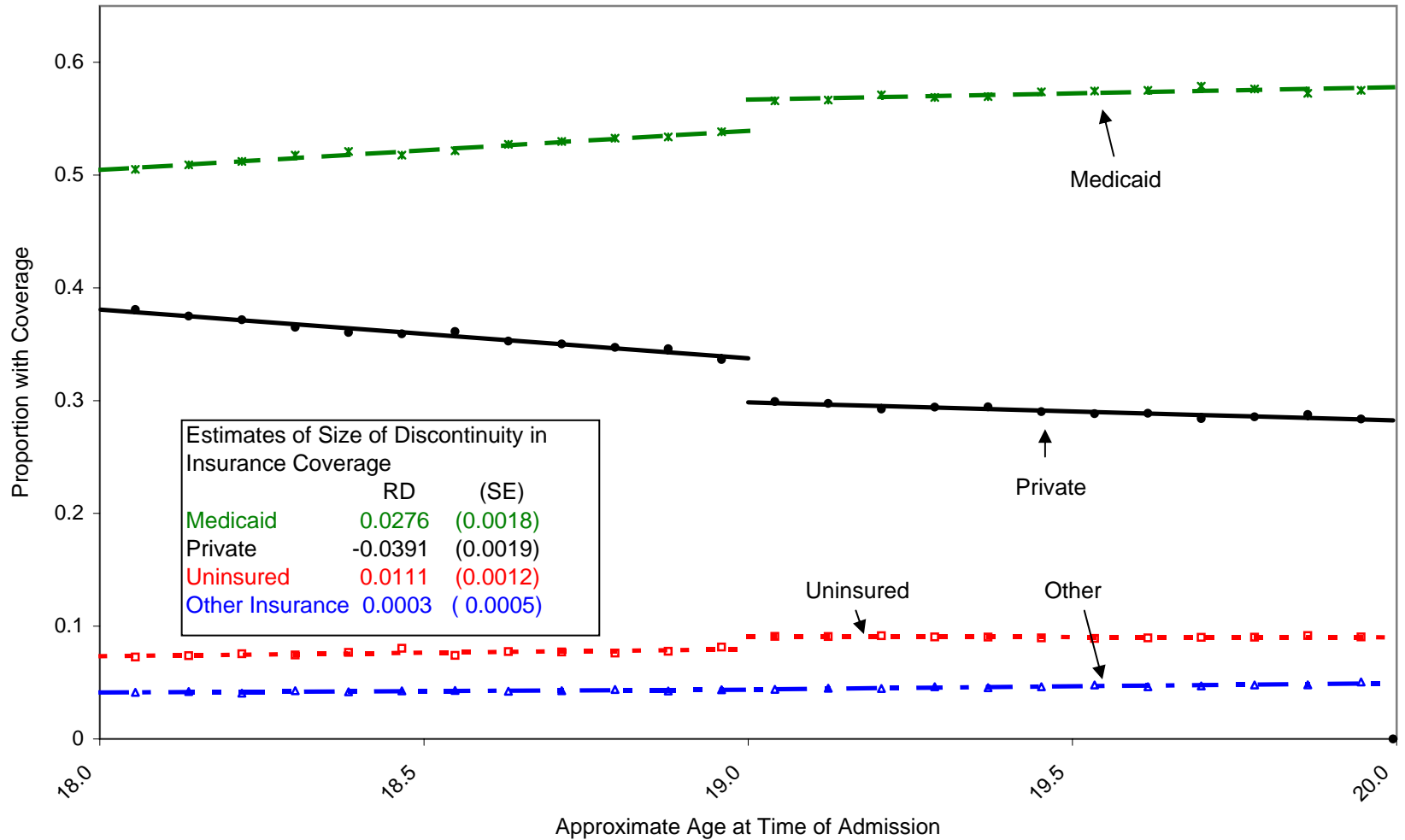
Notes: See notes from Figure 8. The estimates of the decrease in admissions at age 19 is presented in both rates and logs.

Figure 10: Age Profile of Emergency Department Visits By Ownership of Hospital



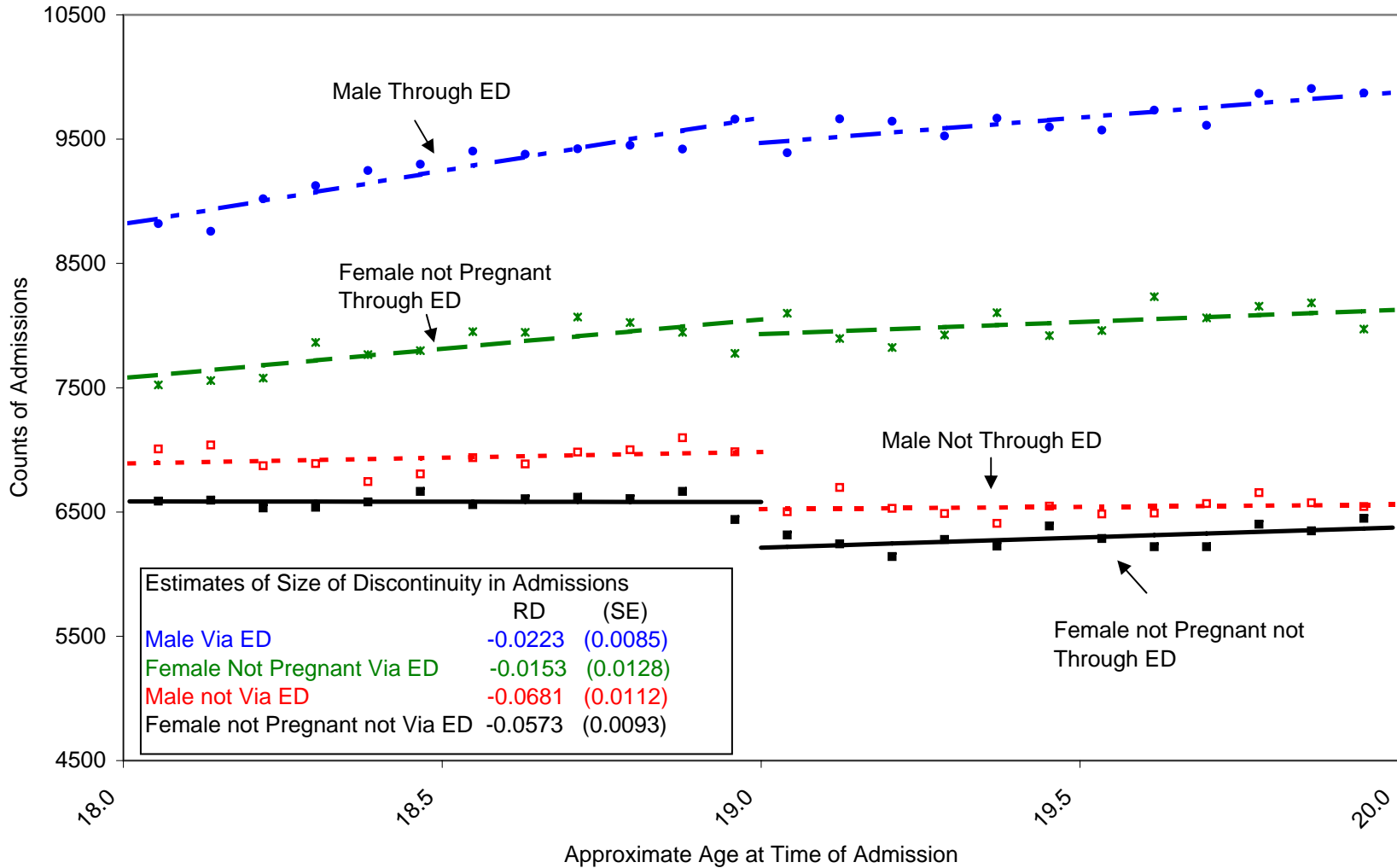
Notes: See notes from Figure 9. Approximately 1.4 percent of people are admitted to hospitals of unknown ownership type. The profiles are in rates per 10,000 person

Figure 11: Insurance Coverage for People Admitted to the Hospital
California (1990-2005), New York (1992-2005) and Texas (1999-2003)



Notes: The data used to construct this figure are a near census of hospitalizations. Only admissions to hospitals under federal oversight are not included in the analysis. The regressions superimposed over the means are from a linear polynomial in age interacted with an indicator variable that takes on a value of 1 for people over age 19. The regressions are estimated of the cell means rather than the underlying micro data.

Figure 12: Age Profile of Hospital Admission
 California (1990-2005), New York (1992-2005) and Texas (1999-2003)



Notes: See notes from Figure 11. The regression lines are fitted to the count data. The dependant variable in the regression estimates of the size of the discontinuity is log(admissions)

Table 1: Differences Between Insured and Uninsured Young Adults
(National Health Interview Survey 1997-2007)

	Insured	Uninsured	Difference Between Insured and Uninsured	T-static of Difference in Proportions	Regression Estimates of Discrete Jump at 19
White	0.697	0.491	-0.205	-36.6	0.026
Black	0.138	0.162	0.025	5.9	-0.015
Hispanic	0.110	0.296	0.186	45.3	-0.004
Male	0.491	0.538	0.047	7.8	-0.005
HS Diploma	0.601	0.547	-0.054	-9.2	-0.024
Some College	0.344	0.196	-0.148	-26.8	0.102
Employed	0.423	0.507	0.083	14.1	-0.108

Notes: The means above are computed for young adults (age 18 or 19) from the NHIS person files 1997-2007. There are 42,897 observations total. The regression discontinuity estimates in the final column are from a linear polynomial interacted with an indicator variable for over 19.

Table 2: Change in Insurance Coverage at Age 19
National Health Interview Survey 1997-2007

	Private Insurance		Uninsured		Medicaid		Other Insurance		Lost Ins. Due to School/Age	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
All	-0.0276 [0.0100]	-0.0339 [0.0095]	0.0543 [0.0081]	0.0580 [0.0079]	-0.0141 [0.0054]	-0.0118 [0.0052]	-0.0130 [0.0052]	-0.0126 [0.0052]	0.0473 [0.0056]	0.0477 [0.0056]
	0.6510		0.1933		0.0917		0.0687		0.0576	
Male	-0.0391 [0.0141]	-0.0407 [0.0137]	0.0629 [0.0120]	0.0616 [0.0119]	-0.0107 [0.0070]	-0.0085 [0.0068]	-0.0126 [0.0069]	-0.0119 [0.0070]	0.0513 [0.0084]	0.0517 [0.0084]
	0.6742		0.2048		0.0616		0.0629		0.0638	
Female	-0.0153 [0.0141]	-0.0264 [0.0134]	0.0463 [0.0113]	0.0529 [0.0111]	-0.0185 [0.0087]	-0.0150 [0.0085]	-0.0136 [0.0079]	-0.0127 [0.0079]	0.0434 [0.0076]	0.0435 [0.0076]
	0.6270		0.1814		0.1226		0.0745		0.0513	
High School or Less	-0.1136 [0.0133]	-0.1089 [0.0127]	0.1161 [0.0118]	0.1124 [0.0115]	0.0043 [0.0079]	0.0035 [0.0075]	-0.0065 [0.0070]	-0.0067 [0.0070]	0.0865 [0.0083]	0.0866 [0.0083]
	0.5889		0.2301		0.1182		0.0725		0.0696	
More than High School	-0.0025 [0.0172]	-0.0106 [0.0168]	0.0246 [0.0123]	0.0292 [0.0124]	-0.0062 [0.0087]	-0.0037 [0.0083]	-0.0159 [0.0101]	-0.0149 [0.0101]	0.0193 [0.0074]	0.0203 [0.0074]
	0.8142		0.0959		0.0327		0.0593		0.0228	
Covariates	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Notes: For each population above the table includes an estimate of the discrete change in the variable that occurs at age 19 with its standard error in brackets below. Underneath the standard error we include an estimate of the average level of the variable just before people turn 19. The regressions all include a dummy for over age 19 and a linear term in age interacted with the dummy. The regressions are weighted to take into account the stratified sampling frame in the NHIS. The second regression of each pair includes the following covariates Hispanic, black, and male. The regressions include young adults from ages 17.25 to 20.75 of which there are 42,897 in the NHIS person files between 1997 and 2007 for whom month of birth is available (11.6% of people in this age range do not have a recorded month of birth). Of the individuals with birth months available 21,327 are male, 21,570 are female, 30,705 have a high school education or less at the time of the survey and 12,192 have more than a HS education at the time of the survey.

Table 3: Change in Access to Care and Utilization at Age 19
National Health Interview Survey 1997-2007

	Delay Care Due to Cost		No Care Due to Cost		See Provider Last 2 Weeks	
	(1)	(2)	(3)	(4)	(5)	(6)
All	0.0149 [0.0055]	0.0146 [0.0055]	0.0114 [0.0044]	0.0115 [0.0044]	-0.0042 [0.0070]	-0.0061 [0.0069]
	0.0557		0.0403		0.1052	
Male	0.0174 [0.0076]	0.0175 [0.0076]	0.0092 [0.0057]	0.0095 [0.0057]	-0.0001 [0.0096]	-0.0007 [0.0095]
	0.0470		0.0333		0.0699	
Female	0.0122 [0.0083]	0.0120 [0.0083]	0.0132 [0.0067]	0.0135 [0.0067]	-0.0100 [0.0105]	-0.0115 [0.0105]
	0.0635		0.0474		0.1415	
High School or Less	0.0256 [0.0078]	0.0259 [0.0077]	0.0230 [0.0066]	0.0230 [0.0066]	-0.0197 [0.0084]	-0.0184 [0.0083]
	0.0602		0.0454		0.1044	
More than High School	0.0048 [0.0096]	0.0046 [0.0096]	0.0029 [0.0065]	0.0032 [0.0065]	0.0063 [0.0130]	0.0038 [0.0129]
	0.0458		0.0271		0.1136	
Covariates	No	Yes	No	Yes	No	Yes

Notes: See notes from Table 2. The dependent variable in the regressions in columns 1 through 4 are constructed based on the answer to the following two questions. "During the past 12 months, has medical care been delayed for {person} because of worry about the cost? (Do not include dental care)." "During the past 12 months, was there any time when {person} needed medical care, but did not get it because {person} couldn't afford it?"

Table 4: IV Estimates of Effect of Being Uninsured on Access to Care
National Health Interview Survey 1997-2007

	Delay Care Due to Cost		No Care Due to Cost		See Provider Last 2 Weeks	
	(1)	(2)	(3)	(4)	(5)	(6)
All	0.2746 [0.1027]	0.2525 [0.0957]	0.2091 [0.0830]	0.1988 [0.0774]	-0.0781 [0.1272]	-0.1054 [0.1182]
Male	0.2767 [0.1222]	0.2834 [0.1248]	0.1458 [0.0907]	0.1538 [0.0929]	-0.0011 [0.1519]	-0.0119 [0.1545]
Female	0.2633 [0.1758]	0.2269 [0.1526]	0.2848 [0.1470]	0.2553 [0.1269]	-0.2153 [0.2254]	-0.2182 [0.1978]
High School or Less	0.2207 [0.0673]	0.2304 [0.0692]	0.1980 [0.0572]	0.2044 [0.0591]	-0.1698 [0.0725]	-0.1634 [0.0744]
More than High School	0.1933 [0.3861]	0.1570 [0.3234]	0.1185 [0.2559]	0.1098 [0.2143]	0.2551 [0.5369]	0.1315 [0.4404]
Covariates	No	Yes	No	Yes	No	Yes

Notes: See notes from Table 3.

Table 5: Change at Age 19 in Insurance Coverage of Emergency Department Visits
 Arizona (2005-2006), California (2005-2006), and New Jersey (2004-2006)

	Private (1)	Uninsured (2)	Medicaid (3)	Other Insurance (4)
All	-0.0634 [0.0028] 0.4425	0.0761 [0.0044] 0.2344	-0.0099 [0.0025] 0.2462	-0.0028 [0.0013] 0.0769
Male	-0.0668 [0.0040] 0.455	0.0789 [0.0055] 0.265	-0.0119 [0.0033] 0.1837	-0.0001 [0.0023] 0.0962
Female	-0.0610 [0.0035] 0.4307	0.0730 [0.0053] 0.2151	-0.0081 [0.0035] 0.2944	-0.0039 [0.0013] 0.0598

Notes: The parameter estimates in the table above are the percentage point change in insurance coverage when people age out of their insurance coverage on the last day of the month in which they turn 19. The standard errors are in brackets directly below the parameter estimates. Below the SE we have included the estimated level of the dependant variable immediately before people age out. The parameter estimates are adjusted for the decline in admissions under the assumption that the decline in admission is due entirely to people loosing their insurance coverage. The adjustment is made by estimating the insurance coverage regression and the log(admissions) regressions via seemingly unrelated regression then using the estimated percent drop in admissions to adjust the coverage estimates. The regressions are run on the averages for one month cells as this is the most refined version of the age variable available. The regressions include all individuals 18 to 20 that appear in the Emergency Department data. There are 941,102 individuals in this age range, of these 534,027 are female 375,167 are male and 3.3 percent are of unknown gender.

Table 6: Change at Age 19 in Volume of Emergency Department Visits
 Arizona (2005-2006), California (2005-2006), and New Jersey (2004-2006)

	All Visits (1)	Public Hospitals (2)	Non Profit Hospitals (3)	For Profit Hospitals (4)
All	-0.0343 [0.0057]	-0.0021 [0.0085]	-0.0389 [0.0063]	-0.0450 [0.0120]
Male	-0.0361 [0.0062]	0.0104 [0.0153]	-0.0409 [0.0078]	-0.0695 [0.0200]
Female	-0.0318 [0.0074]	-0.0073 [0.0121]	-0.0363 [0.0077]	-0.0292 [0.0162]

Notes: See notes from Table 5. The dependent variable in all the regressions above is the log of admissions at each age in months. Patients that present at the Emergency Department and are admitted to the hospital are not included in the Emergency Department data so they are not included in the estimates above. They account for approximately 7 percent of total visits and show no evidence of a discrete change in level at age 19. Of the 941,102 total visits among people age 18 and 19: 134,581 are to public hospitals, 671,975 are to non profits, 121,650 are to for profit hospitals and the remaining 1.4% of admissions are to hospitals of unknown ownership type.

Table 7: Estimates of Impact of Insurance Coverage on Emergency Department Visits
 Arizona (2005-2006), California (2005-2006), and New Jersey (2004-2006)

	All Admissions (1)	Public Hospitals (2)	Non Profit Hospitals (3)	For Profit Hospitals (4)
All	0.4430 [0.0440]	0.0277 [0.1014]	0.5008 [0.0491]	0.5786 [0.1283]
Male	0.4495 [0.0436]	-0.1324 [0.1823]	0.5076 [0.0637]	0.8513 [0.2133]
Female	0.4281 [0.0632]	0.0995 [0.1455]	0.4889 [0.0674]	0.3936 [0.1851]

Notes: See notes from Table 6. The estimates above are the ratio of the change in admissions to the overall change in insurance coverage. The standard errors are in brackets below the estimates. The ratios and their standard errors are computed by estimating the relevant regressions via seemingly unrelated regression.

Table 8: Insurance Coverage of People Admitted to the Hospital
California (1990-2005), New York (1992-2005) and Texas (1999-2003)

	Private (1)	Uninsured (2)	Medicaid (3)	Other Insurance (4)
All	-0.0441 [0.0025] 0.3376	0.0263 [0.0052] 0.0795	0.0182 [0.0034] 0.5393	-0.0004 [0.0006] 0.0436
Male	-0.0675 [0.0038] 0.4857	0.0625 [0.0049] 0.1363	0.0060 [0.0033] 0.2882	-0.0010 [0.0016] 0.0899
Female not Pregnant	-0.0589 [0.0041] 0.5116	0.0478 [0.0079] 0.1039	0.0108 [0.0047] 0.3259	0.0003 [0.0005] 0.0585
Female Pregnant	-0.0317 [0.0027] 0.2305	0.0080 [0.0077] 0.0499	0.0239 [0.0057] 0.6983	-0.0002 [0.0005] 0.0213

Notes: This table presents estimates of the change in insurance coverage (among people admitted to the hospital) that occurs on the first day of the month after people turn 19. Directly below the estimates are the standard errors of the estimates and below the standard errors are the proportion of the population with this type of coverage immediately before people age out at 19. The estimates are made using a linear polynomial in age for estimated using admissions among people age 18 to age 20. There are 1,819,875 admissions total in this age range. Of these 388,789 are for men, 344,644 are for women that are not pregnant and 1,074,464 are for pregnant women.

Table 9: Change at Age 19 in Admissions to the Hospital
California (1990-2005), New York (1992-2005) and Texas (1999-2003)

	All Visits (1)	Via Emergency Department (2)	Not Via Emergency Department (3)
All	-0.0192 [0.0081]	-0.0109 [0.0062]	-0.0196 [0.0080]
Male	-0.041 [0.0058]	-0.0222 [0.0085]	-0.0681 [0.0111]
Female not Pregnant	-0.0339 [0.0087]	-0.0153 [0.0128]	-0.0573 [0.0093]
Female Pregnant	-0.0041 [0.0086]	0.0127 [0.0111]	-0.0068 [0.0090]
Public	0.0035 [0.0081]	0.0208 [0.0097]	-0.0135 [0.0132]
Private Non Profit	-0.0154 [0.0059]	-0.0244 [0.0084]	-0.0120 [0.0082]
Private For Profit	-0.0335 [0.0095]	-0.0330 [0.0185]	-0.0334 [0.0114]

Notes: See notes from Table 8. The dependant variable is the log of admissions.

Table 10: Impact of Insurance on Admissions to the hospital
California (1990-2005), New York (1992-2005) and Texas (1999-2003)

	All Visits	Via Emergency Department	Not Via Emergency Department
All	0.6340 [0.0733]	0.4111 [0.2082]	0.7395 [0.1510]
Male	0.6429 [0.0382]	0.3522 [0.1095]	1.0545 [0.1203]
Female not Pregnant	0.6968 [0.0546]	0.3184 [0.1970]	1.1653 [0.1637]
Female Pregnant	0.5071 [0.4942]	-1.5915 [2.5442]	0.8430 [0.3013]
Public	-0.1339 [0.3010]	-0.8003 [0.4118]	0.5114 [0.3881]
Private Non Profit	0.5828 [0.1132]	0.9150 [0.3033]	0.4533 [0.2124]
Private For Profit	1.2523 [0.2710]	1.2361 [0.6885]	1.2474 [0.2977]

Notes: The elasticities above are the impact of insurance on hospital admissions. They are computed by dividing the percent change in admissions by the percent change in the population that is uninsured.

Appendix 1: Average Age Over Days from Last Day of Birth Month

