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ACCESS TO HEALTH INSURANCE AND THE USE OF INPATIENT MEDICAL CARE: EVIDENCE FROM THE AFFORDABLE CARE ACT YOUNG ADULT MANDATE

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Access to Health Insurance and the Use of Inpatient Medical Care: Evidence from the Affordable Care Act Young Adult Mandate

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ABSTRACT

The Affordable Care Act of 2010 expanded coverage to young adults by allowing them to remain on their parent's private health insurance until they turn 26 years old. While there is evidence on insurance effects, we know very little about use of general or specific forms of medical care. We study the implications of the expansion for the use of inpatient hospitalizations. Given the prevalence of mental health needs for young adults, we also specifically study mental health related inpatient care. We find evidence that compared to those aged 27-29 years, treated young adults aged 19-25 years increased their inpatient visits by 3.5 percent. Visits related to mental illness increased 9.0 percent. The prevalence of uninsurance among hospitalized young adults decreased by 12.5 percent; however, it does not appear that the intensity of inpatient treatment changed despite the change in reimbursement composition of patients.

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I. Introduction

In the United States, the transition from adolescence to young adulthood is associated with the loss of health insurance coverage (Anderson, Dobkin, and Gross, 2012). Prior to the Affordable Care Act (ACA), uninsurance among the non-elderly peaked at around ages 21 to 23 at close to 40 percent.[1] The precarious health insurance status of young adults motivated the early ACA provision that starting in September 2010 has allowed young adults to remain as dependents on their parents' private health insurance plans until they turn 26 years old. The mandate has substantially reduced uninsurance in this population (Cantor et al., 2012; Sommers and Kronick, 2012; Sommers et al., 2013; and Akosa Antwi, Moriya, and Simon, 2013). However, there is as yet sparse evidence on the effect of this health insurance expansion on young adults' use of health care.

Young adults are a key population targeted under the ACA even beyond the specific mandate we study. On the one hand, because young adults are comparatively healthy, high young-adult enrollment is seen as an important goal for the success of health insurance exchanges (Weaver and Radnofsky, 2013). On the other hand, young adults tend to have high mental health care needs (Grant and Potenza, 2010). Estimating the effect of this ACA young adult insurance expansion on health care use in general as well as mental health care use in particular is crucial for understanding the law fully, as well as for anticipating the effects of later expansions on this population. Empirical evidence of the impact of this provision is of high

[1] Author's calculation using 2008 Current Population Survey data.

interest to policymakers, who will likely continue to fine-tune the details of the ACA for some time; it also contributes to the growing academic literature on the effect of health insurance on medical care use.

We use the Nationwide Inpatient Sample (NIS), a nationally-representative database of inpatient admissions, to evaluate the early effect of the ACA young adult insurance expansion on the use of inpatient medical care in general and mental healthcare specifically, on treatment intensity, and on insurance status of inpatient visits. Inpatient visits are rare but expensive medical events and are a vital component of any effort to "bend the health care cost curve". For instance, for 19-to-25-year age group targeted by the ACA dependent care mandate, inpatient visits represented about 31 percent of total health care expenditures even though only 5.4 percent of individuals in this age group had an inpatient visit in 2008.[2] We identify the effects of policy on the targeted age group using a differences-in-differences (DD) method that compares the treatment group of 19-to-25-year-olds to 27-to-29-year-olds, the latter being a comparison group that is close to but excluded from the expansion. We also conduct extensive robustness checks regarding the assumptions underlying this identification strategy and find them to be viable.

We first examine the impact of the ACA young adult mandate on the total number of non-birth hospitalizations. The transition from adolescence to adulthood often involves many life changes that can trigger mental distress, making services related to mental illness an important component of young adult medical care (Patel et al., 2007; and Yu et al., 2008). Not surprisingly,

[2] Author calculations from 2008 Medical Expenditure Panel Survey.

mental disorder is the most frequent reason why young adults seek hospital-based care, aside from visits related to childbirth.[3] Thus, the second aspect we consider is the effect of the mandate on mental illness admissions. For both types of utilization, we analyze the impact of the mandate separately on admissions that originate from the emergency room (ER) and those that are direct admissions. To shed light on the changes that hospitals will likely face in reimbursement for young adult care as a result of reform, we estimate the change in insurance composition as well. We end by evaluating the impact of the law on treatment intensity as measured by length of stay, number of procedures, and hospital charges.

We find that compared to slightly older young adults, those targeted by the law increased their overall non-birth inpatient visits by 3.5 percent after the law's implementation. This is driven by direct inpatient admissions which tend to be more discretionary than admissions that result from the ER, and might be more responsive to changes in health insurance coverage. Consistent with evidence that mental illness treatment is more responsive to health insurance coverage than general medical care, mental-illness-related inpatient visits increase by 9.0 percent, driven mainly by visits that originate through the ER. Corresponding to these changes in service utilization, we find that the fraction of hospitalized young adults without insurance decreased by 12.5 percent compared to other adults who did not benefit from the expansion. In examining whether treatment intensity of hospital usage is affected, we find no robust evidence of the impact of the law on length of stay, number of procedures, and total charges.

[3] This is based on author's calculations from the National Inpatient Sample.

II. Prior Literature

The Effect of Health Insurance Expansion on Inpatient Care

A large body of empirical research studies the effect of health insurance expansions on the use of inpatient care. Studies on Medicaid and Medicare, for instance, find that they lead to an increase in the consumption of inpatient medical care (Dafny and Gruber, 2005; Card, Dobkin, and Maestas, 2008; and Finkelstein et al., 2012). But research on the impact of a near-universal health insurance coverage expansion in Massachusetts finds no change in hospitalizations (Kolstad and Kowalski, 2012).

Research especially relevant for our work studies the impact of health insurance on medical-care use by young adults. Anderson, Dobkin, and Gross (2012 and 2014) estimate the effect of health insurance coverage on inpatient and ER visits by exploiting the sharp change in insurance coverage rates that result from young adults "aging out" of their parent's health insurance plans at ages 19 and 23. They find significant reductions in inpatient and ER visits at both age cutoffs. Losing health insurance at 23 decreases the probability of an inpatient visit by 77 percent. The same statistic at age 19 is 61 percent.

Effect of Insurance Expansion on Inpatient Mental Health Care

Evidence from the RAND health insurance experiment shows that mental health care is almost three times as responsive to insurance generosity as other forms of health care, (Manning

et al. 1989). While this evidence pertains to outpatient care only, it might have implications for inpatient care as well. Research from the 2007 Massachusetts health insurance expansion in Meara et al (2014) shows that there was little to no change in inpatient admissions for mental health among young adults (consistent with Kolstad and Kowalski (2012)'s result for inpatient care in general), and a small but statistically significant reduction in admissions for substance use disorders. The authors caution that the generalizability of evidence from Massachusetts is not straightforward since the availability of behavioral health outpatient providers is much higher in Massachusetts than in other states.[4]

Effect of ACA Dependent Coverage on Use of Medical Care

Although there is no prior work on the effect of the young adult mandate on inpatient care, Sommers et al. (2013) find evidence that the mandate increased self-reported access to care but had no statistically significant effect on self-reported usual source of care. Mulcahy et al. (2013) find that the expansion led to a 3.1-percentage-point increase in the share of non-discretionary emergency care that is paid by private insurance.

Taken together, prior literature on the impact of health insurance on all and mental health inpatient admissions is rather mixed. Some studies find a sizeable increase in use while others find small or no effects. There is no literature on the impact of the ACA young adult mandate

[4] Meara et al. (2014) report that Massachusetts has 32.4 psychiatrists per 100,000 residents compared with 14.5 for the United States.

inpatient admissions, but evidence suggests an increase in access to healthcare in general, but not necessarily an increase in a usual source of care.

Our research makes several distinct contributions. In addition to providing the first evidence on the impact of the ACA dependent coverage expansion on inpatient use, we contribute to the literature on the effect of insurance on use of care among young adults by evaluating the effect of gaining rather than losing health insurance on medical use. Evidence provided by Anderson, Dobkin, and Gross (2012 and 2013) measure the effect of anticipated loss of health insurance on medical-care use. The effect of gaining and losing health insurance may not be symmetric. Third, we examine the national impact of providing coverage to young adults on their use of inpatient mental health care, a particularly high need in this age group. Fourth, we examine the effect of the law on prevalence of insurance coverage among young adults using inpatient services, and its implications for intensity of treatments provided.

III: Mechanisms

The mechanisms by which the availability of health insurance is expected to affect medical-care use have been well covered in prior literature (Finkelstein et al., 2012; Kolstad and Kowalski, 2012; and Miller, 2012), thus our discussion of the hypotheses remains brief.

Access to health insurance reduces the cost of medical care for the newly insured, and moral hazard suggests that newly insured young adults would increase their consumption of medical care. The effect of health insurance on how newly insured young adults enter the

medical system is not clear. If inpatient and outpatient care are substitutes for some conditions, then having health insurance could reduce hospital admissions through better outpatient care. Several studies reviewed above find inpatient care increases after insurance expansions, suggesting hospital care could be on net a complement rather than a substitute for other forms of care.

The moral hazard of insurance is stronger in mental healthcare than other types of healthcare (Horgan, 1986; Taube et. al, 1986; Frank and McGuire, 2000, Manning et. al 1989), leading to an expectation that the ACA will likely increase mental health care use especially in light of recent reductions in social stigma associated with seeking treatment (Mojtabai, 2007). Garfield et al. (2011) predict that full implementation of the ACA will increase mental health care use (including inpatient forms) by 4.5 percent. This increase will most likely not be uniform across all US states given evidence from Massachusetts suggesting that inpatient mental health care use may not increase in response to an expansion of health insurance coverage if there is capacity for improved outpatient care (Meara et al. 2014). In addition, in response to the perceived higher moral hazard of mental health care, insurers have traditionally placed greater limitations on coverage for mental health services than other forms of care. These restrictions gave rise to a movement of state mandates aimed at parity. Although a federal parity statute passed in 1996, that law is relatively weak compared to state and federal laws passed since 2000 (Buchmueller et al., 2007). The 2008 Mental Health Parity and Addiction Equity Act (MHPAEA) was effective January 2010, and required closer parity between mental and medical

care coverage. It is unclear whether strong parity laws will lead to an increase in use of services (HCCI 2014), partly because insurers have been adopting aggressive forms of management for mental health care delivery. Providers could constrain the use of expensive forms of care which is usually inpatient based by contracting with specialized managers to carve out mental health care benefits (Goldman et al.1998 and Sturm, 1997). Barry and Ridgely (2008) find evidence that insurance plans intensified their use of utilization management techniques in response to the increased likelihood of moral hazard due to parity legislation.

There are competing hypotheses about the likely effect of the mandate on overall treatment intensity, conditional on hospitalization. The law is expected to change the health insurance composition of hospitalized young adults by reducing the proportion of uninsured visits and increasing the proportion covered by private insurance. If private health insurance status leads to more treatment by health care providers (Doyle, 2005), then we would expect an increase in treatment intensity after the law. Intensity of care may decrease, if the marginal young adults seeking care after the expansion are healthier than others, especially since young adults whose parents have private insurance tend to be from higher socio-economic status families. Thus, the direction of predicted change in intensity is ambiguous, and we explore this point using analyses that do and do not control for the case-mix of admissions.

IV. Data

The main data we use for our analysis is from the Nationwide Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality. . The NIS data contains all discharges from a 20% stratified sample of community hospitals in the United States. On average the NIS has information on about eight million hospital stays a year from about 40 states in the U.S.[5]

We use the NIS data from 2007 to 2011 (the latest year for which data is available) to allow a sufficient look-back period to test for differences in trends between treatment and control groups. Each observation in the NIS is a patient discharge abstract, which includes detailed clinical information, such as primary and secondary diagnoses, and demographic information, such as age, gender, and race/ethnicity. We restrict our attention to discharges for ages 19 to 29. We follow prior literature by using non-birth visits.[6] Our final sample is composed of 794,392 hospital visits. In our secondary analysis of mental illness visits, we restrict our sample 128,310 visits that belong to Major Diagnostic Category (MDC) 19: Mental Diseases and Disorders.[7] Henceforth we refer to non-birth admissions as "all" admissions to distinguish them from our secondary analysis which singles out mental health related admissions. Our data also includes

[5] Data from Alabama, Delaware, the District of Columbia, and Idaho are not in our sample because they do not contribute data to the NIS in any year of our sample. We exclude data from California, Maine, and Texas because precise information on age, which is crucial for our study design, is not available and thus prevents us from separating the control and treatment groups. However, we note that results are qualitatively the same when we include these states and estimate models with less than ideal control and treatment group age definitions.

[6] Non-birth visits here denote all inpatient visits except those classified as major diagnostic category 14: pregnancy, childbirth and puerperium.

[7] The majority of mental health hospitalizations occur in community hospitals (Meara et al, 2014), but we note here that specialty psychiatric hospitals and prison hospitals, which do not report data to AHRQ, are also a major source of care.

information on health insurance status such as private insurance, Medicaid, Medicare, other insurance, and no insurance. We cannot separately identify treated young adults who are dependents on their parent's health insurance from those who have their own ESI or non-group insurance. To calculate our dependent variables measuring number of inpatient visits, we aggregate hospital discharges by age and year-quarter for each hospital.

V. Method

To estimate the effect of the federal young adult coverage expansion on inpatient medical care, one must isolate the policy's impact from contemporaneous national changes. We use a difference-in-difference (DD) method that compares all targeted young adults, 19-25-year-olds and a control group of 27-29-year-olds, who are as similar as possible in age but excluded from the insurance expansion. We also conduct sensitivity checks comparing separately those who are 19-22 years and 23-25 years as alternate treatment subgroups to those 27-29 years (control group). We also compare young adults on either side of the age cutoff, that is, 25 year-olds vs. age 27 year-olds. We exclude 26-year-olds since we cannot accurately classify them as part of either group. Our empirical strategy rests on the strong assumption that the control group will account for other time-varying factors that would have led the treatment group to experience different rates of medical care access and use after reform. We start our empirical work by testing the validity of the DD estimator assumptions including common trends and also conduct placebo tests using data prior to the ACA.

Our main analysis examines how the reform affected the use of inpatient medical care. Using aggregated discharge data, we estimate a model similar to that of Kolstad and Kolwalski (2012), who use the NIS to evaluate health reform in Massachusetts. Our estimating equation is:

$$[1]\ Y_{hsgt} = \alpha + \gamma\, Age_g + \delta\, Implement_t + \vartheta\, Enact_t + \eta\left(Treat_g * Implement_t\right) + \sigma\left(Treat_g * Enact_t\right) + X_{st}\beta + \tau_t + \zeta_{hs} + \varepsilon_{hsgt},$$

where Y_{hsgt} represents our outcome variables of interest for age$_g$ in hospital *h*, state *s*, and quarter *t*. *Implement*$_t$ represents a dummy for the period after the law was implemented in September 2010. Since our analysis is at the quarterly level, our implementation phase starts from the fourth quarter of 2010 and runs through the latest period of available data , the fourth quarter of 2011. The variable *Treat*$_g$ is a binary variable for membership in the 19-25 age range (relative to the 27-29 range); in the non-interacted term *Age*$_g$ we include a full set of age indicators. The interaction of *Implement*$_t$ and *Treat*$_g$ captures the average impact after the law was implemented in September 2010 by comparing hospital visits during this period to visits before the enactment of the law among the treatment group relative to the control group.

To examine possible anticipatory changes, we add a dummy variable,$Enact_t$, to capture the period between enactment and implementation of the law, from April 2010 to September 2010, and its interaction with the treatment dummy variable. The X_{st} vector represents quarterly linear state-specific time trends. The recession and the subsequent slow recover span our sample period. These national macroeconomic conditions could differentially affect the use of hospital-based medical care by our treatment and control groups. Although we conduct tests of

differential time trends prior to reform to validate our study design, we account for the possibility that the macroeconomy could also influence age trends after reform by including two variables: the quarterly unemployment rate, and its interaction with age dummies. We also include dummy variables for year and quarter in τ_t, to control for seasonality and year fixed effects that are common to the treatment and control groups. We include hospital fixed effects in ζ_{hs} to account for time-invariant hospital characteristics. We use ordinary least squares to estimate all of our continuous outcomes and the linear probability models for our binary outcomes. To account for correlation of hospital-level errors over time due to common forces, we cluster standard errors by hospital. However, inference drawn from this model may be incorrect as the policy variation occurs only at the age by time level. We are not able to block-bootstrap the standard errors as suggested by Bertrand et al. (2004) because we have an extremely small number of "groups" (two). Thus, we follow Cameron, Gelbach, and Miller (2008) by estimating our main model alternatively by aggregating data to the national age by year-quarter level, and implement the Wild cluster bootstrap method using time as the grouping variable. Our results from this estimation, which we report in the appendix, reinforce the results stemming from our models that cluster at the hospital level. We also estimate all reported models by aggregating data to the age by time level and clustering at the age level, and find qualitatively similar results [results available upon request].

VI. Results

Summary Statistics

We present sample means of our treatment and control groups, before and after ACA implementation, in Table 1. Other than for the expected age differences between the older and younger cohorts, the means of most demographic and clinical variables appear similar across groups and over time. Targeted young adults have a higher likelihood of a mental health admission (17.7 percent) compared to slightly older adults (15.2 percent) in the period prior to ACA enactment. The spread increases in the post implementation period, with the likelihood rising to 19.2 percent for the targeted group relative to 15.7 percent for the slightly older group. There is very little other evidence in the descriptive statistics of differential changes in clinical characteristics or utilization measures.

When we consider health insurance status as our outcome, we see some stark differences in the mean changes experienced by the two groups. Conditional on seeking inpatient care, older adults are less likely to have private health insurance over time (37.9 percent vs. 32.4 percent) while private coverage increases slightly among targeted young adults (38.9 percent vs 39.5 percent). There is corresponding evidence of reductions in uninsurance among targeted young adults relative to slightly older adults.[8]

Validity of Study Design

[8] Means of aggregated variables such as group totals of admissions are reported in regressions tables.

Estimating the impact of policies by comparisons between national treatment and control groups involve especially strong assumptions. For example, when we identify the impact of the mandate on hospitalizations by comparing the count of admissions by our treatment and control groups before and after the law, we assume the control group and treatment group would have similar trends absent the law. Given the fact that our sample coincides with the most recent recession, this assumption is even stronger if there is a differential impact of the recession on younger vs older adults. Roberts and Terrell (2014) find evidence that job market prospects deteriorated furthest for new job market entrants during the past recession. A volatile macroeconomy is linked to greater indications of depressive symptoms (Tefft, 2011), increased suicide (Luo et al., 2011), and losses of health insurance (Cawley, Moriya and Simon, 2013) which likely further exacerbate health conditions. Maclean (2013) finds that leaving school in a bad economy has a persistent negative impact on the health outcomes of men and Kuhn, Lalive and Zweimüller (2009) find that job loss increases the use of mental health care, including inpatient care. Our treatment group of 19 to 25 year-olds contain ages when young adults leave school and are new workers, thus we turn next to testing the time trends of outcomes by age prior to the law.

Following Akosa Antwi, Moriya, and Simon (2013), one approach to increasing confidence in our ability to use those older than 26 to capture trends in hospitalizations that would have affected younger adults had the policy not occurred would be to examine the trends of our outcomes of interest prior to the law's implementation. If we were to find that

hospitalization rates increased for the treatment group relative to the control group even prior to the policy, this would suggest that the impact we estimate could be a continuation of prior trends.

We first present visual pre-trends of main analysis in Figures 1- 4. In Figure 1, we show trends for number of visits for our treatment and control groups. The vertical lines represent the passage of the law, the implementation of the law in September 2010 and the start of 2011, when most new health insurance plans start respectively. We plot graphs for overall visits, visits through an ER, and visits not through an ER for our main sample and sample with mental illness diagnosis. The plots are quarterly unconditional means of the aforementioned variables. For all visits, visits that originated from the ER, and visits not originating from the ER (top row), we observe differences between the treatment and control groups in levels, but no visible differences in trends. There is some evidence of differential trends after the implementation of the law, especially in the bottom row graph for mental illness admissions through an ER.

In Figure 2, we examine trends by health insurance status. In the first row of plots, visual inspection of the first graph shows that the two groups follow a similar trend before the law, with a sharp increase in the share of treatment group visits paid by private insurance after the implementation. The second plot shows the trend for the uninsured. Again, the two groups follow a similar trend before the law, with a sharp post-law decrease in the share of visits accounted for by uninsured young adults who are targeted by the law. In Figures 3 and 4, we show trends for our treatment intensity variables for all visits and mental illness visits. These plots show no strong pre-trends and no sharp changes post-law either.

We formalize our trend tests in Table 2 by estimating regressions with our outcomes of interest as left-hand-side variables. We only use data prior to the enactment of the law. The right-hand-side variables for this regression include the same control variables as our main model, described above, except that the key variable of interest is an interaction between the linear time trend and the treatment group dummy instead of the usual difference-in-difference variables. In the first panel of Table 2, which covers all admissions and mental illness admissions, we show that none of the trends are statistically significantly different between the treatment and control groups in the period prior to the ACA. In the second and third panels, we report our pre-reform trend test for insurance results and intensity of treatment for both types of care. For all health insurance outcomes, our treatment and control groups follow similar pre-trends. In the intensity of treatment trends, we see one marginally statistically significantly different trend for log length of stay (LOS) when risk adjustment variables are included, and four statistically significantly different trends in terms of charges (both levels and logs), when risk adjustment variables are excluded. Overall, these pre-trend tests are reassuring, especially for admissions volume, and health insurance composition of the admissions. As additional checks on the validity of our study design, we also conduct placebo tests, and estimate models that compare between 25 and 27 year olds, who are very close in age, and thus less likely to be differentially affected by other forces such as recession. All analyses provide reassuring evidence that the assumptions behind the DD study design are valid.

Impact of the ACA Young Adult Mandate on Use of Medical Care and Source of Admission

Table 3 contains regression results from Equation [1], where the dependent variable is the number of admissions at the quarter, hospital, and age level. The results indicate that the implementation of the law had a statistically significant impact on overall inpatient visits. Relative to a mean average quarterly visits per hospital per age of 7.27 prior to the passage of the law, the coefficient of 0.253 in the second set of rows of column 1 of Table 3 indicates that the overall number of visits increased by 3.5 percent. Our result on the impact of the ACA dependent coverage expansion on overall visits is comparable in direction with Anderson, Dobkin, and Gross (2012), who find that young adults decrease their visits for non-birth inpatient visits when they age out of insurance.

In considering the possible substitution away from ER care to outpatient care, we investigate the effect of the health insurance expansion on the source of inpatient admission by estimating the impact of the law on ER and non-ER admissions. In columns 2 and 3 of Table 3, we find that our overall result is driven by direct hospital admissions that bypass the ER. Direct hospital admissions tend to be scheduled visits and are likely more sensitive to health insurance access, hence the larger percent increase is not surprising.

Impact of the ACA Young Adult Mandate on Mental Illness Visits

We study mental health admissions separately because they may be especially impacted by the ACA young adult mandate given the particular health needs of this population. We

present our analysis of the impact of the mandate on the total number of mental health admissions in the last three columns of Table 3. We find a statistically significant 9 percent increase in the number of visits after implementation. These results differ from Meara et al. (2014) finding for Massachusetts that shows no or small decreases in mental health inpatient visits after reform. Parsing our results by the source of admission, we find that visits originating from the ER comprise a significant portion of our overall mental health results. Our estimate for non-ER admissions after the law, while positive and marginally statistically significant, is smaller in magnitude.

Impact of the ACA Young Adult Mandate on the Health Insurance Status of Inpatient Visits

In Table 4, we evaluate the impact of the mandate on the health insurance composition of young adults who sought inpatient care after the reform using the same sample and regression framework we describe above. The dependent variable here is the fraction of the hospital-age-quarter-level inpatient population with private insurance, no insurance, Medicaid, Medicare, and other insurance. These health insurance categories are mutually exclusive, so the horizontal sum of all the coefficients presented in Table 4 is zero. Our DD estimate presented in the first column of the top panel of Table 4 shows that the proportion of young adults in our treatment group with private insurance increased by 2.1 and 6 percentage points, respectively, as a result of the enactment and the implementation of the law. Relative to the mean baseline quarterly fraction of privately insured visits, these represent 5.3 and 15.3 percent increases in private coverage of all

visits among our treatment group. This result is not surprising as mandate expanded health insurance coverage to young adults whose parents have private health insurance. Our next set of results shows that the fraction of young adults in our treatment group without health insurance decreased by a marginally statistically significant 1 percentage point (4.4 percent) and statistically significant 2.9 percentage points (12.5 percent) as a result of the law's enactment and implementation respectively. There is a statistically significant negative coefficient associated with reform implementation for Medicaid and other insurance coverage.

The bottom panel of Table 4 shows the impact of the law on the health insurance status of hospitalized young adults with a mental illness diagnosis. In the first column, we estimate a 5.8 percentage-point (17.7 percent) increase in the fraction of young adult mental-health-related inpatient visits paid through private health insurance. There is also suggestive evidence of a small decrease in the prevalence of uninsurance among mental-illness-related inpatient care. We also find evidence of a large decline, 3.1 percentage points (9.1 percent), in mental illness visits reimbursed by the Medicaid program. We find no meaningful impact of the law on Medicare or on other forms of insurance payment (last two columns).

Impact of the ACA Young Adult Mandate on the Treatment Intensity of Inpatient Visits

We study treatment intensity using a DD regression model that is similar to Equation [1] except that the unit of observation for this model is at the individual level rather than the hospital-quarter level. In the Massachusetts context, Kolstad and Kowlaski (2012) argue that if

health insurance expansion alters the observable characteristics of patients who seek care, then including these characteristics in a regression framework would blunt any estimated impact of the reform. As a result they estimate models with and without controlling for patient demographics and clinical characteristics and consider the model without patient characteristics as the preferred specification. We do the same in our evaluation of the impact of the mandate on treatment intensity. For models in which we include patient characteristics, we include a new vector Z_{ighst} not present in Equation [1]. This vector contains patient demographics and clinical indicators such as age, gender, race/ethnicity, whether the patient was admitted on the weekend, Charlson Index, the number of diagnosis codes (up to nine codes), an indicator for each of 27 comorbidity measures calculated using the HCUP Comorbidity Software, and indicator variables for Major Diagnostic Categories (MDCs).

As with our study of the number of hospitalizations, we consider all non-birth inpatient visits (Table 5) and visits related to mental illness (Table 6). Starting in columns 1 and 2 of Table 5, we find that there is no statistically significant effect of the law on the levels or log transformation of length of stay. There is also no effect on the number of procedures. We find marginally statistically significant effect on total charges (but not log charges), with the enactment and implementation showing opposite signed and small changes. Thus, our results for total charges are sensitive to the inclusion of patient characteristics and functional form assumption, but overall suggest minimal change.

In Table 6, we present the impact of the ACA mandate on intensity of mental-health-related inpatient visits. Across the different specifications, there are only two coefficients that are statistically significant, and they are both significant at the 10 percent level only. Moreover, both results are small and are sensitive to functional form (in one case the log specification is significant while the level is not, and vice versa in the other case). Overall we find a small and mainly statistically insignificant effect of the young adult mandate on the treatment intensity of young adults.

VII. Heterogeneous Effect of the Mandate

Given prior research findings from Massachusetts that mental health results can vary by exact type, and that substance use is a closely related disorder that is also highly relevant to the young adult population, we explore this heterogeneity in analysis presented in Table 7. We separated the MDC 19 mental health category into subcategories of depression, psychoses and other mental illness, using the relevant International Classification of Diseases (ICD) 9 codes.

In Table 7, we see that for depression, there are sizable and statistically significant increases in all inpatient admissions and visits through the ER. Using unreported baseline means, the coefficient magnitudes are on the order of 8.5 percent and 11.3 percent increases. There are also sizable insurance shifts in this category of hospitalizations, with private insurance increasing, and uninsurance and Medicaid decreasing by similar magnitudes; other insurance also decreases. We also observe sizable increases in psychoses admissions after implementation,

stemming mostly from visits through the ER. There is no statistically significant increase in other mental illness admissions, although insurance composition shifts towards private coverage and away from Medicaid. The health insurance shifts are not surprising given the strong negative link between mental health and employment that prior to the law, young adults who suffer from mental illness are likely to participate in the Medicaid program. In Table 7, we also examine another category of admission that is of high relevance for young adults: substance abuse admissions (Frank and McGuire, 2000; Meara et al. 2014). Somewhat surprisingly, there is no indication of increases in inpatient admissions, although consistent with all our other findings, we document evidence of strong private insurance gains. The lack of increase in substance use admissions could indicate that becoming insured allows better management of care outside the hospital for this disorder, as this is the category of care for which inpatient admissions decreased the most in Meara et al (2014).

Another dimension of heterogeneity we explore is at the age level. Although our main analysis uses treatment and control groups that are relatively close in age (19-25-year-olds vs. 27-29-year-olds), a closer comparison would use those just below and above the age cutoff of 26. Specifically, we evaluate the impact of the mandate by comparing 25-year-olds to 27-year-olds. These two age groups are likely the most similar on observable characteristics and the influence of macroeconomic factors. We re-estimate our analysis reported in Table 3 (inpatient admissions volume) in Table 8, and find estimates that are consistent with but larger than our main results in Table 3. Compared to 27-year-olds and relative to the period before the law, among 25-year-

olds, the number of admissions increased by 5.9 percent; admissions through the ER increased by 5.3 percent, and admissions that did not originate from the ER increased by 7.1 percent. The corresponding numbers in Table 3 are 3.5 percent, 6 percent and 9 percent.

VIII. Further Robustness Checks

An implicit assumption we make in comparing the change in volume of inpatient admissions for the treatment versus control group is that the relative cohort size of the two groups does not change during our sample period. However, an alternative explanation for the 3.5-percent increase in the number of visits we estimate could be that the population of 19-to-25-year-olds increased faster than the population of 25-to-29-year-olds. We verify that population trends do not drive our results by aggregating our data to the national level (by age and time) and dividing by population estimates available from U.S. Census Bureau from 2007 to 2011. We also use this specification to implement the standard error solution suggested by Cameron, Gelbach, and Miller (2008) in the presence of a small number of groups across which variation occurs. We present these results in Appendix Table 1, along with a test of the common trends assumption for this model. We see that the results are qualitatively very similar to those in Table 3. Statistical significance of results in Appendix Table 1 is slightly higher in one case, but the same in all other cases, relative to Table 3. Inpatient admissions now increase by 2.75 percent (relative to 3.5 percent earlier), and mental health admissions increase by 7.25 percent (relative to 9 percent earlier); results for other specifications are also similar. The common trends tests also remains

fairly plausible, but there is now one statistic (for admissions not through the ER) that is marginally statistically significantly different.

While in Table 8 we showed results for the 25 year old subset of the treatment group, in Appendix Table 2 and 3, we show results for further subsets. In Appendix Table 2 we find that among 19-22 year olds (relative to 27-29 year olds), there is a 3.9 percent increase in inpatient admissions and a 11.3 percent increase in mental health visits. Appendix Table 3 shows that among 23-25 year olds, relative to 27-29 year olds, there is a 2.9 percent increase in inpatient visits and 5.8 percent increase in mental health, suggesting that there are statistically significant effects among both younger and older segments of the treatment group. There is evidence of common trends between treatment and control groups for all relevant statistics except one.

Last, we conduct a set of placebo tests where we estimate several additional models falsely assuming that the reform took place in quarters prior to March 2010. For each of the 11 quarters between January 2007 and March 2010 and using data from this time period, we re-estimate Equation [1] assuming a placebo date for the ACA law and create a distribution of the results from the replications. We perform this test for both all and mental illness admissions, as well as for our subsample analysis of 25- vs. 27-year-olds and report results in Appendix Table 4.

We first examine the mean and standard deviation of the estimates reported in Appendix Table 4 relative to the values obtained in Tables 2, and 3 for our sample of all and mental-health-related admissions, for quantity of visits as well as the insurance composition of visits. When we

consider our sample of all admissions, only one specification out of eight has two or more placebo results that are statistically significant at the 10-percent-or-smaller level. One specification contains one placebo result that is statistically significant at the 10% percent level. We note that the coefficients of placebo laws are smaller than those we obtain in Tables 3 and 4. Among the mental health illness categories, only four out of 88 possible estimates are statistically significantly different from zero: one at the 1-percent level, and three at the 10-percent level. Since significance at the 10 percent level contains zero, we interpret our placebo analysis as suggesting that the impact of the law that we estimate is not due to chance.

As with our trends tests, even though of estimates of the impact of the law on treatment intensity are sensitive to functional form assumptions and are mainly not statistically significant, we find instances of statistically significant tests for our treatment intensity variables in our placebo analysis. In Appendix Tables 6, we show that in total there are 19 placebo results that are statistically significant at the 5% or lower level, out of a possible 132 cases. In Appendix Table 7, we present placebo tests for the treatment intensity of mental illness admissions. We see here that there are 17 placebo tests that show statistically significant effects, out of a possible 132. In summary, the validity tests in this section confirm that our study design is reasonable and that our estimates likely capture the effects of the mandate rather than the difference in trends between the treatment and control groups. Even though the number of estimates that are significant for our treatment intensity variables is not very far from what would be expected by

chance alone, we note that these are also the outcomes that show the least consistent effects due to reform.

IX. Discussion and Conclusion

We present the first estimates of the impact of the ACA health insurance expansion on inpatient medical care received by young adults using a nationally representative database of inpatient hospital visits. We estimate the impact of the law on 19-25-year-olds, for whom access to parental insurance coverage was especially poor prior to the ACA. We find evidence of greater demand response to health insurance coverage for mental health care than for medical care. Compared to another group of individuals who are close in age but excluded from the law (27-29-year-olds), young adults who benefitted from the mandate increased their overall number of non-birth inpatient visits by 3.5 percent. This result is driven mainly by admissions not through the ER. In our exploration of the impact of the mandate on mental health visits, an important component of inpatient care use by young adults, we find that young adults increased their visits by 9 percent. Unlike general admissions, the increase in mental health admissions arises mainly through the ER. We also find strong evidence that the law achieved its intended purpose of decreasing uninsurance among young adults who use hospital-based care. The fraction of young adult hospitalizations that is uninsured decreased by 2.9 percentage points (12.5 percent) due to the law. Our analysis of the impact of the mandate on the intensity of medical care shows no consistent or significant change in how long young adults stay in a hospital, the number of procedures that are performed on them, or on hospital charges.

Our findings contribute to the literature on the effect of health insurance coverage on access and medical care utilization. The general consensus in the literature is that health insurance increases the use of medical services, including inpatient care. Our findings are consistent with this hypothesis as we find that young adults increased their overall use of inpatient services in response to gaining access to health insurance.

However, our results differ from the experience of Massachusetts which saw no change in general inpatient admissions (Kolstad and Kowalski, 2012) and no change or small decreases in use of mental health care by young adults (Meara et al 2014). We note that the health insurance expansion we study here is much smaller than other large-scale efforts such as the near-universal health insurance expansion in Massachusetts. In addition, we study the short-run effect of the ACA health insurance expansion on young adults, leaving for future work the examination of the long-run effects. The findings by Meara et al.(2014) of no change or decreases in the use of hospital-based mental health care by young adults after the Massachusetts health insurance reform could reflect the availability of outpatient mental health care providers in Massachusetts that might be absent in other states. This means that the interaction of demand and supply-side constraints could determine the long and short run impact of health insurance expansions. Cunningham (2009) finds that shortage of mental health care providers is as much a barrier to mental health care access as lack of health insurance coverage.

There are several other limitations to our work. Since we use hospital discharge data that do not contain individual identifiers, we are unable to distinguish whether the increase in

inpatient visits we document is the result of increased frequency of visits by the same patients or an increase in visits by new patients. We also do not observe visits to private mental health hospitals. Future work using household- or individual-level surveys as well as more comprehensive hospital data sets will help us better understand the mechanism behind the increase in inpatient care use found in this study, as well as shed light on the effects of the law on the use of care in other settings.

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Table 1: Summary Statistics of Treatment and Control Group

	19-25 years old		27-29 years old	
	Before ACA enactment	After ACA implementation	Before ACA enactment	After ACA implementation
Demographic characteristics				
Age	22.1	22.1	28.0	28.0
Indicator: male	0.500	0.501	0.474	0.473
Indicator: white	0.622	0.602	0.617	0.607
Indicator: African-American	0.207	0.235	0.210	0.233
Indicator: Hispanic	0.103	0.097	0.104	0.097
Clinical Characteristics				
Indicator: mental illness	0.177	0.192	0.152	0.157
Number of diagnosis codes	4.74	5.22	5.15	5.66
Indicator: admitted on weekend	0.238	0.221	0.237	0.223
Indicator: admitted through ER	0.654	0.652	0.628	0.638
Utilization measures				
Length of stay (LOS)	4.38	4.36	4.33	4.35
Log of LOS	1.39	1.39	1.40	1.40
Number of procedure codes	1.08	1.08	1.15	1.15
Total charges	24,298	28,972	24,333	29,648
Log of total charges	9.55	9.71	9.58	9.75
Health insurance status				
Indicator: covered by private insurance	0.389	0.395	0.379	0.324
Indicator: uninsured	0.214	0.193	0.195	0.203
Indicator: covered by Medicaid	0.275	0.291	0.263	0.298
Indicator: covered by Medicare	0.045	0.048	0.095	0.103
Indicator: covered by other insurance	0.073	0.065	0.064	0.065
Number of observations	523,487	213,482	270,630	106,715

Note: Sample estimates from the NIS data, 2007-2011, using data of non-birth related admissions of young adults aged from 19-29, except for the removal of 26 year olds who are in neither control nor treatment. Means of the variables are obtained for treatment and control groups before ACA enactment (2007 Q1- 2010 Q1) and after ACA implementation (2010 Q4 and onward). The data from California, Maine and Texas are excluded because precise information on age was not available. Observations in which length of stay exceeds 90 days are excluded. The mean for the race categories is calculated using observations in which race\ethnicity variable is available in the data. Not all states provide information on race\ethnicity for all years in the NIS dataset.

Table 2: Test for Equality of Pre-Reform Trends

	Number of admissions and admissions by source					
	Non-birth Related Admissions			Mental Illness Admissions		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of all admissions	Number of admissions through ER	Number of admissions not through ER
Interaction of time trend and a	-0.047	-0.050	0.003	-0.006	-0.008	0.002
dummy variable for treatment group	(0.046)	(0.031)	(0.025)	(0.031)	(0.022)	(0.019

	Fraction of Admissions by Health Insurance				
	Private Insurance	Uninsured	Medicaid	Medicare	Other Insurance
Non-birth admissions					
Interaction of time trend and a	0.000	-0.001	-0.002	0.001	0.002
dummy variable for treatment group	(0.002)	(0.002)	(0.002)	(0.001)	(0.001)
Mental illness admissions					
Interaction of time trend and a	0.005	-0.001	-0.001	0.000	-0.002
dummy variable for treatment group	(0.004)	(0.003)	(0.004)	(0.003)	(0.002)

	Intensity of treatment				
	LOS	Log of LOS	Number of procedures	Total charges	Log of total charges
Non-birth admissions					
Risk-adjustment variables (including individuals' demographic characteristics) are excluded.					
Interaction of time trend and a dummy	-0.022	-0.003	-0.004	-261.9 ***	-0.005 **
variable for treatment group	(0.016)	(0.002)	(0.004)	(97.2)	(0.002)
Risk-adjustment variables are included.					
Interaction of time trend and a dummy	-0.022	-0.003 *	-0.002	-216.4 **	-0.004 **
variable for treatment group	(0.014)	(0.002)	(0.004)	(87.4)	(0.002)
Mental illness admissions					
Risk-adjustment variables (including individuals' demographic characteristics) are excluded.					
Interaction of time trend and a dummy	0.040	0.000	0.001	85.1	0.003
variable for treatment group	(0.041)	(0.004)	(0.003)	(83.0)	(0.004)
Risk-adjustment variables are included.					
Interaction of time trend and a dummy	0.054	0.002	0.001	115.8	0.004
variable for treatment group	(0.041)	(0.004)	(0.003)	(83.2)	(0.004)

Note: (1) First panel: Number of observations is 95,040 for the first three columns and 34,730 for the last three columns. Second panel: Number of observations is 70,782 for the first set of rows and 24,536 for the second set of rows. Third panel: Number of observations in the first set of rows is 731,727 in the first four columns and 729,116 in the last two columns, and the number of observations in the second set of rows is 122,546 in the first four columns and 122,275 in the last two columns. (2) First and second panels: Quarterly hospital-age level variables are calculated, using young adults aged from 19-29, except for the removal of 26 year olds who are in neither control nor treatment. Third panel: Individual level variables are used. (3) Data: The NIS data for the period from the first quarter of 2007 to the fourth quarter of 2009, which is

prior to the passage of the ACA in March 2010. The data from California, Maine and Texas are excluded because precise information on age was not available. Observations in which length of stay exceeds 90 days are excluded. (4) Dependent variables in the first panel - column 1: number of all non-birth related admissions; column 2: number of non-birth related admissions originated from the ER; column 3: number of non-birth-related admissions that did not originate from the ER; column 4: number of total mental illness admissions; column 5: number of mental illness admissions originated from the ER; and column 6: number of mental illness admissions that did not originate from the ER. Second panel - column 1: ratio of non-birth admissions covered by private health insurance; column 2: ratio of uninsured non-birth admissions; column 3: ratio of non-birth admissions covered by Medicaid; column 4: ratio of non-birth admissions covered by Medicare; and column 5: ratio of non-birth admissions covered by other insurance. Third panel - column 1: length of stay; column 2: log of the sum of length of stay and one; column 3: number of procedure codes (up to six codes); column 4: total charges; and column 5: log of the sum of total charges and one. (5) Cells of the table contain: coefficients, and standard errors in parentheses. Coefficients are from the interaction of a dummy variable for treatment group and a linear measure for time trend (number of quarters since the first quarter of 2007), which shows whether there was a different time trend for the control vs. the treatment group in the period prior to policy enactment. (6) Other regressors are a linear time trend, a dummy variable for the treatment group, and all other explanatory variables included in our main specification. (7) Standard errors are clustered at the hospital level.

Table 3: Effect of Mandate on the Number and Sources of Admissions

	All non-birth admission			Mental illness admissions		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of admissions	Number of admissions through ER	Number of admissions not through ER
ACA Enactment Effect	0.124	0.047	0.077	0.032	-0.007	0.039
(2010 Q2-Q3)	(0.117)	(0.078)	(0.064)	(0.091)	(0.067)	(0.052)
ACA Implementation Effect	0.253 **	0.092	0.162 ***	0.315 ***	0.234 ***	0.081 *
(2010 Q4-)	(0.113)	(0.076)	(0.061)	(0.086)	(0.061)	(0.048)
Dependent Variable Means						
Treatment, before ACA enactment	7.27	4.75	2.52	3.52	2.09	1.43
Control, before	8.76	5.50	3.26	3.64	2.15	1.49
Treatment, after ACA implementation	7.70	5.02	2.69	4.08	2.41	1.67
Control, after	8.99	5.73	3.26	3.89	2.25	1.65

Notes: (1) Number of observations is 158,740 in the first three columns and 57,930 in the last three columns. (2) Quarterly hospital-age level variables are calculated using the non-birth related admissions (for columns 1-3) and mental illness admissions (for columns 4-6) of young adults aged from 19-29, except for the removal of 26 year olds who are in neither control nor treatment. (3) Cells of the table contain: coefficients and standard errors in parentheses. Coefficients in the first row are from the interaction of a dummy variable for treatment group (19-25 years old) and a dummy variable for the period after ACA enactment but before implementation (the second and third quarters of 2010); coefficients in the second row are from the interaction of a dummy variable for treatment group and a dummy variable for the period after ACA implementation (the fourth quarter of 2010 and onwards). (4) Data: The NIS data from 2007 to 2011. The data from California, Maine and Texas are excluded because precise information on age was not available. Observations in which length of stay exceeds 90 days are excluded. (5) Dependent variables— column 1: number of all non-birth related admissions; column 2: number of non-birth related admissions originated from the ER; column 3: number of non-birth-related admissions that did not originate from the ER; column 4: number of total mental illness admissions; column 5: number of mental illness admissions originated from the ER; and column 6: number of mental illness admissions that did not originate from the ER. (6) Other regressors are an indicator for each age, year fixed effects, quarterly fixed effects, state-specific linear time trend, hospital-specific fixed effects, quarterly national-level unemployment rate, interaction of unemployment and an indicator for each age. (7) Means of dependent variables are obtained for treatment and control groups before ACA enactment (2007 Q1- 2010 Q1) and after ACA implementation (2010 Q4 and onward). See *Note* (7) under Table 2. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 4: Fraction of Admissions Insured: Non-Birth Related Admissions and Mental Illness Admissions

	All non-births admissions				
	Private Insurance	Uninsured	Medicaid	Medicare	Other Insurance
ACA Enactment Effect	0.021 ***	-0.010 *	0.005	-0.012 ***	-0.003
(2010 Q2-Q3)	(0.007)	(0.006)	(0.006)	(0.004)	(0.003)
ACA Implementation Effect	0.060 ***	-0.029 ***	-0.020 ***	-0.005	-0.006 **
(2010 Q4-)	(0.005)	(0.004)	(0.005)	(0.003)	(0.003)
Dependent Variable Means					
Treatment, before ACA enactment	0.392	0.228	0.265	0.040	0.070
Control, before	0.394	0.196	0.256	0.086	0.062
Treatment, after ACA implementation	0.398	0.211	0.276	0.042	0.066
Control, after	0.335	0.210	0.291	0.093	0.064
	Mental illness admissions				
	Private Insurance	Uninsured	Medicaid	Medicare	Other Insurance
ACA Enactment Effect	0.006	-0.001	0.006	-0.006	-0.004
(2010 Q2-Q3)	(0.011)	(0.008)	(0.011)	(0.009)	(0.006)
ACA Implementation Effect	0.058 ***	-0.013 *	-0.031 ***	-0.003	-0.009 *
(2010 Q4-)	(0.009)	(0.007)	(0.009)	(0.008)	(0.005)
Dependent Variable Means					
Treatment, before ACA enactment	0.326	0.179	0.341	0.067	0.081
Control, before	0.273	0.165	0.323	0.169	0.064
Treatment, after ACA implementation	0.346	0.170	0.340	0.060	0.076
Control, after	0.224	0.179	0.358	0.161	0.070

Notes: (1) Number of observations is 117,771 in the first set of rows and 40,469 in the second set of rows. (2) Quarterly hospital-age level variables are calculated using the non-birth related admissions (for the first panel) and mental illness admissions (for the second panel) of young adults aged from 19-29, except for the removal of 26 year olds who are in neither control nor treatment. (3) Dependent variables—column 1: ratio of admissions covered by private health insurance; column 2: ratio of uninsured admissions; column 3: ratio of admissions covered by Medicaid; column 4: ratio of admissions covered by Medicare; and column 5: ratio of admissions covered by other insurance. (4) See *Note* (7) under Table 2 and *Notes* (3), (4), (6) and (7) under Table 3. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 5: Effect of Mandate on Intensity of Treatment for All Non-births Admissions

	LOS	Log of LOS	Number of procedures	Total charges	Log of total charges
Risk-adjustment variables (including individuals' demographic characteristics) are excluded.					
ACA Enactment Effect (2010 Q2-Q3)	0.021	0.002	0.018	730.5 *	0.008
	(0.046)	(0.005)	(0.012)	(410.2)	(0.007)
ACA Implementation Effect (2010 Q4-)	-0.009	0.000	-0.003	-537.5 *	-0.009
	(0.037)	(0.005)	(0.009)	(304.2)	(0.006)
Risk-adjustment variables are included.					
ACA Enactment Effect (2010 Q2-Q3)	0.012	0.002	0.007	530.9	0.004
	(0.043)	(0.005)	(0.011)	(369.7)	(0.006)
ACA Implementation Effect (2010 Q4-)	-0.027	-0.003	0.008	-322.0	-0.002
	(0.031)	(0.004)	(0.007)	(259.6)	(0.005)
Dependent Variable Means					
Treatment, before ACA enactment	4.38	1.39	1.08	24,298	9.54
Control, before	4.33	1.40	1.15	24,333	9.58
Treatment, after ACA implementation	4.36	1.39	1.08	28,972	9.71
Control, after	4.35	1.40	1.15	29,648	9.75

Notes: (1) Number of observations is 1,246,517 in the first four columns and 1,242,770 in the last two columns. (2) Observations are non-birth-related admissions of young adults aged from 19-29, except for the removal of 26 year olds who are in neither control nor treatment. Observations in which length of stay exceeds 90 days are excluded. (3) Dependent variables—column 1: length of stay; column 2: log of the sum of length of stay and one; column 3: number of procedure codes (up to six codes); column 4: total charges; and column 5: log of the sum of total charges and one. (4) Other regressors - an indicator for the period after ACA enactment but before implementation, an indicator for the period after ACA implementation, an indicator for treatment group, year-specific fixed effects, quarter-specific fixed effects, quarterly state-specific linear time trends, hospital-specific fixed effects, quarterly national unemployment rate, and interaction of unemployment rate and an indicator for each age are included in the both sets of regressions. Risk-adjusted variables that are included in the second set of the regressions are an indicator for each year of age, gender, race/ethnicity, an indicator for admission occurred on the weekend, Charlson Index, the number of diagnosis codes (up to nine codes), an indicator for each of 27 comorbidity measures obtained by the HCUP Comorbidity Software, and indicator variables for major diagnostic categories. (5) See *Note* (7) under Table 2 and *Notes* (3), (4), (5) and (7) under Table 3. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 6: Effect of Mandate on Intensity of Treatment for Mental Illness Admissions

	LOS	Log of LOS	Number of procedures	Total charges	Log of total charges
Risk-adjustment variables (including individuals' demographic characteristics) are excluded.					
ACA Enactment Effect (2010 Q2-Q3)	-0.147	-0.011	-0.007	-130.6	-0.005
	(0.131)	(0.011)	(0.011)	(284.8)	(0.013)
ACA Implementation Effect (2010 Q4-)	-0.129	-0.015	0.008	-297.7	-0.003
	(0.103)	(0.009)	(0.007)	(220.6)	(0.010)
Risk-adjustment variables are included.					
ACA Enactment Effect (2010 Q2-Q3)	-0.154	-0.011	-0.008	-150.2	-0.006
	(0.124)	(0.011)	(0.011)	(273.3)	(0.012)
ACA Implementation Effect (2010 Q4-)	-0.160	-0.018 **	0.008	-362.6 *	-0.008
	(0.099)	(0.009)	(0.007)	(212.5)	(0.009)
Dependent Variable Means					
Treatment, before ACA enactment	6.49	1.73	0.24	13,135	9.06
Control, before	6.63	1.76	0.27	13,399	9.10
Treatment, after ACA implementation	6.40	1.73	0.26	15,093	9.23
Control, after	6.64	1.76	0.27	15,568	9.26

Notes: (1) Number of observations is 214,785 in the first four columns and 214,403 in the last two columns. (2) Observations are mental illness admissions of young adults aged from 19-29, except for the removal of 26 year olds who are in neither control nor treatment. Observations in which length of stay exceeds 90 days are excluded. (3) Other regressors are the same as those listed in Note (4) under Table 4 except that we include an indicator variable for DRGs instead of an indicator variable for major diagnostic categories. (4) See *Note* (7) under Table 2, *Notes* (3), (4), (5) and (7) under Table 3, and *Note* (3) under Table 4. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Table 7: Effect of Mandate on Mental Illness Admissions Subcategories, and Substance Abuse Admissions

	Number of admissions		Number of admissions through ER		Number of admissions not through ER		Private Insurance		Uninsured		Medicaid		Medicare		Other Insurance	
Mental illness admissions																
Depression																
ACA Enactment Effect	0.010		-0.020		0.029		-0.005		0.014		-0.007		0.0015		-0.005	
(2010 Q2-Q3)	(0.041)		(0.030)		(0.028)		(0.017)		(0.013)		(0.018)		(0.0090)		(0.009)	
ACA Implementation Effect	0.096	**	0.072	***	0.024		0.092	***	-0.035	***	-0.035	***	0.0002		-0.018	**
(2010 Q4-)	(0.037)		(0.027)		(0.022)		(0.014)		(0.011)		(0.013)		(0.007)		(0.007)	
Psychoses																
ACA Enactment Effect	-0.032		-0.017		-0.015		0.002		0.013		0.003		-0.0015		-0.015	
(2010 Q2-Q3)	(0.058)		(0.042)		(0.032)		(0.014)		(0.012)		(0.018)		(0.0156)		(0.009)	
ACA Implementation Effect	0.167	***	0.145	***	0.022		0.035	***	0.001		-0.025	*	-0.0109		-0.001	
(2010 Q4-)	(0.049)		(0.037)		(0.029)		(0.011)		(0.009)		(0.013)		(0.012)		(0.006)	
Other mental illness																
ACA Enactment Effect	0.055		0.030		0.025		0.033	*	-0.024	*	0.001		-0.0027		-0.005	
(2010 Q2-Q3)	(0.041)		(0.030)		(0.027)		(0.017)		(0.014)		(0.019)		(0.0136)		(0.011)	
ACA Implementation Effect	0.052		0.017		0.035	*	0.070	***	-0.018		-0.038	***	0.0008		-0.013	*
(2010 Q4-)	(0.033)		(0.024)		(0.020)		(0.014)		(0.011)		(0.014)		(0.010)		(0.008)	
Substance abuse admissions																
ACA Enactment Effect	0.082		0.042		0.039		0.065	***	-0.038	**	-0.020		-0.0201	**	0.011	
(2010 Q2-Q3)	(0.060)		(0.031)		(0.046)		(0.019)		(0.018)		(0.019)		(0.0097)		(0.011)	
ACA Implementation Effect	0.064		0.030		0.035		0.102	***	-0.049	***	-0.039	***	-0.0092		-0.005	
(2010 Q4-)	(0.047)		(0.028)		(0.033)		(0.015)		(0.014)		(0.015)		(0.007)		(0.008)	

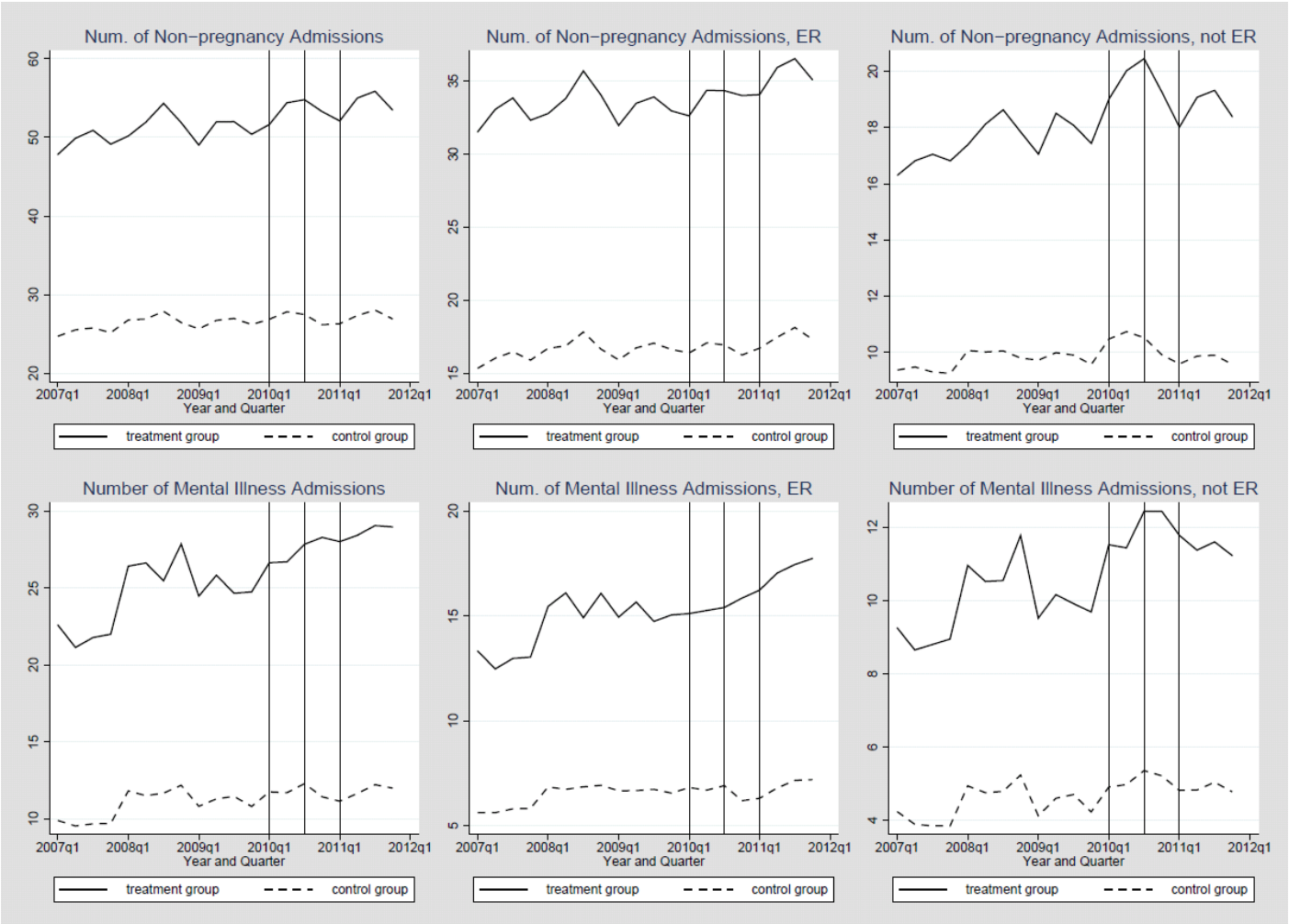
Note: (1) Number of observations is 57,930 in the first three columns and 27,924 in the last five columns in the first three panels. Number of observations is 62,970 in the first three columns and 22,295 in the last five columns in the last panel. (2) Quarterly hospital-age level variables are calculated using admissions related to each condition of young adults aged from 19-29, except for the removal of 26 year olds who are in neither control nor treatment. (3) Dependent variables— column 1: number of admissions; column 2: number of admissions originated from the ER; column 3: number of admissions that did not originate from the ER; column 4: ratio of admissions covered by private health insurance; column 5: ratio of uninsured admissions; column 6: ratio of admissions covered by Medicaid; column 7: ratio of admissions covered by Medicare; and column 8: ratio of admissions covered by other insurance. (3) See *Note* (7) under Table 2 and *Notes* (3), (4), (6) and (7) under Table 3.

Table 8: Effect of the Mandate on the Number and Sources of All Non-birth Admissions among 25 and 27 years old

	Number of admissions		Number of admissions through ER		Number of admissions not through ER	
ACA Enactment Effect	0.168		0.039		0.129	
(2010 Q2-Q3)	(0.152)		(0.108)		(0.094)	
ACA Implementation Effect	0.470	***	0.273	***	0.197	***
(2010 Q4-)	(0.119)		(0.092)		(0.066)	
Dependent Variable Means						
Treatment, before ACA enactment	7.90		5.14		2.76	
Control, before	8.53		5.41		3.13	
Treatment, after ACA implementation	8.25		5.40		2.85	
Control, after	8.52		5.47		3.04	

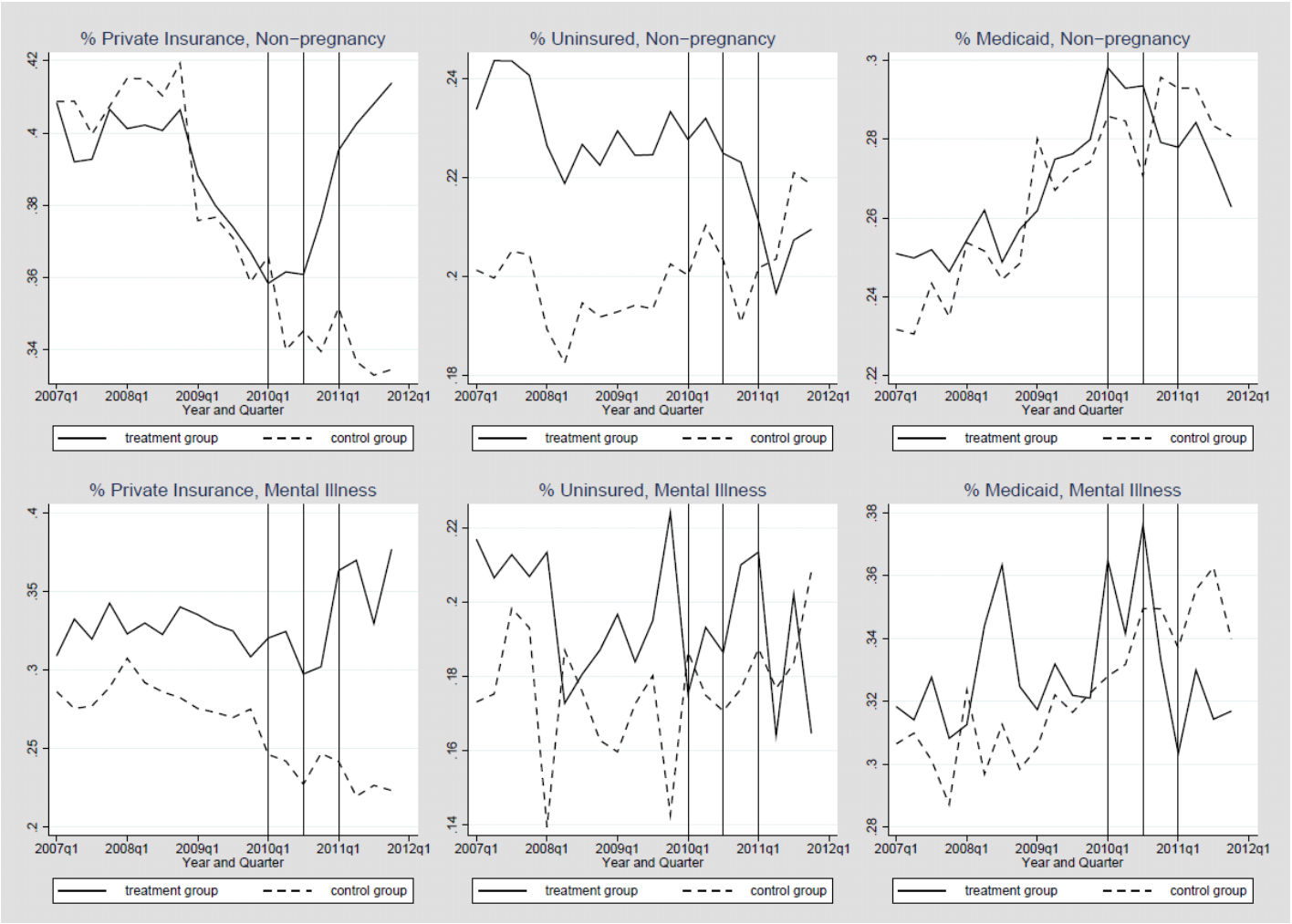
Notes: (1) Number of observations is 31,748. (2) Quarterly hospital-age level variables are calculated using the non-birth related admissions of young adults aged 25 and 27. (2) Dependent variables—column 1: number of all non-birth related admissions; column 2: number of non-birth related admissions originated from the ER; and column 3: number of non-birth-related admissions that did not originate from the ER. (3) See *Note* (7) under Table 2 and *Notes* (3), (4), (6) and (7) under Table 3. *** Significant at the 1 percent level. ** Significant at the 5 percent level. * Significant at the 10 percent level.

Figure 1: Number of Admissions



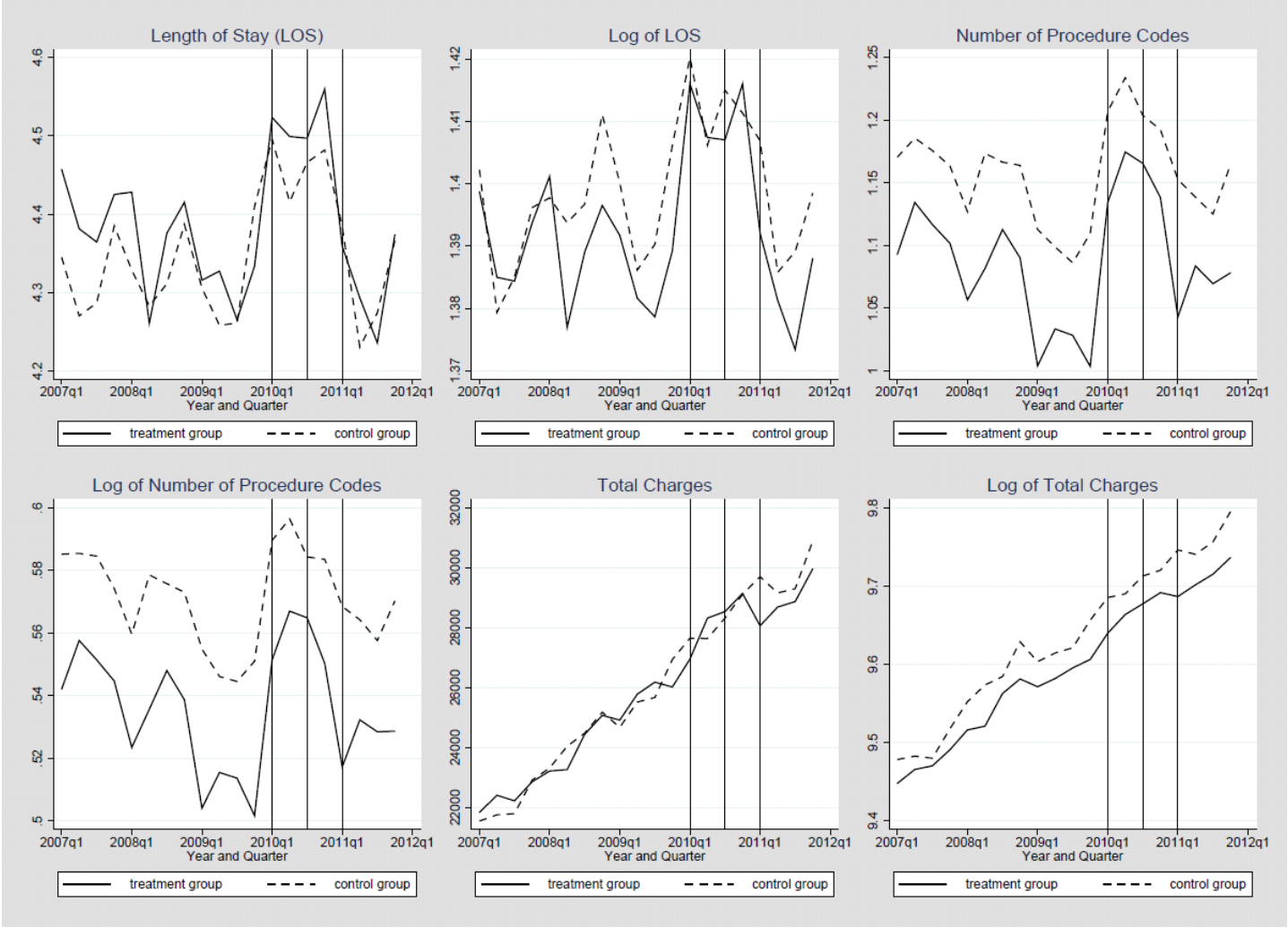
Notes: (1) Sample estimates from the NIS data, using data from 2007 to 2011. (2) The solid line indicates number of admissions among 19-25-year-olds per hospital, and the dashed line indicates number of admissions among 27-29-year-olds per hospital. (3) The first vertical line indicates the first quarter of 2010 when the ACA was passed, the second vertical line indicates the third quarter of 2010 when the dependent coverage mandate was implemented, and the third vertical line indicates the first quarter of 2011 when most new insurance plan years start after the implementation of the mandate.

Figure 2: Percent of Admissions Insured



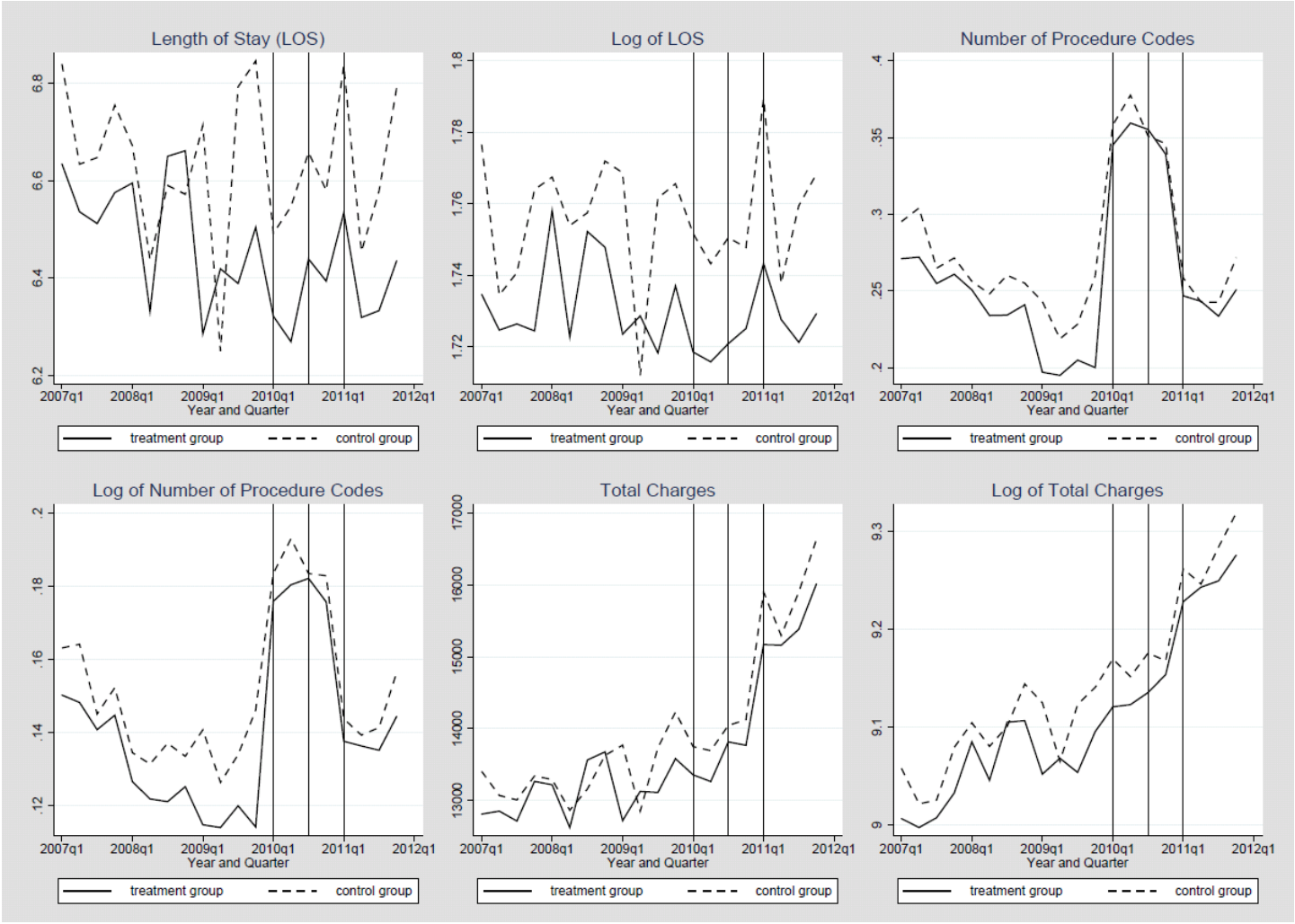
Notes: (1) The solid line indicates the mean of the percent of admissions for each insurance type among 19-25-year-olds at the hospital level, and the dashed line indicates mean of the percent of admissions for each insurance type among 27-29-year-olds at the hospital level. (2) See Notes (1) and (3) under Figure 1.

Figure 3: Treatment Intensity of Non-birth Admissions



Notes: (1) The solid line indicates the mean of each outcome among 19-25-year-olds admitted for non-birth related conditions, and the dashed line indicates mean of each outcome among 27-29-year-olds admitted for non-birth related conditions. (2) See Notes (1) and (3) under Figure 1.

Figure 4: Treatment Intensity of Mental Illness Admissions



Notes: (1) The solid line indicates the mean of each outcome among 19-25-year-olds admitted for mental illness, and the dashed line indicates mean of each outcome among 27-29-year-olds admitted for mental illness. (2) See Notes (1) and (3) under Figure 1.

Appendix Table 1: DD Results using Aggregated Quarterly Data and Wild Cluster Bootstrap-t Procedure

Effect of Mandate on the Number and Sources of Admissions

	Non-birth Related			Mental Illness		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of admissions	Number of admissions through ER	Number of admissions not through ER
ACA Enactment Effect	0.046	-0.003	0.049	0.004	-0.009	0.013
(2010 Q2-Q3)	(0.602)	(0.876)	(0.532)	(0.882)	(0.508)	(0.256)
ACA Implementation Effect	0.186 ***	0.050	0.136 ***	0.087 ***	0.067 ***	0.021 *
(2010 Q4-)	(0.002)	(0.204)	(0.002)	(0.000)	(0.000)	(0.078)
Dependent Variable Means						
Treatment, before ACA enactment	6.74	4.42	2.33	1.20	0.71	0.48
Control, before	8.42	5.30	3.12	1.28	0.76	0.52
Treatment, after ACA implementation	6.72	4.38	2.35	1.29	0.77	0.53
Control, after	8.15	5.19	2.96	1.29	0.74	0.54

Notes: (1) The number of observations is 200. (2) Outcome variables are the number of admissions per 1,000 people for each age per quarter. (3) P-values are in parentheses. We cluster on year-quarter and perform wild cluster bootstrap-t test with 999 replications, following Cameron, Gelbach and Miller (2008).

Test for Equality of Pre-Reform Trends for Number of Admissions

	Non-birth Related Admissions			Mental Illness Admissions		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of all admissions	Number of admissions through ER	Number of admissions not through ER
Interaction of time trend and a	0.015	-0.009	0.024 *	0.003	0.000	0.003
dummy variable for treatment group	(0.022)	(0.016)	(0.013)	(0.008)	(0.006)	(0.005)

Notes: (1) The number of observations is 200. (2) See *Notes* (2) and (3) under the panel above.

Appendix Table 2: 19-22 yrs old vs 27-29 yrs old: Extensive Margin Results and Trend Test

Effect of Mandate on the Number and Sources of Admissions

	Non-birth Related			Mental Illness		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of admissions	Number of admissions through ER	Number of admissions not through ER
ACA Enactment Effect	0.170	0.073	0.097	0.070	0.047	0.023
(2010 Q2-Q3)	(0.144)	(0.096)	(0.078)	(0.108)	(0.080)	(0.061)
ACA Implementation Effect	0.276 *	0.079	0.197 ***	0.398 ***	0.280 ***	0.118 **
(2010 Q4-)	(0.142)	(0.095)	(0.076)	(0.099)	(0.072)	(0.053)
Dependent Variable Means						
Treatment, before ACA enactment	6.98	4.56	2.43	3.51	2.07	1.44
Control, before	8.76	5.50	3.26	3.64	2.15	1.49
Treatment, after ACA implementation	7.48	4.83	2.65	4.20	2.47	1.74
Control, after	8.99	5.73	3.26	3.89	2.25	1.65

Notes: (1) Number of observations is 111,118 in the first three columns and 40,551 in the last three columns. (2) Quarterly hospital-age level variables are calculated using the non-birth related admissions (for columns 1-3) and mental illness admissions (for columns 4-6) of young adults aged from 19-22, and 27-29 year olds. (3) Cells of the table contain: coefficients and standard errors in parentheses. Coefficients in the first row are from the interaction of a dummy variable for treatment group (19-22 years old) and a dummy variable for the period after ACA enactment but before implementation (the second and third quarters of 2010); coefficients in the second row are from the interaction of a dummy variable for treatment group and a dummy variable for the period after ACA implementation (the fourth quarter of 2010 and onwards). (4) See *Note* (7) under Table 2 and *Notes* (4) –(7) under Table 3.

Test for Equality of Pre-Reform Trends for Number of Admissions

	Non-birth Related Admissions			Mental Illness Admissions		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of all admissions	Number of admissions through ER	Number of admissions not through ER
Interaction of time trend and a	-0.038	-0.047	0.008	0.004	-0.005	0.009
dummy variable for treatment group	(0.056)	(0.038)	(0.029)	(0.037)	(0.025)	(0.023)

Notes: (1) Number of observations is 66,528 in the first three columns and 24,311 in the last three columns. (2) See *Notes* (3), (5), (6) and (7) under Table 2, *Note* (5) under Table 3, *Note* (2) under the panel above.

Appendix Table 3: 23-25 yrs old vs 27-29 yrs old: Extensive Margin Results and Trend Test

Effect of Mandate on the Number and Sources of Admissions

	Non-birth Related			Mental Illness		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of admissions	Number of admissions through ER	Number of admissions not through ER
ACA Enactment Effect	0.063	0.012	0.051	-0.018	-0.079	0.061
(2010 Q2-Q3)	(0.104)	(0.074)	(0.059)	(0.096)	(0.070)	(0.057)
ACA Implementation Effect	0.223 **	0.108 *	0.115 **	0.205 **	0.173 ***	0.033
(2010 Q4-)	(0.093)	(0.065)	(0.053)	(0.089)	(0.062)	(0.056)
Dependent Variable Means						
Treatment, before ACA enactment	7.64	5.00	2.64	3.52	2.10	1.42
Control, before	8.76	5.50	3.26	3.64	2.15	1.49
Treatment, after ACA implementation	8.00	5.26	2.74	3.92	2.33	1.58
Control, after	8.99	5.73	3.26	3.89	2.25	1.65

Notes: (1) Number of observations is 95,244 in the first three columns and 34,758 in the last three columns. (2) Quarterly hospital-age level variables are calculated using the non-birth related admissions (for columns 1-3) and mental illness admissions (for columns 4-6) of young adults aged from 23-29, except for the removal of 26 year olds who are in neither control nor treatment. (3) Cells of the table contain: coefficients and standard errors in parentheses. Coefficients in the first row are from the interaction of a dummy variable for treatment group (23-25 years old) and a dummy variable for the period after ACA enactment but before implementation (the second and third quarters of 2010); coefficients in the second row are from the interaction of a dummy variable for treatment group and a dummy variable for the period after ACA implementation (the fourth quarter of 2010 and onwards). (4) See *Note* (7) under Table 2 and *Notes* (4) – (7) under Table 3.

Test for Equality of Pre-Reform Trends for Number of Admissions

	Non-birth Related Admissions			Mental Illness Admissions		
	Number of all admissions	Number of admissions through ER	Number of admissions not through ER	Number of all admissions	Number of admissions through ER	Number of admissions not through ER
Interaction of time trend and a	-0.060	-0.055 **	-0.005	-0.020	-0.011	-0.008
dummy variable for treatment group	(0.039)	(0.027)	(0.022)	(0.032)	(0.023)	(0.020)

Notes: (1) Number of observations is 57,024 in the first three columns and 20,838 in the last three columns. (2) See *Notes* (3), (5), (6) and (7) under Table 2, *Note* (5) under Table 3, *Note* (2) under the panel above.

Appendix Table 4: Effects of Placebo Laws on the Number of Admissions

	Distribution of the coefficients of the placebo laws		Number of coefficient estimates that are significant in the placebo law regressions (out of 11 estimates for each row)			Estimated effects in the main specification			
	Mean	Standard deviation	1% level	5% level	10% level	Enactment effect (2010 Q2-Q3)		Implementation effect (2010 Q4-)	
Non-birth related Admissions									
Number of total admissions	-0.026	0.114	0	0	0	0.124		0.253	**
Number of admissions through ER	-0.028	0.119	1	0	2	0.047		0.092	
Number of admissions not through ER	0.002	0.056	0	0	0	0.077		0.162	***
Rate of private health insurance	0.000	0.004	0	0	0	0.021	***	0.060	***
Rate of uninsured	0.000	0.004	0	0	0	-0.010	*	-0.029	***
Rate of Medicaid	-0.002	0.005	0	0	0	0.005		-0.020	***
Rate of Medicare	0.001	0.004	0	0	0	-0.012	***	-0.005	
Rate of other insurance	0.001	0.004	0	0	1	-0.003		-0.006	**
Mental Illness Admissions									
Number of total admissions	0.000	0.072	0	0	0	0.032		0.315	***
Number of admissions through ER	-0.008	0.056	0	0	0	-0.007		0.234	***
Number of admissions not through ER	0.009	0.044	0	0	0	0.039		0.081	*
Rate of private health insurance	0.005	0.013	0	0	1	0.006		0.058	***
Rate of uninsured	-0.001	0.014	1	0	0	-0.001		-0.013	*
Rate of Medicaid	-0.002	0.014	0	0	0	0.006		-0.031	***
Rate of Medicare	-0.001	0.012	0	0	1	-0.006		-0.003	
Rate of other insurance	-0.001	0.009	0	0	1	-0.004		-0.009	*

Note: (1) Data: The NIS data for the period from the first quarter of 2007 to the fourth quarter of 2009, which is prior to the passage of the ACA in March 2010. The data from California, Maine and Texas are excluded because precise information on age was not available. (2) We select each possible quarter between the second quarter of 2007 and the fourth quarter of 2009 one at a time. We then estimate the main model using each separate placebo date for defining the "Implement" variable. We show here the means and standard deviations of the coefficients we obtain. (3) The last two columns repeat estimates from Tables 3 and 4 for comparison.

Appendix Table 5: Effects of Placebo Laws on Treatment Intensity, Non-Birth Related Admissions

	Distribution of the coefficients of the placebo laws		Number of coefficient estimates that are significant in the placebo law regressions (out of 11 estimates for each row)			Estimated effects in the main specification			
	Mean	Standard deviation	1% level	5% level	10% level	Enactment effect (2010 Q2-Q3)		Implementation effect (2010 Q4-)	
Risk-adjustment variables (including individuals' demographic characteristics) are excluded.									
Length of stay (LOS)	-0.017	0.047	0	0	0	0.021		-0.009	
Log of LOS	-0.001	0.008	0	1	0	0.002		0.000	
Number of procedures	-0.003	0.017	0	1	0	0.018		-0.003	
Total charges	-171.2	567.3	1	2	1	730.5	*	-537.5	*
Log of total charges	-0.002	0.015	2	3	0	0.008		-0.009	
Risk-adjustment variables are included.									
Length of stay (LOS)	-0.017	0.046	0	0	0	0.012		-0.027	**
Log of LOS	-0.002	0.008	0	2	1	0.002		-0.003	**
Number of procedures	-0.002	0.013	0	1	0	0.007		0.008	
Total charges	-152.9	436.2	0	2	1	530.9		-322.0	
Log of total charges	-0.002	0.014	1	4	0	0.004		-0.002	

Note: (1) See *Notes* (1) and (2) under Appendix Table 4. (2) The last two columns repeat estimates from Table 5 for comparison.

Appendix Table 6: Effects of Placebo Laws on Treatment Intensity, Mental Illness Admissions

	Distribution of the coefficients of the placebo laws		Number of coefficient estimates that are significant in the placebo law regressions (out of 11 estimates for each row)			Estimated effects in the main specification		
	Mean	Standard deviation	1% level	5% level	10% level	Enactment effect (2010 Q2-Q3)	Implementation effect (2010 Q4-)	
Risk-adjustment variables (including individuals' demographic characteristics) are excluded.								
Length of stay (LOS)	0.019	0.196	0	0	0	-0.147	-0.129	
Log of LOS	0.001	0.017	0	0	1	-0.011	-0.015	
Number of procedures	0.001	0.016	1	1	0	-0.007	0.008	
Total charges	63.9	357.6	0	1	0	-130.6	-297.7	
Log of total charges	0.003	0.024	0	1	0	-0.005	-0.003	
Risk-adjustment variables are included.								
Length of stay (LOS)	0.026	0.238	0	0	1	-0.154	-0.160	
Log of LOS	0.002	0.016	0	1	0	-0.011	-0.018	**
Number of procedures	0.001	0.016	1	1	0	-0.008	0.008	
Total charges	79.7	399.6	0	1	1	-150.2	-362.6	*
Log of total charges	0.004	0.023	1	1	2	-0.006	-0.008	

Note: (1) See *Notes* (1) and (2) under Appendix Table 4. (2) The last two columns repeat estimates from Table 6 for comparison.