Working Report

Health Insurance and Workers' Compensation Claiming

Evidence from the Affordable Care Act

Philip Armour, Prodyumna Goutam, and Paul Heaton

RAND Institute for Civil Justice

WR-1153
August, 2016

For more information on this publication, visit www.rand.org/pubs/working_papers/WR1153.html

Published by the RAND Corporation, Santa Monica, Calif.

Preface

This report analyzes the impact of health insurance expansion on treatment and billing for medical care received through the workers' compensation (WC) system, drawing on the experience of California, Florida, New Jersey, and New York during the Affordable Care Act's dependent coverage expansion in late 2010. It should be of interest to stakeholders involved in state WC systems, including legislators, insurance regulators, WC insurers, attorneys, and academic researchers. The research was funded in part by generous contributions from Casualty Actuarial Society (CAS) and the RAND Institute for Civil Justice (ICJ). It continues a sequence of work on the effects of ongoing health care reform on the no-fault insurance system.

The RAND Institute for Civil Justice (ICJ) is dedicated to improving the civil justice system by supplying policymakers and the public with rigorous and nonpartisan research. Its studies identify trends in litigation and inform policy choices about liability, compensation, regulation, risk management, and insurance. The institute builds on a long tradition of RAND Corporation research characterized by an interdisciplinary, empirical approach to public policy issues and rigorous standards of quality, objectivity, and independence.

ICJ research is supported by pooled grants from a range of sources, including corporations, trade and professional associations, individuals, government agencies, and private foundations. All its reports are subject to peer review and disseminated widely to policymakers, practitioners in law and business, other researchers, and the public.

ICJ is part of RAND Justice Policy within RAND Justice, Infrastructure, and Environment, a division of the RAND Corporation dedicated to improving policy- and decisionmaking in a wide range of policy domains, including civil and criminal justice, infrastructure protection and homeland security, transportation and energy policy, and environmental and natural resource policy. Questions or comments about this report should be sent to the project leader, Philip Armour (Philip_Armour@rand.org). For more information about the RAND Institute for Civil Justice, see www.rand.org/icj or contact the director at icjdirector@rand.org.

Health Insurance and Workers' Compensation Claiming: Evidence from the Affordable Care Act *

Philip Armour
Prodyumna Goutam
RAND

Paul Heaton
University of Pennsylvania and RAND

August 28, 2016

Abstract

Despite the fact that the U.S. workers' compensation (WC) systems provides tens of billions of dollars in medical care each year, relatively little is known about how changes in health insurance availability affect the incidence and nature of WC claims, and the theoretical relationship is ambiguous. In this paper, we exploit the Affordable Care Act (ACA) young adult dependent coverage expansion to measure the effect of health coverage expansions on WC claim frequency and severity. Using millions of hospital records drawn from four large states with distinct WC systems and a difference-in-differences research design that contrasts WC claims across narrow age bands, we find that a 10 percentage point reduction in uninsurance in the target population was associated with a 6%-9% drop in WC bills, with this decrease driven by harder-to-verify conditions, such as strains and sprains, as well as more expensive WC claims. These results suggest that the ACA coverage expansions may serve to broadly, albeit modestly, lower costs in the WC system.

*The research was funded with the generous support of the Casualty Actuarial Society (CAS) and the RAND Institute for Civil Justice. The content of the paper is solely the responsibility of the authors. The authors can be reached at Philip_Armour@rand.org, Prodyumna_Goutam@rand.org, and pheaton@law.upenn.edu.

1 Introduction

Changing features of the US health care system, most notably the provisions included in the the Patient Protection and Affordable Care Act (ACA), have the potential to affect the cost and composition of medical care in a broad array of settings. Many of these effects are intentional; however, due to its broad scope, the ACA may have additional, unintentional implications for products, services, and markets that are not a direct focus of the ACA, yet nonetheless interact with the US health care system. This paper focuses on one such system: the workers' compensation (WC) system, a component of the liability system which provides wage and medical benefits to injured workers.

Stakeholders in the WC system largely agree that health care reform measures like the ACA may greatly influence utilization of WC medical benefits, but there has been no broad consensus on the magnitude or even direction of the likely impacts of reform. Moreover, the limited research literature on this topic draws mostly qualitative conclusions or focuses on a single state, highlighting the considerable uncertainty that exists regarding reform's future impacts across the entire US. In this paper, we provide some of the first rigorous evidence demonstrating how increased health insurance availability and coverage under the ACA affects medical claims within WC across a range of state environments.

The paucity of evidence linking health insurance to WC can be explained by both data and estimation constraints. On the data side, datasets that co-mingle information about both health insurance status or claim activity and WC claims are relatively uncommon in WC research, in part reflecting the absence of large, publicly available datasets of WC claims. Additionally, separating the impacts of health insurance from other factors likely to affect WC claim frequency and severity is challenging as an estimation problem. The most intuitive approach, comparing the WC claim experience

of workers with and without health insurance, is likely problematic because health insurance status is likely correlated with industry, employer, or job characteristics, many of which may be unobserved, that also affect the risk of workplace injury.

In this paper, we address both problems using a large dataset with millions of individual treatment records, and exploiting the the ACA's expansion of dependent coverage that was limited to young adults under 26. Under a provision of the ACA implemented in 2010, firms that offer dependent coverage are required to allow employees' children to stay on their health insurance until the age of 26. We first demonstrate using survey data that this ACA provision appreciably decreased the uninsurance rate, but that this impact was specific to individuals under age 26. Using over 17 million State Emergency Department Data (SEDD) and State Inpatient Data (SID) hospital records from four large states, we then examine whether the number or nature of WC-related treatment episodes changed for 26-28 year-olds relative to 23-25 year-olds after 2011 using a differences-in-difference analysis. Intuitively, absent a policy intervention we not expect important shifts in the occupational injury risk profiles for 25-year-olds relative to 26-year-olds in 2011, but there was a shift in health insurance coverage. To the extent that we observe measurable changes WC claims, this seems likely attributable to the ACA coverage mandate.

After the ACA's dependent coverage expansion, we find a statistically significant reduction in WC bills. Furthermore, the magnitude of our estimated effect is economically significant, with a 1% reduction in uninsurance equating to a .8% decrease in WC claim frequency and a roughly 1% decrease in overall WC claim costs, meaning that future health coverage expansions could be an important moderating force affecting WC outlays. We also show that these changes are driven by harder-to-verify conditions such as strains and sprains, demonstrating that changes to the private health insurance marketplace carry potential to shift not only the number of WC claims, but also the types of claims presented.

A number of additional analyses bolster the evidence that the impacts we document reflect the causal effect of health insurance coverage expansions. We show that the dependent coverage expansion did not affect the total number of ED hospitalizations, indicating that our results are not likely to reflect obvious forms of sample selection.[1] We demonstrate a "dose-response" relationship across states–in Florida, which was impacted much less by the ACA coverage mandate than the other states, due to a pre-existing state requirement, there was a much smaller decline in WC bills. We also show that the timing of the shift in WC billing strongly favors that ACA coverage mandate as an explanation, and that there are not measurable differences by age in WC billing rates in a placebo analysis focusing on the pre-ACA period.

A major contribution of this paper is its estimation of the relationship between health insurance coverage and WC claims across four populous states: California, Florida, New Jersey, and New York, each of which has a distinct WC system. The fact that we observe impacts of health insurance across four large states bolsters confidence that the ACA is likely to generate modest but widespread impacts on WC throughout the U.S., although the exact effects may vary depending on pre-existing features of state WC markets.

The findings of these analyses present important evidence suggesting that health care reform may reduce WC billing volume and costs. Important questions do, however, remain. First, only hospital care was considered; whether these results translate to other care modalities, such as outpatient visits or pharmaceutical prescriptions, remains to be seen. Second, only the short-run impacts of reform were assessed. Third, additional outcomes likely to be of interest to stakeholders, such as worker health or quality and appropriateness of treatment, were not considered. Despite these limi-

[1] Although general health care expenditures have consistently been shown to increase with greater health care coverage (Lohr et al. 1986), the decision of whether to visit an emergency department, at least among young adults, does not appear to be sensitive to availability of health insurance (see the discussion in the analysis section for a thorough review of analyses of young adults' usage of ED care after the ACA dependent coverage expansion).

tations, however, the results provide important evidence that health care reform may generate spillover effects on non-health insurance lines such as WC and provides insight as to factors that mediate these spillover effects for different states.

Section 2 provides brief background on the U.S. workers' compensation system and the market characteristics of the states examined in the paper. Section 3 discusses dependent coverage legislation and reviews the limited prior works assessing the effect of health insurance on WC claims. Section 4 describes this study's data and methodology; Section 5 presents results; and Section 6 concludes and discusses implications for the effects of the broader ACA expansions on the WC system.

2 Workers' Compensation Systems

WC insurance pays medical bills and replaces lost wages for employees who are injured during the course of employment. In exchange for being able to receive WC benefits, workers cannot sue their employers for negligence. Thus, WC insurance replaces the tort system, which traditionally serves to assign fault and provide compensation in the event of injury, with an administrative system. WC subsidizes a worker's full injury-related medical costs from the day of the injury and also provides earnings replacement for lost time (generally subject to a waiting period of three to seven days), and is nearly universally funded through either insurance premiums collected from employers that are calculated based upon the size of their workforce and other rating factors, or through direct self-financing by the employer itself. WC insurance is regulated at the state level, and benefits to injured workers are set by the state. In contrast to other social insurance programs in US, WC is entirely under the control of states with little to no federal intervention.

Notwithstanding the decentralized nature of WC, most states share certain similarities in the functioning of WC programs. For example, all states except Texas and

Oklahoma mandate WC insurance coverage for private-sector employers, and for nearly all workers wage replacement is capped at some level below full replacement. At the same time, states also differ markedly in some specific characteristics of the program such as the fee schedule in place for reimbursement of medical services, limitations placed on medical treatment, and responsibility for choosing the physician to initiate treatment. (WCRI 2014)

Although some states restrict injured workers' choice of physician, a majority of states allow injured workers to choose their own medical providers. While WC pays for medical care immediately after an injury occurs, injured workers become eligible for income replacement benefits after missing 3-7 days of work, dependent on the state. The injured workers' weekly cash benefits are a function of their weekly earnings subject to a maximum that varies across states.[2]

For thorough overviews of WC, refer to Sengupta and Baldwin (2015) and Utterback et al. (2014). In their summary of WC spending, Sengupta and Baldwin (2015) note that $30 billion was paid to cover injured workers' medical expenses through WC in 2011. They also note that the majority of WC cases (around 76 percent) are medical-only cases and do not involve payments for missed work. Although $30 billion is small compared to 2011's total medical spending of $2.7 trillion, the amount makes up a large percentage of WC costs. According to Sengupta and Baldwin (2015), the share of medical benefits as a percentage of the total amount paid to workers has risen from around 30 percent in the early 1990s to approximately 50 percent in 2011. As many people with work-related injuries do not file for WC, the medical cost of work injuries is higher than total WC medical costs. Leigh (2011) estimates that the true medical cost of work-related injuries in 2007 was $60 billion and that the total cost of work-related

[2]Previous research has studied how claiming behavior responds to a variety of incentives, such as benefit levels and anti-fraud measures. For examples, refer to Boden and Ruser (2003),Bronchetti and McInerney (2012), Guo and Burton (2010), Hansen (2016), Meyer et al. (1995), and Neuhauser and Raphael (2004).

injuries in 2007 was $250 billion, which was more than the cost of cancer, coronary heart disease, and stroke.

For the four states considered in our analysis, medical benefits represented a significant portion of total benefits paid. In 2013, medical benefits represented 51 percent of total benefits paid in New Jersey, 67 percent in Florida, 33 percent in New York, and 55 percent in California (Sengupta and Baldwin 2015). States also vary in the structure of WC insurance markets–while private commercial insurers dominate in all four states, 13.3% of workers in California and 26% of worker's in New York are covered through public or quasi-public insurance funds of last resort. There are no state funds in Florida and New Jersey, so in these states, firms either are covered by private carriers or self-insure.

Relative to California and Florida, both New York and New Jersey offer medical providers substantially more generous reimbursements for medical care furnished under WC. Appendix Table A-1 reports prior estimates of WC system reimbursement rates as a percentage relative to Medicare for each state; New Jersey in particular has no set fee schedule meaning that providers are free to request reimbursement of full list charges from WC carriers. If WC claim frequency or severity is shaped largely by the relative generosity of WC, we might expect to see less of a response to expanded dependent coverage in New Jersey and New York than California and Florida.

3 Dependent Coverage and Effects of Health Insurance in Workers' Compensation

The Patient Protection and Affordable Care Act (ACA), signed into law on March 23, 2010, marks a notable development in the broader effort to reform the U.S. health care system. The ACA arose in the wake of initiatives in several individual states,

most notably Massachusetts, to enact comprehensive health care reforms that would expand the availability of coverage, increase quality, and lower costs. Although there is widespread agreement among stakeholders in the WC system that health care reform measures more broadly and the specific reforms in the ACA will likely affect the cost and composition of medical care received under WC, there is no broad consensus as to the magnitude or even direction of likely impacts of reform. The limited research literature on this topic (e.g., Eaton 2010; Casualty Center 2010) draws mostly qualitative conclusions and highlights the considerable uncertainty that currently exists regarding reform's future impacts.

Although the ACA enacts changes to a broad range of regulations governing access to and provision of health care, of particular interest are the provisions of the law designed to increase access to health insurance and expand coverage. Major coverage expansion elements of the ACA include the dependent coverage expansion, individual and employer mandates, Medicaid expansions, establishment of state or federally-managed health insurance exchanges for those needing to access the individual and small-group health insurance market, and provision of exchange subsidies for low-income individuals and families.

Theoretically, expansions of access to health insurance may impact WC costs through a number of channels. First, WC and private health insurance might act as substitutes (Auerbach et al. 2014). In the absence of private health insurance, individuals might have an incentive to treat their non-work related injuries through the WC system. Consequently, the expansion of private health insurance would serve to reduce WC claims as well as costs. Alternatively, employees might regard filing WC claims as a nuisance (and possibly damaging to the employer-employee relationship) and, if given the option of using private health insurance, might elect to treat their work-related injuries through their private insurance. If this behavior occurs, then coverage expansions might similarly serve to reduce WC claims and costs through this mechanism.

There is also the possibility that the ACA might increase WC costs. Since the ACA is expected to reduce Medicare and private reimbursement rates (representing a potential loss of revenues to providers), healthcare providers might seek to generate additional revenue, either by more aggressively seeking to bill care to WC when it provides more generous reimbursement than other payers[3], or by providing additional procedures to patients covered by WC. The former behavior might serve to increase both claim frequency and severity, while the latter mechanism - referred to in the WC insurance industry as "cost shifting" and called "induced demand" by health economists - would primarily affect claim severity.

Improvements in access to health care could also have indirect effects on WC to the extent that they alter the employment patterns of those who are newly covered. For example, if workers with lower tenure are more likely to be involved in accidents, and health insurance expansions lower average tenure by decoupling employment and health insurance and reducing "job-lock,"[4] freeing workers to more easily change jobs, expansions might increase WC claim activity. Similarly, if coverage expansions increase the relative attractiveness of work in industries that tend to not offer health insurance benefits, and workers in such industries are disproportionately prone to accidents, greater coverage might spur more claim activity. For the particular intervention we study, the ACA dependent expansion, evidence to date does not suggest significant employment effects, but research is ongoing (Bailey and Chorniy 2016; Bailey 2013; Heim et al. 2014).

The welfare implications of expanding coverage also depend in part on which, if any, of the above mechanisms dominate. If substitution predominates, for example, the effect of is primarily distributional as care shifts from one payer (WC) to another

[3]This could be accomplished by, for example, more carefully auditing patient records to identify care episodes that were attributable to workplace causes.

[4]Fairlie et al. (2016) provide some empirical evidence in favor of the job-lock hypothesis in the case of unemployed workers.

(private health insurance), whereas if induced demand is significant, there may be real welfare losses as extra resources are inefficiently applied to treat WC patients.

Empirically, a number of studies have examined the link between having access to health insurance and WC claiming behavior. Card and McCall (1996) analyze the impact of access to health insurance on the so-called "Monday Effect" (the observation that employees are more likely to file WC claims for easy-to-conceal injuries such as strains and sprains on Mondays). If employees treat WC and private health insurance as substitutes then those without medical insurance should be more likely to claim "Monday" injuries. The results suggest no difference between employees with and without insurance coverage when it comes to Monday filings. More recently, Lakdawalla et al. (2007) examine the link between an employer offering health insurance and the likelihood of filing WC claims using data from the National Longitudinal Survey of Youth. They find a significant positive link between an employer offering health insurance and individual propensity to file health insurance. Their results suggest that employers who offer health insurance might be more amenable to workers filing claims (perhaps due to reduced stigma).

In line with our analysis, Heaton (2012) analyzes the impact of the Massachusetts Health Care Reform of 2006 on WC claims using emergency and inpatient data from the state. The study demonstrates that WC bills decreased below the expected level given the medical and demographic characteristics of the patient population, and that this decrease coincided with the timing of the implementation of coverage expansions in the state. It also demonstrates that areas of the state less impacted by the reform had correspondingly less movement in WC billing activity. Overall, the study finds the Massachusetts health care reform reduced the number of ER and inpatient bills by 5 to 10 percent and had a negligible impact on charges and treatment volume. While the study addresses the issue of how an expansion of insurance coverage affects WC claims, there are two potential limitations to the generalizability of the results: first, MA is

a relatively small state and somewhat of an outlier on both WC benefit generosity and injury rates, the results from Massachusetts may not generalize to other states with different industry mix or WC systems, most notably those with more generous reimbursement rates and fee schedules. Second, the time period considered in the analysis coincides with the onset with the Great Recession starting in December 2007, which may affect the external validity of the estimates with regard to the ACA's implementation.

This paper focuses on the earliest of the ACA's coverage expansion reforms targeting dependents of individuals with employer-sponsored health insurance. As of September 23, 2010, the ACA mandated that employers had to allow young adults to stay on their parents' health insurance until the age of 26 beginning with the next renewal date of their plans. Research has found that extending dependent coverage was successful in raising coverage for young adults (Antwi et al. 2013; O'Hara and Brault 2013). Overall, for people ages 19 through 25, the likelihood of having employer-sponsored health insurance as a dependent rose by 7 percentage points, while the likelihood of having any health insurance rose by about 3 percentage points. Sommers et al. (2013) find that less healthy young adults were more likely to sign up for dependent coverage and that this increased coverage has led to increases in the usage of health services for young adults. If these less-healthy individuals are considering using WC in the absence of health insurance coverage, expanding coverage may disproportionately reduce WC costs.

Many states extended dependent coverage in the decade before the ACA went into effect. In our sample of four states, Florida, New York and New Jersey all provided some form of dependent coverage prior to the ACA (Cantor et al. 2012). However, research has found that the effects of states extending dependent coverage on overall health insurance were small compared to the effects of the ACA because many who took advantage of extended dependent coverage were students, and the effects of these

coverage laws developed over many years (Dillender 2014; Levine et al. 2011; Monheit et al. 2011). The ACA dependent care expansion, in contrast, had immediate and large effects, likely because it was well-publicized and broader than most state-level laws, extending to self-insured employers and including married young adults. Antwi et al. (2013) find no evidence of differential effects of the ACA's dependent coverage mandate between states with and without prior dependent coverage. As most states passed their dependent coverage laws in the few years before the ACA was enacted, this finding is consistent with no early effects of state-level dependent coverage.

To illustrate the impact of the dependent coverage expansion, Figure 1 shows the fraction of American Community Survey (ACS) respondents without health insurance by age in 2009, before the dependent coverage expansion, and in 2012, after the dependent coverage expansion's full implementation but prior to implementation of other ACA provisions such as the individual mandate, insurance exchanges, and Medicaid expansions. Although the rate of uninsurance is largely equal across these years for those under 18 and and over 26, there is a marked decrease in uninsurance rates for the age band affected by the dependent coverage expansion.[5] Nationally, this difference represents approximately a quarter of the uninsured young adult population for those in their early- to mid-20s, or about 7 percentage points for those age 23 to 25 (Antwi et al. 2013).

To assess the impacts of the ACA dependent care expansion in the states that are the focus of this analysis, we estimated differences-in-difference regressions using the single year Public-Use Microdata Sample (PUMS) American Community Surveys (ACS) published by the Census Bureau for 2007 through 2012. Consistent with our analysis below, we focused attention on those ages 23 to 28. Here the outcome is whether a particular individual has health insurance, and our regressions control for

[5]The large increase in uninsurance at age 19 occurs because individuals previously eligible for state children's insurance programs age out at the age of majority.

age and year fixed effects, with the impacts of the reform measured using interaction terms for those below age 26 in 2011 and later. Table 1 shows the change in likelihood of being uninsured for each state in our analysis. Although in California, New Jersey, and New York the uninsured share of the target population dropped by about 6 percentage points (or between 19% and 26%), in Florida, the state with the strongest pre-existing dependent coverage legislation, there was only a 1 percentage point or 3% drop. These estimates are precise and highly statistically significant.

Our analysis of ACS data generates results consistent with prior work demonstrating that the dependent care coverage expansion was effective at shifting a non-negligible fraction of the uninsured young adult population to coverage through private health insurance.

The study most closely related to ours is Dillender (2015). The study examines the impact of the ACA dependent coverage provision on WC claims and bills in Texas. The age 26 cutoff provides a natural discontinuity to examine the impact of expanding insurance access on WC. Comparing those above 26 to those below, the study finds that the 10 percentage point difference in insurance coverage between 25 and 26 year olds post-ACA leads to a 15% decrease in the number of WC bills. While this study provides valuable insights regarding the health insurance/WC link, Texas represents a fairly unique setting for examining this question for several reasons. First, Texas is one of only two states where WC is not mandated, meaning that employers are self-selecting to be a part of the system. Given the importance of employer characteristics in driving WC claiming behavior noted in Lakdawalla et al. (2007), this could present some challenges to the broader applicability of the estimates. Second, Texas already had pre-existing state dependent coverage (Cantor et al. 2012) which might further constrain the extent to which the results from the state can be translated to other states without pre-existing dependent coverage such as California.

Overall, there is strong reason to suspect important effects of health insurance

expansion on WC claims, although the consistency of these effects across states and well as the types of WC claims affected are as-of-yet unanswered questions.

4 Data and Methodology

Our primary data are drawn from the State Emergency Department Data (SEDD) and State Inpatient Data (SID) files for California, Florida, New Jersey, and New York,[6] which are collected by the Agency for Healthcare Research and Quality's Healthcare Cost and Utilization Project (HCUP). The SEDD contains abstracted patient discharge records for ED visits that do not result in an outpatient observation stay or an inpatient admission. The SID contains abstracted patient discharge records for inpatient stays, as well as whether these inpatient stays began as ED visits. For each state, we combine the two datasets together to construct an analytic file that covers the near universe of hospital treatment episodes originating in the ED. Appendix Table A-2 demonstrates that the vast majority of hospitals in each of the four states we examine are covered in the data. We omit SID records that do not originate in the ED from this analysis.[7]

The data include information about the time and month of each visit, demographic characteristics of the patient, 3-digit ZIP code of the hospital, diagnoses codes, medical procedures performed, billed hospital charges, identity of primary and secondary expected payers for care, if any, and patient disposition.[8] The payer codes included on each patient record identify the payer billed by the hospital for each patient's care, for

[6] Although data are from 2007-2012 visits for Florida, New Jersey, and New York, California stopped releasing SID and SEDD files in 2012, so the California analysis uses years 2005-2011.

[7] We include all hospitals in the SID and SEDD for these states in the sample windows in question; however, a small number of hospitals show large changes in certain data fields due to idiosyncratic or systematic transcription errors as well as record keeping changes. Such outlier changes do not appear to affect our measure of WC charges, however, and we have conducted a range of robustness checks with different exclusion criteria with no corresponding changes in our results.

[8] Note that California has a smaller set of variables available; it does not include the total of each hospital charge nor 3-digit ZIP codes; California and Florida both do not include month of admission for the entire sample.

example, Medicaid, Medicare, WC insurers, specific private health insurers (such as TRICARE or Blue Cross), or self-pay (in the case of individuals without insurance). Because we relied on hospital rather than claim data to be able to make comparisons with treatment and billing patterns for patients covered by payers other than WC, our unit of analysis was a WC bill rather than a WC claim. However, since insurers will typically not reimburse bills received from hospitals or other medical providers without a corresponding claim filed by a worker, a high correlation between WC bills and WC claims can be expected, although it is common for multiple treatment episodes to be contained within a single claim.[9]

The main advantage of the HCUP data is that they provide a complete picture of emergency hospital care in these four states both before and after the dependent coverage expansion was implemented, and contain considerable detail regarding patient characteristics and payers. Moreover, they cover care received not only through WC, but also other payers. However, an important disadvantage of hospital data is that they exclude some types of medical care - such as chiropractic visits, most pharmaceutical prescriptions, and psychiatric care - that are argued to be important recent cost drivers in WC (see Heaton (2012) for a further discussion of how hospital data diverges from medical care more broadly in the WC context). Moreover, there are important differences between care offered in hospital and in non-hospital settings that may affect the interaction between billing incentives and health care reform. For example, in non-hospital settings, patients exercise considerably more autonomy over what and how much treatment to pursue, and some non-hospital providers obtain significant fractions of their total revenue from WC. These differences counsel significant caution in

[9]Although our data records the payer initially billed by the hospital, it does not capture whether this billing is eventually denied or subrogated. The latter in particular is a concern for measuring the ultimate shift in cost borne by WC versus health insurance due to coverage expansion. Such an analysis is outside of the scope of the current paper, given the substantial data requirements, but is an area for future research when estimating how much shifting of costs occurs after the ED visit, and in particular, if there is a systematic change in subrogation efforts and corresponding administrative costs for each party.

extrapolating this study's findings to the broader universe of medical care provided by WC. Given that care received in emergency situations may be less elective than other forms of care, it seems reasonable to expect that the effects we estimate, if anything, might be lower than those that would be observed for care in other settings.

While our inability to look beyond the hospital represents an important limitation of the study, hospital care does account for a sizable fraction of WC medical costs. Recent estimates suggest that 40 percent of WC claims include ER charges; and Lipton et al. (2009) find that hospital costs account for almost one-third of total costs in the largest WC claims and about 20 percent of overall medical costs. The HCUP data include information about billed hospital charges but not the actual amounts received by hospitals from payers, which usually differ from billed charges because providers often negotiate discounts with particular insurers or there is a fee schedule in place. Table 2 presents summary statistics describing the basic attributes of patients included in the HCUP data. Across these four states, WC claims account for approximately 3% of ED visits. Visits billed to WC are disproportionately simpler (fewer diagnoses) and cheaper (lower charges), more likely to involve male patients, and less likely to be on the weekend or result in an inpatient admission.

5 Analysis

To estimate the impact of the coverage expansion on WC billing patterns,[10] we use a difference-in-differences identification strategy. Young adults ages 26-28 are likely to have approximately similar underlying health conditions and similar jobs as those aged 23-25. Thus, once we account for pre-existing differences in WC billing across

[10]Note again that the analysis in this paper is focused on *medical* WC billing and analyses of health insurance expansion's effect on time-loss WC claims is outside its scope due to data limitations. Furthermore, we cannot distinguish between changes in extensive margin WC claims vs. intensive margin WC claims, only the extent to which hospital medical care was billed to WC.

groups, the experience of the older group beginning in 2011 is likely to provide a useful counterfactual for what would have happened to the younger group, absent any coverage expansions. In particular, to the extent that there are unobserved factors that change within states that might affect WC claim patterns - for example, new WC regulations or legal decisions, shifts in the state's industrial mix, or developments in WC insurance markets, etc. - there is no strong reason to believe that impacts would be different for 26-28 year olds versus 23-25 year olds. Using 26-28 year-olds as a comparison group thus furnishes a way to potentially control for such unobservable factors. In order for the differences-in-differences analysis to recover the causal effect of the coverage expansions, we must assume that there are no unobservable factors that differentially impact 26-28 year olds beginning in 2011. We implement the differences-in-differences analysis via the following linear probability model regression equation:

$$P(Visit_{it} = WC) = \beta(year_t >= 2011)X(age_{it} < 26) + year_t + age_{it} + \Gamma X_{it} + \epsilon_{it} \quad (1)$$

The unit of observation is an emergency hospital care episode, and the outcome variable is an indicator for whether the visit is charged to WC.[11] In our estimates of Equation 1, we control for both year and age fixed effects as well as a range of demographic and other controls (Γ), including diagnosis, race, gender, hospital fixed effects, time of day, weekend admission, month of year, and age-specific, annual unemployment rates for each state.[12] Additionally, for New Jersey and New York, the county of residence of the patient is reported, allowing us to include county-level unemployment rates provided by the Bureau of Labor Statistics.[13] The coefficient of interest, β, measures the change

[11]Some states report multiple payers, so this variable corresponds to any of these payers being identified as WC

[12]We calculated these unemployment rates for ages 23-25 and 26-28 separately for each state using the CPS ASEC supplements for our sample window in question.

[13]For all analyses, the results are not sensitive to the inclusion or omission of either one of these labor force measures.

in the probability that a care episode is billed to WC.[14] Reported standard errors are clustered at the hospital level.

To properly interpret our estimates of β as capturing changes in WC claim/bill frequency, we must know whether the dependent coverage expansion affected the likelihood of visiting the ED in the short term. At a theoretical level, the expected coverage/ED visit relationship is ambiguous - if ED visits operate like a normal good, lowering the price by providing insurance is likely to increase the quantity utilized.[15] However, if the previously uninsured receive better preventative care through office-based physician visits after gaining coverage, this preventative care might preempt later ED visits. Prior research on changes in ED visits by 25 and under individuals after the ACA dependent coverage expansion are mixed: Mulcahy et al. (2013) specifically study changes in the *fraction* of ED visits, determining that there was a sizable drop in the share of uninsured visits and a corresponding rise in the share of privately covered visits. Jhamb et al. (2015) examine a range of medical care changes for young adults affected by the ACA dependent coverage expansion, and although they find greater likelihood of contact with doctors, specifically with regard to office-based visits, they find no change in the likelihood of visiting the ED. Perhaps the most relevant study, Hernandez-Boussard et al. (2014), estimates the effect of the ACA dependent coverage expansion on the number of ED visits in three states - California, Florida, and New York - finding a 1.5% decline among the treated group. However, both this finding and the other notable study finding a decline in ED visits among newly covered young adults, Antwi et al. (2015) which found an even lower decline of under a 1% drop in ED visits, may be biased toward false positives, as noted in Slusky (2015). Namely, inclusion of wider age bands from 19 to 30 can contaminate the treatment effect with

[14]The results presented below come from linear probability models; logit analysis yields qualitatively and quantitatively similar results.

[15]The Oregon Medicaid Experiment provides evidence consistent with this view (Finkelstein et al. 2011).

systematically different labor market trends across these age groups. Of even more concern is that Hernandez-Boussard et al. (2014) estimates the largest drop in Florida, the state that had the weakest treatment due to its strong pre-existing dependent coverage law. Despite these methodological concerns, if these estimated drops in ED visits are spread equally across all potential payers, our preferred estimates would be only minimally reduced. Furthermore, additional analyses in Tables A-4 and A-3 of the effect of log changes in overall WC ED visits and the share of WC ED visits provide broadly similar results as our main analysis. To assess whether the coverage expansions increased ED visits in our data, we estimate the following model at the hospital level:

$$log(Visits_{aht}) = \beta(year_t >= 2011)X(age_{at} < 26) + year_t + age_{at} + \alpha_h + \epsilon_{aht} \quad (2)$$

where $Visits_{aht}$ represents the total number of ED cases in hospital h for age group a in year t, and the unit of observation is an age/year/hospital cell. We control for year, age, and hospital fixed effects and cluster standard errors at the hospital level. Here, we estimate whether being exposed to the coverage expansion increases the likelihood of visiting the ED at all (coefficient β).[16]

Table 3 presents the results when we estimate equation Equation 2. None of the coefficient estimates is statistically significant or practically large, and the estimates are sufficiently precise so as to rule out changes in the number of visits of more than a few percentage points in either direction.[17] This analysis suggests that the ACA dependent coverage expansion did not measurably change the number of trips to the

[16]Note that although in both specifications 1 and 2, we refer to the treated period as beginning in 2011 for the sake of convenience, our analysis in fact assigns treatment status as of October, 2010, when the ACA dependent coverage takes effect. Furthermore, in our preferred specification in Table 4, we further omit March 2010-September 2010 from our analysis altogether due to possible contamination of our policy estimate by pre-implementation changes to coverage by insurers anticipating the enactment Antwi et al. (2013).

[17]Additional hospital-level analyses that estimated any effect on log total, age-specific hospital-level WC billings show similar results.

ED by those who gained coverage, which lessens concerns that estimates of Equation 1 would be affected by selection. This pattern seems consistent with an environment in which emergency hospital visits are largely non-elective, or alternatively, an environment in which the uninsured access the ED in similar ways as the insured due to the Emergency Medical Treatment and Labor Act (EMTALA)'s requirement that EDs accept all patients.

Table 4 presents our main results, in which we estimate Equation 1 separately for each state. The coefficient estimate of -0.00143 for CA, for example, means that after controlling for injury and patient demographics, the probability that a particular emergency hospital visit was billed to WC fell by 0.143 percentage points among those under age 26 following the dependent care expansion. Given that 2.8 percent of ED hospitalizations are billed to WC, this represents a 5.1% reduction in WC bills for the target group. This effect is highly statistically significant.

To interpret the magnitude of this effect and to compare across states, we note that in California, the rate of uninsurance for the affected group dropped 6.3 percentage points after the ACA dependent coverage expansion (Table 1). Rescaling this coefficent by a factor of $\frac{0.1}{0.063}$ provides an estimate of the change in WC bill frequency that would be expected from a 10 percentage point reduction in uninsurance. The final results row of 4 reports the change in WC bills corresponding to this 10pp reduction, which for California is 8.1%. Recent estimates (CBO 2015) indicate that, when fully implemented, the ACA's coverage expansion is expected to decrease the uninsurance rate for the adult population by about 10 percentage points compared to a baseline without the ACA.

For three of the four states considered in Table 4, there was a statistically significant decline in WC bills for the newly covered population. Florida provides an instructive contrast with the other states, because it experienced a much smaller change in coverage from the ACA dependent coverage expansion due to a pre-existing dependent care law.

If our statistical model is correctly identifying the impacts of health insurance on WC claim frequency, we might expect to observe a smaller change in WC bills there, because there was a correspondingly small coverage gain, and this is precisely what the data show. Although the point estimate for FL is not statistically significant, it is actually of comparable magnitude to the estimate for California when properly scaled to account for the small change in coverage there. Together, the results for Florida and California provide "dose-response" evidence consistent with the notion that Table 4 is capturing the effects of the ACA, because the response of WC bills is smaller when the dose of coverage expansion is lower. For the patterns in Table 4 to reflect the effects of omitted variables rather than the ACA, it would have to be the case that the omitted variables affected Florida differently from the other state in our sample, which seems implausible.

Table 4 shows that there are measurable reductions in WC claim frequency in New Jersey and New York as well among the newly covered group. After scaling, however, the estimate for New Jersey is smallest. While the precise reason for this difference remains unclear, one important difference between New Jersey and the other states in our sample is related to reimbursement generosity–evidence from the Workers' Compensation Research Institute (WCRI) (Appendix Table A-1) suggests that providers receive more generous reimbursements in New Jersey. One possibility is that WC claiming is "stickier" in states with more generous reimbursements, as providers may more aggressively seek to ensure that work-related injuries are properly attributed to WC.

In Table 5, we examine the robustness of these findings to alternative logical choices of sample and specification. For reference in row 1, we report the coefficients from our baseline, preferred specification from Table 4. Although controlling for predetermined factors such as patient diagnosis is likely preferable given the possibility that these could at least in theory change over time across groups, Specification 2 demonstrates that we

obtain similar results when we use a more limited set of controls, namely age, year, and hospital fixed-effects, and rely primarily on the differences-in-differences assumption of parallel trends in outcomes. Specifications 3, 4, and 5 demonstrate that, as we narrow the range of ages considered in our analysis–which likely lessens the possibility that the treatment and control age groups are differentially subject to uncontrolled factors that affect WC claims and, in the case of specification 5, omits 26-year-old young adults who may still be on their parent's plan depending on the structure of dependent coverage, but at the cost of having a smaller sample with which to identify impacts, we nevertheless find results consistent with our baseline specification, albeit statistically noisier. In specification 6, when we exclude the entire year 2010, which was the year in which policies transitioned to take into account to new requirement, we find statistically indistinguishable results from our Table 4 analysis.

As a way to test the validity of our assumption that 26-28 year-olds provide a good counterfactual for those aged 23-25, in the seventh specification of Table 5 we report coefficients from a placebo regression that limits the sample to hospitalizations occurring in 2009 and earlier, and codes "treatment" as occurring as of July 1, 2008. If there are unobserved factors that differentially affect the older age group over time, we might see an impact of this placebo policy change, but we see no such systematic or statistically significance difference, suggesting that the cross-age comparisons allows the differences-in-differences model to correctly control for unobserved confounds. We perform two additional placebo tests: first, we limit our analysis to 23 and 24 year-olds, and assign the 23 year-olds treatment status while the 24 year-olds act as our control. Both, in fact, were treated, and this specification provides correspondingly attenuated effects. Second, we conduct a similar placebo test on 27 vs. 28 year-olds, both of which are in fact controls, and find no effects.

As an additional means of assessing whether our regressions capture the causal impact of health insurance, in Table 6 we report coefficients from variants of the main

specification where the impact of the coverage expansions is allowed to change over time. Prior to 2010, there is no consistent or statistically significant differences in likelihood of WC charging across these age groups, but once the ACA dependent coverage expansion occurs, we find the statistically significant decrease in likelihood found in the overall analysis. The timing of these impacts strongly suggests that they were driven by the ACA rather than other uncontrolled factors.

We further estimate a treatment effect for each age separately in Table 7. Although we fail to statistically reject the hypothesis that effects do not vary across age in each of the states, the point estimates do appear to be consistently smallest for 25 year-olds compared to the younger treated patients. This pattern would be expected if younger adults are more likely to remain on a parent's insurance plan when they are newly able to do so. Indeed, when we plot the coefficient estimates from Table 7 against the age/state-specific change in health insurance coverage, estimated in a manner analogous to the regressions in Table 1, there is a strong positive relationship. As shown in Figure 2, the age groups that were most likely to gain coverage though the ACA experienced correspondingly larger reductions in WC bills, and the gradient across age/state groups (shown with a best fit line) suggests that a 10 percentage point decrease in coverage would be associated with a roughly 8 percent decrease in WC bills, very much in line with the estimates reported in Table 4.

Next, we decompose the effect of the dependent coverage on the type of hospital visit, defining four categories via ICD-9 codes: strains and sprains, open wounds, non-strain/sprain occupational injuries (back issues, crushing, burns, superficial injury/contusion, and other injuries due to external causes), and other. The first three categories cover over 75% of all ED visits charged to WC among the states in the years of our sample. They are also 3-5 times more likely to be billed to WC. Table 8 shows estimates of the treatment interacted with these conditions for each state, while controlling for all the covariates included in Table 4's analysis.

The consistently strongest treatment effect among these conditions and across states is the interaction with strains or sprains, which are often considered more difficult-to-verify conditions (Card and McCall 1996, Butler et al. 1996). These injuries may be more "marginal" from the perspective of the patient–absent other sources of reimbursement, patients could claim such injuries to be work related with little risk of detection, which is one reason that sprains and strains are commonly used as indicator of fraud (Bolduc et al. 2002). If young adults newly covered by their parents' plan are less likely to charge marginal injuries to WC, we might expect the decrease in WC bill frequency to be concentrated among these conditions.

We can also examine whether the types of bills that are exiting the WC system are more expensive than average. In other words, are the ED visits on the margin of being charged to WC relatively low-charge visits or high-charge visits? Our analysis thus far has focused on volume or claim frequency effects; if high cost or low cost patients are differentially affected by the reform, the young adult expansion may also have altered the average cost per bill, or claim severity.

To address this question, we fit a model of predicted charge size for each of the three states we have charge amount (Florida, New Jersey, and New York) separately in 2007. This model controls for diagnoses, hospital, time of day, weekend admission, calendar month, and age, but specifically excludes the payer. We then predict for every visit in our sample what the expected charge would be, given these characteristics, and then categorize these expected charges into quintiles, with the first quintile being the visits in the lowest fifth of expected charge amount, and the fifth quintile being the most expensive fifth of visits. Although the exact distribution differs across states, the vast majority of WC charges derive from the bottom three quintiles of charges, since based on diagnoses and the other observable characteristics used to predict the charge amount, visits charged to WC tend to be simpler and thus less expensive than the average overall ED visit. We then separately fit Equation 1, with all the covariates from

Table 4, for the patients belonging in each expected charge quintile in each state. The coefficients from these regressions tell us whether low cost patients respond differently to the ACA coverage expansion than high cost patients, after allowing the data to identify which patients are low and high cost. These results are reported in Table 9.

Given the small overall marginal effect in Florida, there are no strong effects by quintile, although the third and fourth quintile have the largest point estimates. In New Jersey, the overall effect appears to be driven by the second and third charge quintile. Given that fewer than 45% of the WC charge distribution is above the second quintile these are disproportionately expensive ED visits to the WC system. New York's overall effect is driven by declines at the second and fourth quintile, again representing more expensive WC visits. Because the overall effect is skewed toward the top of the charge distribution, the implication is that average cost per claim (claim severity) should also drop, meaning that the overall expected percentage decrease in WC claim costs would be greater than the decrease in the likelihood of charging to WC alone. In both New Jersey and New York, we expect total system outlays to decline by roughly 133% of the decrease in bill frequency due to these shifts in claim severity.[18]

These findings contrast with previous estimates (Dillender 2015) for Texas, where less expensive WC bills were displaced when health insurance coverage expanded. However, if less-healthy young adults are disproportionately more likely to be covered as a dependent, as suggested by some past research (Antwi et al. 2013), it would not be implausible for moderate- to large-sized ED hospital visits to be displaced by a coverage expansion such as that occurring under the ACA.

[18]This calculation of an additional 33% decline in payments derives from the average change in likelihood of charging in each quintile, weighted by the frequency of charging to WC at all in that quintile; if the overall decrease was equally spread over the entire quintile distribution, then the drop in total WC charges would be the same as the drop in likelihood of WC charging.

6 Discussion and Conclusion

This paper provides some of the first empirical evidence demonstrating the health insurance and workers' compensation can serve as substitutes in covering medical care for injured workers by showing that an exogenous shift in health coverage reduced WC bills. A significant contribution of this paper is its estimation of the relationship between health insurance coverage and WC claims across four separate states: California, Florida, New Jersey, and New York, each of which has a distinct WC system, market environment, and pre-existing dependent coverage requirement. The fact that we observe WC billing declines across a range of different market contexts suggests that the substitutability between health insurance and WC may be a more universal phenomenon. Moreover, the magnitude of the relationship we uncover is economically significant, with a 1% reduction in uninsurance equating to a .8% decrease in WC claim frequency and a roughly 1% decrease in overall WC claim costs, meaning that future health coverage expansions could be an important moderating force affecting WC outlays. We also show that these changes are driven by harder-to-verify conditions such as strains and sprains, demonstrating that changes to the private health insurance marketplace carry potential to shift not only the number of WC claims, but also the types of claims presented.

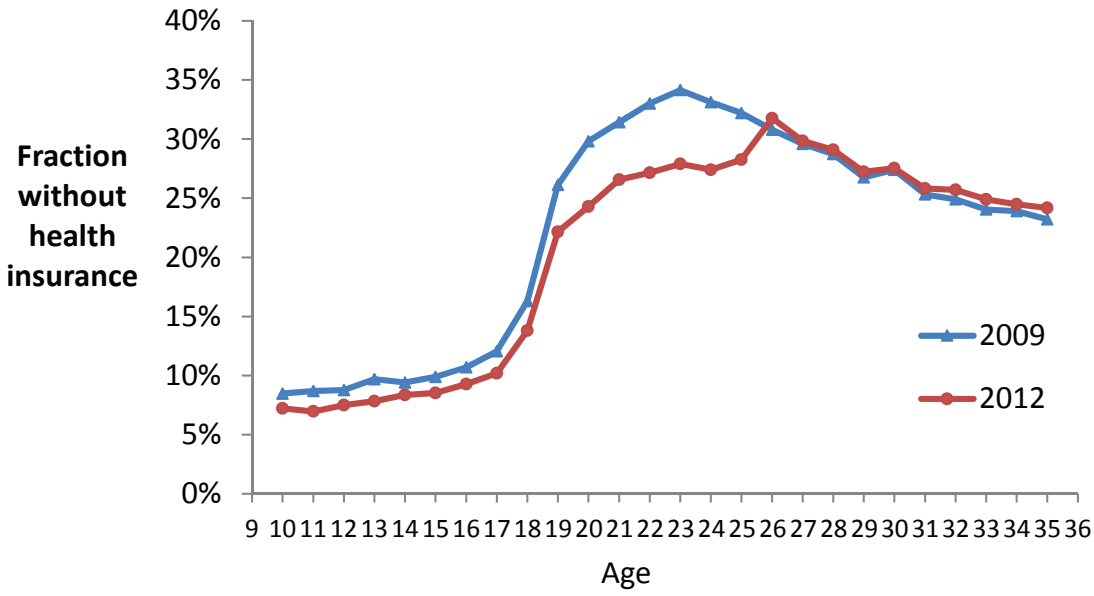
Whether the effects we document here would extend to the full suite of ACA-induced coverage expansions, and to other efforts to make health insurance coverage more universal remains an open question. Beyond the young adult mandate, the ACA seeks to expand coverage though Medicaid expansions, state- and federally-run insurance exchanges, and employer offer and individual purchase mandates. These other reforms differ from the young adult expansion studied here in two key dimensions that likely have implications for WC. First, future reforms will affect workers of different ages, who also possess a different occupational mix and health profile than young adults. Second,

the young adult expansion shifts individuals primarily into employer-based private health insurance, whereas other reforms will shift individuals into other types of health plans which may differ appreciably in their co-pay structure, generosity, and provider networks. The substitutability of health coverage and WC seems likely to depend on the convenience and cost of accessing insured care for patients; to the extent that these factors vary due to the types of coverage offered young adults versus other segments of the adult population, the results from this expansion may not generalize to the full suite of ACA reforms.

Our paper also focuses on one particular care setting–hospital care. While this represents an important component of the overall medical bill for WC, patients and providers may respond differently to the incentives introduced by a change in health coverage in the outpatient context. Moreover, it seems plausible that shifts in the propensity to file medical claims might also spill over into lost work claims (indemnity), but this study does not examine such effects. The research design we outline in this paper could be fruitfully applied to data on indemnity payments or non-hospital care to provide a more comprehensive portrait of the interplay between health coverage and WC claim frequency and severity.

Even if coverage expansions primarily serve to shift provision of care from the WC system to the private health insurance system without much changing the care that is ultimately received, such shifts are not without welfare consequences. WC and health insurance serve different goals, are regulated in very different ways, are subject to different legal rules and procedures, and entail costs borne by different segments of society. In considering changes to the private health insurance system, policymakers need to be cognizant that such changes can have spillover effects on other administrative and legal systems designed to handle injury.

Figure 1: Health Insurance Coverage by Age, 2009 and 2012



Source: Authors' calculations from the single-year 2009 and 2012 American Community Survey Public Use Microdata Samples.

Figure 2: Relationship Between Coverage Expansion and WC Billing by Single Year of Age

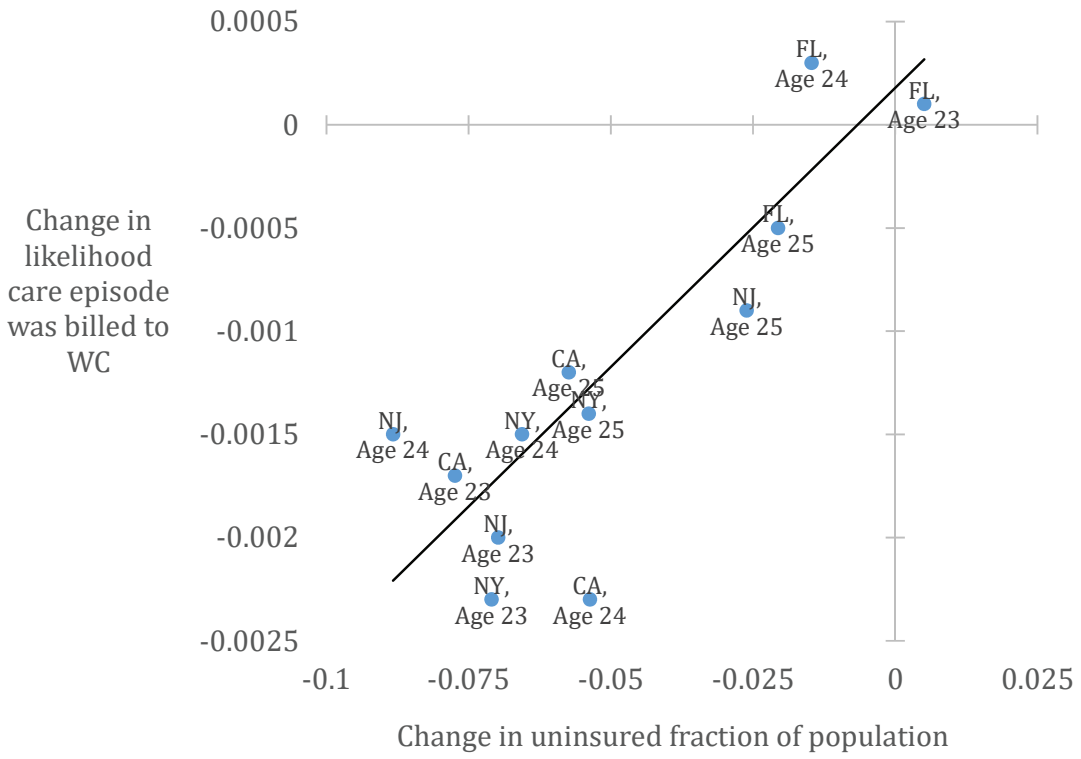


Table 1: Estimated Change in Likelihood of Being Uninsured Due to ACA Dependent Coverage Expansion By State, Young Adults Age 23-28, by State

	CA	FL	NJ	NY
Change for under 26, after 2011	-0.0628***	-0.0104***	-0.0604***	-0.0632***
	(0.000478)	(0.000750)	(0.00103)	(0.000623)
Fraction uninsured pre-2011	0.328	0.376	0.257	0.236
Implied % change	-18.9%	-2.8%	-23.5%	-26.8%
N	16,396,960	7,106,620	3,246,521	8,191,548
R^2	0.002	0.002	0.003	0.003

Note: This table reports differences-in-differences estimates from a linear probability model where the unit of observation is an individual, the outcome is a zero/one indicator for whether the individual is insured, and the explanatory variables are age dummies, year dummies, and an indicator for exposure to the dependent care expansion (¡26 years old in 2011 and later). Each column reports results from a separate regression. The sample includes individuals aged 23-28 observed in the 2007-2012 ACS PUMS samples. Robust standard errors in parentheses, *** p<0.01, ** p<0.05, * p<0.1

Table 2: Descriptive Statistics of Hospital Visits Originating in ED of Young Adults Age 23 to 28, By State

	California		New Jersey	
	All	WC	All	WC
Female	59%	33%	59%	31%
White	39%	39%	43%	59%
Insurance Type				
Medicare	3%	0%	2%	0%
Medicaid	26%	0%	13%	0%
Private	33%	0%	41%	0%
WC	3%	100%	3%	100%
None	28%	0%	39%	0%
Other	8%	0%	2%	0%
Average # diagnoses	2.08	1.61	2.18	1.70
Weekend	29%	25%	28%	21%
Inpatient admission	7%	3%	7%	2%
Average charge	n/a	n/a	$5,588	$3,287
N	6,703,853	178,508	1,976,385	50,172

	New York		Florida	
	All	WC	All	WC
Female	60%	34%	63%	36%
White	41%	62%	52%	61%
Insurance Type				
Medicare	2%	0%	3%	0%
Medicaid	28%	0%	28%	0%
Private	39%	0%	24%	0%
WC	3%	100%	2%	100%
None	26%	0%	41%	0%
Other	2%	0%	3%	0%
Average # of diagnoses	2.07	1.59	2.52	1.90
Weekend Billing	27%	20%	27%	24%
In-Patient Admission	11%	2%	8%	3%
Charges	$3,398	$1,745	$5,295	$3,467
N	4,753,271	150,340	4,749,320	77,729

Note: HCUP SEDD and SID Data, Age 23-28, 2005-2011 for CA, 2007-2012 for FL, NJ, and NY

Table 3: Changes in the Number of Emergency Department Visits Due to Dependent Coverage Expansion

	Log-Level of Total ED Hospital Visits			
	CA	FL	NJ	NY
Change for under 26, after 2011	-0.105	-0.054	0.042	-0.026
	(0.154)	(0.058)	(0.041)	(0.021)
Mean	-9.855	-6.392	-6.163	-6.996
N	13,700	7,719	3,516	7,993
R^2	0.873	0.959	0.967	0.955

Note: This table reports coefficient estimates from differences-in-differences regressions of the log total number of emergency department hospital visits per 1,000 individuals in the state of that age in that year, on an indicator for exposure to the ACA dependent coverage expansion. The unit of observation is an age/hospital/year cell, and all analyses include age, year, and hospital fixed effects, as well as age-specific, state-level unemployment rates calculated from the CPS ASEC. Each entry reports results from a separate regression. Standard errors, clustered at hospital level, in parentheses., *** p<0.01, ** p<0.05, * p<0.1

Table 4: Change in Likelihood of Emergency Hospitalization Being Charged to Workers' Compensation Due to ACA Dependent Coverage Expansion

	Likelihood Visit Charged to WC at All			
	CA	FL	NJ	NY
Change for under 26, after 2011	-0.00143***	-0.00026	-0.00129**	-0.00185***
	(0.000492)	(0.000249)	(0.000548)	(0.000507)
Control for:				
Demographics?	Yes	Yes	Yes	Yes
Age?	Yes	Yes	Yes	Yes
Year?	Yes	Yes	Yes	Yes
Hospital?	Yes	Yes	Yes	Yes
Diagnosis?	Yes	Yes	Yes	Yes
Weekend?	Yes	Yes	Yes	Yes
Age-Specific Unemployment Rate	Yes	Yes	Yes	Yes
County-Level Unemployment Rate	N/A	N/A	Yes	Yes
Hour of Admission?	N/A	Yes	Yes	Yes
Baseline Likelihood	0.028	0.027	0.035	0.034
Implied % Change	-5.1%	-0.9%	-3.7%	-5.4%
Projected % effect of 10pp decrease in uninsurance	-8.1%	-9.3%	-6.1%	-8.6%
N	6,703,853	4,749,320	1,976,385	4,753,271
R^2	0.055	0.043	0.060	0.078

Note: This table reports coefficient estimates from differences-in-differences linear probability regressions of an indicator for whether an emergency hospital treatment was billed to WC on an indicator for exposure to the ACA dependent coverage expansion. The unit of observation is a hospital visit. Each entry reports results from a separate regression. Listed controls are implemented using a full set of fixed effects. Standard errors, clustered at hospital level, in parentheses., *** p<0.01, ** p<0.05, * p<0.1

Table 5: Robustness Checks of Main Specification

Specification	CA	FL	NJ	NY
1. Baseline	-0.00143***	-0.00026	-0.00141**	-0.00158***
	(0.000492)	(0.000249)	(0.000552)	(0.000504)
2. Limited controls	-0.00113***	-0.000314	-0.000959**	-0.00175***
	(0.000470)	(0.000251)	(0.000491)	(0.000508)
3. Limit to 24-27 year-olds only	-0.00180***	-0.000286	-0.00165***	-0.00120**
	(0.000475)	(0.000298)	(0.000584)	(0.000529)
4. Limit to 25 and 26-year-olds	-0.00081	-0.000531	-0.001052	-0.00124*
	(0.000522)	(0.000426)	(0.000917)	(0.000683)
5. Limit to 25 and 27-year-olds	-0.00155***	-0.0007*	-0.0021**	-0.00107**
	(0.000593)	(0.00044)	(0.00084)	(0.00050)
6. Exclude 2010 from analysis	-0.00193***	-0.000539	-0.00146***	-0.00212***
	(0.000482)	(0.000475)	(0.000529)	(0.000551)
7. Placebo–pre 2010, treatment in 2008	-0.00013	0.000317	-0.000867	0.000227
	(0.000807)	(0.000433)	(0.000736)	(0.000477)
8. Placebo–treatment for 23 vs. 24	-0.00052*	-0.00009	-0.00056*	-0.0006*
	(0.00028)	(0.00023)	(0.00033)	(0.0003)
9. Placebo–treatment for 27 vs. 28	0.00027	-0.00007	-0.00009	-0.00006
	(0.00029)	(0.00026)	(0.00041)	(0.00031)

Note: This table reports coefficient estimates from variants of the main specification. See note for Table 4. Specification 2 estimates a simple differences-in-difference model with age and year fixed effects only. Specification 7 estimates a placebo regression where the sample is limited to 2005-2009 for CA and 2007-2009 for other states, and treatment is assumed to occur as of July 1, 2008. Specification 8 and 9 estimate placebo regressions with the actual treatment timing, but limiting the sample to the corresponding ages and assigning treatment status to 23 and control status to 24 (both of whom were actually treated) or 27 vs. 28 (neither of whom were treated). Each table entry is a coefficient from a separate regression.

Table 6: Change in Likelihood of Emergency Hospitalization Being Charged to Workers' Compensation By Age Over Time

	CA	FL	NJ	NY
Change for under 26, 2008 (T -2)	-0.0005	0.0003	0.0021	0.0001
	(0.0006)	(0.0004)	(0.0014)	(0.0002)
Change for under 26, 2009 (T -1)	-0.00038	0.0006	-0.0003	0.0004
	(0.0005)	(0.0009)	(0.0003)	(0.0008)
Change for under 26, 2010 (T 0)	-0.00166***	-0.0002	-0.0006**	-0.0012*
	(0.0004)	(0.0002)	(0.0003)	(0.0007)
Change for under 26, 2011 (T +1)	-0.00294***	-0.0003	-0.0022***	-0.0016***
	(0.0005)	(0.0004)	(0.0006)	(0.0006)
Change for under 26, 2012 (T +2)		-0.0008*	-0.0031***	-0.0022***
		(0.0004)	(0.0007)	(0.0006)
N	6,703,853	4,749,320	1,976,385	4,753,271
R^2	0.055	0.043	0.060	0.078

Note: This table reports coefficient estimates from variants of the main specification where the effects of the coverage expansion are allowed to vary by year. See note for Table 4. Each column reports coefficients from a separate regression.

Table 7: Change in Likelihood of Emergency Hospitalization Being Charged to Workers' Compensation For Each Treated Age

	CA	FL	NJ	NY
Change for age 23	-0.0017***	0.0001	-0.0020**	-0.0023***
	(0.0006)	(0.0003)	(0.0008)	(0.0006)
Change for age 24	-0.0023***	0.0003	-0.0015**	-0.0015**
	(0.0006)	(0.0004)	(0.0007)	(0.0006)
Change for age 25	-0.0012**	-0.0005	-0.0009	-0.0014**
	(0.0005)	(0.0003)	(0.0007)	(0.0006)
N	6,703,853	4,749,320	1,976,385	4,753,271
R^2	0.055	0.043	0.060	0.078

Note: This table reports coefficient estimates from variants of the main specification where the effects of the coverage expansion are allowed to vary by age. See note for Table 4. Each column reports coefficients from a separate regression.

Table 8: Change in Likelihood of Emergency Hospitalization Being Charged to WC by Condition

	Likelihood Visit Charged to WC at All, by Condition			
	CA	FL	NJ	NY
Treated X Strain/Sprain	-0.0175***	-0.00939***	-0.0102***	-0.0308***
	(0.00115)	(0.00110)	(0.00197)	(0.00394)
Treated X Open Wound	-0.0159***	-0.0102***	-0.0119***	-0.00567**
	(0.00116)	(0.00182)	(0.00313)	(0.00275)
Treated X Non-Strain	-0.0112***	-0.00469***	-0.00674***	-0.0161***
	(0.000778)	(0.000763)	(0.00147)	(0.00196)
Strain or Sprain	0.0481***	0.0289***	0.0423***	0.0867***
	(0.000336)	(0.00127)	(0.00266)	(0.00409)
Open Wound	0.0754***	0.0747***	0.101***	0.103***
	(0.000331)	(0.00259)	(0.00740)	(0.00511)
Non-Strain Occupational	0.0387***	0.0279***	0.0428***	0.0654***
	(0.000233)	(0.000946)	(0.00270)	(0.00263)
Treated	0.00197***	0.00146***	0.00101	0.00275***
	(0.000417)	(0.000247)	(0.000635)	(0.000636)
Baseline Likelihood	0.028	0.027	0.035	0.034
N	6,703,853	4,749,320	1,976,385	4,753,271
R^2	0.051	0.037	0.054	0.072

Note: This table reports variants of the main specification that include interactions between categories of injury and treatment. The reported coefficients measure the extent to which there were differential impacts of the expansion on WC claiming for patients with particular conditions. See notes for Table 4.

Table 9: Impacts by Predicted Charge Quintile

FL

Charge Quintile	% Charged to WC, Baseline	Average Charge	Effect Estimate
1	1.7%	2,252	-0.000744
			(0.000535)
2	2.1%	2,670	0.000756
			(0.000643)
3	2.1%	3,301	-0.000748
			(0.000612)
4	1.4%	4,359	-0.000869*
			(0.000507)
5	0.9%	12,527	0.000285
			(0.000402)

NJ

Charge Quintile	% Charged to WC, Baseline	Average Charge	Effect Estimate
1	2.6%	1,496	-0.000838
			(0.00136)
2	4.9%	1,880	-0.00304*
			(0.00159)
3	3.3%	2,433	-0.00211*
			(0.00113)
4	1.5%	2,953	-0.00001
			(0.000800)
5	1.0%	3,660	-0.000904
			(0.000700)

NY

Charge Quintile	% Charged to WC, Baseline	Average Charge	Effect Estimate
1	3.1%	1,229	-0.00191*
			(0.000987)
2	5.1%	1,462	-0.00453***
			(0.00118)
3	3.2%	1,849	0.00193**
			(0.000752)
4	3.0%	2,639	-0.00321***
			(0.000744)
5	1.5%	8,928	-0.000750
			(0.000647)

Note: This table reports variants of the main specificaiton where the number of bills is allowed to vary based upon the predicted quintile of changes. Charge quintiles are predicted using 2007 data for each states and are based upon the demographics and injury conditions of the patient. Average charges in 2007 dollars. Treatment effects estimated in separate regressions within charge quintile, controlling for all covariates from Table 4. See notes for Table 4.

References

Antwi, Yaa Akosa, Asako S Moriya, and Kosali Simon (2013) "Effects of Federal Policy to Insure Young Adults: Evidence from the 2010 Affordable Care Act's Dependent-Coverage Mandate," *American Economic Journal: Economic Policy*, Vol. 5, pp. 1–28.

Antwi, Yaa Akosa, Asako S Moriya, Kosali Simon, and Benjamin D Sommers (2015) "Changes in emergency department use among young adults after the Patient Protection and Affordable Care Acts dependent coverage provision," *Annals of emergency medicine*, Vol. 65, pp. 664–672.

Auerbach, David I, Paul Heaton, and Ian Brantley (2014) "The Impact of the Affordable Care Act on Liability Insurance," *Santa Monica, CA: RAND Corportation, 2014*.

Bailey, James B (2013) "Health Insurance and the Supply of Entrepreneurs: New Evidence from the Affordable Care Act's Dependent Coverage Mandate," *Unpublished Manuscript*.

Bailey, James and Anna Chorniy (2016) "Employer-Provided Health Insurance and Job Mobility: Did the Affordable Care Act Reduce Job Lock?" *Contemporary Economic Policy*, Vol. 34, pp. 173 – 183.

Boden, Leslie I and John W Ruser (2003) "Workers' Compensation "Reforms," Choice of Medical Care Provider, and Reported Workplace Injuries," *Review of Economics and Statistics*, Vol. 85, pp. 923–929.

Bolduc, Denis, Bernard Fortin, France Labrecque, and Paul Lanoie (2002) "Workers' Compensation, Moral Hazard and the Composition of Workplace Injuries," *The Journal of Human Resources*, Vol. 37, pp. 623–652, URL: http://www.jstor.org/stable/3069684.

Bronchetti, Erin Todd and Melissa McInerney (2012) "Revisiting Incentive Effects in Workers' Compensation: Do Higher Benefits Really Induce More Claims?" *Industrial & Labor Relations Review*, Vol. 65, pp. 286–315.

Butler, Richard J, David L Durbin, and Nurhan M Helvacian (1996) "Increasing claims for soft tissue injuries in workers' compensation: cost shifting and moral hazard," *Journal of Risk and Uncertainty*, Vol. 13, pp. 73–87.

Cantor, Joel C, Alan C Monheit, Derek DeLia, and Kristen Lloyd (2012) "The Role of Federal and State Dependent Coverage Eligibility Policies on the Health Insurance Status of Young Adults," *National Bureau of Economic Research Working Paper No. 18254*.

Card, David and Brian P McCall (1996) "Is Workers' Compensation Covering Uninsured Medical Costs? Evidence from the "Monday Effect"," *Industrial & Labor Relations Review*, Vol. 49, pp. 690–706.

Casualty Center, WC Center of Excellence (2010) *The Impact of US Health Care Reform on Workers' Compensation and Other Casualty Lines*: Swiss Reinsurance Company.

CBO (2015) "Effects of the Affordable Care Act on Health Insurance Coverage - January 2015 Baseline Projections," *Congressional Budget Office*.

Coomer, Nicole M and Te-chun Liu (2010) *Benchmarks for Designing Workers' Compensation Medical Fee Schedules, 2009*: Workers Compensation Research Institute.

Dillender, Marcus (2014) "Do More Health Insurance Options Lead to Higher Wages? Evidence from States Extending Dependent Coverage," *Journal of Health Economics*, Vol. 36, pp. 84–97.

——— (2015) "The Effect of Health Insurance on Workers' Compensation Filing: Evidence from the Affordable Care Act's Age-Based Threshold for Dependent Coverage," *Journal of Health Economics*, Vol. 43, pp. 204–228.

Eaton, Thomas A (2010) "The Impact of the Patient Protection and Affordable Health Care Act of 2010 On State Workers' Compensation Systems," *Public Law*, Vol. 111.

Fairlie, Robert W, Kanika Kapur, and Susan Gates (2016) "Job Lock: Evidence from a Regression Discontinuity Design," *Industrial Relations: A Journal of Economy and Society*, Vol. 55, pp. 92–121.

Finkelstein, Amy, Sarah Taubman, Bill Wright, Mira Bernstein, Jonathan Gruber, Joseph P Newhouse, Heidi Allen, Katherine Baicker et al. (2011) "The Oregon Health Insurance Experiment: Evidence from the First Year," *National Bureau of Economic Research Working Paper No. 17190*.

Fomenko, Olesya and Te-chun Liu (2012) *Designing Workers' Compensation Medical Fee Schedules*: Workers Compensation Research Institute.

Guo, Xuguang Steve and John F Burton (2010) "Workers' Compensation: Recent Developments in Moral Hazard and Benefit Payments," *Industrial & Labor Relations Review*, Vol. 63, pp. 340–355.

Hansen, Benjamin (2016) "Californias 2004 Workers Compensation Reform Costs, Claims, and Contingent Workers," *Industrial & Labor Relations Review*, Vol. 69, pp. 173–198.

Heaton, Paul (2012) "The Impact of Health Care Reform on Workers Compensation Medical Care," *Santa Monica, CA: RAND Corporation, 2012*.

Heim, Bradley, Ithai Lurie, and Kosali Simon (2014) "The Impact of the Affordable Care Act Young Adult Provision on Labor Market Outcomes: Evidence from Tax Data," in *Tax Policy and the Economy, Volume 29*: University of Chicago Press.

Hernandez-Boussard, Tina, Carson S Burns, N Ewen Wang, Laurence C Baker, and Benjamin A Goldstein (2014) "The Affordable Care Act reduces emergency department use by young adults: evidence from three states," *Health Affairs*, Vol. 33, pp. 1648–1654.

Jhamb, Jordan, Dhaval Dave, and Gregory Colman (2015) "The Patient Protection and Affordable Care Act and the Utilization of Health Care Services among Young Adults," *International Journal of Health and Economic Development*, Vol. 1, p. 8.

Lakdawalla, Darius N, Robert T Reville, and Seth A Seabury (2007) "How Does Health Insurance Affect Workers' Compensation Filing?" *Economic Inquiry*, Vol. 45, pp. 286–303.

Leigh, J Paul (2011) "Economic burden of occupational injury and illness in the United States," *Milbank Quarterly*, Vol. 89, pp. 728–772.

Levine, Phillip B, Robin McKnight, and Samantha Heep (2011) "How effective are public policies to increase health insurance coverage among young adults?" *American Economic Journal: Economic Policy*, Vol. 3, pp. 129–156.

Lipton, Barry, Gina Cooper, and John Roberston (2009) "Medical Services by Size of Claim," *National Council on Compensation Insurance (NCCI) Research Report*.

Lohr, Kathleen N, Robert H Brook, Caren J Kamberg, George A Goldberg, Arleen Leibowitz, Joan Keesey, David Reboussin, and Joseph P Newhouse (1986) "Use of medical care in the RAND Health Insurance Experiment: diagnosis-and service-specific analyses in a randomized controlled trial," *Medical care*, Vol. 24, pp. S1–S87.

Meyer, Bruce D, W Kip Viscusi, and David L Durbin (1995) "Workers' Compensation and Injury Duration: Evidence from a Natural Experiment," *The American Economic Review*, pp. 322–340.

Monheit, Alan C, Joel C Cantor, Derek DeLia, and Dina Belloff (2011) "How Have State Policies to Expand Dependent Coverage Affected the Health Insurance Status of Young Adults?" *Health Services Research*, Vol. 46, pp. 251–267.

Mulcahy, Andrew, Katherine Harris, Kenneth Finegold, Arthur Kellermann, Laurel Edelman, and Benjamin D Sommers (2013) "Insurance coverage of emergency care for young adults under health reform," *New England Journal of Medicine*, Vol. 368, pp. 2105–2112.

Neuhauser, Frank and Steven Raphael (2004) "The Effect of an Increase in Workers' Compensation Benefits on the Duration and Frequency of Benefit Receipt," *Review of Economics and Statistics*, Vol. 86, pp. 288–302.

O'Hara, Brett and Matthew W Brault (2013) "The Disparate Impact of the ACA-Dependent Expansion across Population Subgroups," *Health Services Research*, Vol. 48, pp. 1581–1592.

Sengupta, Ishita and Marjorie L Baldwin (2015) "Workers; Compensation: Benefits, Coverage, and Costs, 2013," *National Academy of Social Insurance*.

Slusky, David JG (2015) "Significant Placebo Results in Difference-in-Differences Analysis: The Case of the ACA's Parental Mandate," *Eastern Economic Journal*.

Sommers, Benjamin D, Thomas Buchmueller, Sandra L Decker, Colleen Carey, and Richard Kronick (2013) "The Affordable Care Act has Led to Significant Gains in Health Insurance and Access to Care for Young Adults," *Health Affairs*, Vol. 32, pp. 165–174.

Utterback, David F, Alysha R Meyers, and Steven J Wurzelbacher (2014) "Workers' Compensation Insurance: A Primer for Public Health," *DHHS (NIOSH) Publication No. 2014 - 110*.

WCRI (2014) "Workers' Compensation Laws: As of January 1, 2014," *Workers' Compensation Research Institute*.

Appendix

Table A-1: Workers' Compensation Fee Schedule Premium over Medicare Fee Schedule (Percentage Greater Than or Less Than Medicare Fee Schedule)

	December 2009		July 2011	
	Overall	ER Services	Overall	ER Services
California	15%	26%	-1%	24%
Florida	9%	4%	2%	3%
New Jersey	n/a	n/a	n/a	n/a
New York	24%	46%	15%	86%

Source: Fomenko and Liu (2012); Coomer and Liu (2010)

Table A-2: Hospitals and Hospital Emergency Departments Included in the State Inpatient Database (SID) and State Emergency Department Database (SEDD)

	Hospital EDs in State	Hospital EDs in SEDD	Hospital EDs Not in SEDD	% Not in SEDD
California	325	308	17	5.2%
Florida	208	208	0	0.0%
New Jersey	72	71	1	1.4%
New York	201	198	3	1.5%

	Hospitals in State	Hospitals in SID	Hospitals Not in SID	% Not in SID
California	443	437	6	1.4%
Florida	281	280	1	0.4%
New Jersey	116	116	0	0.0%
New York	226	225	1	0.4%

Table A-3: Changes in the Log of WC Emergency Department Visits Due to Dependent Coverage Expansion

	Log-Level of WC ED Hospital Visits			
	CA	FL	NJ	NY
Change for under 26, after 2011	-0.063**	-0.011	-0.059**	-0.086***
	(0.025)	(0.023)	(0.022)	(0.022)
N	8,930	7,124	2,568	6,795
R^2	0.392	0.652	0.749	0.710

Note: This table reports coefficient estimates from differences-in-differences regressions of the log total number of emergency department hospital visits billed to WC per 1,000 individuals in the state of that age in that year, on an indicator for exposure to the ACA dependent coverage expansion. The unit of observation is an age/hospital/year cell, and all analyses include age, year, and hospital fixed effects, as well as age-specific, state-level unemployment rates calculated from the CPS ASEC. Each entry reports results from a separate regression. Standard errors, clustered at hospital level, in parentheses., *** p<0.01, ** p<0.05, * p<0.1

Table A-4: Changes in the Log Share of Emergency Department Visits Due to Dependent Coverage Expansion

	Log of WC's Share of ED Hospital Visits			
	CA	FL	NJ	NY
Change for under 26, after 2011	-0.086***	-0.044*	-0.074***	-0.061***
	(0.023)	(0.023)	(0.027)	(0.021)
N	12,626	7,124	2,568	6,795
R^2	0.694	0.548	0.763	0.712

Note: This table reports coefficient estimates from differences-in-differences regressions of the log share of ED visits charged to WC. The unit of observation is an age/hospital/year cell, and all analyses include age, year, and hospital fixed effects, as well as age-specific, state-level unemployment rates calculated from the CPS ASEC. Each entry reports results from a separate regression. Standard errors, clustered at hospital level, in parentheses., *** p<0.01, ** p<0.05, * p<0.1