The Effects of the Affordable Care Act Adult Dependent Coverage Expansion on Mental Health

Marguerite E. Burns,[1*] **Barbara L. Wolfe**[2]

[1]*Ph.D., University of Wisconsin - Madison, Department of Population Health Sciences, Madison, USA*
[2]*Ph.D., University of Wisconsin - Madison, Departments of Economics, Population Health Sciences and La Follette School of Public Affairs, Madison, WI, USA*

Abstract

Background: In September 2010, the Affordable Care Act increased the availability of private health insurance for young adult dependents in the United States and prohibited coverage exclusions for their pre-existing conditions. The coverage expansion improved young adults' financial protection from medical expenses and increased their mental health care use. These short-term effects signal the possibility of accompanying changes in mental health through one or more mechanisms: treatment-induced symptom relief or improved function; improved well-being and/or reduced anxiety as financial security increases; or declines in self-reported mental health if treatment results in the discovery of illnesses.

Aims: In this study, we estimate the effects of this insurance coverage expansion on young adults' mental health outcomes one year after its implementation.

Methods: We use a difference-in-differences (DD) framework to estimate the effects of the ACA young adult dependent coverage on mental health outcomes for adults ages 23-25 relative to adults ages 27-29 from 2007-2011. Outcome measures include a global measure of self-rated mental health, the SF-12 mental component summary (MCS), the PHQ-2 screen for depression, and the Kessler index for non-specific psychological distress.

Results: The overall pattern of findings suggests that *both* age groups experienced modest improvements in a range of outcomes that captured both positive and negative mental health following the 2010 implementation of the coverage expansion. The notable exception to this pattern is a 1.4 point relative increase in the SF-12 MCS score among young adults alone, a measure that captures emotional well-being, mental health symptoms (positive and negative), and social role functioning.

Discussion: This study provides the first estimates of a broad range of mental health outcomes that may be responsive to changes in mental health care use and/or the increased financial security that insurance confers. For the population as a whole, there were few short-term changes in young adults' mental health outcome relative to older adults. However, the relative increase in the SF-12 score among young adults, while small, is likely meaningful at a population level given the observed effect sizes for this measure obtained in clinical trials.

Implications: The vast majority of mental illnesses emerge before individuals reach age 24. Public policy designed to expand health insurance coverage to this population has the potential to influence mental health in a relatively short time frame.

Introduction

The health insurance rate for young adults rose by approximately 4-7 percentage points in the first 18 months after the Affordable Care Act's (ACA) expansion of health insurance for adult dependents, ages 19 to 25, in September 2010.[1-6] Few would argue, however, that this increased rate of insurance coverage reflects the final objective of the expansion. Insurance coverage for young adults is a potential means to other ends: financial protection from catastrophic medical expenses;[7] flexibility regarding employment and schooling choices;[8] and improved health care access, utilization, and health.[2,9] In addition to increasing young adults' financial protection from medical expenses,[2,10,11] the ACA dependent coverage expansion has had its most pronounced effects on health care consumption in the domain of mental health.[11-14] Whether or to what extent these effects on mental health care use have influenced mental health outcomes is less clear.

There are several mechanisms by which an exogenous increase in the availability of health insurance may influence young adults' mental health outcomes. Newly available, or more generous, health insurance may increase consumption of mental health services through a reduction in the price of care and/or an increase in income. Reports of better or worse health may follow depending on the alignment between needed and received treatment on the one hand and for example, the discovery of previously undiagnosed illness on the other. Absent a change in consumption, mental health status may still be sensitive to the availability of health

insurance. For example, if the financial security that new or more generous health insurance confers translates into improved well-being or reduced stress, mental health outcomes may also improve.[15] There is growing evidence that the ACA adult dependent coverage expansion affected each of these intermediate outcomes in the short term – financial security and mental health care consumption – increasing the plausibility of an effect on mental health outcomes.

The ACA adult dependent coverage expansion lowered rates of delayed and foregone care due to cost[2] and reduced high out-of-pocket health care spending among young adults compared to adults unaffected by the policy.[10] Likewise, the payer mix for health care providers and institutions shifted to include a greater proportion of private insurance relative to no insurance for young adults' service use.[12,16] This latter finding echoes the experience of Massachusetts' hospitals following that state's insurance expansion in which young adults' behavioral health care use was increasingly paid for by private insurers.[17] Coupled with the risk-reducing function of insurance more generally, these results suggest that the expansion improved young adults' actual and/or perceived financial security with respect to health care expenses.

Reduced cost-related barriers to care for young adults following the implementation of the ACA's dependent coverage policy influenced the use of mental health services. This domain of service use is particularly salient for young adults because the vast majority of mental illnesses emerge before individuals reach age 24[18] while the gap between disease prevalence and treatment receipt among adults has historically been largest among young adults.[19] Among adults who screened positive for symptoms of psychological distress, Saloner and Le Cook[12] observed a 17% increase in the use of any mental health services among young adults relative to older adults following the dependent coverage expansion. While the Saloner study concerned mental health service use in *any* care setting, Antwi *et al.*[14] observed a nationwide 5.8% increase in inpatient visits for psychiatric conditions among adults ages 23-25 compared to slightly older adults and no significant change in emergency department visits for mental illness.[13] Golberstein *et al.*[11] investigated the potential effects of the young adult expansion on hospital based mental health care among young adults as a whole and stratified by sex. Together, young men and women experienced an 8.4% relative increase in psychiatric inpatient discharges following the expansion. When disaggregated by sex, the effect sizes among young men and women were 11% and 4.5% respectively. For young women, emergency department visits for psychiatric conditions increased at a slower rate relative to older women after the expansion.

Have these changes in financial access to care and in mental health care use, been accompanied by changes in mental health? Two studies have considered the mental health effects of ACA's dependent coverage provision. Chua and Sommers[20] compared the change in the proportion of adults ages 19-25 that reported ''excellent'' mental health in 2002-2009 to the proportion who reported excellent mental health in 2011 relative to the analogous change for adults 26-34. In this study, the authors found a 4-percentage point relative increase in excellent mental health among young adults. Increasingly, however, evaluations of the ACA young adult coverage expansion have deployed more narrow age bandwidths for both study groups to isolate the ''older'' young adult subgroup that was most likely to be affected and to improve the comparability of the unaffected comparison group.[1,11,13-14,21]

Barbaresco *et al.*[1] took this approach and employed a difference-in-differences framework to examine the relative health effects of the expansion for adults ages 23-25 compared to adults ages 27-29. That study's single measure of mental health assessed symptoms of poor mental health, the number of days not in good mental health within the past 30. There was no difference between young and older adults in the change after the expansion compared to the pre-policy period overall or by sex. Coupled with the results of the Chua and Sommers[20] study, the authors suggested that on average the insurance expansion's health effects may be concentrated at the upper end of the health distribution (i.e., excellent compared to non-excellent health). However, in subgroup analyses they also observed improvements at the lower end of the health distribution. Among college graduates the reported number of days not in good mental health within the past 30 days declined for young adults relative to the comparison group after the expansion. This result is intriguing for several reasons. It provides the first empirical signal of *any* mental health improvement among young adults in poor mental health. Additionally, according to their estimates, health insurance coverage rates increased similarly for young adult college graduates and non-graduates. Thus the decline in poor mental health among college graduates alone suggests that policy-induced changes at the intensive margin of health insurance and/or a relatively greater capacity to take advantage of coverage may contribute to reductions in poor mental health.

In this study we use a difference-in-differences (DID) framework to estimate the effects of the ACA young adult dependent coverage on mental health outcomes for adults ages 23-25 relative to adults ages 27-29 from 2007-2011. We extend the current research by examining the insurance expansion's effects on a broader range of mental health outcomes than those previously examined to capture the potential policy effects across the distribution of mental health. As such, the paper complements the growing body of research that demonstrates the policy's effects on mental health care use. In addition to the familiar, five-category measure of self-reported mental health, we include measures of depression, serious psychological distress, and the SF-12 Health Survey mental component summary (MCS) score. We first examine whether the previously documented increase in excellent self-reported mental health[20] holds when the study groups are defined using more narrow age bandwidths. Using an ordered probit analysis,[22] we then investigate the effect of the insurance expansion on each of the four lesser health states (i.e., very good, good, fair, poor). A net change at the upper end of the distribution of health does not preclude a simultaneous increase in the proportion

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of young adults who reported fair or poor health. We execute all analyses for the sample as a whole to facilitate comparison with the extant literature and separately by sex because of demonstrated differences between young men and women in the effects of the 2010 coverage expansion.[1,4,11] Finally, we examine the sensitivity of results to inclusion of 19-22 year old adults within the young adult group, and the potential differential effects of the policy for adults with and without a college degree.

In a preview of our findings, the most consistent effect of the coverage expansion was a small, relative increase among young adults in the SF-12 mental component summary (MCS) score indicating an improvement in emotional well-being, mental health symptomatology and social role functioning. For the sample as whole, the magnitude of this increase was 1.4 points, or approximately 0.14 standard deviations. When disaggregated by sex, the increase was statistically significant for young women only. In contrast to prior research,[20] we observed similar changes over the study period between young and older adults in ''excellent'' mental health whether modeled as a binary outcome or as one category among 5 ordinal response options. Our findings among college graduates are consistent with those reported by Barbaresco et al.[1] For young adult graduates relative to older adult graduates, we found a 3-percentage point decline in the likelihood of screening positive for depression. The decline in positive depression screens was driven by a 4-percentage point decrease among young women while the likelihood of screening positive for serious psychological distress declined by 2-percentage points for young male college graduates compared to older male graduates. Among adults without a college diploma, there were no significant differences in mental health changes among young adults as a whole relative to older adults after the policy change.

Method

We examine the effects of the ACA insurance expansion on young men and women's health using a difference-in-differences framework. The DID analysis compares health outcomes before (2007-2009) and after (2011) the implementation of the coverage expansion for young adults relative to slightly older adults. We exclude 2010 from our analyses during which time the policy was enacted (March) and implemented (September) because we cannot accurately assign outcomes to a ''pre'' or ''post'' policy period. The ACA insurance expansion may be viewed as a natural experiment in which the ''assignment to treatment,'' or eligibility for young adult dependent coverage, was determined by a political process plausibly unrelated to the study outcomes. As such, the endogeneity of treatment eligibility is not a primary threat to the internal validity of study inferences.

Identification Strategy

Our young adult sample includes adults ages 23-25. The comparison sample includes adults ages 27-29 consistent with the more recent research in this area.[1,23] This choice of age groups reflects two considerations.

First, we expect that any potential effect of the coverage expansion on health would be more readily observable in an ''older'' young adult group. Adults ages 23-25 were less likely to have had access to dependent coverage than adults ages 19-22 before the expansion.[3] Thus, the new policy was more likely to influence their insurance status than those of 19-22 year olds – at least along the extensive margin of ''any coverage.'' Indeed after the implementation of the ACA's adult dependent coverage expansion, 23-25 year old adults experienced relatively greater decreases in uninsurance rates than 19-22 year olds Antwi et al.[23]

Second, these relatively narrow age groups improve the likelihood of satisfying the identifying assumption for the DID design compared to the wider age bandwidths used in prior research (e.g., 19-25 and 26-34 years).[21] That is, in the absence of this 2010 insurance expansion, the trend over time in the outcome (or confounding variables) for young adults should run parallel to that of the comparison group as they are close in age. Barbaresco et al.[1] provided additional support for the plausibility of this assumption through the use of multiple placebo tests in which the young adult group is defined with narrow and wide age bandwidths.

While it is not possible to test this identifying assumption because all young adults experienced the policy change at the same time, parallel trends in outcomes variables between young and slightly older adults before the expansion would strengthen the plausibility of this assumption. In addition, we are able to assess time trends for one of our study outcomes which is assessed at multiple time points during each year. Specifically, we collapsed the ordinal measure of self-reported mental health into a binary measure of excellent or non-excellent health and tested for differences in linear trend between adults ages 23-25 and adults ages 27-29. There were no significant differences in linear trends for self-reported mental health overall, for men or for women. A graphical presentation of the outcome trends is illustrated in **Figure 1**.

The empirical model for our DID analysis takes the following general form:

$$(1) \quad \begin{aligned} Y_{it} = \alpha_0 + \alpha_1(YA)_i + \alpha_2(policy)_t + \\ + \alpha_3(YA*policy)_{it} + \alpha_4(X)_{it} + \varepsilon_{it}. \end{aligned}$$

in which it indexes the health outcome at the person-year or person-round depending on the measure. The key independent variable in the regression models is an interaction term that equals one for the observations of young adults in the post-policy period, January 2011 through December 2011, and equals zero for observations in the pre-policy year, January 2007 through December 2009.

We implement linear regression to estimate our continuous and binary outcomes, and ordered probit models to evaluate the policy's impact on ordinal measures of health.[22] In the selection of covariates, we aimed to minimize the possibility of endogenous covariates. This decision resulted in a relatively limited set of covariates for our preferred specification. The selected variables are associated with the outcomes and/or age but are unlikely to introduce omitted
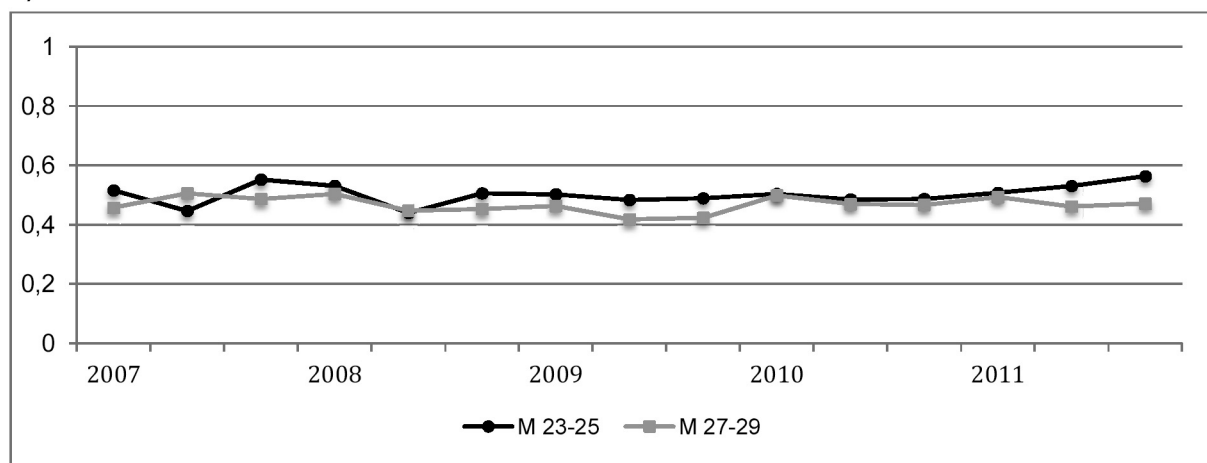
b) Women

Figure 1. National Trends in Self-reported Excellent Mental Health, 2007-2011.

Source: Authors' calculations from the Medical Expenditure Panel Survey, 2007-2011.
Estimates are weighted to represent the civilian, non-institutionalized U.S. population.

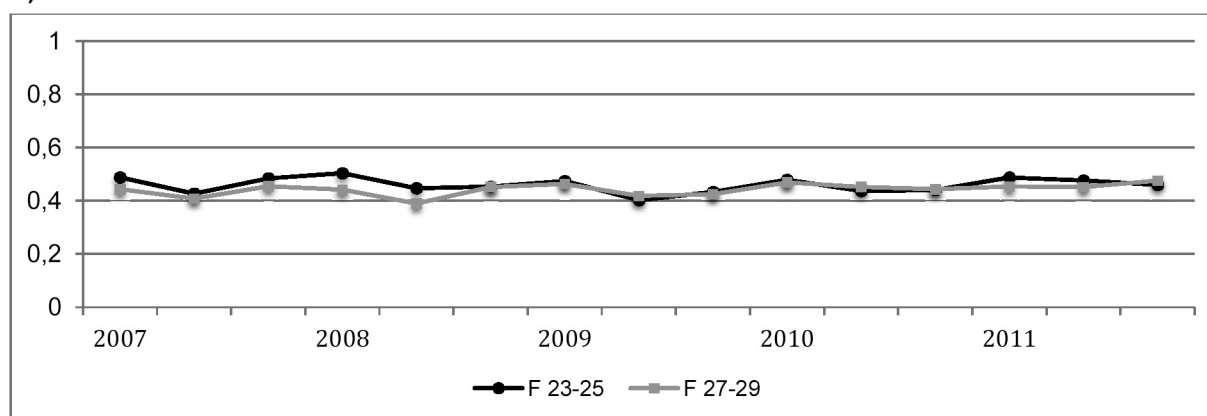variables bias: race, ethnicity, residence in a metropolitan statistical area, and census region. For ease of interpretation, we present the predicted percentage point change for ordinal measures calculated from the ordered probit regression estimates. Analyses are weighted to reflect the civilian, non-institutionalized population. Standard errors are estimated using a Huber variance estimator[24] where observations were clustered by primary sampling unit to account for the complex survey design of the MEPS and within-person correlation over time. All analyses were conducted using Stata 13 software (Stata Corp Inc., College Station, TX).

Data

The data source for the study is the nationally representative Medical Expenditure Panel Survey (MEPS). The MEPS design includes five interviews over roughly two years for each household member to assess health insurance coverage, health care use, and health status, and accommodates the type of repeated cross-sectional analyses used in this study. The publicly available dataset that we use does not include state identifiers that might allow analysis of potential

heterogeneous policy effects in states with and without prior young adult dependent coverage mandates.[25] Although the restricted MEPS does include these data elements, our past experience with these data suggest that the sample sizes for this study would be insufficient to support state-based analyses.[26] Additionally, recent research on the effect of the young adult coverage expansion on health care use and health outcomes (including mental health), found no difference in policy impacts according to the presence of prior state mandates.[1] Our estimates will reflect the national average effects of the 2010 policy change.

Sample Construction

To construct our sample, we identify the young and older adults in each year, 2007-2009 and 2011. The total unweighted sample includes 4,387 adults ages 23-25 and 4,389 adults ages 27-29. The sample size for each analysis varies slightly according to the unit of analysis that we employ. Specifically, once allocated to the young adult or comparison group, each subject contributes data for each observation in which s/he was age eligible for inclusion. For
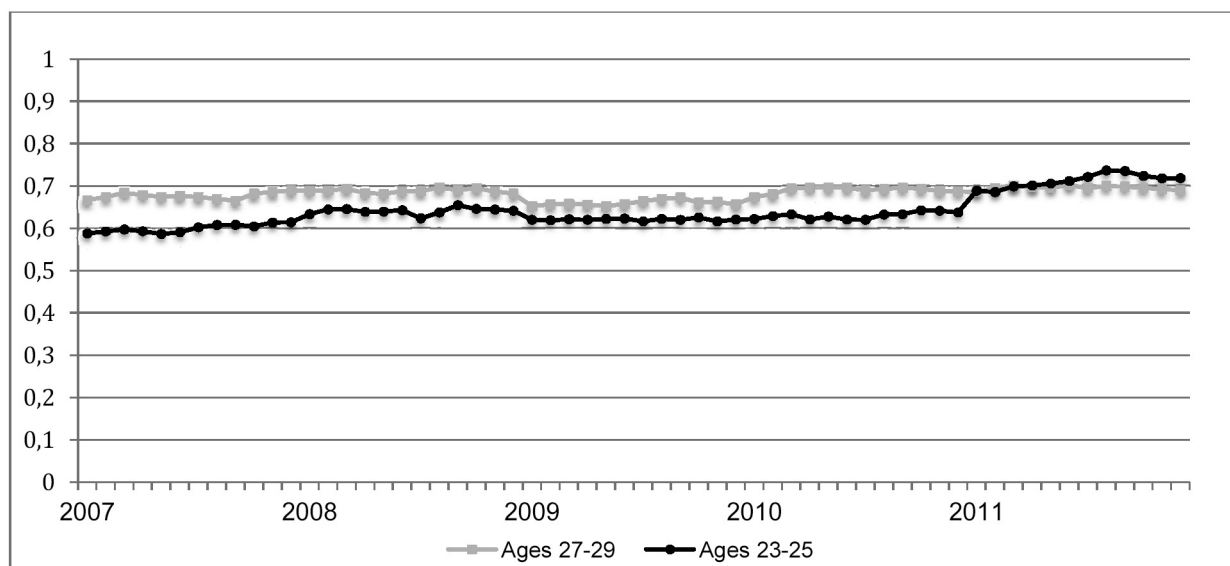
c) All

Figure 2. Proportion of Adults Insured, 2007-2011.

Source: Authors' calculations from the Medical Expenditure Panel Survey, 2007-2011.
Estimates are weighted to represent the civilian, non-institutionalized U.S. population.

example, the global measure of self-reported mental health is assessed during each MEPS interview or survey round. A survey round corresponds to approximately a four to five month segment. Thus, an individual that turned age 23 on April 1, 2009 contributed 2 rounds of data to those analyses. **Table 1** provides a summary of the sample characteristics. There were no marked differences at baseline in demographic characteristics across study groups overall or within sex.

Outcomes

This study examines the policy's impact on four measures of self-reported mental health status. A complete description of the health outcome measures is included in the **Appendix, Table A1**. Our global measure of mental health is a variable that includes five response categories: excellent, very good, good, fair, poor (EVGFP). This measure captures a dimension of perceived health that is associated with social role functioning and mental health care use.[27,28] It is assessed at each of the interviews (or survey rounds) in which a subject participates, approximately 3 times in a survey year. Thus, the unit of analysis for this outcome is the person-round. We analyze this outcome first as a binary outcome in which the five responses are collapsed into ''excellent'' or ''non-excellent'' and subsequently as an ordinal variable.

Our additional mental health outcomes are derived from the three instruments contained in the MEPS self-administered questionnaire (SAQ) for household respondents over the age of 18, and are administered only once per year. These include the Short-Form 12 Health Survey (SF-12);[29] the Kessler index of non-specific psychological distress (K6);[30] and the Patient Health Questionnaire (PHQ-2).[31] The SF-12 yields a mental health component (MCS)

summary score. Using a proprietary weighting algorithm,[32] these scores are constructed from the individual items on the SF-12 and normalized to a range of 0-100 with a population mean of 50 and a standard deviation of 10. For the MCS summary score, the algorithm weights more heavily those SF-12 items that assess emotional well-being (e.g., feelings of calm, peacefulness, downheartedness, depression, etc.,) and social role functioning that is related to the reported feelings. A higher score indicates better mental health. We analyze this outcome as a continuous measure.

The Kessler index is comprised of six questions that assess mental health during the past 30 days.[30,33] This index was developed to distinguish cases of mental illness from non-cases in a community sample that reflect severity regardless of the particular diagnosis. The summation of the six items produces the K6 Summary Score with a range of 0 to 24 in which a higher value indicates a greater likelihood of mental illness. A score of 13 or higher is a suggested threshold as an indicator of serious psychological distress. We create a binary measure of serious psychological distress (SPD) and assign a value of one if the subject met or exceeded that cutoff value. Finally, the PHQ-2 is a depression screening tool for which a summary score of 3 or higher indicates a positive screen.[31] Our dichotomous measure of a positive depression screen thus equals one if the subject's PHQ-2 score is at or above this threshold.

We additionally estimate the effect of the expansion on insurance status within this sample and data source to assess consistency with prior research. During each interview, subjects report on their health insurance status for each month of the 4-5 month look-back period. To describe trends in health insurance status from 2007-2011, we use this monthly measure of ''any'' health insurance coverage. (**Figure 2**) We use the summary measure of any health insurance coverage *in the year* for our DID analyses to

Table 1. Sample Characteristics at Baseline, 2007-2009

	FULL SAMPLE		MEN		WOMEN	
	Ages 23-25	Ages 27-29	Ages 23-25	Ages 27-29	Ages 23-25	Ages 27-29
Unweighted N	4387	4389	1532	1471	1614	1706
Hispanic	19.6 (1.5)	19.6 (1.4)	21.2 (1.8)	21.6 (1.8)	18.0 (1.6)	17.8 (1.4)
Race						
White	79.4	79.8	79	80.6	79.8	79.1
Black	13	12.7	13	11.8	12.9	13.6
Other	7.6	7.5	8	7.6	7.3	7.4
Resides in MSA	86.3(1.8)	88.3(1.4)	85.7 (2.0)	88.8 (1.6)	86.8 (1.8)	87.8 (1.6)
Census Region						
Northeast	17.6	18.7	18.3	17.6	17	19.7
Midwest	23.3	21	23.8	20.5	22.7	21.5
South	36	35.2	35	34.4	37	36
West	23.1	25.1	23	27.6	23.3	22.8

Notes: Authors' calculations from the Medical Expenditure Panel Survey, 2007-2009. Estimates are weighted to reflect the civilian, non-institutionalized population of the United States. Standard errors in parentheses are adjusted for the complex sampling design. **p <0.05; ***p <0.01.

estimate the change in insured status following the insurance expansion for young adults compared to their older peers.

Results

Health Insurance

As illustrated in **Figure 2**, the proportion of young adults with any health insurance in the month rose substantially in early 2011 and continued to increase throughout the year compared to adults ages 27-29. The unadjusted annual rate of any health insurance coverage in the year increased by 8 percentage points [p < 0.01] for adults ages 23-25 after the insurance expansion relative to the baseline study years, 2007-2009, as reported in **Table 2**. There was no significant change in insurance coverage for the comparison group of older adults over the same period. Results from the DID linear probability models are presented in **Table 3**. The proportion of young adults with any health insurance coverage in the year increased by 7 percentage points [p < 0.01] relative to the comparison group. The magnitude of this effect is consistent with previously published estimates of the policy's impact on coverage when study groups are defined with the age bandwidths that we deploy here.[1] Compared to older adults, health insurance coverage increased by approximately 8 percentage points [p =0.05] for young men and 4 percentage points [p=0.20] for young women after the coverage expansion. The estimated effects for young women are not statistically different from zero. However, for both young men and women this study's point estimates are very similar to published estimates.[1] We surmise that the substantially smaller sample size available in

the MEPS compared to previously published studies explains the less precisely estimated effects.[1,4]

Self-rated Mental Health

Among young adults and older adults, the distribution of responses to the ordinal measure of global mental health showed a tendency toward higher values after the intervention relative to the baseline period (**Table 2**); however, these distributional changes were not statistically significantly different from zero. We first assessed the effect of the policy on ''excellent'' self-reported mental health to examine whether the previously published increase in this outcome holds when study age groups are defined more narrowly. For adults ages 23-25, there was no significant change in the proportion that reported excellent mental health after the policy relative to adults ages 27-29 [β=0.0008; se=0.03]. (**Table 3**) The separately estimated effects for young men and for young women were not statistically different from zero. We then considered if or to what extent the policy affected young adults' self-reported global mental health at other points along the distribution (i.e., very good, good, fair, poor). The adjusted DID probit analyses are presented in **Table 4**. Overall, both age groups experienced an increase in the proportion of adults that reported excellent mental health and offsetting declines in the four lesser categories. However, these within-group changes were statistically significant for adults age 27-29 only (p <0.05), and the DID estimates are very small and not significantly different from zero. In sub-group analyses, the policy had no significant effect on this global measure of self-reported mental health for young men or for young women relative to the comparison group.

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Table 2. Health and Health Insurance Status Before and after the Young Adult Dependent Coverage Expansion

	FULL SAMPLE					
	Ages 23-25			Ages 27-29		
	Proportion or Mean (se)					
	Pre	Post	p-value	Pre	Post	p-value
Insured	0.72 (0.01)	0.80 (0.02)	0.01	0.75 (0.01)	0.76 (0.02)	0.59
Self-reported mental health			0.18			0.2
Excellent	0.48	0.50		0.45	0.47	
Very good	0.29	0.29		0.3	0.31	
Good	0.19	0.17		0.21	0.19	
Fair	0.04	0.03		0.04	0.04	
Poor	0.007	0.00		0.009	0.01	
SF-12 Mental Component Score (mean)	50.42 (0.25)	51.88 (0.36)	0.01	50.53 (0.24)	50.55 (0.31)	0.94
Positive screen for depression (PHQ-2)	0.09 (0.007)	0.06 (0.01)	0.05	0.07 (0.006)	0.06 (0.009)	0.52
Positive screen for serious psychological distress(K6)	0.04 (0.005)	0.03 (0.008)	0.27	0.05 (0.005)	0.04 (0.006)	0.24

	MEN					
	Ages 23-25			Ages 27-29		
	Proportion or Mean (se)					
	Pre	Post	p-value	Pre	Post	p-value
Insured	0.64 (0.02)	0.75 (0.03)	0.01	0.67 (0.02)	0.69 (0.02)	0.6
Self-reported mental health			0.51			0.33
Excellent	0.5	0.53		0.46	0.48	
Very good	0.28	0.27		0.3	0.31	
Good	0.18	0.16		0.2	0.17	
Fair	0.04	0.04		0.03	0.04	
Poor	0.005	0.006		0.009	0.005	
SF-12 Mental Component Score (mean)	51.72 (0.33)	52.56 (0.58)	0.2	51.56 (0.33)	52.44 (0.42)	0.83
Positive screen for depression (PHQ-2)	0.08 (0.009)	0.07 (0.02)	0.62	0.07 (0.009)	0.06 (0.01)	0.67
Positive screen for serious psychological distress(K6)	0.04 (0.006)	0.04 (0.01)	0.78	0.04 (0.006)	0.04 (0.009)f	0.97

	WOMEN					
	Ages 23-25			Ages 27-29		
	Proportion or Mean (se)					
	Pre	Post	p-value	Pre	Post	p-value
Insured	0.80 (0.01)	0.85 (0.02)	0.04	0.81 (0.01)	0.83 (0.02)	0.58
Self-reported mental health			0.05			0.25
Excellent	0.46	0.47		0.43	0.46	
Very good	0.30	0.31		0.29	0.30	
Good	0.19	0.19		0.22	0.20	
Fair	0.04	0.03		0.04	0.03	
Poor	0.009	0.001		0.008	0.005	
SF-12 Mental Component Score (mean)	49.09 (0.39)	51.23 (0.46)	0.01	49.55 (0.31)	49.63 (0.46)	0.89
Positive screen for depression (PHQ-2)	0.10 (0.01)	0.06 (0.01)	0.02	0.08 (0.008)	0.07 (0.01)	0.63
Positive screen for serious psychological distress(K6)	0.05 (0.007)	0.03 (0.01)	0.20	0.06 (0.008)	0.04(0.008)	0.09

Notes: Authors' calculation from the Medical Expenditure Panel Survey. Pre-period includes years 2007-2009; post-period is 2011. Estimates are weighted to reflect the civilian, non-institutionalized population of the United States. Standard errors account for the complex survey design and within person correlation.

Table 3. Change in Health Insurance and Self-Reported Health Among Adults Ages 23-25 Compared to Adults Ages 27-29 after ACA Adult Dependent Coverage Expansion

	Insured	Mental Component Score	Excellent Mental Health	Depression	Serious Psychological Distress
FULL SAMPLE					
Young Adult					
β	–0.0257*	–0.104	0.0307**	0.0152*	–0.00254
se	0.0147	0.329	0.0150	0.00921	0.00687
p-value	0.079	0.752	0.041	0.099	0.711
Post Expansion					
β	0.0152	0.00291	0.0235	–0.00724	–0.00980
se	0.0190	0.388	0.0185	0.0110	0.00832
p-value	0.425	0.994	0.203	0.510	0.239
Young Adult * Post Expansion					
β	0.0693***	1.429***	0.000755	–0.0157	–0.000272
se	0.0262	0.549	0.0263	0.0149	0.0118
p-value	0.008	0.009	0.977	0.292	0.982
Constant					
β	0.807***	50.24***	0.406***	0.0750***	0.0482***
se	0.0249	0.672	0.0303	0.0152	0.0133
p-value	0.000	0.000	0.000	0.000	0.000
Observations	8,776	8,714	26,295	8,637	8,612
MEN					
Young Adult					
β	–0.0323	0.148	0.0369*	0.00825	0.00223
se	0.0232	0.451	0.0200	0.0129	0.00861
p-value	0.165	0.744	0.065	0.522	0.796
Post Expansion					
β	0.0289	–0.182	0.0172	–0.00485	0.000360
se	0.0285	0.527	0.0243	0.0149	0.0109
p-value	0.310	0.730	0.479	0.744	0.974
Young Adult * Post Expansion					
β	0.0796*	0.993	0.0164	–0.00370	–0.00335
se	0.0406	0.850	0.0368	0.0234	0.0161
p-value	0.051	0.243	0.657	0.875	0.836
Constant					
β	0.728***	51.60***	0.417***	0.0650***	0.0456***
se	0.0364	0.867	0.0393	0.0225	0.0173
p-value	0.000	0.000	0.000	0.004	0.009
WOMEN					
Young Adult					
β	–0.0104	–0.420	0.0230	0.0221*	–0.00727
se	0.0180	0.473	0.0199	0.0133	0.00994
p-value	0.562	0.375	0.249	0.096	0.465
Post expansion					
β	0.00905	0.0820	0.0286	–0.00876	–0.0194*
se	0.0216	0.579	0.0245	0.0161	0.0114
p-value	0.676	0.887	0.244	0.585	0.088
Young Adult * Post Expansion					
β	0.0398	2.018**	–0.0102	–0.0284	0.00281
se	0.0310	0.822	0.0354	0.0217	0.0162
p-value	0.200	0.014	0.774	0.192	0.863
Constant					
β	0.876***	48.91***	0.396***	0.0852***	0.0503***
se	0.0314	0.881	0.0362	0.0213	0.0180
p-value	0.000	0.000	0.000	0.000	0.005

Notes: Linear difference-in-differences models adjust for ethnicity, race, census region, and urbanicity; Pre-period includes 2007-2009; post-period includes 2011. The unit of analysis is the person-round for ''excellent mental health'', and the person-year for all other outcomes. Estimates are weighted to represent the civilian, non-institutionalized U.S. population. Standard errors are adjusted for the complex sampling design and within-person correlation. *$p < 0.10$; **$p < 0.05$; *** $p < 0.01$.

Table 4. Change in the Predicted Probability of Self-Reported Mental Health Among Adults Ages 23-25 Compared to Adults Ages 27-29 after ACA Adult Dependent Coverage Expansion

	23-25 Years of Age		27-29 Years of Age		
	Baseline Probability	Change from Baseline (se)	Baseline Probability	Change from Baseline (se)	Difference-in-Differences (se)
FULL SAMPLE					
EXC	0.48	0.033 (0.019)	0.45	0.032 (0.016)**	0.001 (0.024)
VG	0.29	–0.008 (0.005)	0.3	–0.007 (0.004)	–0.002 (0.006)
GD	0.19	–0.017 (0.01)	0.21	–0.017 (0.009)**	–0.0001 (0.01)
FR	0.04	–0.006 (0.003)	0.04	–0.006 (0.003)**	0.0005 (0.004)
PR	0.007	–0.001 (0.001)	0.009	–0.002 (0.001)	0.0002 (0.001)
MEN					
EXC	0.5	0.031 (0.028)	0.46	0.022 (0.021)	0.009 (0.035)
VG	0.28	–0.009 (0.008)	0.3	–0.005 (0.005)	–0.004 (0.009)
GD	0.18	–0.016 (0.014)	0.2	–0.012 (0.011)	–0.004 (0.018)
FR	0.04	–0.005 (0.005)	0.03	–0.004 (0.004)	–0.001 (0.006)
PR	0.005	–0.001 (0.001)	0.009	–0.001 (0.001)	–0.0001 (0.001)
WOMEN					
EXC	0.46	0.036 (0.02)	0.43	0.040 (0.021)	–0.003 (0.030)
VG	0.30	–0.008 (0.006)	0.29	–0.008 (0.004)	–0.0007 (0.007)
GD	0.19	–0.02 (0.013)	0.22	–0.022 (0.011)	0.002 (0.017)
FR	0.04	–0.007 (0.004)	0.04	–0.008 (0.004)	0.001 (0.006)
PR	0.009	–0.002 (0.001)	0.008	–0.002 (0.001)	0.0004 (0.001)

Notes: Ordered probit models adjust for ethnicity, race, census region, and urbanicity; Estimates are weighted to represent the civilian, non-institutionalized US population. Baseline period includes 2007-2009; post-period includes 2011. Standard errors are adjusted for the complex sampling design of the MEPS and within-person correlation. **p <0.05; ***p <0.01.

Emotional Well-being and Social Role Functioning

The average unadjusted increase in the SF-12 mental health component score was approximately 1.5 points in the young adult group (p<0.01) after the insurance coverage expansion.(**Table 2**) There was no comparable increase among adults ages 27-29. In adjusted DID analyses, a relative increase of 1.4 points in the MCS score persisted for young adults compared to older adults [β=1.43; se=0.55]. (**Table 3**) This effect size translates into a difference of 0.14 standard deviations. In separate analyses for men and women, young women experienced an increase in the MCS score compared to the older female cohort [β=2.02; se=0.82]. There was no significant change in the MCS score for men ages 23-25 relative to men ages 27-29 after the policy's implementation.

Depression and Serious Psychological Distress

The unadjusted proportion of young adults that screened positive for depression decreased from 0.09 at baseline to 0.06 [p<0.01] after the coverage expansion. (**Table 2**) This decline was driven by changes among young women for whom the proportion screening positive for depression decreased from 0.10 at baseline to 0.06 in 2011 [p=0.02]. Young men, and older adults, experienced a decrease of 1

percentage point in the proportion screening positive for depression that was not significantly different from zero. In adjusted DID analyses, there were no significant differences between young adults and older adults in the probability of screening positive for depression after the coverage expansion compared to the baseline period. (**Table 3**) However, consistent with the descriptive findings, the direction of effects was negative (i.e., a decrease in positive screens for depression). The proportion of young and older adults that screened positive for SPD at baseline was 0.04 and 0.05 respectively. (**Table 2**) Each age group experienced a 1-percentage point decline after the dependent coverage expansion; these unadjusted changes were not statistically significant. Similarly, the DID estimated difference in the likelihood of screening positive for SPD between young adults and older adults as a whole and within sex after the expansion was close to zero and not statistically significant. (**Table 3**)

Robustness Checks and Heterogeneity

We re-estimated our models using a broader set of covariates that has often been used in this literature including marital status, educational attainment, and income less than 200% of the federal poverty level. The results were very similar. (**Table 5** and **Table 6**) Returning to our preferred model specifications, we then implemented all analyses holding the

Table 5. Change in Health Insurance and Self-Reported Health Among Adults Ages 23-25 Year Compared to Adults Ages 27-29 Years after ACA Adult Dependent Coverage Expansion

	Insured	Mental Component Score	Excellent Mental Health	Depression	Serious Psychological Distress
FULL SAMPLE					
Young Adult					
β	0.00395	0.290	0.0544***	0.00590	−0.00953
se	0.0139	0.338	0.0148	0.00929	0.00692
p-value	0.776	0.391	0.000	0.525	0.169
Post Expansion					
β	0.00329	0.0150	0.0142	−0.00502	−0.00906
se	0.0172	0.376	0.0183	0.0107	0.00814
p-value	0.848	0.968	0.439	0.640	0.266
Young Adult * Post Expansion					
β	0.0750***	1.412***	0.00633	−0.0159	0.000322
se	0.0256	0.543	0.0256	0.0147	0.0117
p-value	0.004	0.010	0.805	0.279	0.978
Constant					
β	0.610***	49.73***	0.317***	0.106***	0.0663***
se	0.0340	0.894	0.0393	0.0214	0.0178
p-value	0.000	0.000	0.000	0.000	0.000
MEN					
Young Adult					
β	−0.00332	0.612	0.0625***	0.000962	−0.00582
se	0.0221	0.468	0.0201	0.0126	0.00881
p-value	0.880	0.191	0.002	0.939	0.509
Post Expansion					
β	−0.00009	−0.283	−0.000865	0.000153	0.00322
se	0.0252	0.514	0.0236	0.0148	0.0108
p-value	0.997	0.582	0.971	0.992	0.767
Young Adult * Post Expansion					
β	0.0953**	0.990	0.0258	−0.00433	−0.00319
se	0.0390	0.842	0.0357	0.0232	0.0160
p-value	0.015	0.240	0.470	0.852	0.842
Constant					
β	0.543***	50.11***	0.319***	0.120***	0.0824***
se	0.0449	1.114	0.0463	0.0301	0.0230
p-value	0.000	0.000	0.000	0.000	0.000
WOMEN					
Young Adult					
β	0.0103	0.130	0.0488**	0.00959	−0.0147
se	0.0178	0.485	0.0197	0.0135	0.0103
p-value	0.562	0.789	0.013	0.476	0.154
Post expansion					
β	0.0113	0.122	0.0248	−0.00822	−0.0195*
se	0.0203	0.570	0.0246	0.0158	0.0112
p-value	0.576	0.830	0.313	0.604	0.084
Young Adult * Post Expansion					
β	0.0384	1.955**	−0.00680	−0.0274	0.00424
se	0.0300	0.818	0.0349	0.0215	0.0161
p-value	0.202	0.017	0.846	0.202	0.792
Constant					
β	0.758***	48.17***	0.296***	0.0912***	0.0489*
se	0.0465	1.286	0.0505	0.0311	0.0266
p-value	0.000	0.000	0.000	0.003	0.066

Notes: Linear difference-in-differences models adjust for ethnicity, race, census region, urbanicity, **educational attainment, marital status, and income <200%**; Pre-period includes 2007-2009; post-period includes 2011. The unit of analysis is the person-round for ''excellent mental health'', and the person-year for all other outcomes. Estimates are weighted to represent the civilian, non-institutionalized U.S. population. Standard errors are adjusted for the complex sampling design and within-person correlation. * p <0.10; ** p <0.05; *** p <0.01.

Table 6. Change in the Predicted Probability of Self-Reported Mental Health Among Young Adults Compared to Adults Ages 27-29 after ACA Adult Dependent Coverage Expansion

	(1) Ages 23-25 & 27-29 Wider Young Adult Age Range	(2) Ages 23-25 & 27-29 Expanded Set of Covariates	(3) Ages 23-25 & 27-29 College Graduates	(4) Ages 23-25 & 27-29 Non-College Graduates
	DID (se)	DID (se)	DID (se)	DID (se)
FULL SAMPLE				
EXC	–0.001 (0.024)	0.009 (0.020)	0.064 (0.049)	0.016 (0.026)
VG	–0.001 (0.006)	–0.004 (0.006)	–0.028 (0.021)	0.001 (0.005)
GD	0.001 (0.013)	–0.004 (0.012)	–0.030 (0.023)	0.009 (0.015)
FR	0.001 (0.004)	–0.001 (0.004)	–0.006 (0.005)	0.004 (0.006)
PR	0.000 (0.001)	0.000 (0.001)	–0.001 (0.001)	0.001 (0.002)
MEN				
EXC	0.007 (0.035)	0.020 (0.034)	0.098 (0.076)	–0.007 (0.039)
VG	–0.003 (0.010)	–0.007 (0.010)	–0.053 (0.040)	0.001 (0.008)
GD	–0.003 (0.018)	–0.010 (0.017)	–0.037 (0.029)	0.004 (0.021)
FR	–0.001 (0.006)	–0.003 (0.006)	–0.007 (0.007)	0.002 (0.008)
PR	0.000 (0.001)	–0.001 (0.001)	–0.002 (0.002)	0.001 (0.002)
WOMEN				
EXC	–0.006 (0.030)	0.003 (0.030)	–0.044 (0.065)	–0.028 (0.034)
VG	0.000 (0.007)	–0.004 (0.006)	–0.017 (0.024)	0.001 (0.005)
GD	0.004 (0.017)	–0.001 (0.016)	–0.022 (0.034)	0.016 (0.019)
FR	0.002 (0.006)	0.001 (0.006)	–0.004 (0.007)	0.008 (0.008)
PR	0.001 (0.001)	0.000 (0.001)	0.000 (0.000)	0.003 (0.002)

Notes: Ordered probit models Estimates are weighted to represent the civilian, non-institutionalized US population. Baseline period includes 2007-2009; post-period includes 2011. Models 1, 3 and 4 adjust for ethnicity, race, census region, and urbanicity. Model 2 additionally adjusts for marital status, highest educational attainment, and income < 200% FPL; Standard errors are adjusted for the complex sampling design of the MEPS and within-person correlation. ** p <0.05; *** p <0.01.

comparison group constant and expanding the young adult group to include 19-22 year olds in addition to 23-25 year old adults. We anticipated that their inclusion would reduce the magnitude of our point estimates to the extent that increases at the extensive margin of coverage influence mental health outcomes. Prior research had indicated that the relative increase in health insurance coverage after the expansion was less pronounced in this younger subset of young adults.[23] The results of these analyses are consistent with this expectation as reported in **Table 6** and **Table 7**. Health insurance coverage increased by 4 percentage points among young adults ages 19-25 relative to older adults [β=0.04; se=0.02]. As we observed for the more narrowly defined young adult group, the MCS score increased after the policy change for young adults as a whole and for young women compared to their older peers. However, the magnitude of the effects appears to be smaller.

Finally, we stratified our analyses by college graduation status following Barbaresco *et al.*,[1] to explore the mechanisms by which the policy may influence mental health. Barbaresco *et al.*,[1] found that among college graduates poor mental health decreased for adults ages 23-25 following the coverage expansion relative to adults ages 27-29. Because they also found similar gains in health insurance coverage across college graduates and non-graduates, this finding suggested that changes at the intensive margin of

coverage and/or graduates' relatively greater capacity to convert health insurance resources into health were potential causal mechanisms. Among college graduates in our sample (N=1,860), the estimated increases in health insurance coverage for young adults were consistent with published estimates but were not statistically different from zero. (**Table 8**) The substantial reduction in the analytic sample size likely contributes to this null finding. The MCS component score increased by 2.4 points [β=2.4; se=1.0] among young adults compared to adults ages 27-29. Additionally, there was a marginally significant 3 percentage point decline in the likelihood of screening positive for depression for young adults relative to older adults [β=–0.033; se=0.019]. When stratified by sex, there was a significant relative increase in the MCS score among young men [β=3.35; se=1.45] compared to older men but not among young women relative to older women. There were marginally significant decreases in the likelihood of screening positive for SPD among young men [β=–0.023; se=0.013] and for depression among young women [β=–0.041; se=0.024] compared to their older peers. The estimated effects from the ordered probit analyses overall and by sex did not differ statistically between young and older adults. (**Table 6**)

Among subjects without a college degree, the rate of health insurance coverage increased after the coverage expansion

Table 7. Change in Health Insurance and Self-Reported Health Among Adults Ages 19-25 Compared to Adults Ages 27-29 after the Adult Dependent Coverage Expansion

	Insured	Mental Component Score	Excellent Mental Health	Depression	Serious Psychological Distress
FULL SAMPLE					
Young Adult					
β	–0.0247*	0.362	0.0320**	0.00739	–0.00324
se	0.0131	0.285	0.0152	0.00745	0.00605
p-value	0.060	0.205	0.036	0.322	0.593
Post Expansion					
β	0.0102	0.00195	0.0238	–0.00773	–0.00978
se	0.0195	0.39	0.0185	0.0110	0.00835
p-value	0.602	0.996	0.200	0.481	0.242
Young Adult * Post Expansion					
β	0.0444*	0.949**	–0.000346	–0.00353	0.00360
se	0.0227	0.46	0.0267	0.0124	0.00970
p-value	0.050	0.039	0.990	0.775	0.711
Constant					
β	0.834***	51.11***	0.402***	0.0633***	0.0428***
se	0.0212	0.564	0.0302	0.0115	0.0105
p-value	0.000	0.000	0.000	0.000	0.000
MEN					
Young Adult					
β	–0.0158	0.722*	0.0367*	–0.00389	–0.00172
se	0.0196	0.395	0.0200	0.0109	0.00729
p-value	0.420	0.068	0.067	0.720	0.813
Post Expansion					
β	0.0171	–0.207	0.0165	–0.00570	0.000658
se	0.0300	0.531	0.0245	0.0149	0.0109
p-value	0.569	0.697	0.499	0.703	0.952
Young Adult * Post Expansion					
β	0.0458	0.585	0.0180	0.00457	–0.00744
se	0.0359	0.679	0.0372	0.0183	0.0129
p-value	0.202	0.389	0.627	0.803	0.564
Constant					
β	0.777***	52.83***	0.412***	0.0575***	0.0318***
se	0.0295	0.648	0.0388	0.0171	0.0121
p-value	0.000	0.000	0.000	0.001	0.009
WOMEN					
Young Adult					
β	–0.0269*	–0.116	0.0254	0.0194*	–0.00434
se	0.0156	0.391	0.0197	0.0105	0.00894
p-value	0.085	0.766	0.200	0.065	0.627
Post expansion					
β	0.0110	0.103	0.0297	–0.00909	–0.0199*
se	0.0213	0.580	0.0245	0.0160	0.0115
p-value	0.604	0.860	0.226	0.570	0.083
Young Adult * Post Expansion					
β	0.0302	1.510**	–0.0135	–0.0130	0.0140
se	0.0265	0.678	0.0356	0.0179	0.0134
p-value	0.254	0.026	0.704	0.467	0.299
Constant					
β	0.888***	49.32***	0.393***	0.0702***	0.0537***
se	0.0273	0.758	0.0358	0.0167	0.0159
p-value	0.000	0.000	0.000	0.000	0.001

Notes: Linear difference-in-differences models adjust for ethnicity, race, census region, and urbanicity; Pre-period includes 2007-2009; post-period includes 2011. The unit of analysis is the person-round for ''excellent mental health'', and the person-year for all other outcomes. Estimates are weighted to represent the civilian, non-institutionalized U.S. population. Standard errors are adjusted for the complex sampling design and within-person correlation. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

Table 8. Change in Health Insurance and Self-Reported Health Among College Graduates, Adults Ages 23-25 Compared to Adults Ages 27-29 after ACA Adult Dependent Coverage Expansion

	Insured	Mental Component Score	Excellent Mental Health	Depression	Serious Psychological Distress
FULL SAMPLE					
Young Adult					
β	–0.0288	–0.656	0.0190	0.00921	0.00611
se	0.0236	0.740	0.0314	0.0151	0.0105
p-value	0.223	0.376	0.546	0.542	0.559
Post Expansion					
β	0.00326	–0.177	–0.0161	–0.00289	–0.00831
se	0.0258	0.571	0.0336	0.0150	0.00653
p-value	0.900	0.756	0.633	0.847	0.204
Young Adult * Post Expansion					
β	0.0547	2.420**	0.0834	–0.0335*	–0.00728
se	0.0435	1.000	0.0531	0.0190	0.0130
p-value	0.210	0.016	0.117	0.078	0.575
Constant					
β	0.886***	51.72***	0.480***	0.0317	0.00179
se	0.0453	0.946	0.0533	0.0204	0.00766
p-value	0.000	0.000	0.000	0.121	0.815
MEN					
Young Adult					
β	–0.0258	–0.157	0.0563	–0.0182	0.00920
se	0.0386	0.905	0.0442	0.0224	0.0122
p-value	0.503	0.862	0.204	0.416	0.451
Post Expansion					
β	0.00685	–1.319	–0.0176	0.00392	0.00667
se	0.0506	0.883	0.0503	0.0272	0.00927
p-value	0.892	0.136	0.726	0.886	0.472
Young Adult * Post Expansion					
β	0.0511	3.346**	0.113	–0.0168	–0.0233*
se	0.0826	1.452	0.0796	0.0293	0.0137
p-value	0.536	0.022	0.155	0.566	0.090
Constant					
β	0.799***	52.81***	0.667***	0.0238	0.00662
se	0.0846	1.526	0.0680	0.0229	0.00853
p-value	0.000	0.000	0.000	0.298	0.438
WOMEN					
Young Adult					
β	–0.0329	–0.951	–0.00423	0.0230	0.00435
se	0.0302	1.021	0.0391	0.0197	0.0159
p-value	0.276	0.352	0.914	0.242	0.785
Post expansion					
β	0.00234	0.541	–0.0183	–0.00810	–0.0181**
se	0.0269	0.777	0.0445	0.0164	0.00893
p-value	0.931	0.486	0.681	0.621	0.043
Young Adult * Post Expansion					
β	0.0588	1.771	0.0691	–0.0415*	0.00429
se	0.0442	1.420	0.0711	0.0241	0.0196
p-value	0.184	0.213	0.331	0.086	0.827
Constant					
β	0.929***	51.30***	0.394***	0.0337	–0.00395
se	0.0529	1.187	0.0648	0.0273	0.0115
p-value	0.000	0.000	0.000	0.217	0.732

Notes: Linear difference-in-differences models adjust for ethnicity, race, census region, and urbanicity; Pre-period includes 2007-2009; post-period includes 2011. The unit of analysis is the person-round for ''excellent mental health'', and the person-year for all other outcomes. Estimates are weighted to represent the civilian, non-institutionalized U.S. population. Standard errors are adjusted for the complex sampling design and within-person correlation. *p <0.10; ** p <0.05; *** p <0.01.

for young adults overall by 8.6 percentage points [β=0.086; se=0.033], and for young men by 10.3 percentage points relative to their older counterparts [β=0.103; se=0.051]. (**Table 9**) The estimated 4.2 percentage point increase among young women [β=0.042; se=0.041] was not statistically different from zero. There were no significant differences in mental health outcomes for young adults relative to older adults in the sample of non-college graduates overall. (**Table 9** and **Table 6**) In stratified analyses, the MCS score increased by 2.23 points for young women compared to older women [β=2.23; se=1.06].

Discussion

In September 2010, the ACA increased the availability of private health insurance for young adult dependents and prohibited coverage exclusions for their pre-existing conditions. Our paper focuses on the effects of that policy change on young adults' mental health outcomes one-year after its implementation relative to the 2007-2009, baseline period. Several studies previously assessed the coverage expansion's impact on young adults' mental health care use reflecting the unique health care needs of young adults. Seventy-five percent of all lifetime cases of mental health disorders emerge by age 24.[18] Yet, historically, young adults have been less likely to seek mental health treatment than middle-aged adults; financial barriers are commonly cited reasons for failing to seek treatment.[34]

After the law's implementation, the insurance rate for young adults rose,[1-3,34] financial protection from medical expenses improved,[4,10] and young adults' mental health care use increased.[11,12] These short-term effects signaled the possibility of accompanying changes in mental health outcomes through one or more mechanisms: treatment-induced symptom relief or improved function; improved well-being and/or reduced anxiety as financial security increases; or *declines* in self-reported mental health if treatment results in identification of previously undiagnosed illness. We implemented a DID analysis using the experience of adults ages 27-29 that are just above the eligibility cutoff as our comparison group to account for changes in the economy such as the improving employment rate, which might also affect mental health.

We found that for the population as a whole, there were few short-term changes in young adults' mental health outcomes relative to older adults as a consequence of the 2010 insurance coverage expansion. Rather, the overall pattern of findings suggests that both age groups experienced modest improvements in a range of outcomes that captured both positive and negative mental health. The exception to this pattern is the 1.4-point relative increase in the SF-12 MCS score among adults ages 23-25 relative to those ages 27-29 after the policy change. This summary score reflects well-being, mental health symptoms (positive and negative), and social role functioning. Placing this effect size in context, randomized clinical trials of low-intensity treatment for adults with diagnosed depression or anxiety yield increases of 1-6 points in the MCS score; the upper end of

this range is considered moderate but meaningful while a gain of 1-2 points is of questionable clinical significance.[35,36] The results from our study fall at the lower end of this distribution; however, they reflect population-level estimates rather than estimates obtained from individuals with diagnosed illness that volunteered for trial participation. Thus, we believe the effect observed in this study reflects a significant improvement for young adults.

We did not find between-group differences in self-reported "excellent" mental health. This result contrasts with prior research that found a 4-percentage point relative increase in excellent mental health among adults ages 19-25 compared to adults age 26-34 from a baseline, 2002-2009, to the post-policy period of 2011.[20] The variability in findings from two studies that use the same data source and analytic framework is likely explained by the different choice of study groups and years. We defined the study groups narrowly around the age-eligibility threshold and included baseline years of only 2007-2009 to reduce the potential confounding contribution of more distant (and unobserved) events on the pre-policy average outcomes. Holding our study years constant, when we expand the young adult group to include ages 19-25 we found no between-group difference in this global measure of mental health after the expansion. (**Table 7**) We then expanded the comparison group to include adults ages 26-34 and observed a 2.4 percentage point relative increase among young adults in excellent mental health [β=.024; se=.017] although it did not significantly differ from zero (results not shown). We conclude that within the years proximate to the policy change (i.e., 2007-2009 and 2011), the results are relatively sensitive to the choice of comparison group.

Several studies have found that the effects of the adult dependent coverage expansion were not uniform across men and women, most consistently with respect to health insurance coverage.[1,4] We did not directly compare the policy effects of young men to young women because of sample size constraints; however, the stratified estimates presented in **Table 3** are consistent with prior studies that report relatively larger increases in insurance coverage for young men. To the extent that changes at the extensive margin of coverage influence mental health similarly across men and women, we might then expect significant policy effects to be concentrated in the male subgroup. We do not find such effects. (**Table 3** and **Table 4**) Rather, in stratified analyses, we found a significant relative increase in the MCS score among young women only. While we cannot determine the causal mechanism with our data, there are several potential explanations for this gender-specific effect that future research might consider.

First, women's propensity to use health care (that influences mental health) may be relatively more responsive to the acquisition of new or more generous health insurance. If so, even relatively small gains at the extensive margin of coverage might result in equal or greater use of mental-health related care than young men. This explanation however is complicated by Golberstein *et al.*[11] findings that the coverage expansion increased inpatient psychiatric admissions for both young women and young men, with larger effects observed among men. It remains possible that

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Table 9. Change in Health Insurance and Self-Reported Health Among non-College Graduates, Adults Ages 23-25 Compared to Adults Ages 27-29 after ACA Adult Dependent Coverage Expansion

	Insured	Mental Component Score	Excellent Mental Health	Depression	Serious Psychological Distress
FULL SAMPLE					
Young Adult					
β	−0.00775	0.277	0.0503***	0.0105	−0.0110
se	0.0186	0.405	0.0161	0.0114	0.00940
p-value	0.678	0.495	0.002	0.358	0.241
Post Expansion					
β	0.00177	−0.0612	0.0289	−0.00473	−0.00682
se	0.0253	0.524	0.0216	0.0147	0.0120
p-value	0.944	0.907	0.181	0.748	0.569
Young Adult * Post Expansion					
β	0.0864***	1.108	−0.0266	−0.00911	0.00118
se	0.0331	0.725	0.0288	0.0207	0.0161
p-value	0.009	0.127	0.356	0.659	0.941
Constant					
β	0.790***	49.93***	0.395***	0.0957***	0.0699***
se	0.0319	0.832	0.0336	0.0187	0.0183
p-value	0.000	0.000	0.000	0.000	0.000
MEN					
Young Adult					
β	−0.0177	0.372	0.0488**	0.00923	−0.00391
se	0.0285	0.529	0.0219	0.0152	0.0109
p-value	0.536	0.482	0.026	0.545	0.720
Post Expansion					
β	−0.00526	0.0751	0.0104	−0.00414	0.00188
se	0.0357	0.665	0.0289	0.0184	0.0152
p-value	0.883	0.910	0.719	0.822	0.902
Young Adult * Post Expansion					
β	0.103**	0.307	−0.00299	0.000916	0.00117
se	0.0510	1.029	0.0408	0.0294	0.0213
p-value	0.043	0.765	0.942	0.975	0.956
Constant					
β	0.746***	51.59***	0.384***	0.0722***	0.0552**
se	0.0448	1.035	0.0427	0.0274	0.0214
p-value	0.000	0.000	0.000	0.009	0.010
WOMEN					
Young Adult					
β	0.0125	0.149	0.0517**	0.0121	−0.0193
se	0.0227	0.572	0.0219	0.0171	0.0144
p-value	0.584	0.794	0.018	0.482	0.180
Post expansion					
β	0.0195	−0.338	0.0520*	−0.00435	−0.0160
se	0.0301	0.814	0.0295	0.0243	0.0181
p-value	0.517	0.678	0.078	0.858	0.377
Young Adult * Post Expansion					
β	0.0415	2.226**	−0.0549	−0.0223	0.000490
se	0.0401	1.062	0.0380	0.0310	0.0242
p-value	0.301	0.036	0.149	0.472	0.984
Constant					
β	0.847***	47.84***	0.406***	0.124***	0.0890***
se	0.0385	1.141	0.0408	0.0284	0.0288
p-value	0.000	0.000	0.000	0.000	0.002

Notes: Linear difference-in-differences models adjust for ethnicity, race, census region, and urbanicity; Pre-period includes 2007-2009; post-period includes 2011. The unit of analysis is the person-round for ''excellent mental health'', and the person-year for all other outcomes. Estimates are weighted to represent the civilian, non-institutionalized U.S. population. Standard errors are adjusted for the complex sampling design and within-person correlation. * $p < 0.10$; ** $p < 0.05$; *** $p < 0.01$.

young women's use of non-hospital based mental health care explains their improvement in the MCS score. Unfortunately, there is no evidence regarding the policy's effect on office-based mental health care. We attempted to examine this possibility using our study data because the MEPS contains office-based health care use, but it was as infeasible due to the sample size and the relative infrequency of mental health care use in the young adult population. To make further progress in our understanding of the relationship between this policy change and mental health outcomes, a comprehensive assessment of the effects on outpatient care is needed.

Second, independent of policy-induced changes in mental health care use, the effects of new or improved health insurance on perceived financial security and peace-of-mind may be more pronounced for young women than young men.

Finally, young women may have acquired better insurance coverage, on average, than young men as a function of this policy change in terms of covered services, provider networks, cost-sharing, etc. There is no obvious reason a priori to expect a differential gain in the actuarial value of coverage between young men and women. Nonetheless, a more granular understanding of the attributes of coverage that *did change* would support research on the causal mechanisms that mediate the policy and a variety of outcomes that interest both scholars and policy-makers.

Addressing differences by schooling, among college graduates the adult dependent coverage expansion increased young adults' MCS score by 2.4 points and decreased the probability of screening positive for depression by 3 percentage points. (**Table 8**) The decline in positive depression screens appears to be driven by a 4-percentage point decrease among young women while the likelihood of screening positive for SPD declined by 2-percentage points for young male college graduates compared to older male graduates. Among adults without a college degree, there were no relative improvements in mental health outcomes for young adults as a whole. (**Table 9**) We are limited in the inferences that we may draw from these findings because we did not formally compare the relative effects of the coverage expansion for young adults with and without a college degree due to sample size limitations.The results are suggestive of a differential effect according to educational achievement and consistent with prior findings of an improvement in poor mental health among young adults with a college degree after the coverage expansion.[1]

Our findings should be interpreted in light of several limitations. While each MEPS sample is representative of the non-institutionalized U.S. population, it is possible that compositional changes in the sub-sample of adults ages 23-25 and ages 27-29 from 2007 to 2011 – rather than the coverage expansion – may confound our results. Although we did not find significant changes in observed characteristics within group over time, we cannot rule out the possibility of changes in unobserved factors. We attempted to explore this possibility, by estimating a series of longitudinal fixed effects models in which the cohort is held constant. In general, the MEPS supports such longitudinal analyses over a two-year period for each subject. However,

in this instance the cohort sample size was insufficient to conduct these analyses.

The focus of our study is on the short-term effects of the adult dependent coverage expansion on mental health outcomes. The longer-run effects may differ. Estimating the long-run effects of this policy is a challenging analytic task in part because of the nature of the policy change itself. For example, the DID identification strategy leverages the abrupt implementation of the policy for a policy-eligible population, young adults, relative to an ineligible population of slightly older adults. The availability of an ''unexposed'' comparison group dwindles with each year beyond the implementation period because the cohort of young adults that experienced the policy change ages into the comparison group. Moreover, it becomes more difficult to isolate the effect of the coverage expansion in late 2010 from other events that may have specifically affected young adults in the years after its introduction.

We lacked the sample size to obtain reasonably precise estimates from models that included multiple interaction terms. Thus, we could not formally compare the equivalence of the policy's effects on population subgroups (e.g., men and women; college graduates and non-graduates). Nonetheless, the separate stratified analyses yield important insight into each subgroup's response to the coverage expansion across a varied set of mental health outcomes. A key strength of the MEPS is the availability of multiple measures of mental health; however, that richness in outcomes comes at a cost in terms of sample size that we recognize.

Conclusion

The Affordable Care Act's adult dependent coverage expansion increased young adults' financial protection from medical expenses and their hospital-based mental health care use, outcomes that have the potential to influence mental health. We found limited evidence of an accompanying improvement in mental health outcomes. The important exception was a small population-level increase in emotional well being that may reflect a response to improved financial security and/or access to treatment. Given the short time period studied after implementation even this should be considered an important and promising improvement in mental health.

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Appendix

Table A1. Health Outcome Measures

SF-12v2
General health today
During a typical day, limitations in moderate activities
During a typical day, limitations in climbing several flights of stairs
During the past 4weeks, as a result of physical health, accomplished less than would like
During the past 4 weeks, as a result of physical health, limited in kind of work or other activities
During the past 4 weeks, as a result of mental problems, accomplished less than you would like
During the past 4 weeks, as a result of mental problems, did work or other activities less carefully than usual
During the past 4 weeks, pain interfered with normal work outside the home and housework
During the past 4 weeks, felt calm and peaceful
During the past 4 weeks, had a lot of energy
During the past 4 weeks, felt downhearted and depressed
During the past 4 weeks, physical health or emotional problems interfered with social activities

A proprietary weighting algorithm uses all 12 items to arrive at the mental component summary score (MCS) with a range of 0-100. A higher value indicates better health. The items in bold text are those items that are weighted more heavily in the calculation of the MCS score.

Kessler Index
During the past 30 days, felt nervous
During the past 30 days, felt hopeless
During the past 30 days, felt restless or fidgety
During the past 30 days, felt so sad that nothing could cheer the person up
During the past 30 days, felt that everything was an effort
During the past 30 days, felt worthless

Response values for each item: 0=None of the time; 1=A little of the time; 2=Some of the time; 3=Most of the time; 4=All of the time. The summation of scores from these six items yields the K6 summary score.

PHQ-2
During the past two weeks, bothered by having little interest or pleasure in doing things
During the past two weeks, bothered by feeling down, depressed, or hopeless

Response values include: 0= not at all; 1=several days; 2=more than half the days; 3=nearly every day. The summation of scores from the two items yields the PHQ-2 summary score.