

Supplemental Methods

1. Age-Masking of California Data

A limitation of the California inpatient and ED data is that the state employed a degree of “age masking” of observations to help prevent any of the data from being potentially identifiable. While the data do not indicate which particular observations have been masked, the data documentation (available at <http://oshpd.ca.gov/HID/Products/PatDischargeData/PublicDataSet/index.html>) indicates the process and degree of masking. In both the inpatient and ED data, the masking procedure was the same, although the extent of masking was different. When single year of age was masked, age was recoded into 5-year age groups (the age groups of 15-19, 20-24, and 25-29 are relevant for our study). The vast majority of masked values for age were set to the middle year of the 5-year age group (e.g., age 22 for the 20-24 year old age group), and the remainder were set to the midpoint of age 18-34 (i.e., age 26).

In the ED data, 30% of the single-year of age data are masked. Of those masked observations, the vast majority (76%) were recoded to the midpoint of the 5-year age group, and the remaining 24% were recoded as age 26. This means that in the ED data, approximately 96% of 19-29 year olds are coded within the correct age group that is used for analysis (19-25 or 26-29), even though 30% of observations have masked values for single year of age.

In the inpatient data, 54% of the single-year of age data are masked. Of those masked observations, the vast majority (72%) were recoded to the midpoint of the 5-year age group, and the remaining 28% were recoded as age 26. This means that in the ED data, approximately 90% of 19-29 year olds are coded within the correct age group that is used for analysis (19-25 or 26-29), even though 30% of observations have masked values for single year of age.

In terms of analysis, the consequences of the age masking is that to the extent that any bias exists, it would bias toward the null hypothesis, or finding no change in ED visits after the ACA dependent coverage provisions, because a small proportion of the age 19-25 year old observations would be coded as being in the comparison group (age 26-29). We expect the extent of this bias to be minimal, given the high proportions of the data that are coded as being in the appropriate treatment or comparison group.

2. Parallel Trends Assumption

An important assumption used to interpret estimates from a difference-in-difference study design is that the trends for the target (age 19 to 25) and comparison (age 26 to 29) groups were moving in parallel before the policy change.¹ To test that key assumption, we estimated a model of overall inpatient admission rates, only using data from the period before the ACA's dependent coverage expansion (first quarter 2005 – second quarter 2010). The model included a linear quarterly time trend, a full set of single year of age indicator variables, and an indicator for sex. The model also included an interaction between the age 19-25 year old indicator (age 19-25=1) and the time trend. To assess whether the trends in the outcome were moving in parallel between the two age groups, we tested whether the interaction between the time trend and the treatment indicator was statistically significant. A statistically significant value would indicate a violation of the parallel trends assumption. The significance of the interaction terms was $p=0.233$ in the national inpatient data, $p=0.584$ in the California inpatient data, and $p=.173$ in the California ED data. All of these tests support the assumption of parallel trends in hospital-based behavioral health services before the dependent coverage expansion.

Reference

1. Meyer BD. Natural and Quasi-Experiments in Economics. J Bus Econ Stat. Apr 1995;13(2):151-161.

TABLE S1. Coding of Inpatient Admission and ED Visit Diagnoses & Birth Exclusions

Admission/visit diagnosis	ICD-9 Code	Comments
1. All behavioral health	All codes between 290.xx to 319.xx	Primary diagnosis for Inpatient admissions or any diagnosis for emergency department visits
2. Depression	296.2, 296.3, 300.4, 311.XX, V79.0	Primary diagnosis for Inpatient admissions or any diagnosis for emergency department visits
3. Substance use disorder (SUD)	303.XX, 304.XX, 305.XX AND 292.xx	Primary diagnosis for Inpatient admissions or any diagnosis for emergency department visits
4. Psychoses	293.81 and 293.82, 294.2x-294.9x, 295.xx, 297.xx, 298.xx, 296.8 and 296.9	Primary diagnosis for Inpatient admissions or any diagnosis for emergency department visits
5. SUD with any mental illness.	Any code in #3 plus any code in #1 not in #3	Emergency department visits only
6. Multiple mental health, >1 diagnosis of mental illness (not SUD)	Any 2 or more codes in #1 but not in #3 (i.e. not SUDs)	Emergency department visits only
7. All other behavioral health	All remaining diagnoses between 290.XX and 319.xx not coded above in #2-#4 (inpatient) or #2-#6 (emergency)	Diagnosis #s 2 through 7 are mutually exclusive. For inpatient admissions, the sum of admissions in #s 2,3,4,7 = admissions in #1. For emergency department visits, the sum of visits in #s 2-7 = visits in #1.
8. Codes used to exclude birth related discharges	V22-V24, V27-V39	

TABLE S2. Differential National Inpatient Admissions with Behavioral Health Diagnoses for 19-25 Year Olds After Affordable Care Act Dependent Coverage Provisions, by Primary Diagnosis

Full Sample						
(n = 616 age and sex-specific quarterly admission rates)						
	Interim expansion period, age 19-25 vs. 26-29	(95% CI)	P-value	Post-expansion period, age 19-25 vs. 26-29	(95% CI)	P-value
Any mental illness or SUD ^b	0.06	(-0.003,0.13)	0.063	0.14	[0.10,0.17]	<0.001
Depression	0.005	(-0.01,0.02)	0.524	0.027	[0.01,0.04]	<.001
Psychoses	-0.011	(-0.04,0.02)	0.525	0.050	[0.03,0.07]	<.001
Other mental illness	0.041	(0.01,0.07)	0.005	0.032	[0.01,0.05]	0.001
SUD	0.028	(0.01,0.05)	0.015	0.027	[0.01,0.04]	<.001
Males						
(n = 308 age-specific quarterly admission rates)						
Any mental illness or SUD	0.10	(0.03,0.18)	0.008	0.20	[0.15,0.26]	<0.001
Depression	0.016	(-0.01,0.04)	0.201	0.033	[0.02,0.05]	<.001
Psychoses	-0.019	(-0.08,0.04)	0.497	0.077	[0.05,0.11]	<.001
Other mental illness	0.054	(0.03,0.08)	<.001	0.037	[0.01,0.06]	0.001
SUD	0.053	(0.02,0.09)	0.002	0.058	[0.04,0.08]	<.001
Females						
(n = 308 age-specific quarterly admission rates)						
Any mental illness or SUD	0.02	(-0.05,0.10)	0.515	0.07	[0.02,0.11]	0.004
Depression	-0.005	(-0.03,0.02)	0.726	0.022	[0.002,0.04]	0.030
Psychoses	-0.002	(-0.04,0.04)	0.913	0.022	[-0.001,0.05]	0.063
Other mental illness	0.027	(-0.01,0.06)	0.129	0.026	[-0.001,0.05]	0.057
SUD	0.003	(-0.03,0.03)	0.820	-0.003	[-0.02,0.01]	0.689

a –Table shows coefficient estimate on age 19-25 quarterly admission rates interacted with indicator for post period (4th quarter 2010- through 4th quarter 2011) in regression models of admission rates controlling for age, quarter, and (where appropriate) sex.

b – SUD, substance use disorder

TABLE S3. Differential Inpatient Admissions in California with Behavioral Health Diagnoses for 19-25 Year Olds After Affordable Care Act Dependent Coverage Provisions, by Primary Diagnosis

	Full Sample					
	(n = 616 age and sex-specific quarterly admission rates)					
	Interim expansion period, age 19-25 vs. 26-29			Post-expansion period, age 19-25 vs. 26-29		
		(95% CI)	P-value		(95% CI)	P-value
Any mental illness or SUD ^b	0.011	(-0.19,0.22)	0.911	0.079	[-0.06,-0.22]	0.282
Depression	0.007	(-0.02,0.03)	0.525	0.011	[-0.01,0.03]	0.284
Psychoses	-0.048	(-0.23,0.14)	0.606	-0.032	[-0.15,0.09]	0.597
Other mental illness	0.012	(-0.02,0.04)	0.452	0.026	[0.001,0.05]	0.041
SUD	0.041	(0.001,0.08)	0.047	0.075	[0.04,0.11]	<.001
	Males					
	(n = 308 age-specific quarterly admission rates)					
Any mental illness or SUD	0.0001	(-0.09,0.09)	0.998	0.117	[0.03,0.21]	0.011
Depression	0.021	(-0.01,0.05)	0.201	0.021	[-0.005,0.05]	0.108
Psychoses	-0.092	(-0.16,0.02)	0.010	-0.031	[-0.09,0.02]	0.254
Other mental illness	0.023	(-0.005,0.05)	0.101	0.030	[-0.004,0.06]	0.081
SUD	0.047	(0.01,0.09)	0.017	0.097	[0.07,0.13]	<.001
	Females					
	(n = 308 age-specific quarterly admission rates)					
Any mental illness or SUD	0.023	(-0.05,0.10)	0.560	0.041	[-0.04,0.13]	0.340
Depression	-0.007	(-0.03,0.02)	0.607	0.001	[-0.02,0.03]	0.947
Psychoses	-0.005	(-0.06,0.05)	0.852	-0.034	[-0.08,0.01]	0.164
Other mental illness	0.001	(-0.05,0.05)	0.974	0.021	[-0.01,0.05]	0.162
SUD	0.034	(0.01,0.06)	0.009	0.053	[0.03,0.07]	<.001

a –Table shows coefficient estimate on age 19-25 quarterly admission rates interacted with indicator for post period (4th quarter 2010- through 4th quarter 2011) in regression models of admission rates controlling for age, quarter, and (where appropriate) sex.

b – SUD, substance use disorder

TABLE S4. Differential ED Visits in California for 19-25 Year Olds After Affordable Care Act Dependent Coverage Provisions, by Behavioral Health Diagnoses

	Full Sample (n = 616 age and sex-specific quarterly admission rates)					
	Interim expansion period, age 19-25 vs. 26-29			Post-expansion period, age 19-25 vs. 26-29		
		(95% CI)	P-value		(95% CI)	P-value
Any behavioral health	-0.506	(-0.76,-0.24)	<.001	-0.450	(-0.72,-0.19)	0.001
Depression (only)	-0.044	(-0.09,0.004)	0.072	-0.054	(-0.11,0.01)	0.073
Psychoses (only)	-0.063	(-0.11,-0.02)	0.009	-0.096	(-0.14,0.05)	<0.001
SUD (only)	-0.172	(-0.38,0.04)	0.105	-0.198	(-0.40,0.01)	0.057
2 or more mental disorders	-0.030	(-0.07,0.01)	0.102	-0.027	(-0.05,-0.003)	0.029
Co-occurring SUD and mental health	-0.108	(-0.18,-0.04)	0.002	-0.106	(-0.15,-0.06)	<.001
Other behavioral health	-0.090	(-0.21,0.03)	0.141	0.030	(-0.06,0.12)	0.511
	Males (n = 308 age-specific quarterly admission rates)					
Any behavioral health	-0.317	(-0.65,0.02)	0.063	-0.088	(-0.37,0.20)	0.544
Depression (only)	-0.031	(-0.07,0.004)	0.086	-0.003	(-0.03,0.02)	0.814
Psychoses (only)	-0.080	(-0.15,-0.01)	0.020	-0.090	(-0.15,0.03)	0.005
SUD (only)	-0.080	(-0.23,0.07)	0.282	-0.080	(-0.27,0.11)	0.409
2 or more mental disorders	0.002	(-0.03,0.04)	0.894	0.006	(-0.02,0.03)	0.652
Co-occurring SUD and mental health	-0.020	(-0.11,0.07)	0.651	-0.027	(-0.08,0.03)	0.327
Other behavioral health	-0.108	(-0.23,0.02)	0.088	0.108	(0.03,0.19)	0.011
	Females (n = 308 age-specific quarterly admission rates)					
Any behavioral health	-0.695	(-1.02,-0.37)	<.001	-0.813	(-1.12,-0.50)	<.001
Depression (only)	-0.056	(-0.11,0.002)	0.060	-0.106	(-0.16,-0.05)	<.001
Psychoses (only)	-0.046	(-0.11,0.02)	0.158	-0.101	(-0.15,0.05)	<.001
SUD (only)	-0.264	(-0.41,-0.11)	0.001	-0.316	(-0.50,-0.13)	0.001
2 or more mental disorders	-0.062	(-0.11,-0.01)	0.016	0.060	(-0.09,-0.03)	<.001
Co-occurring SUD and mental health	-0.195	(-0.30,-0.08)	0.001	-0.184	(-0.24,-0.13)	<.001
Other behavioral health	-0.073	(-0.19,0.05)	0.237	-0.048	(-0.016,0.06)	0.398

a –Table shows coefficient estimate on age 19-25 quarterly admission rates interacted with indicator for post period (4th quarter 2010- through 4th quarter 2011) in regression models of admission rates controlling for age, quarter, and (where appropriate) sex.

b – SUD, substance use disorder

c – Individuals with “Depression(only)” “Psychoses (only)” or SUD (only) indicates no other mental illness or substance use disorder diagnosis. Other physical diagnoses may be present on these discharge records.

TABLE S5. Differential ED Visits in California for 19-25 Year Olds After Affordable Care Act Dependent Coverage Provisions, Combining SEDD and SID data to Calculate total ED Visits.

	Full Sample (n = 616 age and sex-specific quarterly admission rates)					
	Interim expansion period, age 19-25 vs. 26-29			Post-expansion period, age 19-25 vs. 26-29		
		(95% CI)	P-value		(95% CI)	P-value
Any behavioral health	-0.671	(-1.20,-0.15)	0.012	-0.571	(-1.02,-0.12)	0.013
	Males (n = 308 age-specific quarterly admission rates)					
Any behavioral health	-0.460	(-0.81,-0.11)	0.010	-0.186	(-0.50,0.13)	0.248
	Females (n = 308 age-specific quarterly admission rates)					
Any behavioral health	-0.881	(-1.23,-0.53)	<.001	-0.956	(-1.29,-0.62)	<.001

TABLE S6. Differential Change in Likelihood that Inpatient Admissions and ED Visits with Behavioral Health Diagnoses for 19-25 Year Olds are Covered by Private Insurance, After Implementation of Dependent Coverage Provision

Outcome	Full Sample (n = 616 age and sex-specific quarterly admission rates)					
	Interim expansion period, age 19-25 vs. 26-29	(95% CI)	P-value	Post-expansion period, age 19-25 vs. 26-29	(95% CI)	P-value
National Inpatient Admissions	0.021	(0.01,0.03)	<0.001	0.084	[0.07,0.10]	<0.001
California Inpatient Admissions	0.027	(0.005,0.05)	0.017	0.090	[0.07,0.11]	<0.001
California ED ^b Visits	0.009	(0.001,0.02)	0.027	0.065	[0.06,0.07]	<0.001
Males (n = 308 age-specific quarterly admission rates)						
National Inpatient Admissions	0.025	(0.01,0.04)	<0.001	0.092	[0.08,0.11]	<0.001
California Inpatient Admissions	0.028	(0.01,0.05)	0.013	0.110	[0.09,0.13]	<0.001
California ED ^b Visits	0.017	(0.01,0.03)	<0.001	0.072	[0.06,0.08]	<0.001
Females (n = 308 age-specific quarterly admission rates)						
National Inpatient Admissions	0.017	(0.003,0.03)	0.015	0.075	[0.06,0.09]	<0.001
California Inpatient Admissions	0.026	(-0.01,0.06)	0.150	0.071	[0.05,0.09]	<0.001
California ED ^b Visits	0.001	(-0.01,0.01)	0.850	0.057	[0.05,0.07]	<0.001

a –Table shows coefficient estimate on age 19-25 quarterly admission/visit rates interacted with indicator for post period (4th quarter 2010-2011) in regression models of share of admissions/visits that were uninsured, controlling for age, quarter, and (where appropriate) sex.

b - ED, emergency department