**Impact of Mental Health Insurance Legislation on Mental Health Treatment in a Longitudinal Sample of Adolescents**

Technical Appendix

1. **Sample Attrition and Missingness**

A total of 8,984 respondents participated in the initial NLSY97 survey (Round 1). During Rounds 13 (2009), 14 (2010), and 15 (2011), 1,425, 1,505, and 1,561 respondents participated in the surveys, respectively. However, only 1,031 participants were missing from all 3 rounds utilized in this study (i.e., Rounds 13-15).

Respondents missing any predictor variable for any reason were retained as a separate category (labeled as ‘unknown’) and were included in our analyses. Only those missing the outcome variable (n=1,031 [11.5%]), were dropped from analyses. Further analysis of missing and non-missing values for the outcome variable by sex, age, and race revealed that those that were missing the outcome variable of interest were significantly more likely to be white, male, and older.

NLSY97 sampling and weighting strategy introduced corrections for nonresponses in the weighting process 1. The NLSY97 Technical Sampling Report by Moore and colleagues reports that “the NLSY97 sample is not dramatically different from another nationally representative sample, the CPS” 1, p. 46. Further, the Report concludes that “both the screening sample and the samples of NLSY97 participants are reasonably balanced demographically and substantively, as determined by comparison of the samples to the CPS” (p. 96).

In NLSY97, over-sampling was done to allow researchers to measure more precisely the changes in key populations such as blacks and Hispanics. NLSY97 provides weights for each round of interview to be used to weight the observations when tabulating sample characteristics in order to describe the population represented. Since NLSY97 weights are specific to the survey year, we used NLSY97 Custom Weighting program to create custom weights for multiple survey years utilized in our study. Per NLSY97 recommendation, we employed these custom weights in calculating descriptive statistics of the variables (Table 1), but not in the regression modeling. However, we had sufficient sample size (minimum n=964)2 not to experience a loss of power or representativeness of the sample due to this. Further, adjusting the data by weighting reduces the impact of each black and Hispanic respondent and removes that bias.

1. **Selection of Risk and Protective Variables**

Risk and protective factors were those occurring during the late childhood period (Round 1), adolescent period (between Rounds 3-10), or adult period (Rounds 13-15). NLSY97 did not ask all questions during every round of surveys. Hence, in our models, we selected variables that were both theoretically important and available in the dataset. We hypothesize that the risk factors contribute to an increased likelihood of MH problems and/or lack of resources to obtain MH treatment for perceived problems. Meanwhile, protective factors enable an individual to reduce their MH risk and/or provide resources that helps them to address their MH problems.

The following risk and protective variables were selected in our study.

* childhood risk factors: having an emotional/learning problem at Round 1 and being female.
* adolescent risk factors: ACEs and the respondent’s family receiving government assistance (any payment assistance except for worker’s compensation or unemployment) at any point in the adolescent period.
* adult risk factors: depression status, lack of health insurance, unemployment, self-report of poor/fair/good health (as compared to very good/excellent health), living in a household with income at <300% federal poverty level (FPL), and living in a state with >7.5% unemployment in 2009.

**Calculation of ACE Variable**

Following Hughes and colleagues3, we used 11 NLSY97 questions (see below) to construct the ACEs variable by summing ‘yes’ responses to ACE that youth may have experienced, with a possible range of 0-11. This variable was used as a categorical variable with four levels (0, 1, 2, or 3+ ACE).

ACEs Ascertained in NLSY97 Survey Waves between 1997-2002

1. Is Youth’s first non-responding biological parent deceased?
2. Is Youth’s second non-responding biological parent deceased?
3. In the last 5 years, since you were x years old, has a close relative of yours died?
4. In the last 5 years, has an adult member of your household other than yourself experienced one or more periods of unemployment lasting at least 6 months?
5. In the last 5 years, have your parents divorced, either from each other or from their former spouse?
6. In the last 5 years, has an adult member of your household other than yourself been sent to jail or prison?
7. In the last 5 years, have you been the victim of a violent crime for example, physical or sexual assault, robbery or arson?
8. Sometimes children go through hard times. For example, they live in a place without water or electricity, or in a homeless shelter. To the best of your knowledge, has [this youth] ever experienced such hard times?
9. Before you turned age 12, were you ever the victim of repeated bullying?
10. Did you ever have your house or apartment broken into between the ages of 12-18?
11. Between ages of 12-19, have you ever been shot at or seen someone get shot or shot at with a gun?

*Note:* These questions were asked across several NLSY97 survey waves between 1997 and 2002. The ‘in the last 5 years’ questions were specifically referencing the period between 1997-2002.

1. **Alternative specification**

We estimated an alternative model where we included all explanatory variables from the main count model in the inflation model. The latter is estimated as a logistic regression. We report results from this alternative model in Table A at the end of this document. In this table, Model A is the model reported in Table 2 of the manuscript and Model B is the alternative model that includes all variables in the inflation model. As can be seen from the results, the alternative model does not change the interpretation of the policy variable, which was our main question. The variables that showed changes were state unemployment and marital status; neither of which were primary. We are merely controlling for these. This exercise shows the robustness of our results.

**References**

1. Moore W, Pedlow S, Krishnamurty P, Wolter K. *National Longitudinal Survey of Youth 1997 (NLSY97), Technical Sampling Report.* Chicago, IL: National Opinion Research Center;2000.

2. Faul F, Erdfelder E, Lang AG, Buchner A. G\*Power 3: a flexible statistical power analysis program for the social, behavioral, and biomedical sciences. *Behav Res Methods.* 2007;39(2):175-191.

3. Hughes K, Bellis MA, Hardcastle KA, et al. The effect of multiple adverse childhood experiences on health: a systematic review and meta-analysis. *Lancet Public Health.* 2017;2(8):e356-e366.

**Table A. Mental Health Policy Impact on the Mental Health Treatment Visit (Alternative estimations)**

|  |  |  |
| --- | --- | --- |
|   | **(A) Original Model (Table 2)** | **(B) Original with full inflation** |
|  | **IRR** | **95% CI** | **IRR** | **95% CI** | **IRR** | **95% CI** | **IRR** | **95% CI** |
|   |   |   |   |   |   |   |   |   |
| **Mental Health Policy Exposure Strength**  | 0.9968\*\* | (0.9937 - 0.9998) |  |   | 0.9970\*\* | (0.9940 - 1.0000) | 0.9995 | (0.9951 - 1.0039) |
| Age | 1.06\*\*\* | (1.016 - 1.104) |  |   | 1.051\*\* | (1.009 - 1.094) | 0.972 | (0.917 - 1.029) |
| **Gender** (ref. male) |  |  |  |  |  |  |  |  |
| Female | 0.904 | (0.785 - 1.042) | 0.447\*\*\* | (0.374 - 0.535) | 0.906 | (0.791 - 1.038) | 0.467\*\*\* | (0.389 - 0.562) |
| **Race** (ref. White) |  |  |  |  |  |  |  |  |
| Black | 0.811\*\* | (0.680 - 0.966) | 2.484\*\*\* | (1.995 - 3.092) | 0.812\*\* | (0.686 - 0.962) | 2.610\*\*\* | (2.061 - 3.305) |
| Other | 0.869 | (0.680 - 1.110) | 0.983 | (0.746 - 1.296) | 0.878 | (0.692 - 1.114) | 0.991 | (0.748 - 1.313) |
| Unknown | 1.197 | (0.489 - 2.929) | 1.327 | (0.459 - 3.841) | 1.364 | (0.574 - 3.242) | 1.241 | (0.489 - 3.146) |
| **Hispanic ethnicity** | 1.012 | (0.807 - 1.269) | 1.692\*\*\* | (1.304 - 2.196) | 1.003 | (0.806 - 1.247) | 1.725\*\*\* | (1.320 - 2.253) |
| **General Health** (ref. excellent) |  |  |  |  |  |  |  |  |
| Good | 1.084 | (0.931 - 1.262) | 0.609\*\*\* | (0.505 - 0.736) | 1.105 | (0.956 - 1.277) | 0.672\*\*\* | (0.555 - 0.814) |
| Fair/Poor | 1.103 | (0.927 - 1.312) | 0.369\*\*\* | (0.290 - 0.469) | 1.124 | (0.949 - 1.332) | 0.448\*\*\* | (0.347 - 0.579) |
| Unknown | 0.32\*\*\* | (0.166 - 0.630) | 0.313 | (0.028 - 3.490) | 0.204\*\*\* | (0.073 - 0.566) | 0.100\*\* | (0.012 - 0.848) |
| **Employment** (ref. full-time) |  |  |  |  |  |  |  |  |
| none | 1.39\*\*\* | (1.154 - 1.678) | 0.464\*\*\* | (0.376 - 0.573) | 1.369\*\*\* | (1.144 - 1.638) | 0.465\*\*\* | (0.372 - 0.582) |
| part-time | 1.224\*\* | (1.040 - 1.441) | 0.606\*\*\* | (0.497 - 0.739) | 1.200\*\* | (1.027 - 1.403) | 0.610\*\*\* | (0.497 - 0.749) |
| Unknown | 1.131 | (0.765 - 1.671) | 0.771 | (0.463 - 1.283) | 1.151 | (0.779 - 1.701) | 0.874 | (0.519 - 1.472) |
| **State Unemployment** (ref. <7.5%) |  |  |  |  |  |  |  |  |
| Over 7.5% | 0.864\*\* | (0.747 - 1.000) |  |   | 0.916 | (0.794 - 1.057) | 1.314\*\*\* | (1.068 - 1.616) |
| Unknown | 0.681\* | (0.448 - 1.034) |  |   | 0.656\* | (0.425 - 1.012) | 1.064 | (0.537 - 2.106) |
| **Gov assistance recipient (ref. no assistance)** |  |  |  |  |  |  |  |  |
| Any welfare during 2005-09 | 0.988 | (0.839 - 1.163) | 0.562\*\*\* | (0.454 - 0.694) | 1.001 | (0.856 - 1.172) | 0.605\*\*\* | (0.482 - 0.759) |
| **Adverse Childhood Events** (ref. none) |  |  |  |  |  |  |  |  |
| 1 ACE | 1.112 | (0.917 - 1.347) | 0.735\*\* | (0.574 - 0.939) | 1.103 | (0.918 - 1.324) | 0.722\*\*\* | (0.563 - 0.924) |
| 2 ACEs | 1.121 | (0.909 - 1.381) | 0.695\*\*\* | (0.538 - 0.896) | 1.112 | (0.910 - 1.358) | 0.675\*\*\* | (0.521 - 0.875) |
| 3+ ACEs | 1.236\* | (0.995 - 1.537) | 0.615\*\*\* | (0.467 - 0.811) | 1.208\* | (0.979 - 1.490) | 0.619\*\*\* | (0.465 - 0.823) |
| **Living in rural area (ref. rural)** |  |  |  |  |  |  |  |  |
| Urban | 0.979 | (0.815 - 1.178) | 0.655\*\*\* | (0.516 - 0.830) | 0.956 | (0.802 - 1.140) | 0.662\*\*\* | (0.520 - 0.843) |
| Unknown | 0.914 | (0.696 - 1.199) | 0.725\* | (0.501 - 1.049) | 0.874 | (0.671 - 1.137) | 0.673\*\* | (0.461 - 0.982) |
| **Poverty level** (ref. 3.00+) |  |  |  |  |  |  |  |  |
| 0 - 0.99 | 0.994 | (0.805 - 1.227) |  |   | 1.001 | (0.816 - 1.229) | 0.958 | (0.732 - 1.255) |
| 1.00 - 1.99 | 0.845\* | (0.692 - 1.031) |  |   | 0.863 | (0.712 - 1.048) | 1.063 | (0.816 - 1.386) |
| 2.00 - 2.99 | 0.773\*\* | (0.618 - 0.965) |  |   | 0.777\*\* | (0.622 - 0.969) | 0.955 | (0.725 - 1.259) |
| Unknown | 1.051 | (0.877 - 1.260) |  |   | 1.019 | (0.851 - 1.221) | 0.780\* | (0.600 - 1.013) |
| **Health insurance** (ref. uninsured) |  |  |  |  |  |  |  |  |
| Insured | 1.36\*\*\* | (1.158 - 1.604) | 0.610\*\*\* | (0.501 - 0.742) | 1.337\*\*\* | (1.147 - 1.559) | 0.578\*\*\* | (0.472 - 0.707) |
| **Depression status (ref. none of the time)** |  |  |  |  |  |  |  |  |
| Some or all the time | 1.45\*\*\* | (1.248 - 1.693) |  |   | 1.221\*\*\* | (1.074 - 1.387) | 0.323\*\*\* | (0.271 - 0.385) |
| Unknown | 1.300 | (0.950 - 1.779) |  |   | 1.158 | (0.838 - 1.601) | 0.646\* | (0.386 - 1.081) |
| **Highest education completed (ref. less than HS)** |  |  |  |  |  |  |  |
| Associate/Junior college | 0.980 | (0.749 - 1.281) |  |   | 0.944 | (0.718 - 1.241) | 0.821 | (0.571 - 1.181) |
| College and above | 1.127 | (0.940 - 1.351) |  |   | 1.094 | (0.914 - 1.309) | 0.819\* | (0.650 - 1.032) |
| Unknown | 1.189 | (0.654 - 2.161) |  |   | 0.998 | (0.536 - 1.860) | 0.618 | (0.239 - 1.600) |
| **Marital Status (ref. never married)** |   |  |  |   |   |  |  |  |
| Married | 0.923 | (0.778 - 1.096) |  |   | 0.928 | (0.785 - 1.097) | 1.086 | (0.883 - 1.336) |
| Separated | 0.780 | (0.504 - 1.208) |  |   | 0.707 | (0.442 - 1.128) | 0.630 | (0.325 - 1.219) |
| Divorced | 0.974 | (0.773 - 1.227) |  |   | 0.932 | (0.736 - 1.180) | 0.845 | (0.596 - 1.198) |
| Widowed | 0.171 | (0.014 - 2.059) |  |   | 0.032\*\*\* | (0.004 - 0.245) | 0.005\*\* | (0.000 - 0.467) |
| Unknown | 4.409\* | (0.976 - 19.91) |  |   | 16.34\*\*\* | (3.062 - 87.27) | 17.232\*\* | (1.753 - 169.423) |
| **Children in the household (ref. none)** |   |  |  |   |   |  |  |  |
| 1-2 | 0.859 | (0.713 - 1.034) | 1.852\*\*\* | (1.480 - 2.316) | 0.877 | (0.733 - 1.049) | 1.733\*\*\* | (1.367 - 2.196) |
| 3+ | 0.978 | (0.749 - 1.276) | 2.769\*\*\* | (1.937 - 3.959) | 1.004 | (0.774 - 1.303) | 2.631\*\*\* | (1.795 - 3.854) |
| Unknown | 0.840 | (0.463 - 1.526) | 3.883 | (0.341 - 44.221) | 0.442 | (0.126 - 1.543) | 1.399 | (0.038 - 51.760) |
| **Percent of state population uninsured (ref. below nat. average)** |   |  |  |   |   |  |  |  |
| Above average | 1.000 | (0.871 - 1.148) | 1.148 | (0.964 - 1.367) | 1.007 | (0.882 - 1.149) | 1.115 | (0.931 - 1.335) |
| Unknown | 0.50\*\*\* | (0.341 - 0.734) | 2.524\*\*\* | (1.517 - 4.197) | 0.509\*\*\* | (0.341 - 0.759) | 2.558\*\*\* | (1.263 - 5.182) |
| **Having Emotional problems at childhood** (ref. no) |   |  |  |   |   |  |  |  |
| Yes |   |  | 0.719\*\*\* | (0.564 - 0.916) |   |  | 0.739\*\* | (0.572 - 0.955) |
| Unknown |   |  | 1.175 | (0.906 - 1.524) |   |  | 1.234 | (0.948 - 1.605) |
| **Intercept** | 0.59 | (0.18 - 1.98) | 36.91\*\*\* | (25.21 - 54.04) | 0.83 | (0.2651 - 2.63) | 108.66\*\*\* | (21.96 - 537.66) |
| lnalpha | 0.44\*\*\* | (0.33 - 0.59) |  |   | 0.39\*\*\* | (0.30 - 0.51) |  |  |
| N | 7,953 |   | 7,953 |   | 7,953 |   | 7,953 |   |

\*\*\* p<0.01, \*\* p<0.05, \* p<0.1