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SUPPLEMENTAL METHODS

Difference-in-Differences (DiD) Analysis

The effect of paid family leave (PFL) policies on outcome Y_{ijt} was modeled for each parent or child i with child birth state j and birth year t using the following equation. This represents a generalized DiD analysis, which applies to the setting of multiple units (i.e., both California and New Jersey) implementing the treatment at different time points:

$$Y_{ijt} = \alpha_j + \beta_1 Policy_{jt} + \beta_2 IndCovar_{ijt} + \beta_3 StateCovar_{jt} + \beta_4(Treat_j * Year_t)$$
$$+ \beta_5 Year_t + \varepsilon_{ijt}$$

where $Policy_{jt}$ is an indicator for whether the child was born in a PFL state after the implementation of the PFL policy, $IndCovar_{ijt}$ is a vector of individual-level covariates, $StateCovar_{jt}$ is a vector of state-level covariates, $(Treat_j * Year_t)$ is a linear group-specific (i.e., PFL vs non-PFL) time trend, $Year_t$ represents indicator variables (fixed effects) for birth year to account for period-specific factors (secular trends), α_j represents fixed effects for state to account for time-invariant state characteristics, and ε_{ijt} is the random error term. The coefficient of interest, β_1, represents the change in outcomes attributable to the PFL policies.

Analyses involved linear models, which are preferred in DiD analyses for interpretability of the key effect measure from the model (in this case, the coefficient of the time- and state-varying indicator variable $Policy_{jt}$).[1,2] All models included heteroskedasticity-robust SEs, clustered by state to account for correlated observations within state. Survey weights were not included in the model since the appropriateness of weighting is diminished when adjusting for variables relating to the sampling strategy, and when the goal of modeling is causal inference rather than descriptive population characteristics.[3] In addition, the NHIS sampling strategy changed during

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the study period,[4–6] and NHIS does not recommend combining weights spanning these changes in survey design. Income was not adjusted for, due to its potential status as a mediator; i.e., it was collected at the time of the survey rather than at the time of the child's birth, and studies have shown that leave-taking influences later employment and income.[7,8] While income was missing for approximately 8.5% of the sample, this variable was only used in a single subgroup analysis, so imputation of missing values was not conducted.

Additional Analyses

Sensitivity of results to state-specific linear time trends was examined by including an interaction term between $State_j$ and $Year_t$. These specifications allow outcomes to change differentially over time by state, and represent a relaxation of the parallel trends assumption.[9] These analyses were robust to inclusion of state-specific linear time trends for parent outcomes, producing estimates that were nearly identical to our main model. For child outcomes, however, similar point estimates but widened CIs were observed, consistent with a loss of precision, although this may also suggest that common trends between states may not be a valid assumption. Preliminary additional analyses were conducted, including one with only neighboring states as a control group for California and New Jersey, and a placebo analysis among never-employed individuals who would not have benefited from PFL policies, but these analyses were underpowered and resulted in small cell sizes and unstable estimates.

In addition to assessing the credibility of DiD assumptions described in the main manuscript, whether the composition of treated and control groups changed differentially over time was examined. To do so, individual-level sociodemographic variables used as covariates in the main analyses were regressed on the $Policy_{jt}$ term, state fixed effects, and year fixed effects. An

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association between a sociodemographic variable and the interaction term indicates a differential

change in composition of that variable in PFL versus non-PFL states. These models revealed

differences in race/ethnicity and parental age and education (Appendix Table 4). These

differences were accounted for by adjusting for each of these covariates in the analytic models,

but changes in unobserved characteristics that may bias results cannot be ruled out.

Appendix
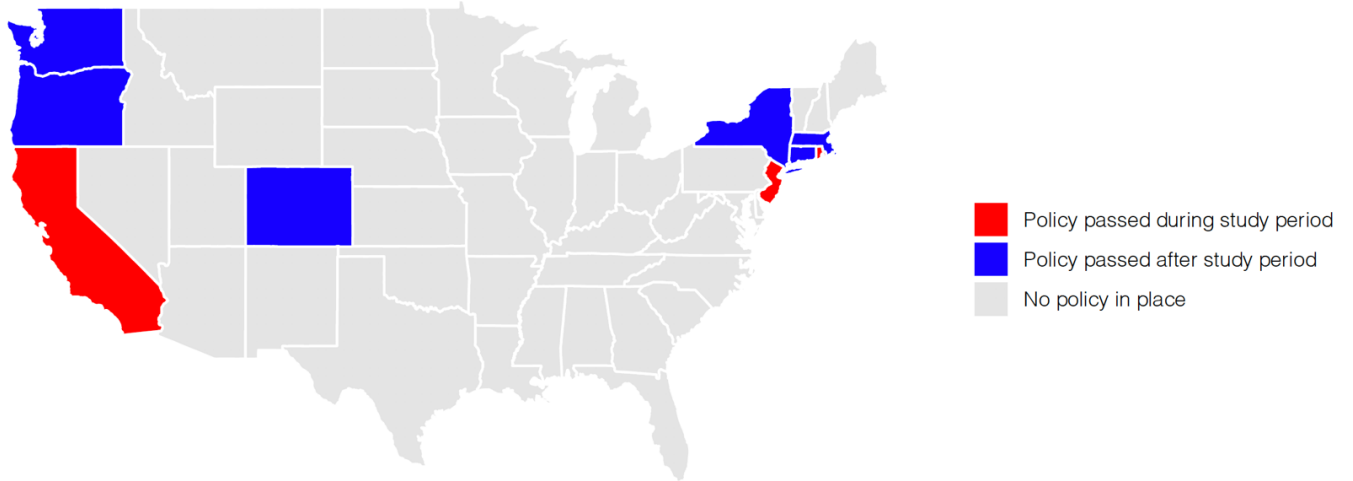**Paid Family Leave and Mental Health in the U.S.: A Quasi-experimental Study of State Policies**
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APPENDIX REFERENCES

1. Athey S, Imbens GW. Identification and inference in nonlinear difference-in-differences models. *Econometrica*. 2006;74(2):431–497. https://doi.org/10.1111/j.1468-0262.2006.00668.x.

2. Karaca-Mandic P, Norton EC, Dowd B. Interaction terms in nonlinear models. *Health Serv Res*. 2012;47(1 Pt 1):255–274. https://doi.org/10.1111/j.1475-6773.2011.01314.x.

3. Solon G, Haider SJ, Wooldridge JM. What are we weighting for? *J Hum Resour*. 2015;50(2):301–316. https://doi.org/10.3368/jhr.50.2.301.

4. Botman SL, Moore TF, Moriarity CL, Parsons VL. Design and estimation for the National Health Interview Survey, 1995–2004. *Vital Health Stat 2*. 2000;(130). https://www.cdc.gov/nchs/data/series/sr_02/sr02_130.pdf.

5. Parsons VL, Moriarity C, Jonas K, et al. Design and estimation for the National Health Interview Survey, 2006–2015. *Vital Health Stat 2*. 2014;165). https://www.cdc.gov/nchs/data/series/sr_02/sr02_165.pdf.

6. National Center for Health Statistics. Survey Description, National Health Interview Survey, 2016. Hyattsville, MD: National Center for Health Statistics; 2017. https://doi.org/10.26616/nioshheta81333935.

7. Ruhm CJ. The economic consequences of parental leave mandates: lessons from Europe. *Q J Econ*. 1998;113(1):285–317.

8. Rossin-Slater M, Ruhm CJ, Waldfogel J. The effects of California's paid family leave program on mothers' leave-taking and subsequent labor market outcomes. *J Policy Anal Manage*. 2013;32(2):224–245.

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9. Wing C, Simon K, Bello-Gomez RA. Designing difference in difference studies: best practices for public health policy research. *Annu Rev Public Health*. 2018;39:453–469. https://doi.org/10.1146/annurev-publhealth-040617-013507.

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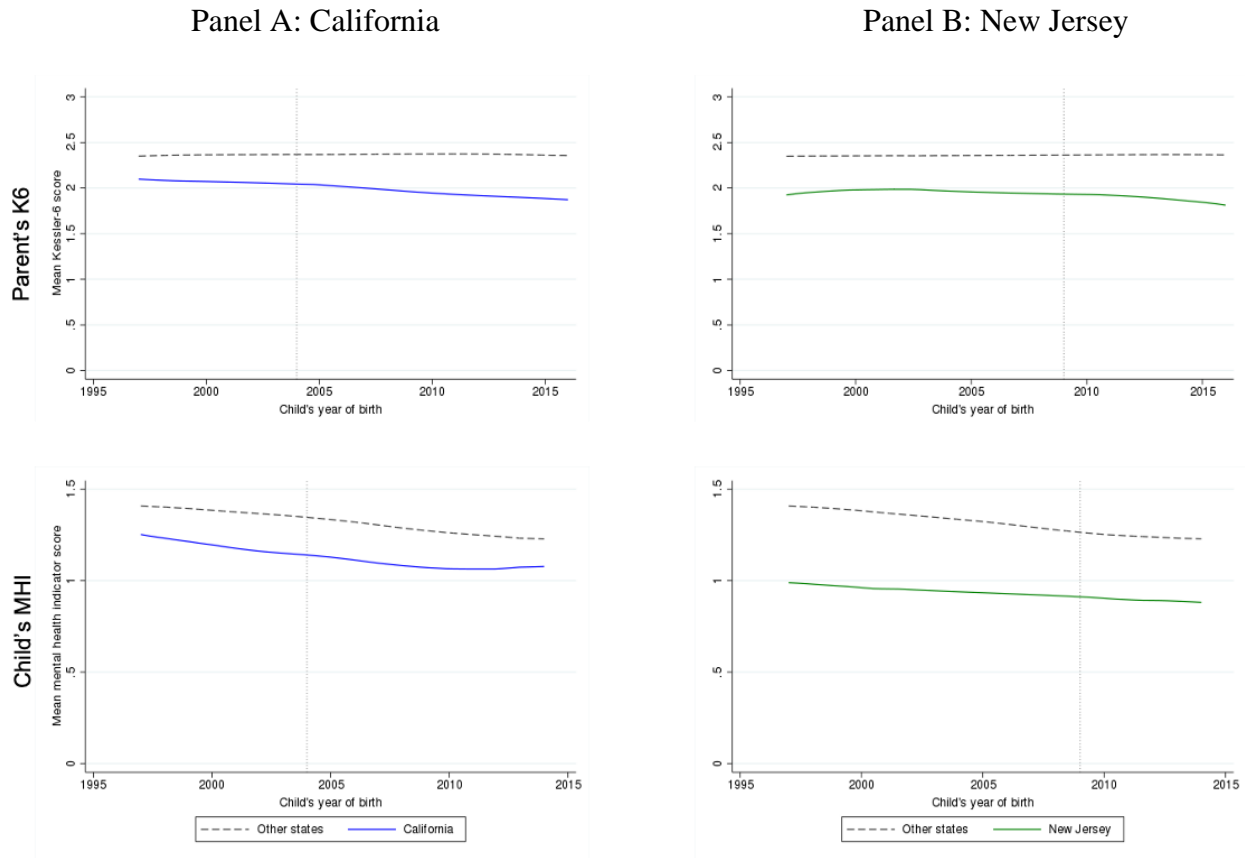**Irish et al.**

Appendix Figure 1. States in the U.S. with paid family leave policies.

Note: No policies have been passed in Alaska or Hawaii.

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Appendix Figure 2. Graphical evaluation of parallel trends assumption in California and New Jersey.

Panel A: California   Panel B: New Jersey

Note: Kessler-6 (K6) scores were measured for parental outcomes and Mental Health Indicator (MHI) scores were measured for child outcomes. The dotted vertical line on each graph indicates when the paid family leave policy took effect in each state.

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Appendix Table 1. Effects of Paid Family Leave Policies by State

Variable	Parent psychological distress	Child behavioral problems
Panel A: California		
Policy effect	**–0.36****	–0.075
	(–0.60, –0.12)	(–0.17, 0.020)
Number of observations	26,718	14,886
Panel B: New Jersey		
Policy effect	**–0.91****	0.041
	(–1.19, –0.63)	(–0.053, 0.14)
Number of observations	23,771	13,325

Note: Sample was drawn from the 1997–2016 waves of the National Health Interview Survey. Analyses were conducted using difference-in-differences multivariable linear models adjusted for state gross domestic product per capita, unemployment, and percent population with less than high school education; linear group-specific (i.e., PFL vs non-PFL) trends; parent's gender, race, educational attainment, marital status, family size, and age. All models included indicator variables for year to adjust for secular trends and state fixed effects. For each coefficient, a 95% CI, derived from robust SEs clustered by state, is shown in parentheses. Boldface indicates statistical significance (*$p<0.05$; **$p<0.01$).

PFL, paid family leave.

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Appendix Table 2. Subgroup Analyses

Variable	Race[a]				Family income tertile			Age[a]		Marital status[a]	
	White	Black	Hispanic	Other	Lowest	Middle	Highest	Under 35 years	Over 35 years	Not married	Married
Panel A: Parent psychological distress											
Policy effect, stratified model	**−0.79**** (−1.33, −0.25)	0.01 (−0.43, 0.44)	−0.23 (−0.60, 0.14)	−0.48 (−1.10, 0.15)	−0.26 (−0.92, 0.39)	**−0.84**** (−1.11, −0.57)	−0.20 (−0.94, 0.54)	**−0.46**** (−0.66, −0.25)	−0.55 (−1.44, 0.34)	**−1.01**** (−1.72, −0.30)	−0.33 (−0.85, 0.19)
Policy effect, interaction model	ref	**0.39*** (0.035, 0.75)	**0.27*** (0.037, 0.51)	0.15 (−0.41, 0.71)	ref	**−0.39*** (−0.74, −0.041)	−0.027 (−0.60, 0.54)	ref	−0.19 (−0.49, 0.11)	ref	−0.036 (−0.21, 0.14)
Panel B: Child behavioral problems											
Policy effect, stratified model	−0.21 (−0.43, 0.0080)	**0.65**** (−0.41, 0.91)	−0.18 (−0.40, 0.029)	0.12 (−0.51, 0.75)	−0.18 (−0.41, 0.05)	−0.096 (−0.31, 0.12)	**0.46**** (0.32, 0.60)	**−0.089*** (−0.17, −0.0078)	**0.22**** (0.08, 0.36)	−0.22 (−0.45, 0.004)	0.003 (−0.13, 0.13)
Policy effect, interaction model	ref	**0.61**** (0.42, 0.80)	0.12 (−0.001, 0.25)	**0.51**** (0.35, 0.67)	ref	−0.13 (−0.34, 0.08)	0.24 (−0.07, 0.56)	ref	**0.35**** (0.21, 0.49)	ref	**0.15**** (0.046, 0.26)

Note: N=27,384 for adult analyses and 13,008 for child analyses. Sample was drawn from the 1997–2016 waves of the National Health Interview Survey. Analyses were conducted using difference-in-differences multivariable linear models adjusted for state gross domestic product per capita, unemployment, and percent population with less than high school education; linear group-specific (i.e., PFL vs non-PFL) trends; parent's gender, race, educational attainment, marital status, family size, and age. All models included indicator variables for year to adjust for secular trends and state fixed effects. Models for income subgroups included a main term and interaction term for income. For each coefficient, a 95% CI, derived from robust SEs clustered by state, is shown in parentheses. Boldface indicates statistical significance (*$p<0.05$; **$p<0.01$). In stratified models, this indicates that the coefficient for each subgroup is statistically significantly different from zero, while in interaction models this indicates that the coefficient for each subgroup is statistically significantly different from the reference group.

[a]Refers to the parent's race, age, and marital status for child subgroups.

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Appendix Table 3. Test of Parallel Trends in Pre-Policy Period

Variable	Parent psychological distress	Child behavioral problems
Panel A: California		
CA × year of birth	−0.024 (−0.069, 0.021)	**−0.024**** (−0.036, −0.013)
Number of observations	12,806	8,548
Panel B: New Jersey		
NJ × year of birth	**0.040**** (0.014, 0.065)	−0.0018 (−0.0080, 0.0044)
Number of observations	17,039	11,083

Note: Sample was drawn from the 1997–2016 waves of the National Health Interview Survey. All models included indicator variables for year to adjust for secular trends and state fixed effects. For each coefficient, a 95% CI, derived from robust SEs clustered by state, is shown in parentheses. Boldface indicates statistical significance (*$p<0.05$; **$p<0.01$).

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Appendix Table 4. Test of Differential Changes in Composition of Treated and Control Groups Over Time

Variable	Coefficient on interaction term
Panel A: Parent covariates	
Age	**0.43**** (0.12, 0.75)
Married	0.015 (–0.00071, 0.031)
Education	
Less than high school	**–0.065**** (–0.097, –0.033)
High school	0.0067 (–0.015, 0.028)
Some college	**0.033**** (0.018, 0.049)
College graduate	**0.025**** (0.013, 0.037)
Parent race	
White	0.030 (–0.0081, 0.067)
Black	0.0011 (–0.013, 0.015)
Hispanic	**–0.040*** (–0.073, –0.0061)
Other	0.0090 (–0.0083, 0.026)
Family size	–0.021 (–0.072, 0.030)
Number of observations	28,638
Panel B: Child covariates	
Girl	0.016 (–0.0043, 0.037)
Age	–0.018 (–0.043, 0.0075)
Race	
White	**0.035**** (0.014, 0.056)
Black	–0.016 (–0.039, 0.0058)
Hispanic	**–0.023*** (–0.044, –0.0018)
Other	0.0048 (–0.011, 0.020)
Family size	–0.0085 (–0.057, 0.040)
Number of observations	15,813

Note: Sample was drawn from the 1997–2016 waves of the National Health Interview Survey. All models included indicator variables for year to adjust for secular trends and state fixed effects. For each coefficient, a 95% CI, derived from robust SEs clustered by state, is shown in parentheses. Boldface indicates statistical significance (*$p<0.05$; **$p<0.01$).