

# The Replication Project

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## INTRODUCTION

For the final replication project, I chose a work by Osborne, Berger, and Magnuson (2012). Using data from the Fragile Families and Child Wellbeing Study (FFCW), this study investigates how mothers' exposure to family structure transitions and its durations are associated with changes in maternal resources—parenting stress, depression, and material hardship. For replication, I focused on parenting stress, for it was the only dependent variable without issues. That is, the authors stated that a hierarchical linear regression of depression with random intercepts and coefficients failed to converge. For material hardship, I found the FFCW data set lacked one variable, phone disconnection, that the authors purported to have used to construct the material hardship scale.

Although I could not find code to replicate the data set and models in the study, I managed to write code to produce a similar data set and models.

## REPLICATION

Table 1 and 2 show the original and replicated coefficients, respectively. The replication was a half-success; the slope parameters of the hierarchical linear models (HLM) were

quite closely replicated but the intercept parameters were not. My conjecture is that the discrepancies in the intercepts can probably result from misconstrued controls. That is, a full set of covariates were included to estimate the intercepts, whereas only a subset of them (and the independent variable) were interacted with AGE to estimate the slopes; as I had no problem cleaning a few controls for the slopes but encountered several issues cleaning controls for the intercepts, more discrepancy is likely in the intercepts. For example, Temporary Assistance for Needy Families (TANF), which should have been included to estimate the intercepts but not the slopes, was missing in the original FFCW data set.

## **Frequentist Replication: Multilevel modeling using lme4**

### **BAYESIAN REPLICATION**

Table 3 lists coefficients produced from the Frequentist and Bayesian models. Although there are some variations between the coefficient pairs, fitting a Bayesian model did not change the results much. Posterior Predictive plot revealed that the estimated bayes model fairly well reproduced the original distribution of the dependent variable, parental stress. However, the PSIS diagnostic values and its plot show that 350 observations had a pareto k that exceeds 0.7, which may originate from not very informative priors or model misspecifications.

Table 1: The Original Model Fit

	<i>Dependent variable:</i>
	Maternal Stress
To 2 BioParents b/w Y0 and Y1	−0.071 (0.057)
To SocialFather b/w Y0 and Y1	0.167 (0.092)
To SingleMother b/w Y0 and Y1	−0.045 (0.082)
Always SingleMother b/w Y0 and Y1	0.021 (0.077)
Ever Transit to 2 BioParents b/w Y1 and Y5	−0.059 (0.083)
Ever Transit to SocialFather b/w Y1 and Y5	0.148* (0.068)
Ever Transit to SingleMother b/w Y1 and Y5	−0.044 (0.047)
Stable SingleMother b/w Y1 and Y5	0.106 (0.080)
Stable SocialFather b/w Y1 and Y5	−0.137 (0.162)
AGE x Ever Transit to 2 BioParents b/w Y1 and Y5	−0.015 (0.016)
AGE x Ever Transit to SocialFather b/w Y1 and Y5	−0.016 (0.013)
AGE x Ever Transit to SingleMother b/w Y1 and Y5	0.029** (0.011)
AGE x Stable SingleMother b/w Y1 and Y5	−0.011 (0.013)
AGE x Stable SocialFather b/w Y1 and Y5	−0.060 (0.036)

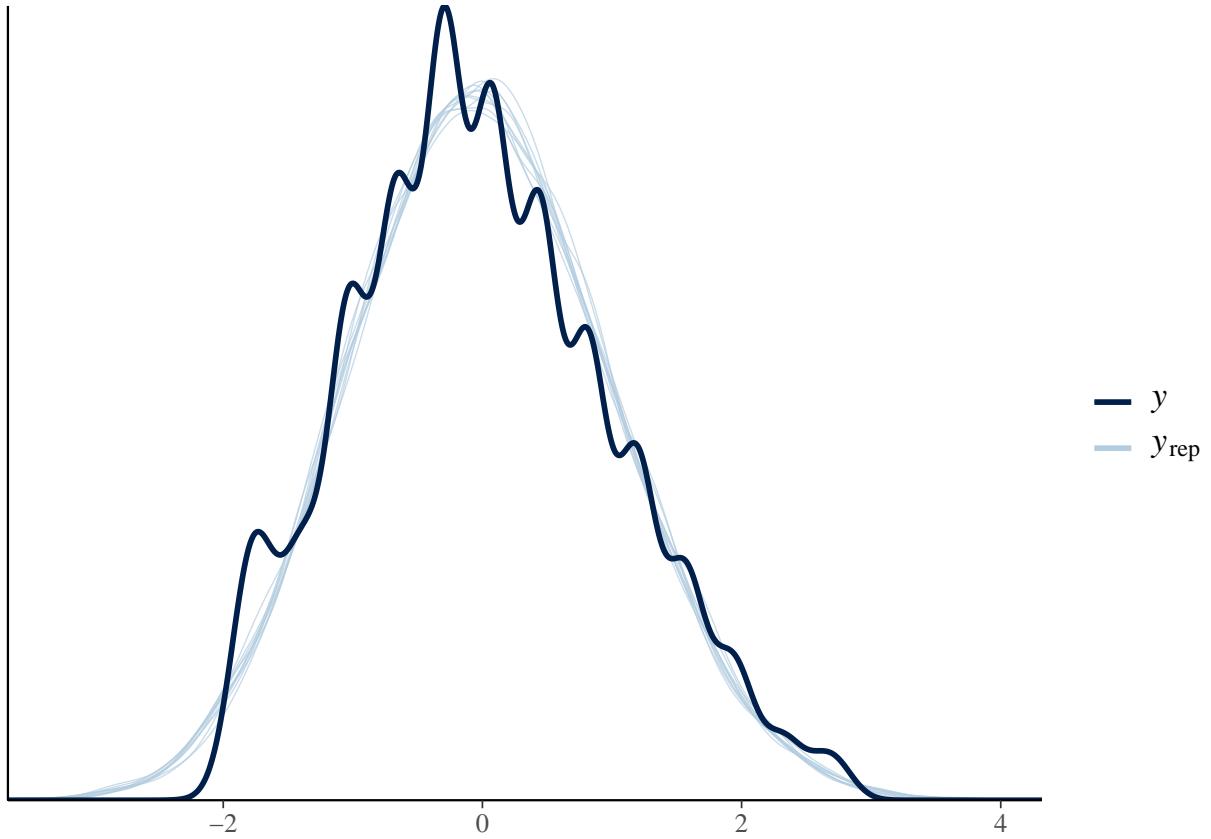
*Note:*

\*p<0.05; \*\*p<0.01; \*\*\*p<0.001

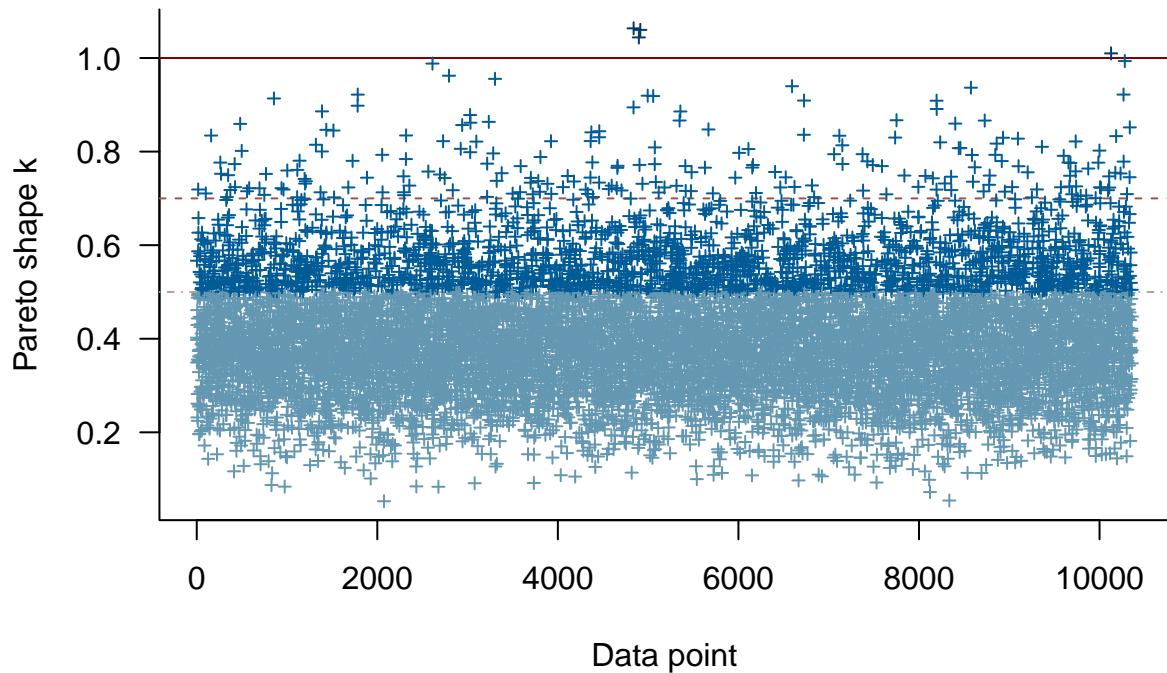
Table 2: Replication Results

	Replicated
Intercept	
To 2 BioParents b/w Y0 and Y1	−0.099 (0.055)
To SocialFather b/w Y0 and Y1	0.172 (0.089)
To SingleMother b/w Y0 and Y1	0.106 (0.092)
Always SingleMother b/w Y0 and Y1	0.149 (0.088)
Ever Transit to 2 BioParents b/w Y1 and Y5	−0.232* (0.095)
Ever Transit to SocialFather b/w Y1 and Y5	0.068 (0.072)
Ever Transit to SingleMother b/w Y1 and Y5	−0.014 (0.050)
Stable SingleMother b/w Y1 and Y5	−0.024 (0.087)
Stable SocialFather b/w Y1 and Y5	−0.167 (0.157)
Slope	
AGE x Ever Transit to 2 BioParents b/w Y1 and Y5	0.011 (0.017)
AGE x Ever Transit to SocialFather b/w Y1 and Y5	−0.017 (0.013)
AGE x Ever Transit to SingleMother b/w Y1 and Y5	0.030** (0.011)
AGE x Stable SingleMother b/w Y1 and Y5	−0.004 (0.012)
AGE x Stable SocialFather b/w Y1 and Y5	−0.060 (0.035)
Num.Obs.	10359
Num.Imp.	10

\* p < 0.05, \*\* p < 0.01, \*\*\* p < 0.001



## PSIS diagnostic plot



## ALTERNATIVE SPECIFICATIONS

I tried three different model specifications: (a) a random-intercept model instead of the original random-coefficient model (in which the coefficient of AGE varied randomly across the grouping variable, `idnum`); (b) a model using extensive controls to estimate slope coefficients, which were originally used to estimate intercepts only; and (c) a model with a completely different, if not improved, independent variable. Table 4 displays coefficient estimates from the alternative models, along with ones from the original replicated model.

I paid extra attention to the third alternative model that uses a differently operationalized independent variable. The original independent variable evaluates if the sample families *ever* experienced transitions into certain family structures (e.g., single-mother family

Table 3: Comparison 1: Frequentist vs. Bayesian Models

	Frequentist	Bayesian
Intercept		
To 2 BioParents b/w Y0 and Y1	-0.10 [-0.21, 0.01]	-0.10 [-0.20, 0.01]
To SocialFather b/w Y0 and Y1	0.17 [0.00, 0.35]	0.17 [0.00, 0.35]
To SingleMother b/w Y0 and Y1	0.11 [-0.07, 0.29]	0.10 [-0.07, 0.27]
Always SingleMother b/w Y0 and Y1	0.15 [-0.02, 0.32]	0.14 [-0.02, 0.31]
Ever Transit to 2 BioParents b/w Y1 and Y5	-0.23 [-0.42, -0.05]	-0.23 [-0.41, -0.05]
Ever Transit to SocialFather b/w Y1 and Y5	0.07 [-0.07, 0.21]	0.07 [-0.07, 0.21]
Ever Transit to SingleMother b/w Y1 and Y5	-0.01 [-0.11, 0.08]	-0.01 [-0.11, 0.08]
Stable SingleMother b/w Y1 and Y5	-0.02 [-0.19, 0.15]	-0.02 [-0.18, 0.15]
Stable SocialFather b/w Y1 and Y5	-0.17 [-0.48, 0.14]	-0.16 [-0.47, 0.14]
Slope		
AGE x Ever Transit to 2 BioParents b/w Y1 and Y5	0.01 [-0.02, 0.04]	0.01 [-0.02, 0.04]
AGE x Ever Transit to SocialFather b/w Y1 and Y5	-0.02 [-0.04, 0.01]	-0.02 [-0.04, 0.01]
AGE x Ever Transit to SingleMother b/w Y1 and Y5	0.03 [0.01, 0.05]	0.03 [0.01, 0.05]
AGE x Stable SingleMother b/w Y1 and Y5	0.00 [-0.03, 0.02]	0.00 [-0.03, 0.02]
AGE x Stable SocialFather b/w Y1 and Y5	-0.06 [-0.13, 0.01]	-0.06 [-0.13, 0.01]
Num.Obs.	10 359	10 359
Num.Imp.	10	
RMSE		0.53

structure) between Year 1 and 5. Problematic here is that the authors constructed a not mutually exclusive set of dummy variables. For example, according to the way the authors constructed the variable, a family that transitioned from a two-parent structure to a single-parent structure between Y1 and Y3 and then to a step-parent structure between Y3 and Y5 belongs to both ‘Ever transitioned to Single Mother’ and ‘Ever transitioned to Social Father’ groups. This one family will thus be used for estimating both coefficients. Although it may not induce statistical problems, it significantly impairs the substantive interpretability of the coefficients.

To deal with this problem, I evaluated the sample families’ family structure at each specific wave (Year 1, 3, and 5) and constructed a new time-varying independent variable.

## DISCUSSION

There are two take-home points worth our attention. First, there were some incongruities between what the paper said they had done and the actual data. For example, I could not find a Temporary Assistance for Needy Families (TANF) measure at Year 0 that the authors purported to have included as a covariate in the models. I am not sure if this variable was removed since new releases of the data set or if it is simply the authors’ mistake.

Second, replicating the original models revealed that the way the authors operationalized the independent variable could have been controversial if the authors had described the strategy in detail. They label the coefficients with a word ‘ever’, which implies that one family can belong to several categories simultaneously. A hypothetical family that stayed in a single-mother structure for a very short period of time and then transitioned into a stepfamily structure and stayed there for the rest of the years can be used for estimating both coefficients; this suggests that the coefficient for single-mother structure may have

been estimated from families that had rarely had the single-mother structure experience. If two differently operationalized variables that are intended to measure the same underlying concept of interest (in this case, family structure transitions) yielded widely discrepant results, not only the replicability but also the validity and reliability of social science might be at stake. Although it is nearly impossible to set forth the ‘correct’ operationalization conventions, this replication project still indicates that researchers should be more explicit about how their variables are constructed and what are the objectives and weaknesses of the variables.

Table 4: Comparison 2: Alternative Specifications

	Replicated	Random Intercept	Extensive Control	Alt. Independent
Intercept				
To 2 BioParents b/w Y0 and Y1	-0.10 (0.05)	-0.10 (0.05)	-0.10 (0.05)	-0.10 (0.06)
To SocialFather b/w Y0 and Y1	0.17 (0.09)	0.17 (0.09)	0.17 (0.09)	0.15 (0.08)
To SingleMother b/w Y0 and Y1	0.11 (0.09)	0.10 (0.09)	0.11 (0.09)	-0.02 (0.06)
Always SingleMother b/w Y0 and Y1	0.15 (0.09)	0.15 (0.09)	0.15 (0.09)	0.05 (0.06)
Ever Transit to 2 BioParents b/w Y1 and Y5	-0.23* (0.09)	-0.23* (0.09)	-0.23* (0.10)	0.00 (0.05)
Ever Transit to SocialFather b/w Y1 and Y5	0.07 (0.07)	0.07 (0.07)	0.07 (0.07)	-0.02 (0.07)
Ever Transit to SingleMother b/w Y1 and Y5	-0.01 (0.05)	-0.01 (0.05)	-0.01 (0.05)	0.10 (0.05)
Stable SingleMother b/w Y1 and Y5	-0.02 (0.09)	-0.02 (0.09)	-0.03 (0.09)	0.07 (0.05)
Stable SocialFather b/w Y1 and Y5	-0.17 (0.16)	-0.17 (0.16)	-0.17 (0.16)	-0.25 (0.18)
Slope				
AGE x Ever Transit to 2 BioParents b/w Y1 and Y5	0.01 (0.02)	0.01 (0.02)	0.01 (0.02)	-0.02 (0.02)
AGE x Ever Transit to SocialFather b/w Y1 and Y5	-0.02 (0.01)	-0.02 (0.01)	-0.02 (0.01)	0.02 (0.02)
AGE x Ever Transit to SingleMother b/w Y1 and Y5	0.03** (0.01)	0.03** (0.01)	0.03* (0.01)	-0.01 (0.02)
AGE x Stable SingleMother b/w Y1 and Y5	0.00 (0.01)	0.00 (0.01)	0.00 (0.01)	-0.01 (0.01)
AGE x Stable SocialFather b/w Y1 and Y5	-0.06 (0.03)	-0.06 (0.03)	-0.06 (0.04)	-0.01 (0.06)
Num.Obs.	10 359	10 359	10 359	10 359
Num.Imp.	10	10	10	10

\* p &lt; 0.05 \*\* p &lt; 0.01 \*\*\* p &lt; 0.001

## REFERENCES

Osborne, Cynthia, Lawrence M. Berger, and Katherine Magnuson. 2012. "Family Structure Transitions and Changes in Maternal Resources and Well-Being." Journal Article. *Demography* 49 (1): 23–47. <https://doi.org/10.1007/s13524-011-0080-x>.