

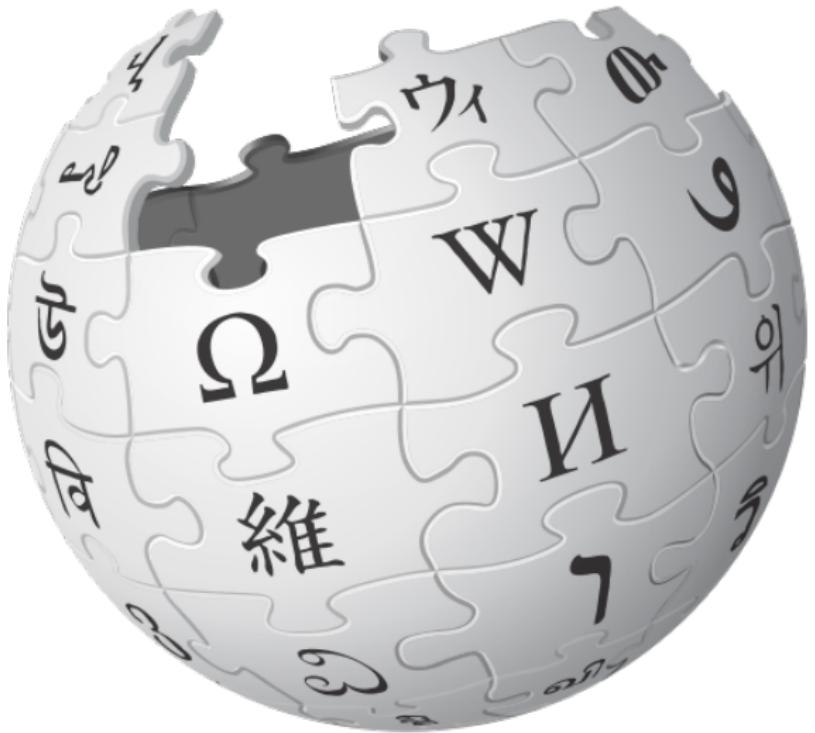
Getting Started Workshop: The Fragile Families Challenge, round 2

Matthew Salganik, Ian Lundberg, Alex Kindel, Sara McLanahan,
and people from around the world

July 24, 2018
AI4ALL
Princeton University

Supported by the Russell Sage Foundation. Board of Advisors: Jeanne Brooks-Gunn, Kathryn Edin, Barbara Engelhardt, Irwin Garfinkel, Moritz Hardt, Dean Knox, Nicholas Lemann, Karen Levy, Sara McLanahan, Arvind Narayanan, Timothy Nelson, Matthew Salganik, & Duncan Watts. Source:

www.github.com/fragilefamilieschallenge/slides 



Initial sequencing and analysis of the human genome

International Human Genome Sequencing Consortium*

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<http://dx.doi.org/10.1038/35057062>

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Combined Measurement of the Higgs Boson Mass in pp Collisions at $\sqrt{s} = 7$ and 8 TeV with the ATLAS and CMS Experiments

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(Received 25 March 2015; published 14 May 2015)

<https://doi.org/10.1103/PhysRevLett.114.191803>

- Conference for Computing in High-Energy and Nuclear Physics (CHEP03), 2003, CHEP-2003-MOLT007, arXiv: physics/0306116.
- [28] L. Moneta, K. Belasco, K.S. Cranmer, A. Lazzaro, D. Piparo, G. Schott, W. Verkerke, and M. Wolf, The ROOSTAT Project, in Proceedings of the 13th International Workshop on Advanced Computing and Analysis Techniques in Physics Research (ACAT2010) (SISSA, 2010), Phys. Sci., ACAT2010 (2010) 057 [arXiv:1009.1003].
- [29] K. Cranmer, O. Lewis, L. Moneta, A. Shihab, and W. Verkerke (ROOT), "HISTFACTORY: A tool for creating statistical models for use with ROOFIT and ROOSTAT," Tech. Rep. CERN-OPEN-2012-016, 2012 (http://cds.cern.ch/record/1456844).
- [30] ATLAS Collaboration, Electron and photon energy calibration with the ATLAS detector using LHC Run 1 data, Eur. Phys. J. C **74**, 3071 (2014).
- [31] ATLAS Collaboration, Measurement of the muon reconstruction performance of the ATLAS detector using 2011 and 2012 LHC proton-proton collision data, Eur. Phys. J. C **74**, 3130 (2014).
- [32] CMS Collaboration, Performance of CMS muon reconstruction in pp collision events at $\sqrt{s} = 7$ TeV, J. Instrum. **7**, P10002 (2012).
- [33] CMS Collaboration, Performance of electron reconstruction and selection with the CMS detector in proton-proton collisions at $\sqrt{s} = 8$ TeV, arXiv:1502.02701 [J. Instrum. to be published].
- [34] CMS Collaboration, Performance of photon reconstruction and identification with the CMS detector in proton-proton collisions at $\sqrt{s} = 8$ TeV, arXiv:1502.02702.
- [35] P.D. Dauncey, M. McKenzie, N. Waddington, and G.J. Davies, Handling uncertainty in background shapes: The discrete profiling method, J. Instrum. **10**, P04015 (2015).
- [36] ALEPH, DELPHI, L3, OPAL, SLD Collaborations, LEP Electroweak Working Group, and SLD Electroweak and Heavy Flavour Groups, Precision electroweak measurements on the Z resonance, Phys. Rep. **427**, 257 (2006).
- [37] ATLAS Collaboration, Observation and measurement of Higgs boson decays to WW^* with the ATLAS detector, arXiv:1412.2641 [Phys. Rev. D (to be published)].
- [38] ATLAS Collaboration, Evidence for the Higgs-boson Yukawa coupling to tau leptons with the ATLAS detector, J. High Energy Phys. 04 (2015) 117.
- [39] CMS Collaboration, Measurement of Higgs boson production and properties in the WW decay channel with leptonic final states, J. High Energy Phys. 01 (2014) 096.
- [40] CMS Collaboration, Evidence for the 125 GeV Higgs boson decaying to a pair of τ leptons, J. High Energy Phys. 05 (2014) 104.

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⁸⁹Also at Texas A&M University at Qatar, Doha, Qatar.
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Fragile Families Challenge

Fragile Families Challenge

A scientific mass collaboration combining

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- ▶ predictive modeling,

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- ▶ predictive modeling,
- ▶ causal inference,

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- ▶ predictive modeling,
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- ▶ and in-depth qualitative interviews

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- ▶ predictive modeling,
- ▶ causal inference,
- ▶ and in-depth qualitative interviews

to develop insights that can improve the lives of disadvantaged children in the US.

FF Fragile Families

& Child Wellbeing Study
PRINCETON | COLUMBIA



- ▶ Birth cohort panel study
- ▶ ≈ 5,000 children born in 20 U.S. cities
- ▶ Followed from birth through age 15

Hundreds of papers and dozens of dissertations

<http://crcw.princeton.edu/publications/publications.asp>

Social Scientists ←→ Data Scientists

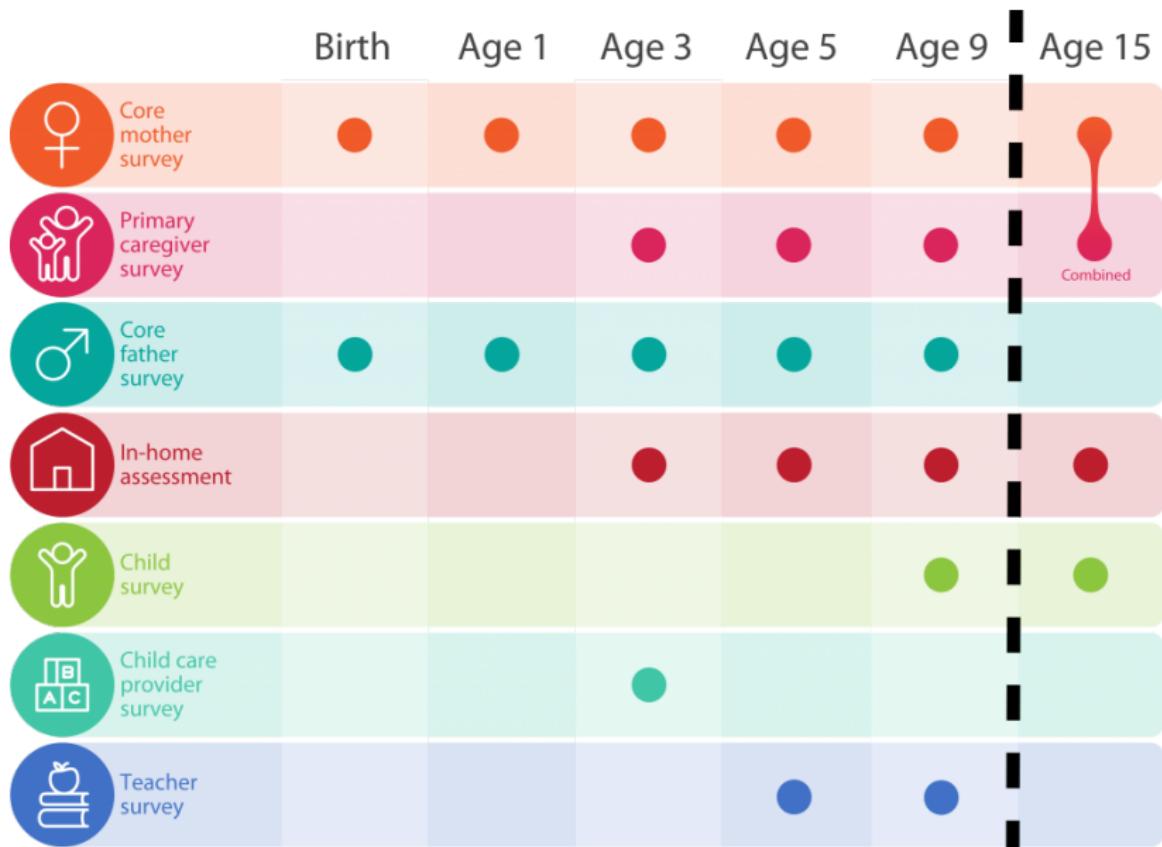
Social Scientists \longleftrightarrow Data Scientists

understanding ($\hat{\beta}$) & prediction (\hat{y})

Mullainathan and Spiess (2017):

<http://dx.doi.org/10.1257/jep.31.2.87>

	Birth	Age 1	Age 3	Age 5	Age 9
 Core mother survey	●	●	●	●	●
 Primary caregiver survey			●	●	●
 Core father survey	●	●	●	●	●
 In-home assessment			●	●	●
 Child survey					●
 Child care provider survey			●		
 Teacher survey				●	●



5,000 families

Birth to age 9
12,000 features

Age 15
1,500 features

4,200 families

12,000 features
birth to age 9

6 outcomes
age 15

Training

Leaderboard

Holdout

Continuous outcomes:

- ▶ GPA
- ▶ Grit
- ▶ Material hardship

Binary outcomes:

- ▶ Housing eviction
- ▶ Layoff of a caregiver
- ▶ Job training for a caregiver

Fragile Families Challenge:

1. common task method

Fragile Families Challenge:

1. common task method
2. use submissions to do cool stuff

What has happened so far?

What has happened so far?

- ▶ Launched one year ago

What has happened so far?

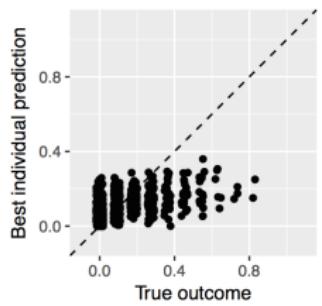
- ▶ Launched one year ago
- ▶ Hundreds of participants from around the world (undergrads, grad students, and professionals)

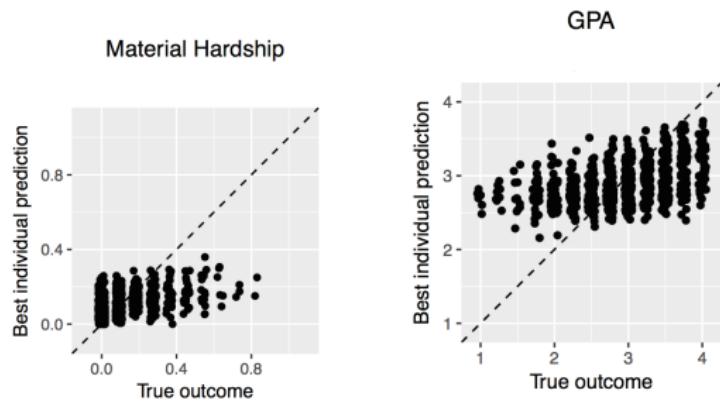
What has happened so far?

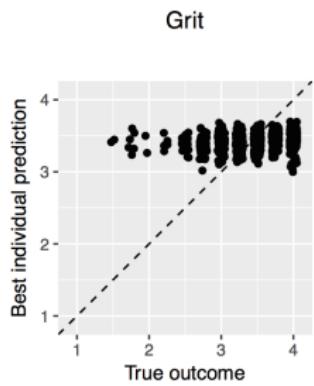
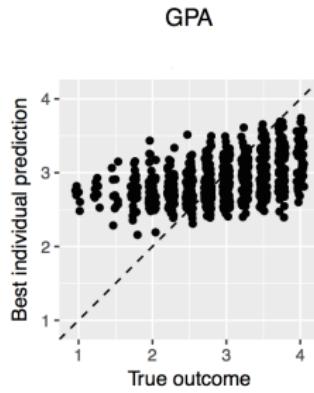
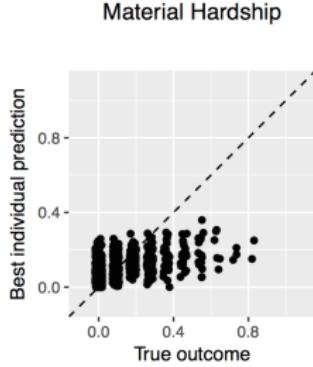
- ▶ Launched one year ago
- ▶ Hundreds of participants from around the world (undergrads, grad students, and professionals)
- ▶ We are now doing in-depth interviews with some of the young adults and their primary care givers

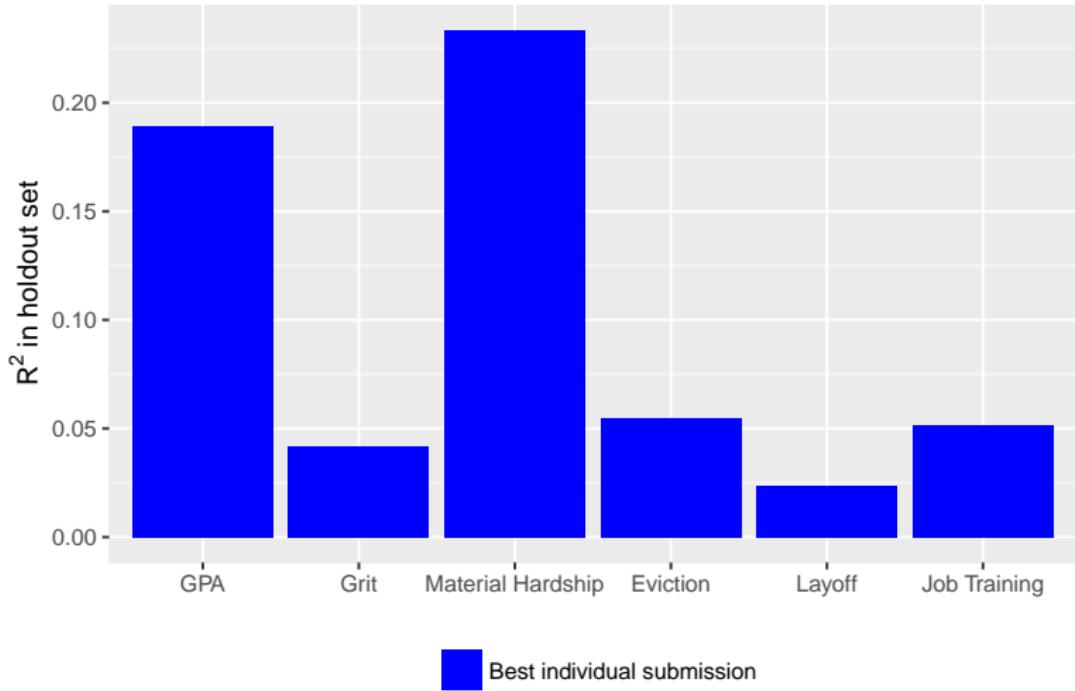
Main result so far: Using high quality social science data and modern machine learning, life outcomes for children and families appear to be difficult to predict accurately.

Material Hardship



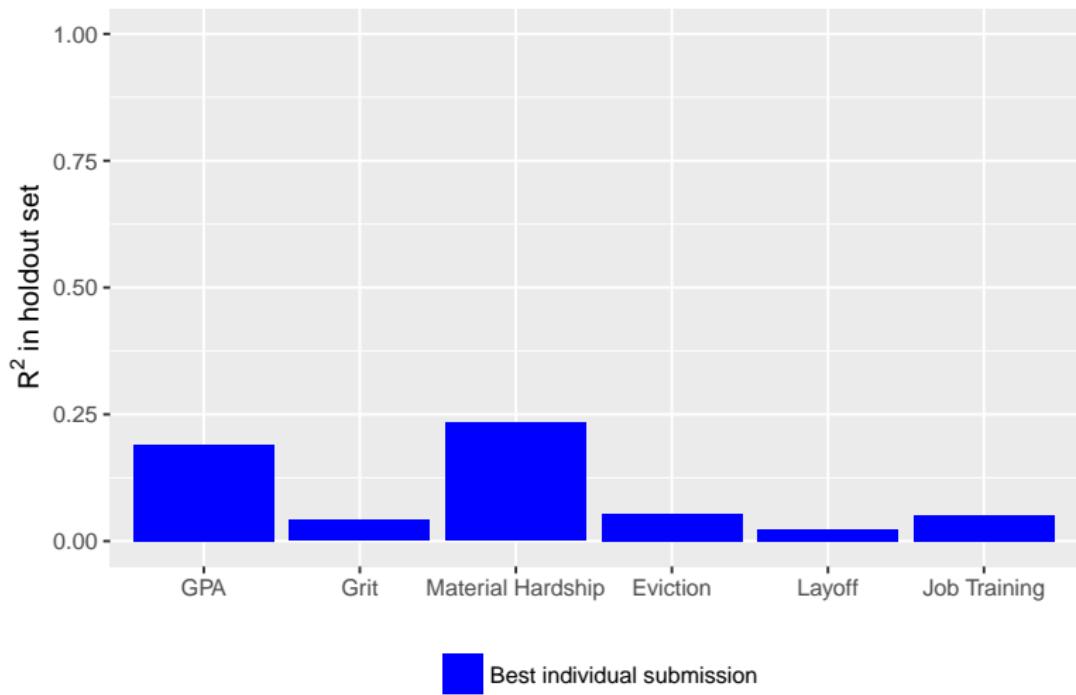






$$R^2 = 1 - \frac{\sum_{i \in \text{holdout}} (\hat{y}_i - y_i)^2}{\sum_{i \in \text{holdout}} (\bar{y}_{\text{train}} - y_i)^2}$$

Talk summarizing the results: <https://youtu.be/HrYPTdXeSaM>



$$R^2 = 1 - \frac{\sum_{i \in \text{holdout}} (\hat{y}_i - y_i)^2}{\sum_{i \in \text{holdout}} (\bar{y}_{\text{train}} - y_i)^2}$$

Talk summarizing the results: <https://youtu.be/HrYPTdXeSaM>

Why should we care about the predictability of social outcomes?

- ▶ Scientific reasons

Why should we care about the predictability of social outcomes?

- ▶ Scientific reasons
- ▶ Policy reasons



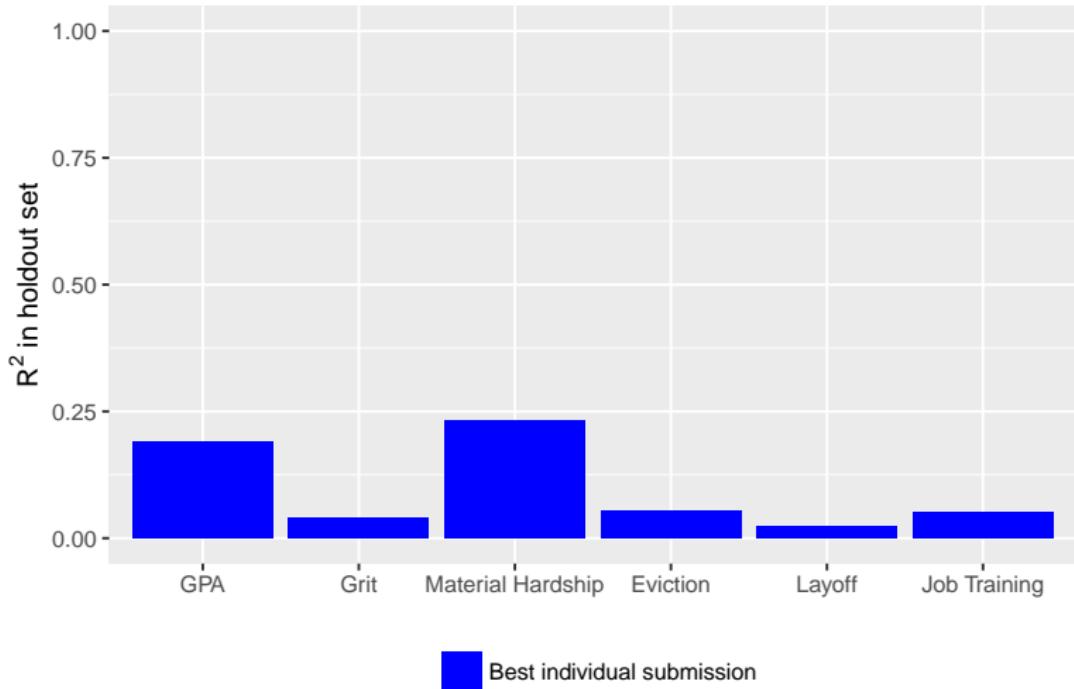
Can an Algorithm Tell When Kids Are in Danger?

Child protective agencies are haunted when they fail to save kids. Pittsburgh officials believe a new data analysis program is helping them make better judgment calls.

By DAN HURLEY JAN. 2, 2018

We need to understand the strengths *and* weakness of predictive models of social behavior

Can you help us figure out this vast empty space?



Introducing the outcome variables

GPA¹

¹Learn more at <http://www.fragilefamilieschallenge.org/gpa/>

GPA¹

How do kids beat the odds academically?

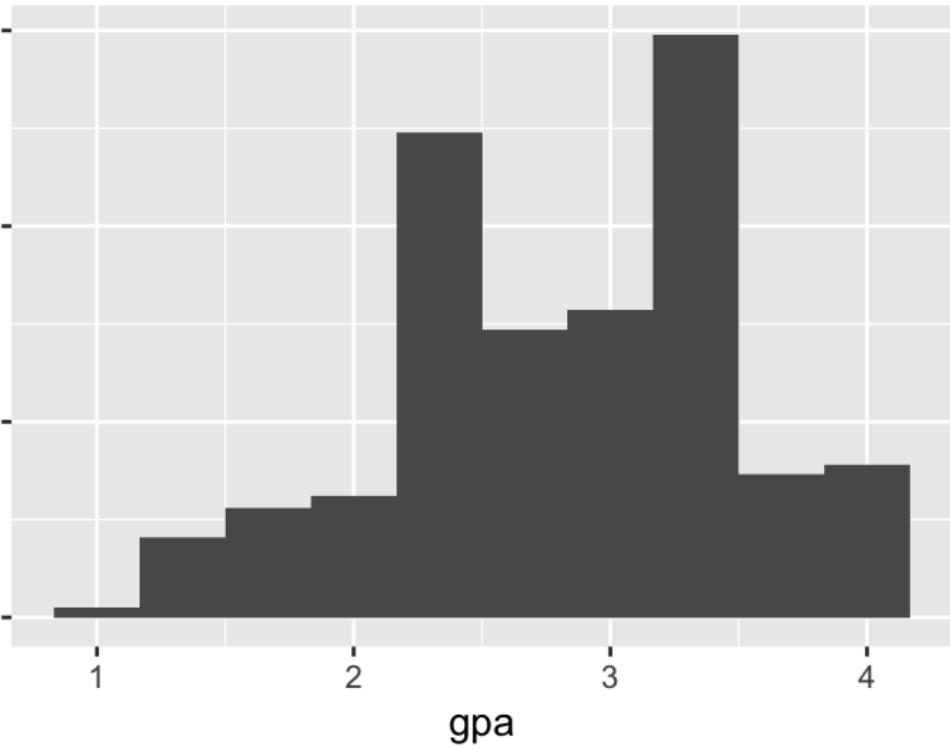
¹Learn more at <http://www.fragilefamilieschallenge.org/gpa/>

GPA²

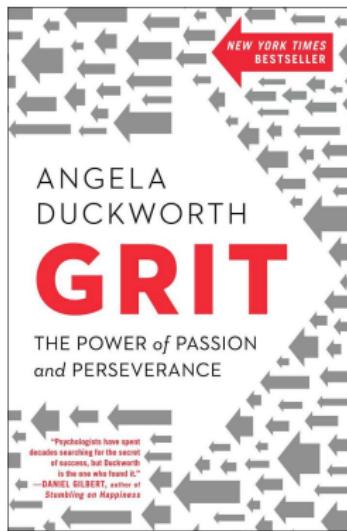
B20. At the {most recent grading period/last grading period in the spring} what was your grade in ...

	A	B	C	D OR LOWE R	NO GRADE OR PASS/FAIL	REF	DK	N/A HOMESCHOoled
B20A English or language arts? ..	1	2	3	4	5	-1	-2	7 → GO TO B22A
B20B Math?	1	2	3	4	5	-1	-2	7 → GO TO B22A
B20C History or social studies? ..	1	2	3	4	5	-1	-2	7 → GO TO B22A
B20D Science?	1	2	3	4	5	-1	-2	7 → GO TO B22A

²This variable is reverse-coded in the data file so that higher values represent higher GPAs.

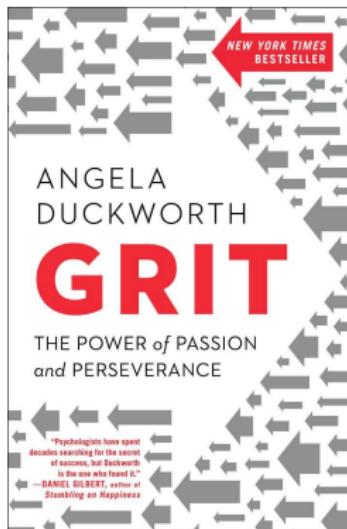


“Grit” predicts success, possibly more than IQ.³



³Learn more at <http://www.fragilefamilieschallenge.org/grit/>

“Grit” predicts success, possibly more than IQ.³



What makes some kids gritty?

³Learn more at <http://www.fragilefamilieschallenge.org/grit/>

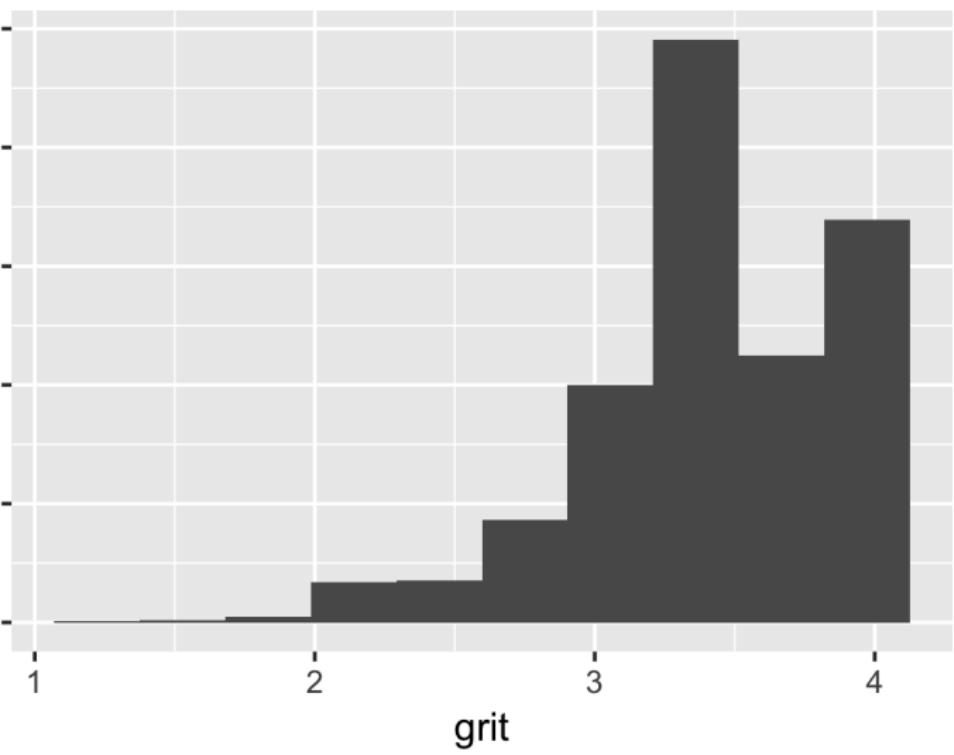
Grit⁴

- D2. Thinking about how you have behaved or felt during the past four weeks, please tell me whether you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with the following statements.

PROBE: Thinking about the past four weeks, do you strongly agree, somewhat agree, somewhat disagree, or strongly disagree with this statement?

	STRONGLY AGREE	SOMEWHAT AGREE	SOMEWHAT DISAGREE	STRONGLY DISAGREE	REF	DK
D2I. I keep at my schoolwork until I am done with it.....	1	2	3	4	-1	-2
D2K. Once I make a plan to get something done, I stick to it.....	1	2	3	4	-1	-2
D2M. I finish whatever I begin.....	1	2	3	4	-1	-2
D2V. I am a hard worker	1	2	3	4	-1	-2

⁴This variable is reverse-coded in the data file so that higher values represent more grit.



Material hardship⁵

⁵Learn more at

<http://www.fragilefamilieschallenge.org/material-hardship/>

Material hardship⁵

What unmeasured predictors are associated with families unexpectedly escaping severe deprivation?

⁵Learn more at

<http://www.fragilefamilieschallenge.org/material-hardship/>

Material hardship⁵

What unmeasured predictors are associated with families unexpectedly escaping severe deprivation?

What sends families unexpectedly into deep poverty?

⁵Learn more at

<http://www.fragilefamilieschallenge.org/material-hardship/>

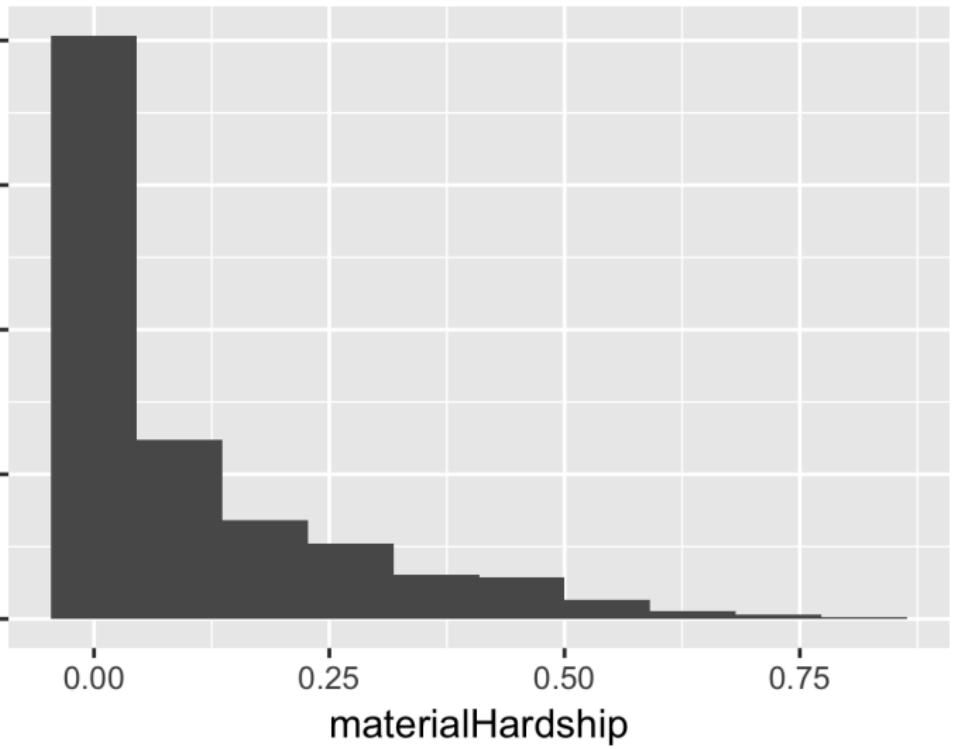
Material hardship

We are also interested in some of the problems that families face making ends meet. In the past twelve months, did you do any of the following because there wasn't enough money?

		YES	NO	REF	DK
J37.	In the past twelve months, did you receive free food or meals?	1	2	-1	-2
J38.	In the past twelve months, were you ever hungry, but didn't eat because you couldn't afford enough food?	1	2	-1	-2
J39.	In the past twelve months, did you ever not pay the full amount of rent or mortgage payments?	1	2	-1	-2
J40.	In the past twelve months, were you evicted from your home or apartment for not paying the rent or mortgage?	1	2	-1	-2
J41.	In the past twelve months, did you not pay the full amount of gas, oil, or electricity bill?	1	2	-1	-2
J42.	In the past twelve months, was your gas or electric services ever turned off, or the heating oil company did not deliver oil, because there wasn't enough money to pay the bills?	1	2	-1	-2
J43.	In the past twelve months, did you borrow money from friends or family to help pay bills?	1	2	-1	-2
J44.	In the past twelve months, did you move in with other people even for a little while because of financial problems?	1	2	-1	-2

Material hardship

J45.	In the past twelve months, did you stay at a shelter, in an abandoned building, an automobile or any other place not meant for regular housing, even for one night?	1	2	-1	-2
J46.	In the past twelve months, was there anyone in your household who needed to see a doctor or go to the hospital but couldn't go because of the cost?	1	2	-1	-2
J47.	In the past twelve months, was your telephone service (mobile or land line) cancelled or disconnected by the telephone company because there wasn't enough money to pay the bill?	1	2	-1	-2



Eviction⁶

⁶Learn more at <http://www.fragilefamilieschallenge.org/eviction/>

⁷Note: You will just create propensity scores for eviction given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Eviction⁶

Does housing eviction **cause** worse outcomes as kids transition to adulthood?⁷

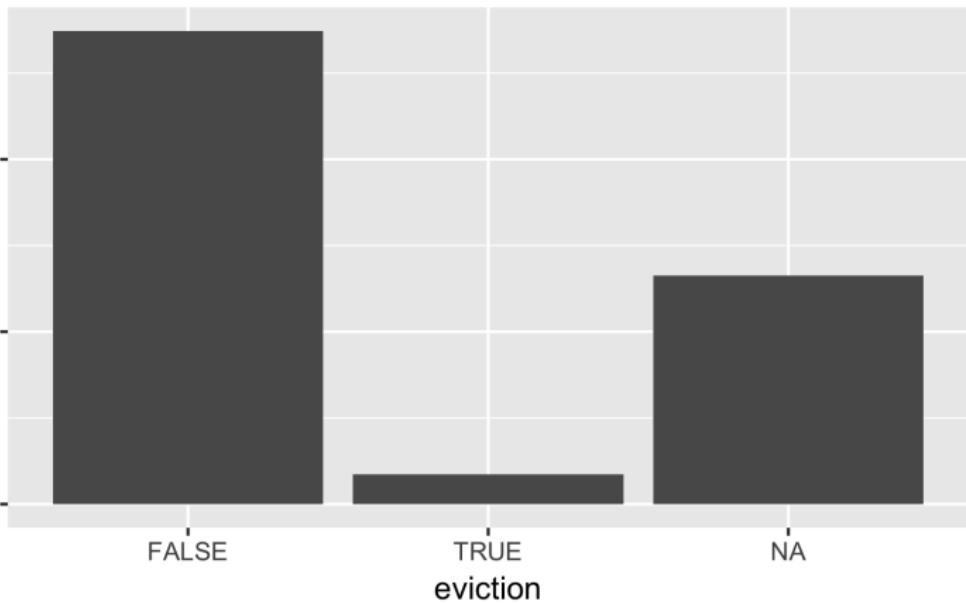
⁶Learn more at <http://www.fragilefamilieschallenge.org/eviction/>

⁷Note: You will just create propensity scores for eviction given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Eviction

J51. Since {MONTH AND YEAR COHORT CITY FIELDDED IN YR 9}, were you evicted from your home or apartment for not paying the rent or mortgage?

YES	1
NO	2
REFUSED	-1
DON'T KNOW	-2



Caregiver layoff⁸

⁸Learn more at <http://www.fragilefamilieschallenge.org/layoff/>

⁹Note: You will just create propensity scores for caregiver layoff given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Caregiver layoff⁸

Does layoff of a caregiver **cause** collateral damage for kids?⁹

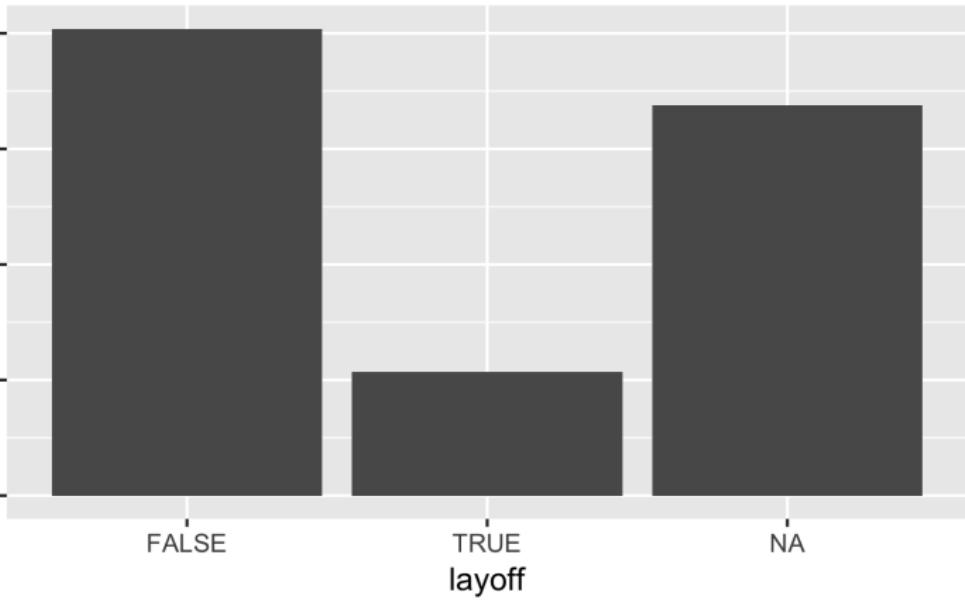
⁸Learn more at <http://www.fragilefamilieschallenge.org/layoff/>

⁹Note: You will just create propensity scores for caregiver layoff given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Caregiver layoff

K13. Since {MONTH AND YEAR COHORT CITY FIELDDED IN YR 9}, have you been laid off from your employer for any time?

- | | |
|------------------|----|
| YES | 1 |
| NO..... | 2 |
| REFUSED..... | -1 |
| DON'T KNOW | -2 |



Job training¹⁰

¹⁰Learn more at

<http://www.fragilefamilieschallenge.org/job-training/>

¹¹Note: You will just create propensity scores for job training given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Job training¹⁰

Does job training for a caregiver **cause** collateral benefits for children?¹¹

¹⁰Learn more at

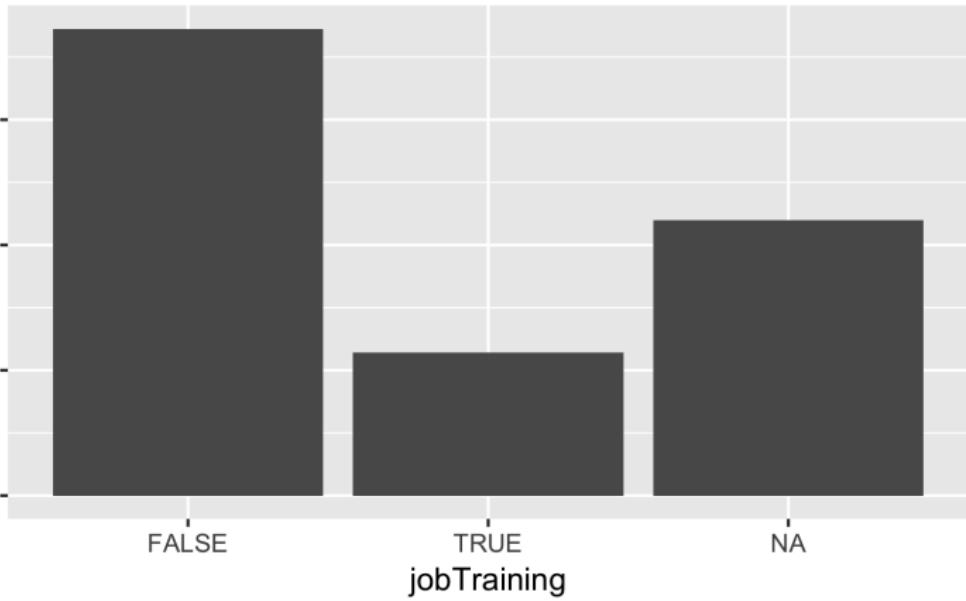
<http://www.fragilefamilieschallenge.org/job-training/>

¹¹Note: You will just create propensity scores for job training given background variables; causal inference comes in the second stage of the Challenge when outcomes are measured several years from now.

Caregiver job training

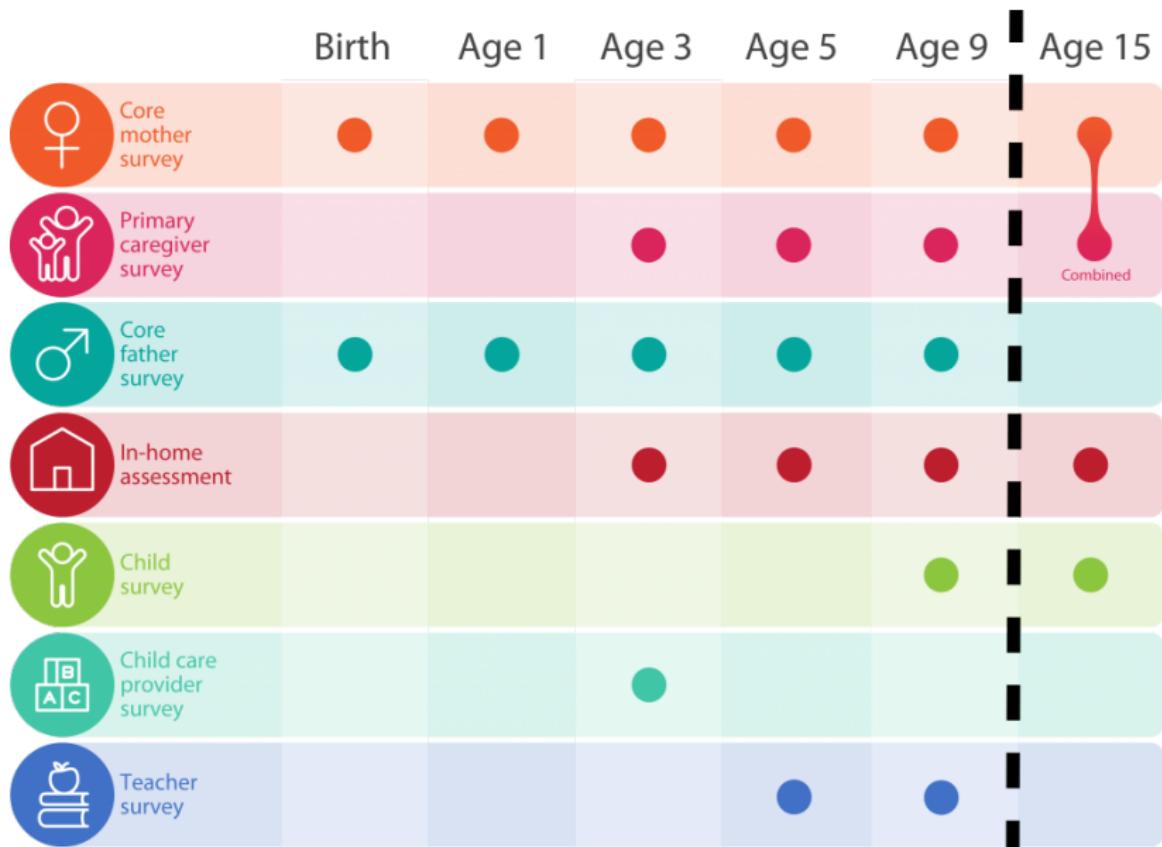
K4. Since {MONTH AND YEAR COHORT CITY FIELDDED IN YR 9}, have you taken any classes to improve your job skills, such as computer training or literacy classes?

- | | |
|------------------|-----|
| YES | .1 |
| NO | .2 |
| REFUSED | -.1 |
| DON'T KNOW | -.2 |



Introducing the data

The Fragile Families and Child Wellbeing Study is a dataset of real people who have selflessly opened up their lives to us for the last 15 years so that their experiences can contribute to scientific research. By participating in the Fragile Families Challenge, you become a collaborator in this project. It is of the utmost importance that you respect the families in the data by using what they have told us responsibly.



RStudio Source Editor

fsf x Filter

	fsf1	fsf1a	fsf2	fsf3	fsf3a	fsf3b	fsf3b1	fsf4	fsf4a	fsf4b	fsf5	fsf6	fsf7a	fsf7b	fsf7c	fsf8a1	fsf8b1	fsf8c1	fsf8a2	fsf8b2	fsf8c2	fsf8a3
1	-9	-9	-9	-9.00	-9.00	-9.000000	-3	-9.00000	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	
2	-9	-9	-9	-9.00	-9.00	-9.000000	-3	-9.00000	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	
3	-9	-9	-9	-9.00	-9.00	-9.000000	-3	-9.00000	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	
4	-6	-6	-6	-6.00	-6.00	-6.000000	-3	-6.00000	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	
5	-6	-6	-6	-6.00	-6.00	-6.000000	-3	-6.00000	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	
6	2	-6	-6	-6.00	-6.00	-6.000000	-3	-6.00000	-6	-6	-6	-6	2	2	2	2	-6	-6	1	12	600	
7	-6	-6	-6	-6.00	-6.00	-6.000000	-3	-6.00000	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	
8	1	3	2	-6.00	-6.00	-6.000000	-3	196.26903	1	2	2	2	2	2	2	-6	-6	2	-6	-6	-6	
9	-6	-6	-6	-6.00	-6.00	-6.000000	-3	-6.00000	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	
10	1	1	1	-6.00	-6.00	-6.000000	-3	1310.50458	-10	2	2	2	2	2	2	-6	-6	2	-6	-6	-6	
11	1	5	4	149734....	11087.07	1.271596	-3	-6.00000	-6	-6	-6	-6	1	2	2	-6	-6	2	-6	-6	-6	
12	-9	-9	-9	-9.00	-9.00	-9.000000	-3	-9.00000	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	
13	1	2	1	-6.00	-6.00	-6.000000	-3	1024.43600	3	2	2	2	2	2	2	-6	-6	2	-6	-6	-6	
14	-6	-6	-6	-6.00	-6.00	-6.000000	-3	-6.00000	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	
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18	1	3	1	-6.00	-6.00	-6.000000	-3	877.82490	1	2	2	2	1	1	2	1	3	176	2	-6	-6	
19	-9	-9	-9	-9.00	-9.00	-9.000000	-3	-9.00000	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	
20	-6	-6	-6	-6.00	-6.00	-6.000000	-3	-6.00000	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	-6	
21	-9	-9	-9	-9.00	-9.00	-9.000000	-3	-9.00000	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	-9	
22	1	1	1	-6.00	-6.00	-6.000000	-3	720.26305	1	2	2	2	1	2	2	-6	-6	2	-6	-6	-6	

Showing 1 to 24 of 4,242 entries



How do I know what these variables are?

The screenshot shows a web browser window with the title bar "FFCWS Metadata | Variables". The address bar contains the URL "browse.fragilefamiliesmetadata.org/variables". The main content area features the "Fragile Families & Child Wellbeing Study" logo with "PRINCETON | COLUMBIA" below it. To the right of the logo is a grid of nine small photographs depicting various family and child scenarios. Below the logo is a navigation bar with links: "FFCWS Metadata", "Browse variables", "Download metadata", "Feedback", and "About FFCWS". The main section is titled "Search variables" and includes a search bar with "Search for..." and a "Search »" button, followed by a "Filter" section with dropdown menus for "Topic", "Wave", and "Respondent".

http:

//metadata.fragilefamilies.princeton.edu/variables

Introducing cm1relf

[http://metadata.fragilefamilies.princeton.edu/
variables/cm1relf](http://metadata.fragilefamilies.princeton.edu/variables/cm1relf)

You can filter variables by:

- ▶ Topic
- ▶ Wave
- ▶ Respondent
- ▶ Source
- ▶ Variable Type

Why cm1relf?

Why cm1relf?

Response type	Respondent	Wave	Leaf
(blank): questionnaire c: constructed	m - mother f - father p - primary caregiver k - child t - teacher h - home o - observations n - non parental caregiver d - child care center r - family care center u - post center observations q - couple	1 - baseline 2 - year 1 3 - year 3 4 - year 5 5 - year 9 6 - year 15	(letter): survey section + (number): question number OR (string): Constructed variable ID OR (string): national or city weight



Advice

Get started with the constructed variables

- ▶ These are variables that domain experts think are important
- ▶ These variables have been partially pre-cleaned
- ▶ These variables add the additional prefix **c** to the front of the variable name.
- ▶ For instance, cm1ethrace indicates constructed mother's wave 1 race/ethnicity.
- ▶ blog post:

<http://www.fragilefamilieschallenge.org/quick-start/>

Leverage the hundreds of papers already written with this data by domain experts

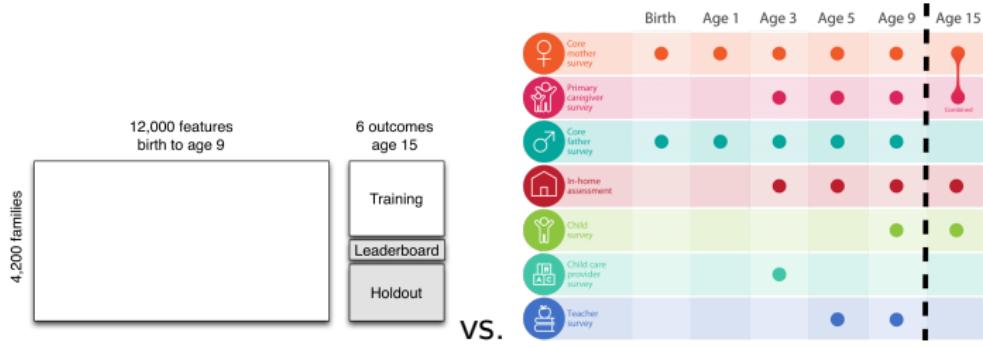
Published Articles

Authors	Date	Title / Link
Brianne Pragg, Chris Knoester	Forthcoming	"Parental Leave Use Among Disadvantaged Fathers" <i>Journal of Family Issues</i> .
Jessica Hardie, Kristin Turney	Forthcoming	"The Intergenerational Consequences of Parental Health Limitations" <i>Journal of Marriage and Family</i> .
Robin Hognas, Heidi Williams	Forthcoming	"Maternal Kinship Involvement and Father Identity in Fragile Families" <i>Journal of Family and Economic Issues</i> .
Manuel Jiménez, Roy Wade, Ofira Schwartz-Solcher, Yong Lin, Nancy Reichman	Forthcoming	"Adverse Childhood Experiences and ADHD Diagnosis at Age 9 in a National Urban Sample" <i>Academic Pediatrics</i> .
Samara Gunter	Forthcoming	"Dynamics of Urban Informal Labor Supply in the United States" <i>Social Science Quarterly</i> .
Juan Shao-Chiu, Heather Washington, Megan Kurlychek	Forthcoming	"Breaking the Intergenerational Cycle: Partner violence, child-parent attachment, and children's aggressive behaviors" <i>Journal of Interpersonal Violence</i> .
Youngmin Yi, Kristin Turney, Christopher Wilderman	Forthcoming	"Mental Health Among Jail and Prison Inmates" <i>American Journal of Men's Health</i> .
Michael McFarland, Sara McLanahan, Bridget Goosby, Nancy Reichman	Forthcoming	"Grandparents' Education and Infant Health: Pathways Across Generations" <i>Journal of Marriage and Family</i> .
Christian King	Forthcoming	"Food Insecurity and Housing Instability in Vulnerable Families" <i>Review of Economics of the Household</i> .
Wan-Yi Chen, Yookyoung Lee	Forthcoming	"The Impact of Community Violence, Personal Victimization, and Paternal Support on Maternal Harsh Parenting" <i>Journal of Community Psychology</i> .
Marcia Carlson, Alicia VanOrman	Forthcoming	"Trajectories of relationship supportiveness after childbirth: Does marriage matter?" <i>Social Science Research</i> .
Jared Durtschi, Kristy Soloski, Jonathan Kimmes	Forthcoming	"The Dyadic Effects of Supportive Coparenting and Parental Stress on Relationship Quality Across the Transition to Parenthood" <i>Journal of Marital and Family Therapy</i> .
Anne Martin, Rebecca Ryan, Elizabeth Riina, Jeannine Brooks-Gunn	Forthcoming	"Coreidential Father Transitions and Biological Parents' Coparenting Quality in Early and Middle Childhood" <i>Journal of Family Issues</i> .
Lawrence Berger, Sarah Font, Kristen Slack, Jane Waldfogel	Forthcoming	"Income and child maltreatment in unmarried families: evidence from the earned income tax credit" <i>Review of Economics of the Household</i> .
Sung-Bong Cho, Ming Cui, Amy Claridge	Forthcoming	"Cohabiting parents' marriage plans and marriage realization: Gender differences, couple agreement, and longitudinal effects" <i>Journal of Social and Personal Relationships</i> .
M. Blake Berryhill	Forthcoming	"Single mothers' home-based school involvement: a longitudinal analysis" <i>Journal of Family Studies</i> .
Colin Flood, Karen Sheehan, Marie Crandall	Forthcoming	"Predictors of Emergency Department Utilization Among Children in Vulnerable Families" <i>Pediatric Emergency Care</i> .
Sarah James, Lauren Hale	Forthcoming	"Sleep Duration and Child Well-Being: A Nonlinear Association" <i>Journal of Clinical Child & Adolescent Psychology</i> .

<http://crcw.princeton.edu/publications/publications.asp>

Use the structure in the data

Use the structure in the data



Common missing codes¹²

Not all missing data is the same

- ▶ -9 Not in wave - Did not participate in survey/data collection component
- ▶ -6 Valid skip - Intentionally not asked question; question does not apply to respondent or response known based on prior information.
- ▶ -2 Don't know - Respondent asked question; responded "Don't Know".
- ▶ -1 Refuse - Respondent asked question; refused to answer question
- ▶ NA also used occasionally

¹²For more complete list and explanation, see
<http://www.fragilefamilieschallenge.org/missing-data/>

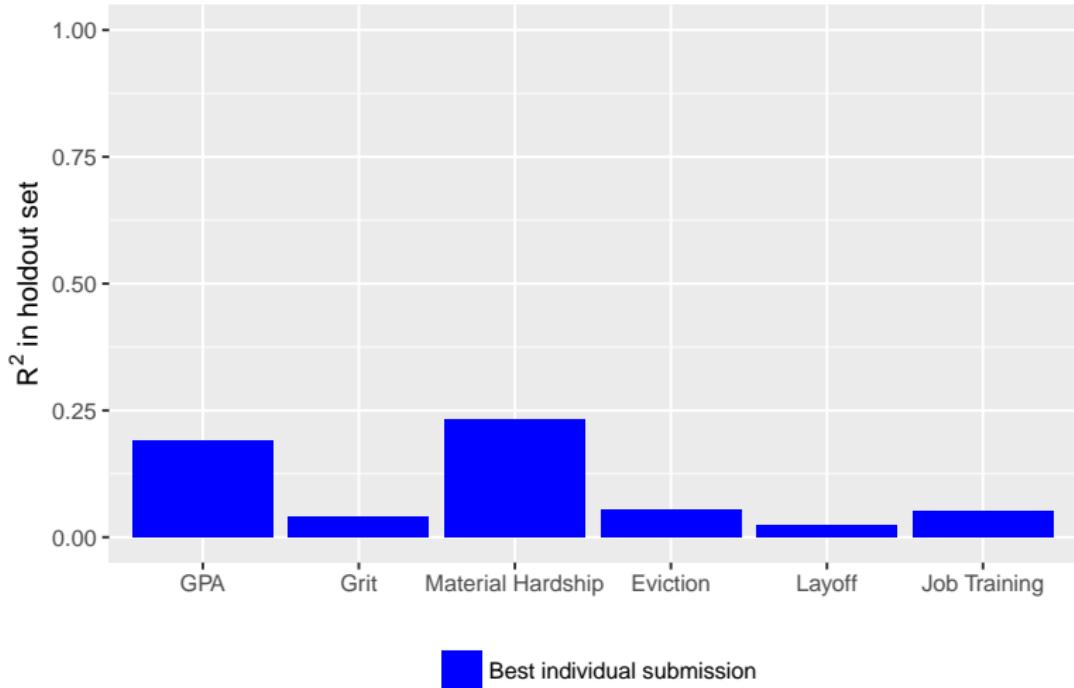
Working with this data may be frustrating . . .



. . . but we are here to help.

<https://www.talk2solicitors.co.uk/blog/limits-frustration-contract/>

Can you help us figure out this vast empty space?



www.fragilefamilieschallenge.org

Questions?

- ▶ Email: fragilefamilieschallenge@gmail.com
- ▶ Blog: www.fragilefamilieschallenge.org/blog-posts/
- ▶ Github: www.github.com/fragilefamilieschallenge