

Fragile Families Challenge

Matthew Salganik, Ian Lundberg, Sara McLanahan,
and we hope many more

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Social Scientists \longleftrightarrow Data Scientists

$\hat{\beta}$ vs \hat{y}



Initial sequencing and analysis of the human genome

International Human Genome Sequencing Consortium*

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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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(CMS Collaboration)[‡]

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A scientific mass collaboration combining predictive modeling, causal inference, and qualitative interviews to 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

	Birth	Age 1	Age 3	Age 5	Age 9	Age 15
 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

Common task method (e.g., Netflix Prize)

5,000 families

Birth to age 9
12,000 features

Age 15
6 key outcomes

training
data

test
data

Fragile Families Challenge:

1. common task method (e.g., Netflix Prize)
2. use submissions to do cool stuff

1. common task method (e.g., Netflix Prize)
2. use submissions to do cool stuff

Six age 15 outcomes:

- ▶ GPA
- ▶ Material Hardship
- ▶ Grit
- ▶ Evicted
- ▶ Job training
- ▶ Job loss

$$\begin{aligned}\hat{y} &= \hat{f}_1(x) \\ \hat{y} &= \hat{f}_2(x) \\ \hat{y} &= \hat{f}_3(x)\end{aligned}$$

$$\boxed{\begin{aligned}\hat{y} &= \hat{f}_1(x) \\ \hat{y} &= \hat{f}_2(x) \\ \hat{y} &= \hat{f}_3(x)\end{aligned}}$$

Community model

$$\longrightarrow \hat{f}_c\left(\hat{f}_1(x), \hat{f}_2(x), \hat{f}_3(x)\right)$$

What's so special about this community model?

Use community model to

- ▶ look for “dark matter”
- ▶ prioritize issues for randomized controlled trials

Use community model to

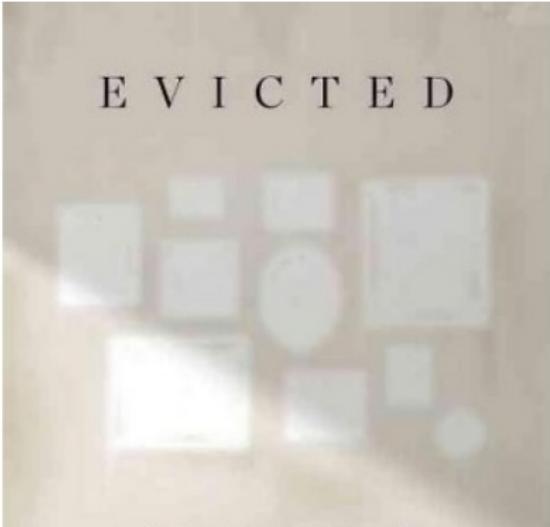
- ▶ look for “dark matter”
- ▶ prioritize issues for randomized controlled trials

- ▶ interview kids and families that are beating the odds (and not)
- ▶ Three continuous outcomes: GPA, Material Hardship, Grit
- ▶ machine learning in the service of in-depth interviews

Use community model to

- ▶ look for “dark matter”
- ▶ prioritize issues for randomized controlled trials

E V I C T E D



POVERTY AND PROFIT IN
THE AMERICAN CITY



MATTHEW DESMOND

Causal inference from observational data is hard but important:

- ▶ Perfectly match two kids who are identical except whether they were evicted or not
- ▶ Propensity score matching (roughly, one dimensional matching)
- ▶ Community model produces propensity scores used for matching
- ▶ In-depth interviews to check assumption of selection on observables

Use community model to

- ▶ look for “dark matter”
- ▶ prioritize issues for randomized controlled trials

Introducing the outcome variables

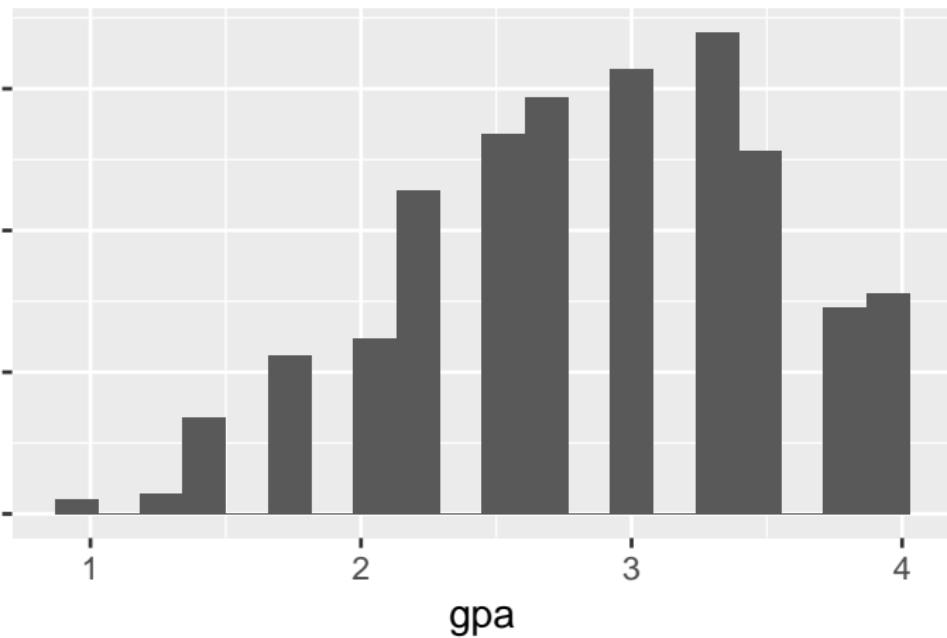
GPA: How do kids beat the odds academically?

GPA

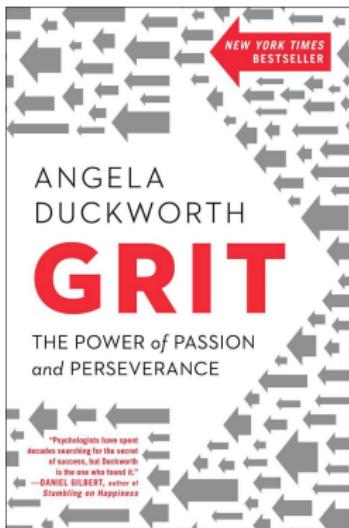
B20. At the {most recent grading period/last grading period in the spring} what was your grade in ...

	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

gpa
N = 1165



“Grit” predicts success, possibly more than IQ.



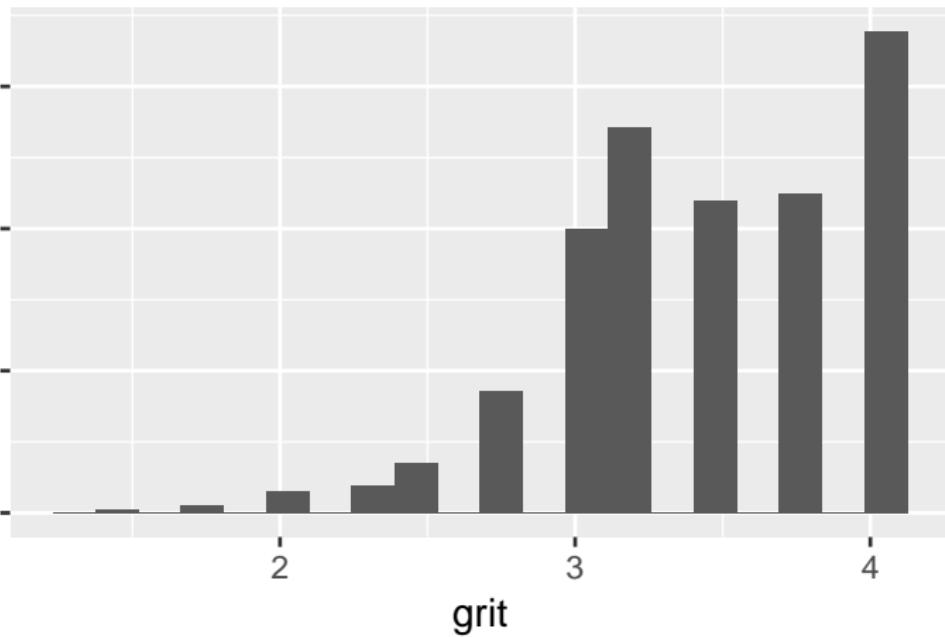
What makes some kids gritty?

Grit¹

	Strongly disagree	Somewhat disagree	Somewhat agree	Strongly agree
I keep at my schoolwork until I am done with it	1	2	3	4
I am a hard worker	1	2	3	4
Once I make a plan to get something done, I stick to it	1	2	3	4
I finish whatever I begin	1	2	3	4

¹This variable is reverse-coded, so we have reproduced the questionnaires with coding in the correct direction.

grit
N = 1418



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?

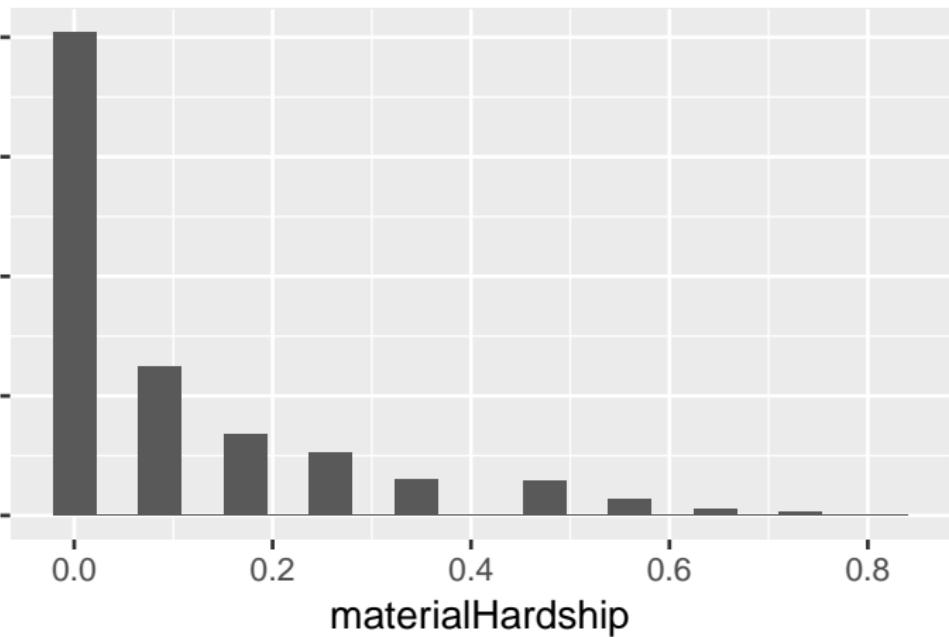
		YES	NO	REF	DK
J37.	In the past twelve months, did you receive free food or meals?	1	2	-1	-2
J38.	In the past twelve months, were you ever hungry, but didn't eat because you couldn't afford enough food?	1	2	-1	-2
J39.	In the past twelve months, did you ever not pay the full amount of rent or mortgage 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

materialHardship

N = 1459

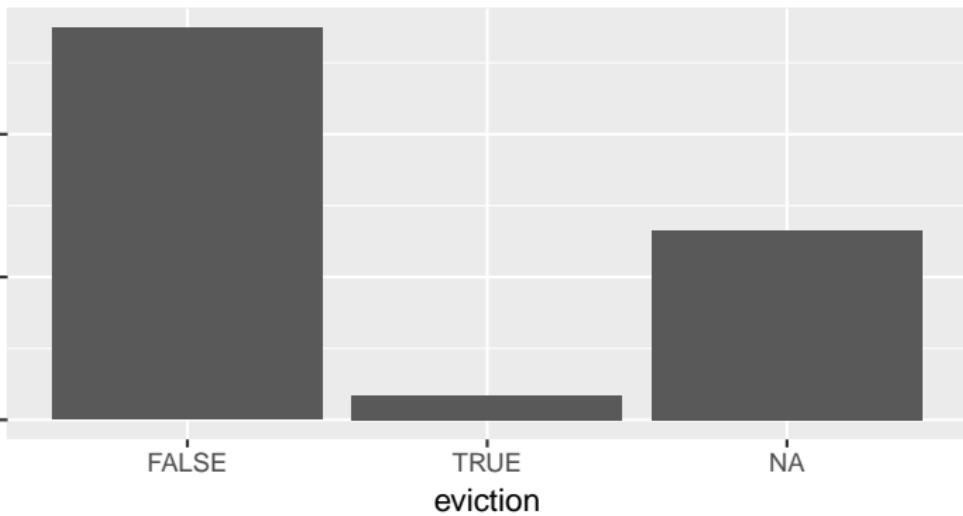


Eviction

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

eviction
N = 1459



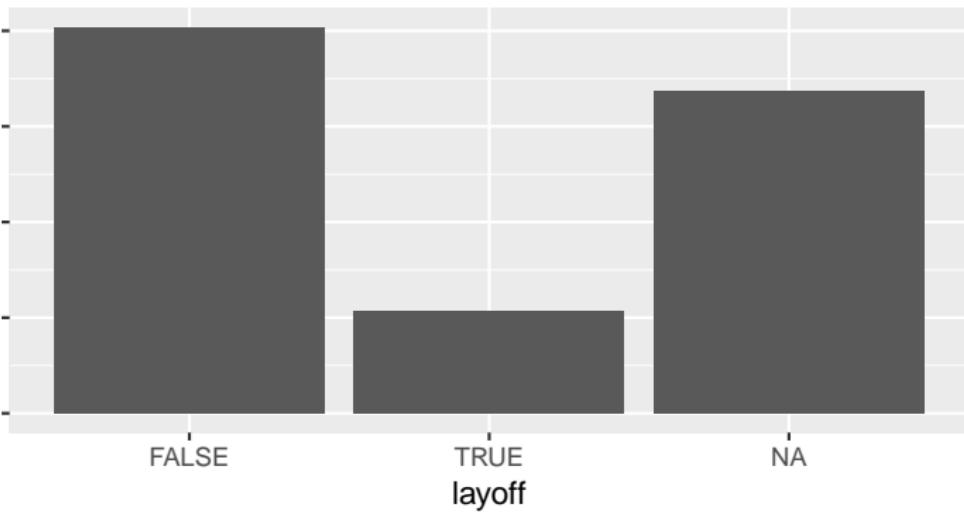
Caregiver layoff

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

[TO ADD - DISTRIBUTION IN TRAINING DATA]

layoff
N = 1277

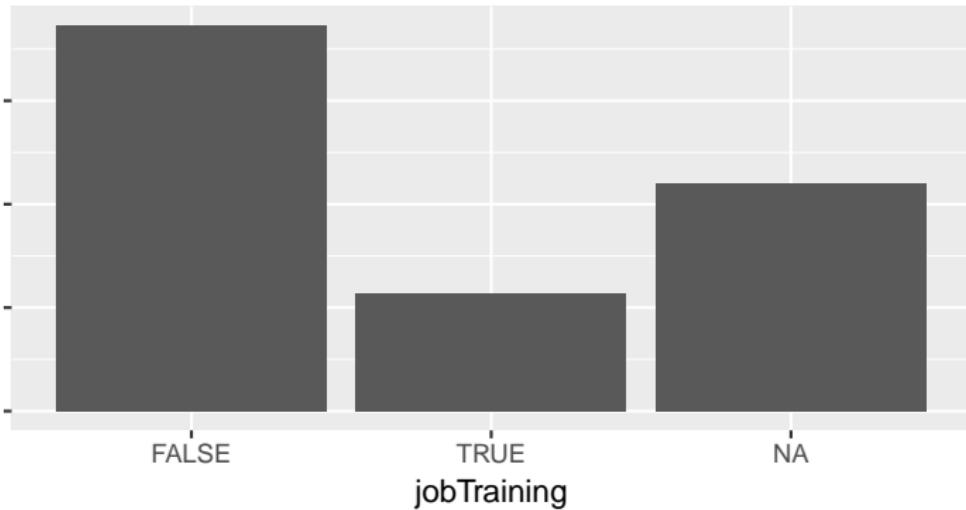


Caregiver job training

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 |

jobTraining
N = 1461



How is this going to work in practice?

In order to enable future research,
at the end of the Challenge,
we will open-source all submitted
predictions, code, and narrative explanations.

Why participate?

- ▶ it is an assignment
- ▶ help the world
- ▶ learn new skills
- ▶ get involved in scientific research
- ▶ win prizes
- ▶ publish papers
- ▶ have fun

This is a pilot test, please help us make the project better:

fragilefamilieschallenge@gmail.com