The Gendered Impact of Young Children's Health on Human Capital: Evidence from Turkey

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AEA Meeting, Topics in Development

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Introduction

1. Technology and Culture
   - How technology interacts with underlying cultural norms can have unintended consequences for development

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   - Effects on mortality, disability and human capital for age-eligible participants

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2. Immunizations and Gender Norms
   - Large scale immunization campaign in Turkey
   - Effects on mortality, disability and human capital for age-eligible participants
   - **Spillover effects on older children**

Motivation: Health, Human Capital and Gender

- Large biomedical and economic literature on the impact of early child/in utero health on later health and socioeconomic outcomes
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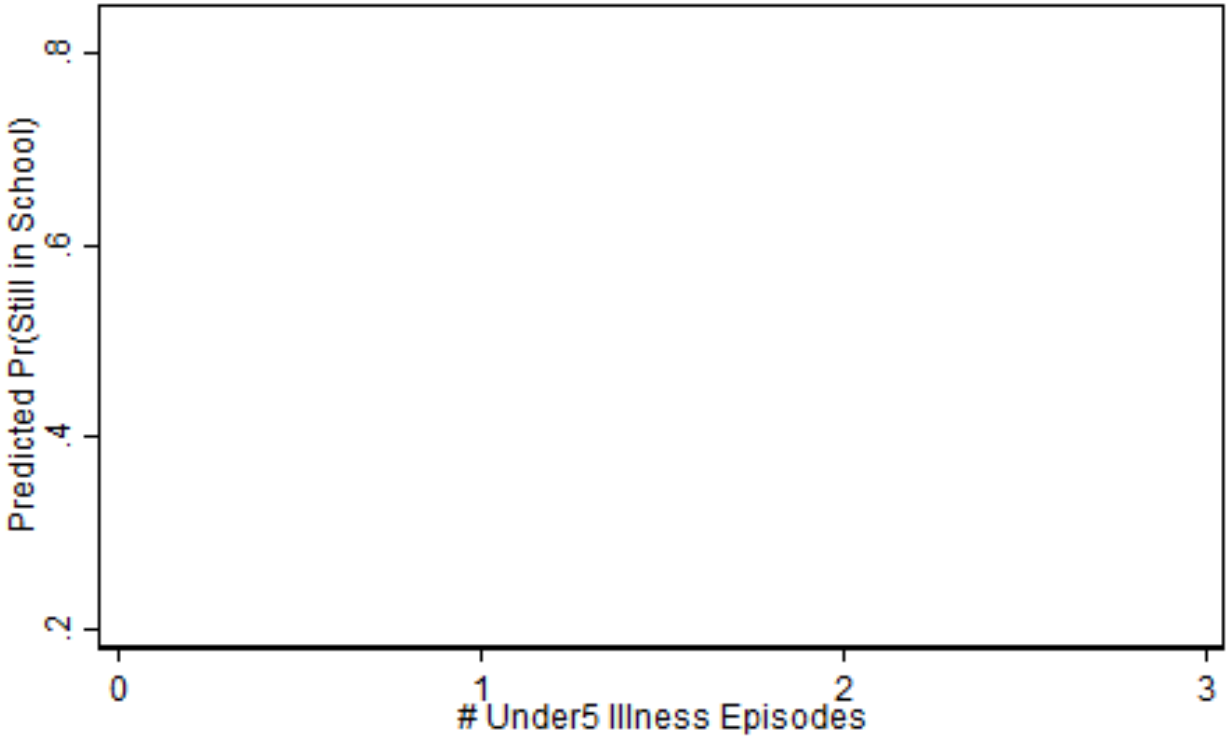
- **Hypothesize** because **girls are tasked with childcare or household chores**, they will **differentially benefit** from early childhood health interventions ▸ Time Use
  - investigate this hypothesis using difference–in-differences estimator of campaign
  - differs from other literature because policy specifically targeted under5
  - complication rate of vaccine preventable disease U-shaped (lowest for middle-schoolage children who will be focus of spillover effects)

Motivation

Schooling and Young Children's Illness (Turkish Boys 11-15)



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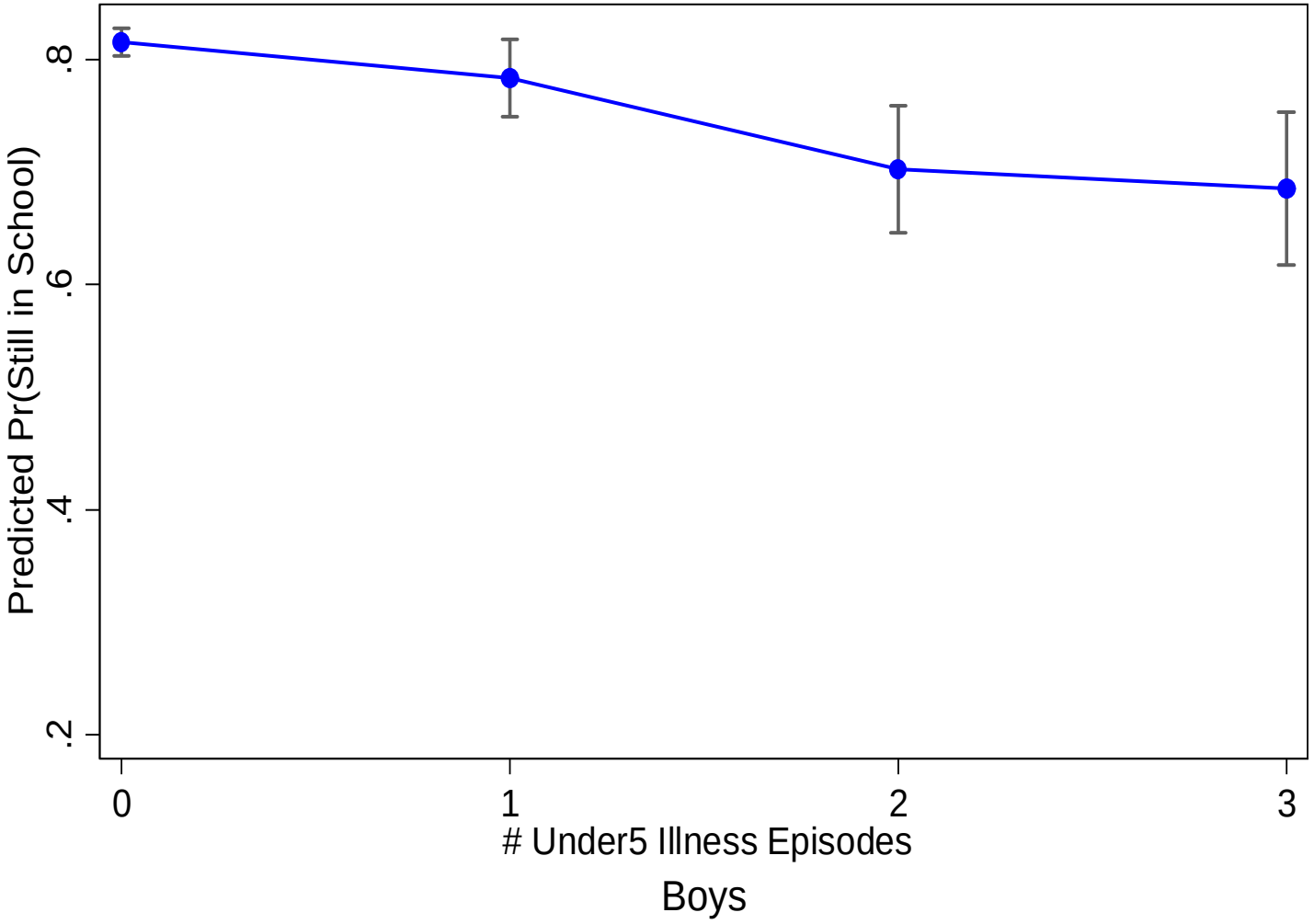

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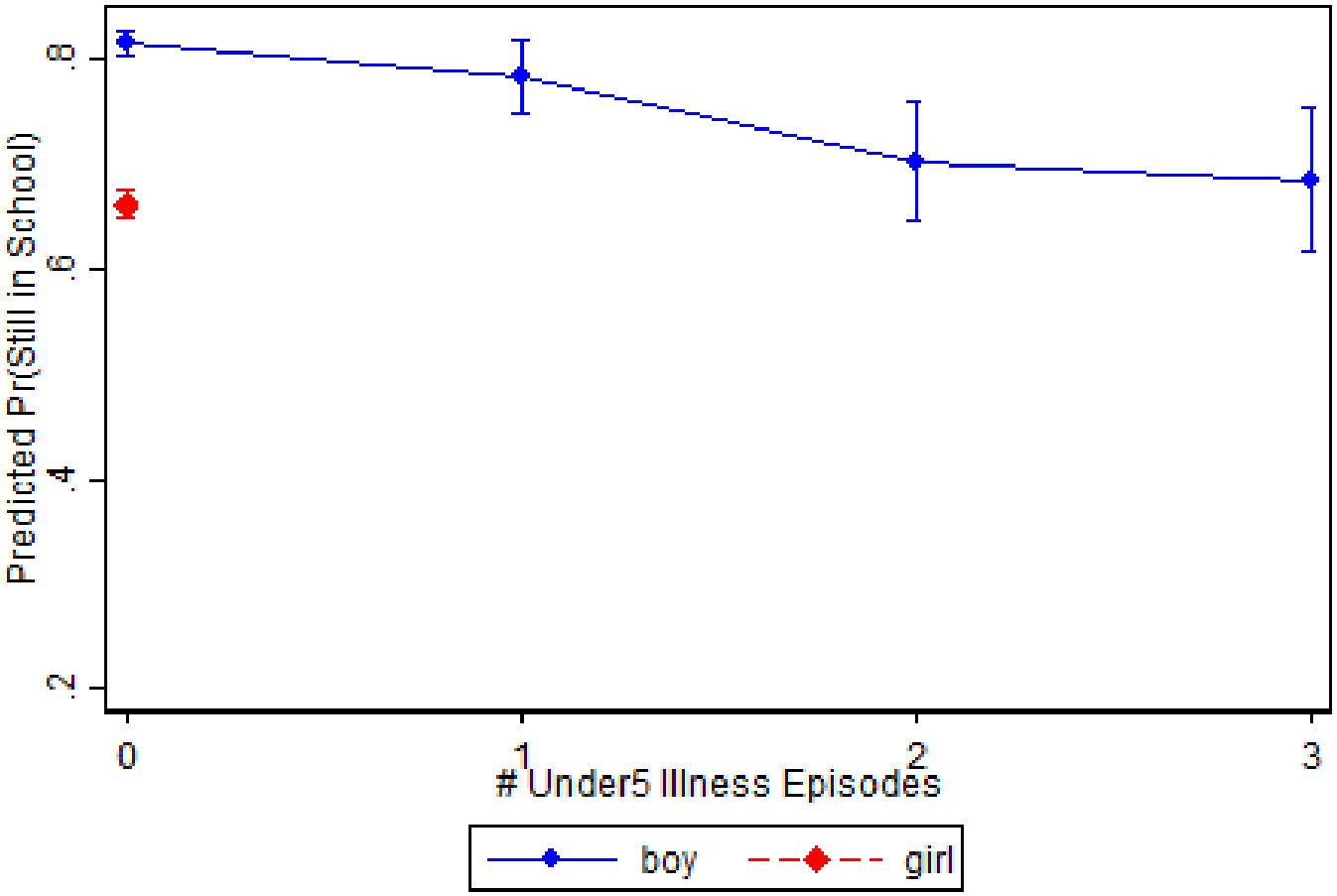

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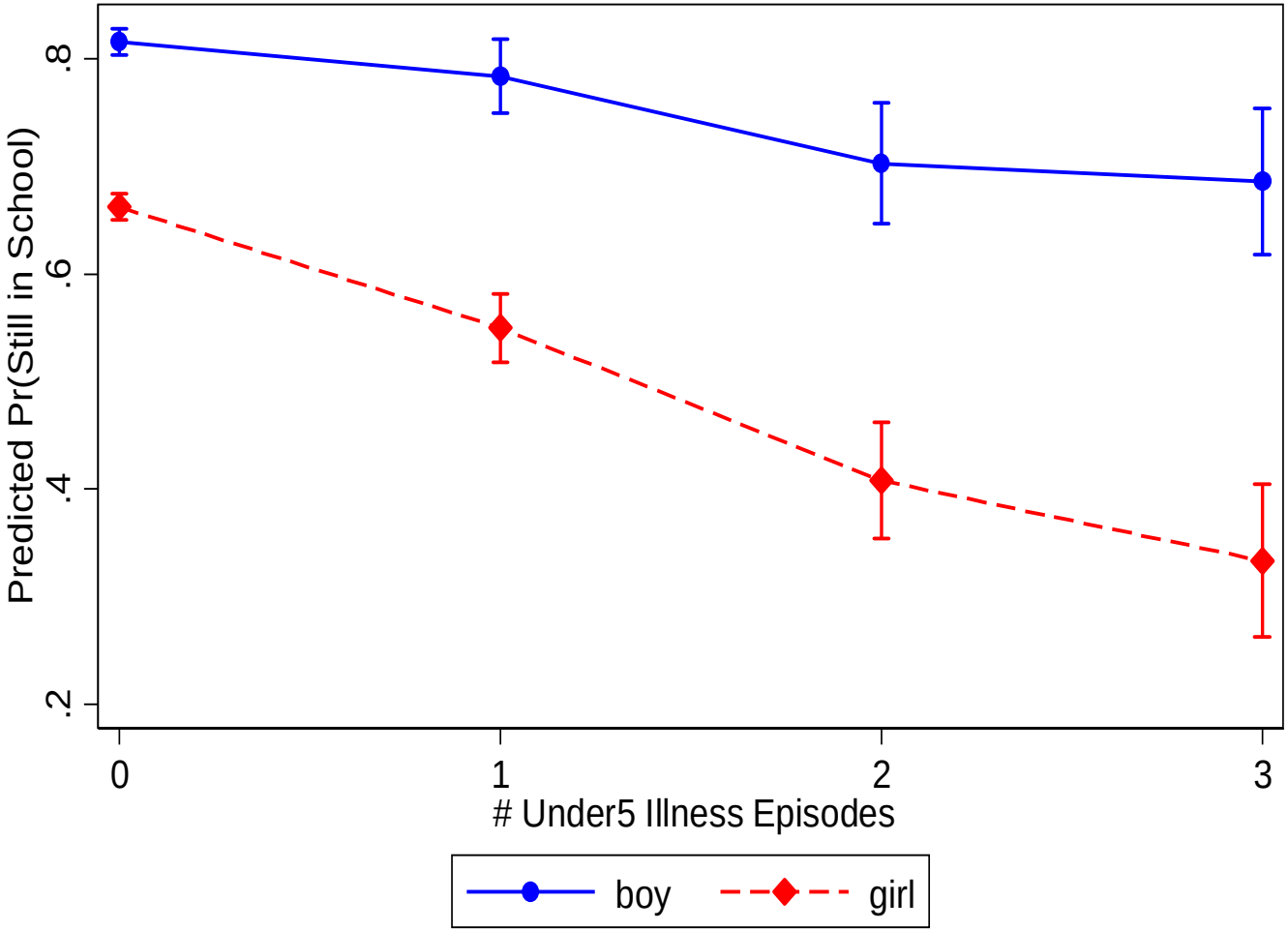


Data from Turkish DHS

Outline

- Background
- Empirical Approach & Data
- Results
- Concluding Comments

Background on Turkish National Immunization Campaign (1)

- Jim Grant a good friend of Turgut Özal
  - friends since the 1960s when Grant worked as USAID Rep to Turkey and Özal was part of the State Planning Organization
- They both get new jobs
  - Grant became the head of UNICEF in 1980 and Özal became the Prime Minister of Turkey in December 1983
- They make a plan
  - In 1984 they decide to make Turkey the test case for a large-scale national immunization of a LMIC (smaller countries had been done before but with limited success)

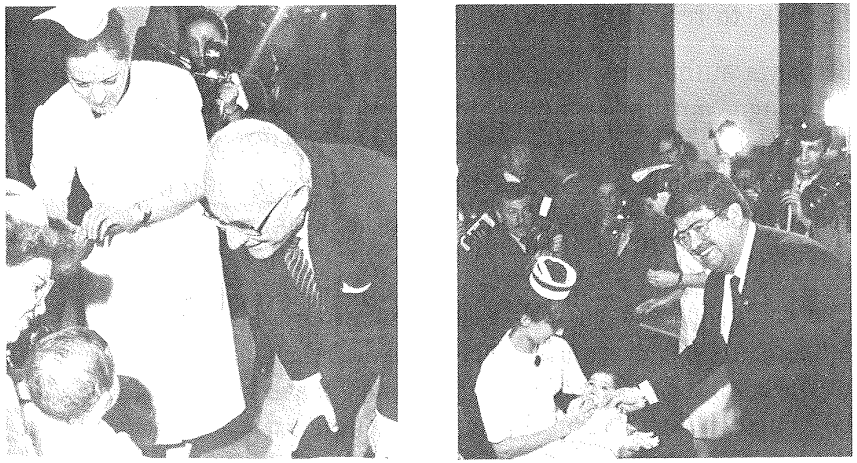
Timeline of Campaign (2)

- Three ten day rounds of mass vaccination
  - launched over a month in 1985
- Immunization Schedule
  - Kids under-five (estimated 5.1 million) receive three doses of DPT and oral polio and kids at least 9 months receive measles

Photos: High Level Political and Religious Involvement

The Strategy of Mass Vaccination

Panel A.

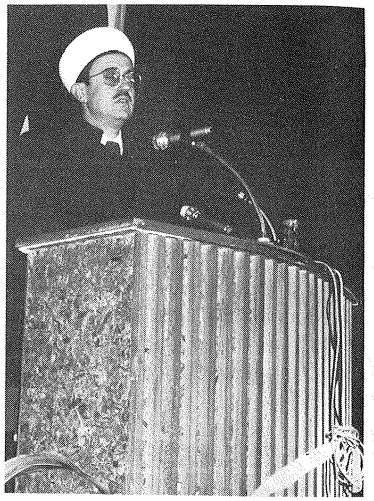


President Evren and Premier Özal lead the campaign.

Panel B.

Men of religion were asked to help:

The Directorate of Religious Affairs contacted directly, issued an official circular to the imams in Turkey's Mosques, calling on their support. The directorate also agreed to publish articles and sermons on the benefits of immunization in its monthly gazette. A sermon was prepared for Imams to preach simultaneaously on the eve of the campaign through the loudspeakers of the country's 54,000 Mosques, many of which also served as



Men of Religion gave sermons.

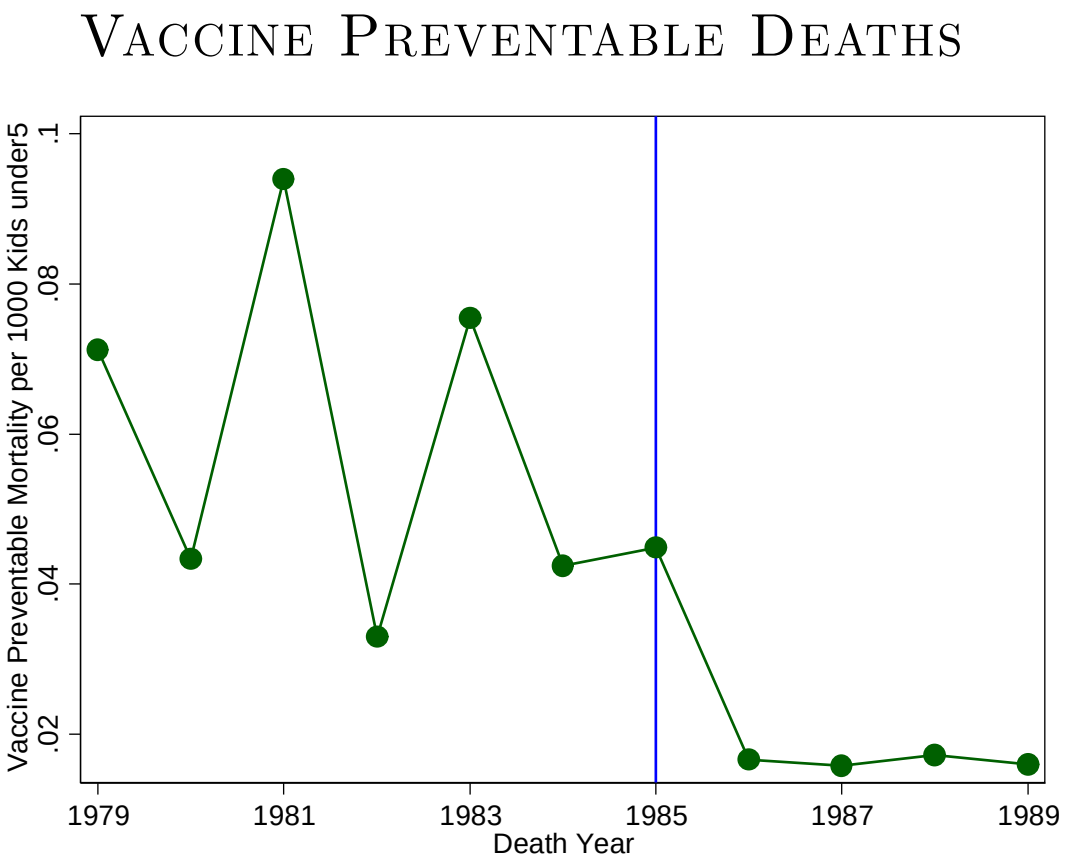
Campaign (3)

- Distribution/Dissemination
  - imported 41 million doses of vaccine, and distributed 27 million
  - 45,000 vaccination stations, aimed at being between 10-15 minute walk from home (used schools, mosques, businesses for distn as well)
  - over 4 million children received at least one dose of vaccine
  - continued to immunize after campaign; though with not as much coordination

Vaccine	*Age Grp*	*Pre (%)*	*Post (%)*
DPT	2-11 months	28	92
&	12-59 months	52	94
OPV	total	47	94
	2-11months	12	72
Measles	12-59 months	40	84
	total	37	83

Source: UNICEF Report

Did the Campaign Achieve its Goals?

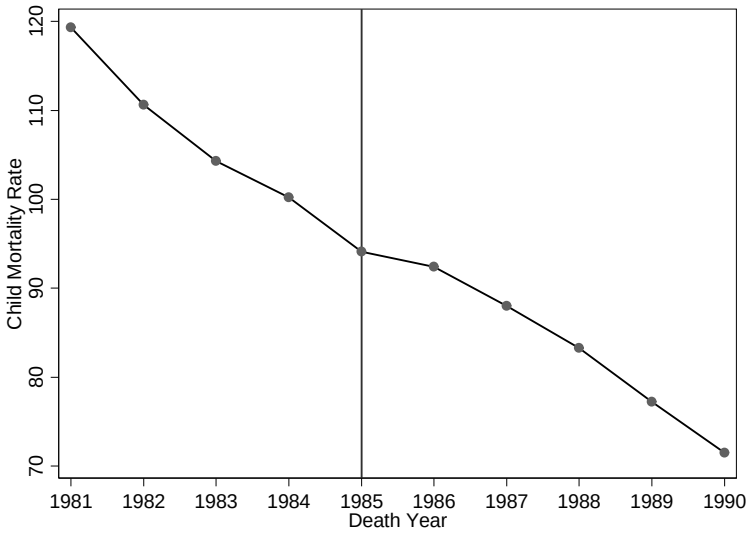


Did the Campaign Achieve its Goals?

▸ Enteritis ▸ MOD

Other health effects

A. Child mortality rate



B. Disability Rate

Data and Sample

- Data: Census (1985 1990 & 2000), DHS (1993 1998 & 2003/4, 2008), Vital Statistics, National Enrollment Statistics
- Age Eligible Sample: individuals ages 15 to 19 across two censuses (1985, 2000)

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  - exclude individuals less than 15 due to major education reform affecting children born >=1986
  - (1997 reform that extended 5 year "compulsory" education instituted by Ataturk to 8 years)

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- Treatment assigned based on province of birth (main sample nonmigrants)
- Two levels of analysis

Empirical Framework (1 of 2)

$$Outcome_{pt} = \alpha + \beta \ \left(VPD_p I_t^{post}\right) + \gamma I_t^{post} + \rho VPD_p + \mathbf{X}'_{pt}\Gamma + \varepsilon_{pt} \quad (1)$$

▸ VPDPrevalence

- p province, t time
  - Card (1992) -federal min wage law
  - Children under-five at the time of the campaign treated : $\left(I_t^{Post} = 1\right)$
  - X : variables suggested to influence outcome variables (demographics, household characteristics, local health infrastructure)
  - *Outcomes:* literacy, disability, educational attainment (none, less primary, primary complete, secondary complete, university/higher), infant and child mortality

Empirical Framework (2 of 2)

$$Outcome_{ipt} = \alpha + \beta(VPD_p I_t^{post}) + \sum_c \gamma_c I_p^c + \sum_j \rho_j I_t^j + \theta I_i^{girl} + \mathbf{X}'_{ipt}\Gamma + \varepsilon_{ipt},$$

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$$\begin{aligned} Outcome_{ipt} &= \alpha + \beta_1(VPD_p I_t^{post}) + \beta_2(VPD_p I_t^{post} I_i^{girl}) + \sum_c \gamma_c I_p^c \\ &+ \sum_j \rho_j I_t^j + \theta I_i^{girl} + \mathbf{X}'_{ipt}\Gamma + \left(I_i^{girl}\mathbf{X}'_{ipt}\right)\Psi \\ &+ \sum_c \gamma_c^{girl}\left(I_i^{girl} I_p^c\right) + \sum_j \omega_j^{girl}\left(I_i^{girl} I_t^j\right) + \varepsilon_{ipt} \end{aligned}$$

- i individual, p province, t time
  - *Outcomes:* literacy, disability, educational attainment

Summary Statistics by VPD Prevalence

Identifying assumptions:CIA, Parallel trends

Province Characteristics in 1985 by VPD Prevalence			
Variable	All	VPD Prevalence	
		without controls	*with controls*
Disabled	0.012	0.0006***	0.0005**
	[0.003]	(0.0002)	(0.0002)
Literate	0.904	-0.0237**	0.001
	[0.116]	(0.0091)	(0.0032)
Educational Attainment	1.927	-0.0563***	0.0002
	[0.151]	(0.0207)	(0.0074)
Father Professional	0.158	-0.0023	0.0001
	[0.044]	(0.0023)	(0.0025)
Mom Literate	0.445	-0.0414***	-0.0056
	[0.187]	(0.0128)	(0.0067)
Family Size	6.263	0.2668***	0.0524
	[1.179]	(0.0833)	(0.0510)
Population Density	66.879	0.1630	0.5564
	[56.869]	(2.2169)	(2.0672)
Fraction Male	0.517	-0.0015	-0.0009
	[0.025]	(0.0017)	(0.0020)
Log Health Personnel	5.787	0.0114	0.0291
	[0.857]	(0.0509)	(0.0523)
Number Provinces	61	61	61

▸ Falsification ▸ First Stage

Age Eligible Sample

province level: morbidity & human capital

Dependent Variable	Disabled	Literate	Educational Attainment	Log Child Mortality Rate	Log Infant Mortality Rate
	(1)	(2)	(3)	(4)	(5)
VPD Prevalence *Post	**-0.0006****	**0.0128****	**0.0234****	0.0143	-0.0459
	(0.0003)	**(0.0058)**	**(0.0111)**	(0.0279)	(0.0400)
Post	0.0074***	-0.0151	0.0247	-0.2775**	-0.1646
	(0.0012)	(0.0170)	(0.0347)	(0.1378)	(0.1712)
VPD Prevalence	0.0005**	-0.0059	-0.0125	0.0028	0.0817**
	(0.0002)	(0.0044)	(0.0092)	(0.0366)	(0.0371)
Observations	122	122	122	120	117
R-squared	0.3769	0.7433	0.8240	0.2642	0.2778
Number Clusters	61	61	61	60	60

Age Eligible Sample

province level: mortality

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	(0.0003)	(0.0058)	(0.0111)	**(0.0279)**	**(0.0400)**
Post	0.0074***	-0.0151	0.0247	-0.2775**	-0.1646
	(0.0012)	(0.0170)	(0.0347)	(0.1378)	(0.1712)
VPD Prevalence	0.0005**	-0.0059	-0.0125	0.0028	0.0817**
	(0.0002)	(0.0044)	(0.0092)	(0.0366)	(0.0371)
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Age Eligible Sample

Individual level-baseline

Dependent Variable	Disability	Literacy	Educational Attainment
VPD Prevalence*Post	-0.0004*	0.0139**	0.0227**
	(0.0002)	(0.0057)	(0.0101)
Observations	342,197	342,096	341,969
Mean Dependent Variable	0.0126	0.920	1.871
Year of Birth Fixed Effects	Yes	Yes	Yes
Birth Province Fixed Effects	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes
No. Clusters	61	61	61

1 SD $\downarrow$ disability by~6-8%,$\uparrow$ literacy by 2-3% and 3-4% forPSC

Age Eligible Effects

Individual level-interacted

DHS Parental Robustness RobustnessGeo

Dependent Variable	Disability	Literacy	Educational Attainment
	Gender Interacted	Gender Interacted	Gender Interacted
VPD Prevalence*Post	-0.0003	0.0102**	0.0166*
	(0.0003)	(0.0049)	(0.0088)
VPD Prevalence *Post *Girl	**-0.0002**	**0.0088****	**0.0155****
	(0.0004)	**(0.0039)**	**(0.0071)**
Observations	342,197	342,096	341,969
Mean Dependent Variable	0.0126	0.920	1.871
Year of Birth Fixed Effects	Yes	Yes	Yes
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Note: all RHS variables interacted with girl

Summary age-eligible results

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    - Pitt et al (2012) microfounded model of inc opportunity cost to schooling for boys as health improves (brawn-based economy)
- Spillover Analysis Setup
  - Exploit that there are two censuses 5 year apart (1985, 1990)
  - Identify those treated via spillovers as middle school aged children with a younger child in household

▸ DisabilityRegressions

Empirical Framework Spillovers

$$Outcome_{ipt} = \alpha + \beta(VPD_p \boxed{\mathbb{I}_t^{postspillover}}) + \theta I_i^{girl} + \mathbf{X}'_{ipt}\Gamma + \varepsilon_{ipt},$$

$$\begin{aligned} Outcome_{ipt} \quad = \quad & \alpha + \beta_1(VPD_p \boxed{\mathbb{I}_t^{postspillover}}) + \beta_2(VPD_p \boxed{\mathbb{I}_t^{postspillover}} I_i^{girl}) + \\ & + \sum_c \gamma_c I_p^c + \sum_j \rho_j I_t^j + \theta I_i^{girl} + \mathbf{X}'_{ipt}\Gamma \\ & + \left(I_i^{girl}\mathbf{X}'_{ipt}\right)\Psi + \sum_c \gamma_c^{girl}\left(I_i^{girl} I_p^c\right) \\ & + \sum_j \omega_j^{girl}\left(I_i^{girl} I_t^j\right) + \varepsilon_{ipt}. \end{aligned}$$

- i individual, p province, t time
  - *Outcomes:* literacy, educational attainment (disability not available in 1990 census)

Spillover Results

Dependent Variable	Literate				Educational Attainment			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Baseline	*Gender Interacted*	*Mother Works Outside Home*	*Cotton Producing Area*	***Baseline***	*Gender Interacted*	*Mother Works Outside Home*	*Cotton Producing Area*
VPD Prevalence*PostSpillover	**0.0052**** **(0.0022)**	0.0022 (0.0015)	0.0024 (0.0017)	0.0015 (0.0022)	**0.0106**** (0.0045)	0.0027 (0.0033)	0.0023 (0.0034)	0.0048 (0.0054)
VPD Prevalence *PostSpillover*Girl		0.0067*** (0.0021)	0.0081*** (0.0024)	0.0095** (0.0035)		0.0174*** (0.0045)	0.0194*** (0.0049)	0.0234*** (0.0069)
Sum of Above		*0.00894**** *(0.00329)*	*0.0106**** *(0.00320)*	*0.0110*** *(0.00522)*		*0.0201**** *(0.00669)*	*0.0217**** *(0.00588)*	*0.0281**** *(0.0110)*
Observations	254,831	254,831	128,443	130,250	254,495	254,495	128,287	130,092
Mean of Dependent Variable	0.909	0.909	0.872	0.894	1.629	1.629	1.54	1.603

Note: all RHS variables interacted with girl in gender interacted specification

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Spillover Mechanisms

Dependent Variable	Literate				Educational Attainment			
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	Baseline	*Gender Interacted*	***Mother Works Outside Home***	***Cotton Producing Area***	*Baseline*	*Gender Interacted*	***Mother Works Outside Home***	***Cotton Producing Area***
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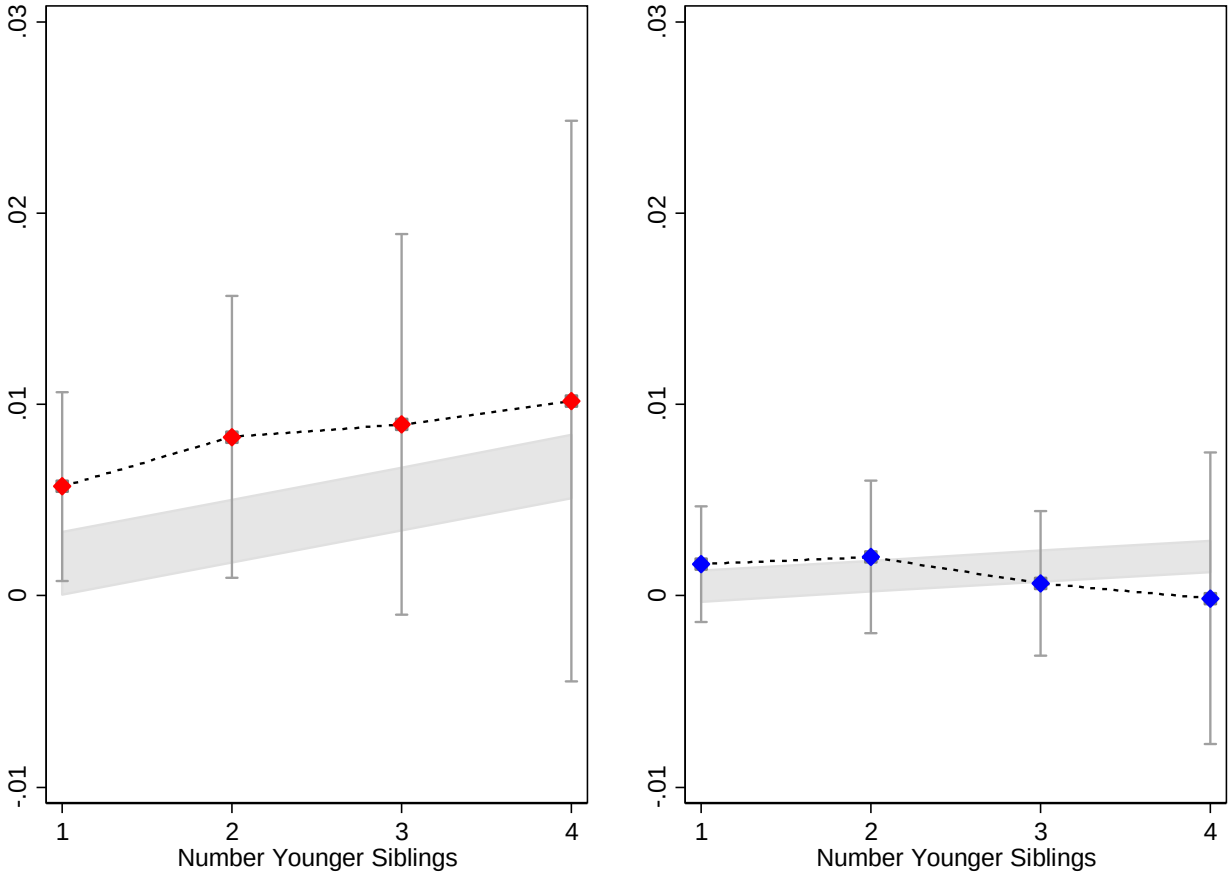
▸ SpilloverPrimary

Heterogenous Spillover Effects by Gender



DHS Evidence

- 1998, 2003/4 and 2008 have place of birth

Dependent Variable	Years Schooling	No Education	Compulsory Education	Additional Years
PANEL A: SPILLOVER EFFECTS				
VPD Prevalence*PostSpillover	-0.0989	-0.0107	0.0096	-0.2686
	(0.0792)	(0.0066)	(0.0064)	(0.1614)
VPD Prevalence *PostSpillover*Girl	0.1627***	-0.0243**	0.0194*	0.0763
	(0.0573)	(0.0099)	(0.0108)	(0.1198)
Observations	8,363	8,367	8,367	8,363
No. Clusters	61	61	61	61
PANEL B: PLACEBO TEST				
VPD Prevalence*PostSpillover	-0.0790	-0.0058	-0.0007	-0.1804
	(0.0769)	(0.0042)	(0.0054)	(0.1130)
VPD Prevalence *PostSpillover*Girl	0.0526	0.0152*	-0.0075	0.1547
	(0.1328)	(0.0077)	(0.0096)	(0.1967)
Observations	4,065	4,071	4,071	4,065
No. Clusters	61	61	61	61

Main Results

- No spillover effect on older brothers, exclusively to older sisters

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- No spillover effect on older brothers, exclusively to older sisters
- Differential increasing if mother works outside the home
- Differential increasing in number of young children in the home
- Suggestive evidence that girls are tasked with childcare or household chores when mother preoccupied with sick child (for various cultural/economic reasons) and gain when childcare needs are reduced
    - no effect of campaign on fertility, sex ratios, occupational scores, asset index

Summary

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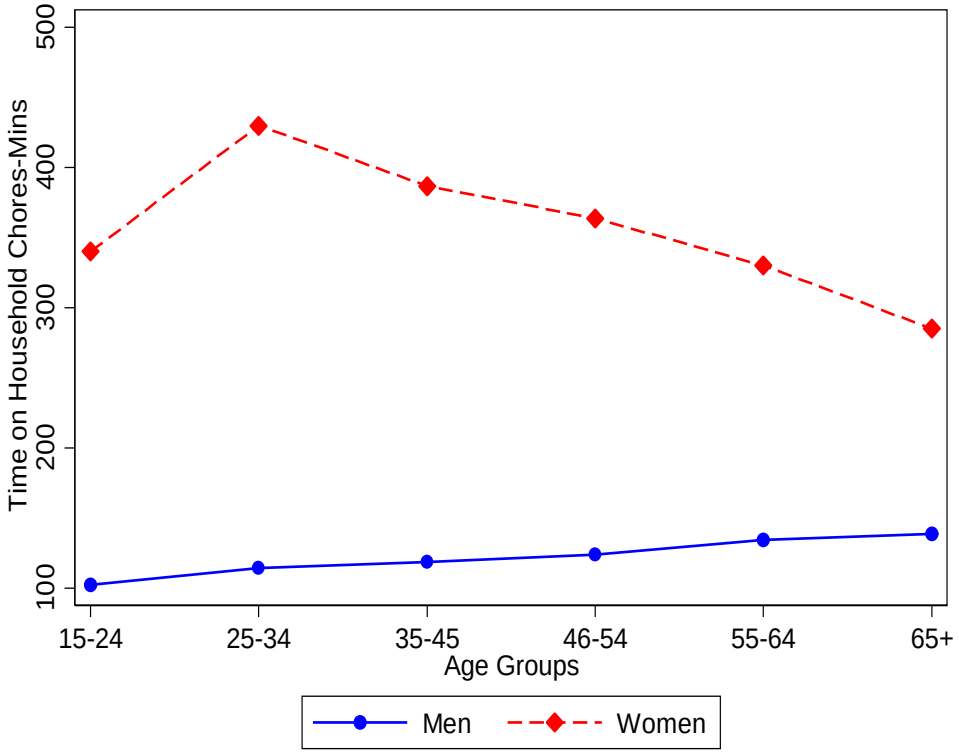
- Spillover effects of vaccine campaign on human capital accrue only to older sisters
- As development agenda moves from reducing early childhood mortality to reducing morbidity, may consider gendered response in education as potential unintended consequence of early child health interventions

Time Use Data (2006)

Separate spheres starts before marriage

Time Spent on Household Chores (Minutes)



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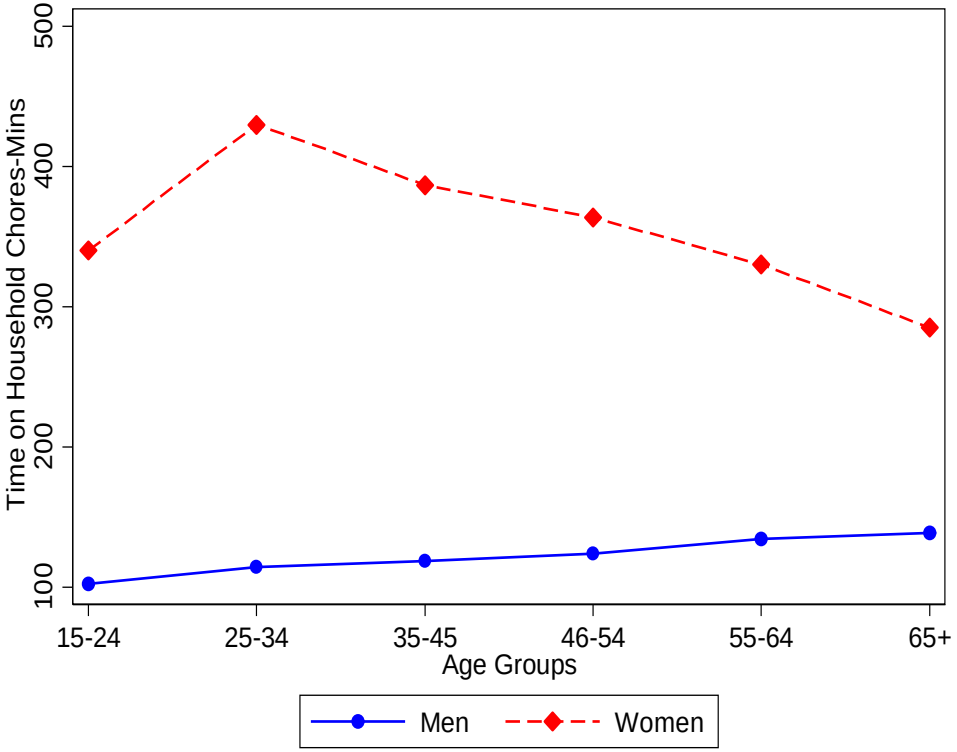


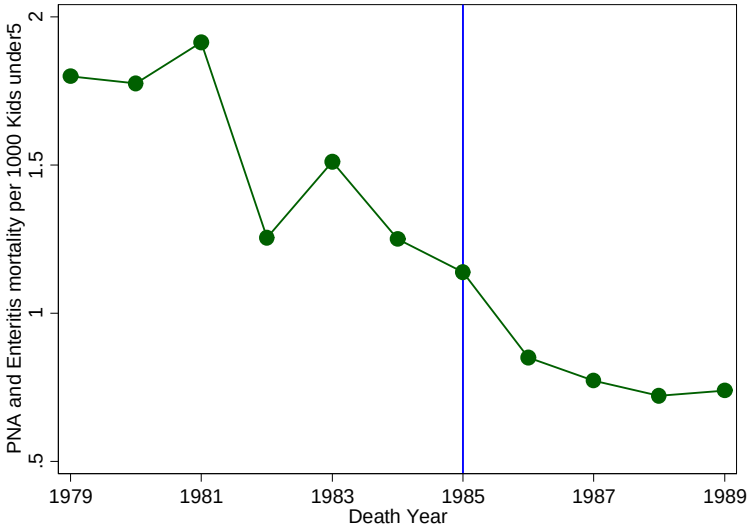
Within households among **never married individuals 15-24** years of age, girls spend ~ **3 hours more** on household chores than their male peers

Hypothesis

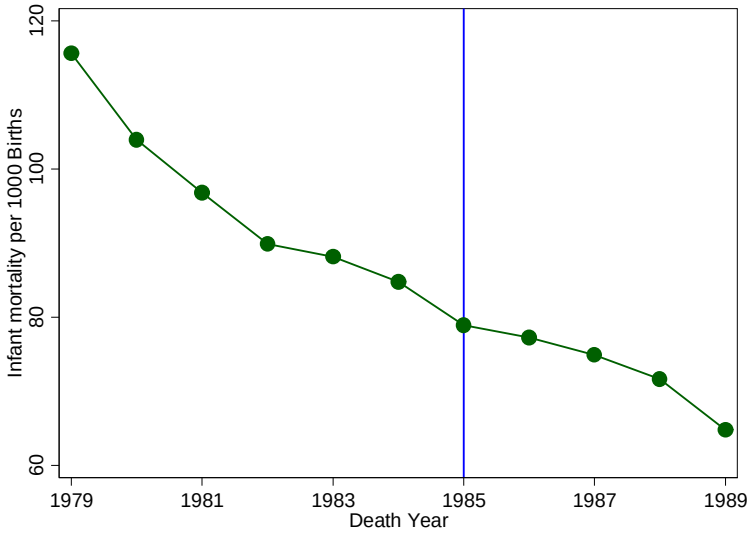
Enteritis and Pneumonia

Health

PNA and Enteritis



IMR



Mechanisms of Disability

Health

- Pertussis: (Whooping Cough)
  - in infants and children very dangerous: pneumonia, violent shaking, seizures/apnea/encephalopathy–>brain damage and death (less contagious than measles but 1.6% of infants could die)
- Measles 
  - cause rash, fever, pneumonia
  - shocks the immune system, increases the likelihood of other infections for up to a year
  - permanent disability from ear infections (deafness) and encephaloapthy (brain damage) ~1%, deaths 1/1000
- Diphtheria: (Croup)
  - thick gray membrane covering throat, difficulty breathing
- Polio
  - paralysis, neuropathy/paresthesia, meningitis (post-polio syndrome) –disability only in 1% of cases, .1% death

Vaccine Preventable Disease Prevalence

ProvinceSpec

- Corrects for **under-reporting** of vital statistics (particularly in rural areas)
- **Use unique question in 1985 census which asked female >=12 about infant deaths and births in past year to construct a correction factor**

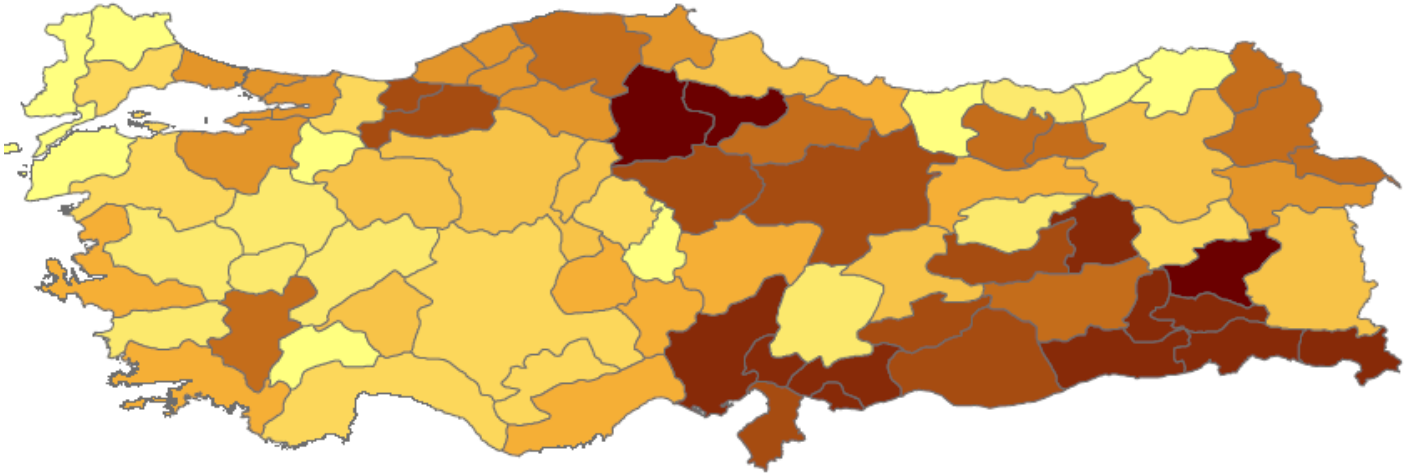
$$\frac{Infant\_Deaths_{1985}^{census}}{Infant\_Deaths_{1985}^{istatiskleri}} = CF_{1985}.$$

- Derive prevalence from mortality using case fatality rate (CFR) :

$$VPDprevalence_p = \frac{\overline{VPD\_deaths}_p * CF_p}{CFR * Under5Pop_p} * 100$$

VPD Prevalence Map

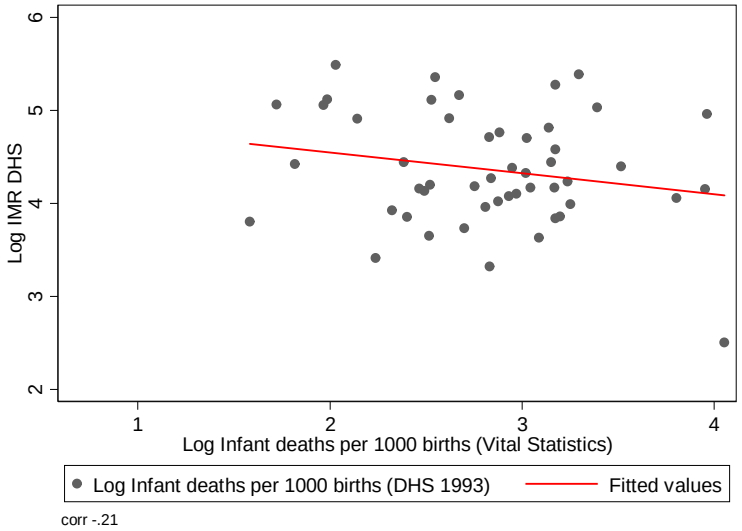
ProvinceSpec



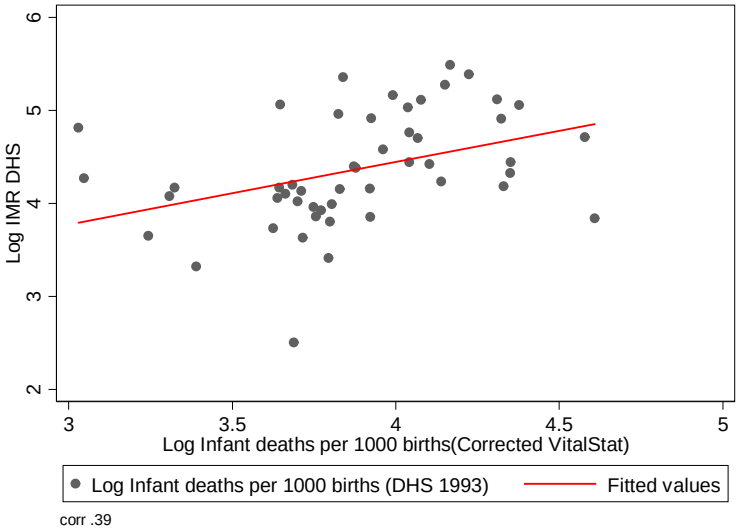
Compare Corrected IMR to DHS IMR

ProvinceSpec

Uncorrected



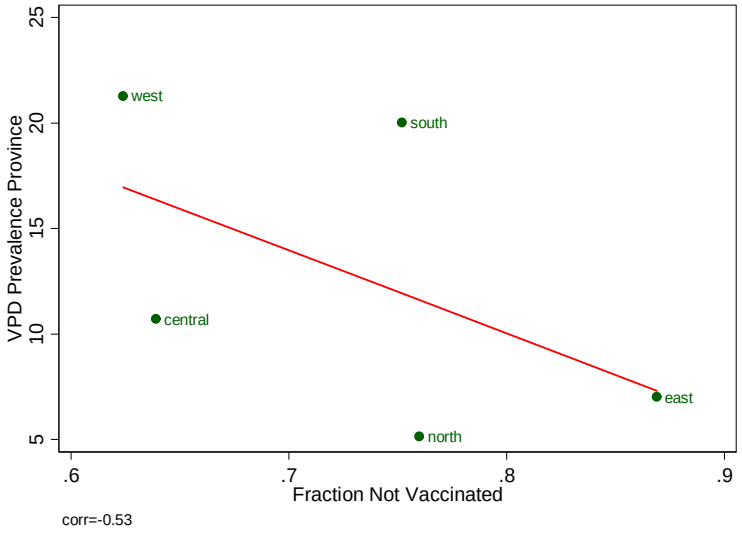
Corrected



Compare Corrected VPD to Regional VPD

ProvinceSpec

Uncorrected



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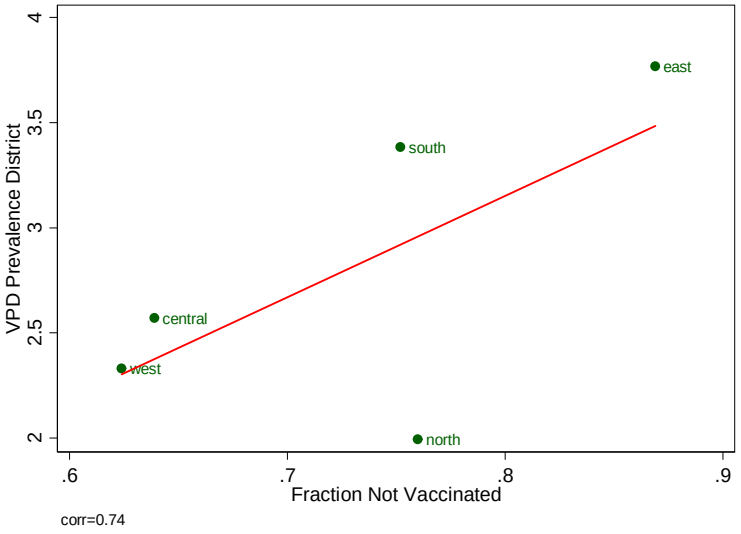


Falsification

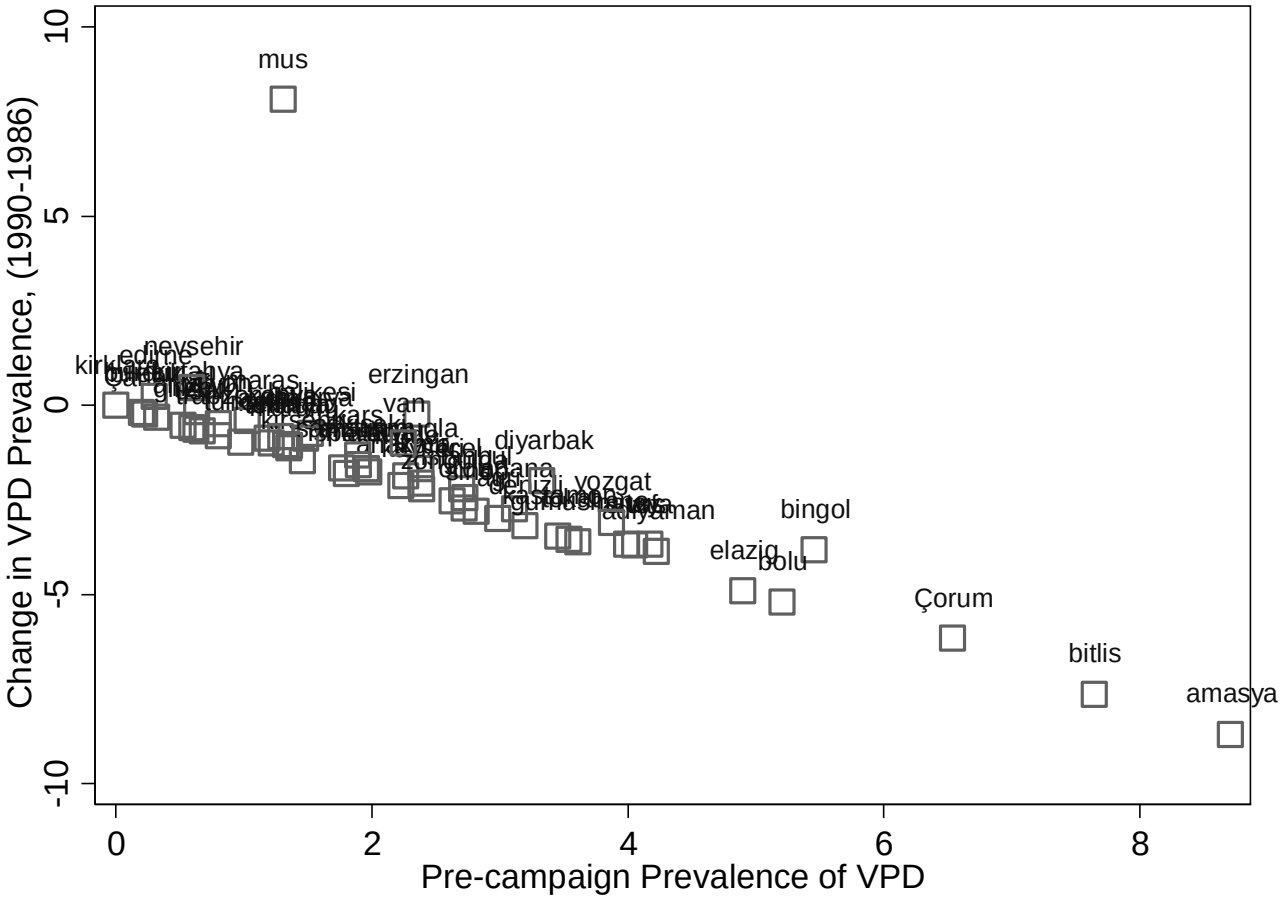
1971-75 vs. 1961-70

CIA

Dependent Variable	Disabled	Literate	Educational Attainment
	(1)	(2)	(3)
VPD Prevalence*Placebo	-0.0002	0.0024	0.0104
Post	(0.0002)	(0.0030)	-0.0079
Post	-0.0001	0.0393**	-0.3221***
	(0.0010)	(0.0156)	-0.0355
VPD Prevalence	0.0005***	0.0025	0.0004
	(0.0002)	(0.0026)	-0.0063
Observations	122	122	122
R-squared	0.3618	0.7901	0.8915
Number Clusters	61	61	61

First Stage

CIA



Robustness

Include those with missing parental characteristics

▸ AgeEligible1

Dependent Variable	Disabled		Literate		Less Than Primary School	
	(1)	(2)	(3)	(4)	(5)	(6)
	Baseline	*Gender Interacted*	*Baseline*	*Gender Interacted*	*Baseline*	*Gender Interacted*
VPD Prevalence*Post	-0.0003	-0.0003	0.0147**	0.0103**	-0.0135**	-0.0088*
	(0.0002)	(0.0003)	(0.0060)	(0.0050)	(0.0056)	(0.0047)
VPD Prevalence *Post *Girl		-0.0000		0.0090**		-0.0097**
		(0.0003)		(0.0036)		(0.0037)
Observations	476,178	476,178	475,975	475,975	419,530	419,530
R-squared	0.0017	0.0019	0.1558	0.1899	0.1428	0.1681
Year of Birth Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
No. Clusters	61	61	61	61	61	61

DHS Births

▸ AgeEligible1

Dependent Variable	Birth		Girl Baby	
	(1)	(2)	(3)	(4)
VPD Prevalence *Post	0.0023	0.0023	-0.0028	-0.0028
	(0.0022)	(0.0022)	(0.006)	(0.006)
Observations	61,793	61,793	9,341	9,341
R-squared	0.0134	0.0183	0.081	0.008
Year of Birth Fixed Effects	Yes	Yes	Yes	Yes
Province FE	Yes	Yes	Yes	Yes
Maternal Characteristics	No	Yes	No	Yes
No. Clusters	58	58	58	58

Additional Robustness Checks

▸ AgeEligible1

Dependent Variable	Disabled	Literate	Disabled	Literate	Disabled	Literate	Disabled	Literate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Region-Year FE		*Province*Linear YOB*		*Health Professionals*		*Mean Reversion*	
VPD Prevalence*Post	-0.0005**	0.0012	0.0022*	0.0143*	-0.0004*	0.0132**	-0.0004	0.0050**
	(0.0002)	(0.0025)	(0.0012)	(0.0073)	(0.0002)	(0.0053)	(0.0003)	(0.0023)
Observations	342,197	342,096	342,197	342,096	342,197	342,096	342,197	342,096
Mean of Dependent Variable	0.0126	0.920	0.0126	0.920	0.0126	0.920	0.0126	0.920
Year of Birth Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Birth Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
No. Clusters	61	61	61	61	61	61	61	61

Robustness to Various Subsamples

▸ AgeEligible1

Dependent Variable	Disabled	Literate	Disabled	Literate	Disabled	Literate
	(1)	(2)	(3)	(4)	(5)	(6)
	Urban		*Rural*		*Drop Kurdish Areas*	
VPD Prevalence*Post	-0.0002	0.0162*	-0.0007*	0.0098	-0.0006**	0.0079*
	(0.0003)	(0.0088)	(0.0003)	(0.0064)	(0.0002)	(0.0042)
Observations	233,414	233,357	108,783	108,739	311,695	311,606
R-squared	0.0023	0.1493	0.0026	0.1726	0.0022	0.1095
Year of Birth Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Birth Province Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Individual Characteristics	Yes	Yes	Yes	Yes	Yes	Yes
No. Clusters	33	33	28	28	56	56

How Disability Affects Literacy

SummaryResults1

Dependent Variable	Literate	
	Boys	*Girls*
Disabled	-0.3031***	-0.3400***
	(0.0100)	(0.0145)
Observations	175,348	166,748
R-squared	0.1222	0.2428
Year of Birth Fixed Effects	Yes	Yes
Province FE	Yes	Yes
Individual Characteristics	Yes	Yes
No. Clusters	61	61

Summary Statistics

variable name	mean	standard deviation
year of birth	1976.47	7.538
year	1993.36	7.45
age	16.89	1.407
famsize	5.90	3.416
less	0.11	0.318
literate	0.94	0.246
disabled	0.01	0.113
gender	0.51	0.50
mother literate	0.58	0.49
vpd prevalence	2.82	1.61
ln total health personnel	6.97	1.29

Model of Intrahousehold Time Allocation in the Presence of Early Childhood Illness (1)

Preferences

- Parent(s) seek to maximize parental welfare (utility) which is additively separable in own consumption (μ) and expected earnings $(\mathbf{E})$ of their children

$$U(\mu, \mathbf{E}) = V[\mu, \mathbf{E}]$$

- Follow Behrman et al. (1982); model allocation as one-period problem
- Assume 3 children (i) per household, older siblings of each gender b, g and younger child y :

$$E_i = E(S_i, X_i) \equiv p(S_i, X_i) w_s + (1 - p(S_i, X_i)) w_u$$

for older children X fixed and younger children, E=E(X), p is concave

Model (2)

constraints

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  - other mechanisms

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$$X_y(I) = \alpha Z_b + Z_g$$

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$$X_y(I) = \alpha Z_b + Z_g$$

- $\alpha \epsilon (0, 1)$ reflects gendered relative efficiency of girl siblings in providing childcare
- older children divide time between caring for young child and schooling

Model (3)

maximization

$$
\begin{aligned}
\max_{S_b S_g} U(\mu, \mathbf{E}) &= v(\mu) + p(S_b, \bar{X}) w_s + (1 - p(S_b, \bar{X})) w_u \\
&\quad + p(S_g, \bar{X}) w_s + (1 - p(S_g, \bar{X})) w_u \\
&\quad + p(X_y(I)) w_s + (1 - p(X_y(I)) w_u \\
s.t.\ X_y(I) &= \alpha Z_b + Z_g,\ \ T = Z_b + S_b \text{ and } T = Z_g + S_g
\end{aligned}
$$

Predictions

Proposition

In equilibrium, boys are allocated more time in school than girls.

Proof.

Dividing the two *FOC* yields: $p'(S_b^*) = p'(S_g^*)\alpha$. Since $\alpha \epsilon (0,1)$, $p'(S_g^*) > p'(S_b^*) \Leftrightarrow S_g^* < S_b^*$. □

Note: if $w_{g,s} < w_{b,s} \rightarrow p'(S_b^*) = p'(S_g^*)\alpha \frac{w_{g,s}}{w_{b,s}}$

Model Predictions

Proposition

Girls' schooling increases when younger siblings are healthy and is more responsive to siblings health than boys' schooling.

Proof.

from the $FOC: \ S_g^* = p'^{-1}p'(X(I)) \rightarrow \frac{\partial S_g^*}{\partial I} = p(\cdot)^{-1''}p(\cdot)''\frac{\partial X}{\partial I} < 0$ since the inverse of a concave function is convex, the 1st and 3rd term are positive and the 2nd is negative. Similarly: $\frac{\partial S_b^*}{\partial I} = \alpha p(\cdot)^{-1''}p(\cdot)''\frac{\partial X}{\partial I} < 0$ which is less than the comparative static for girls by α. □