Social Connections and Health Insurance Utilization

Sisir Debnath   Tarun Jain   Manvendra Singh

Indian School of Business

June 2016

Tertiary healthcare in developing countries

- Lack of medical care in developing countries, especially tertiary care
- Non-communicable diseases increasing as share of healthcare burden
  - ▸ Disease burden
- Structure of healthcare system in developing countries is an open policy question
  - Large out-of-pocket payments may lead to poverty and decrease human capital development
  - Inefficient public operation of healthcare facilities
  - $\Rightarrow$ Publicly financed private provision of healthcare

Burden of disease in India
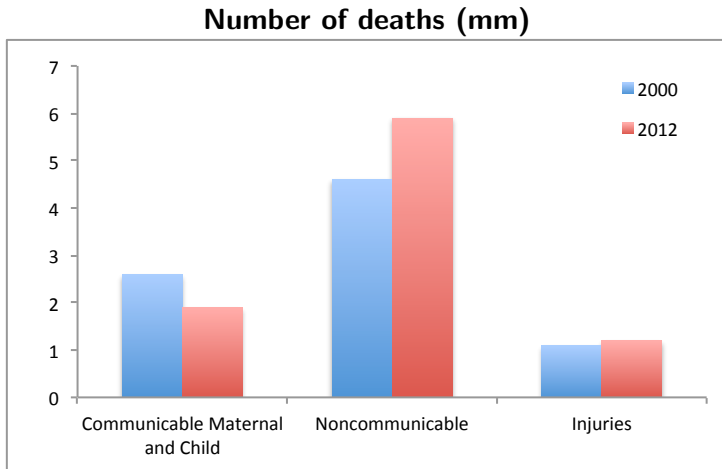
Number of deaths (mm)

Demand Estimation for Healthcare Services

- In resource constrained environment, critical to estimate demand accurately
  - Teritary care resources (doctors, equipment, staff) are expensive
  - Cannot substitute across specialities
  - Even if resources are fully exhausted, heterogeneity in value of treatment
- ⇒ Can social networks predict demand for tertiary healthcare?

Social connections and health insurance utilization

- **Role of social connections in increasing use of a public health insurance program**
- Social connections might help process complex information (Dupas 2011)
    - Program presence, claim limits
    - Facilities, providers, treatment, payment
- Peer behavior might catalyze change in social norms (Dahl, Loken & Mogstad 2014)
    - Especially where information is scarce and perceptions are in formative stage
- Peer use might signal credibility of long-term program viability

Summary of our study

Research questions

1. Does use by social connections predict subsequent first time use of public health insurance?
2. What kinds of information transmission do social connections facilitate?
3. Under what conditions do social connections better predict utilization?

Context

- Answer these questions in context of Aarogyasri, a publicly financed health insurance program in AP, India
- Use administrative data containing information on all individual claims; aggregate to village-caste-quarter level
- Examine if own group utilization can predict subsequent first-time healthcare use

Aarogyasri health insurance program

- Health insurance program started by AP government in 2007
- Phased roll-in complete by July 2008
- Covers BPL families ($> 80\%$ of all households)
- No premiums, cashless, no deductible
- High coverage - Rs. 200,000 per family per year
- 938 listed treatments
- 663 government and private hospitals empaneled as of 2014
- Health camps, ambulances, hospital help desks to facilitate utilization
- 2.1 million procedures performed by December 2013

Aarogyasri procedures
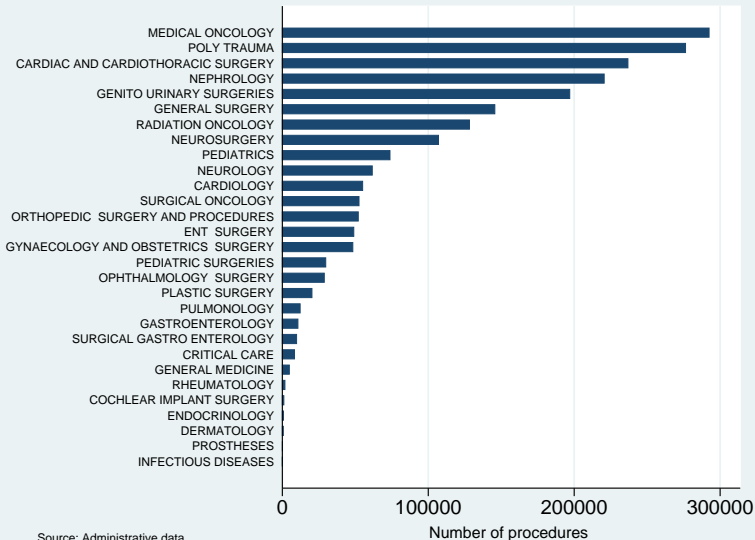
Source: Administrative data

Aarogyasri utilization
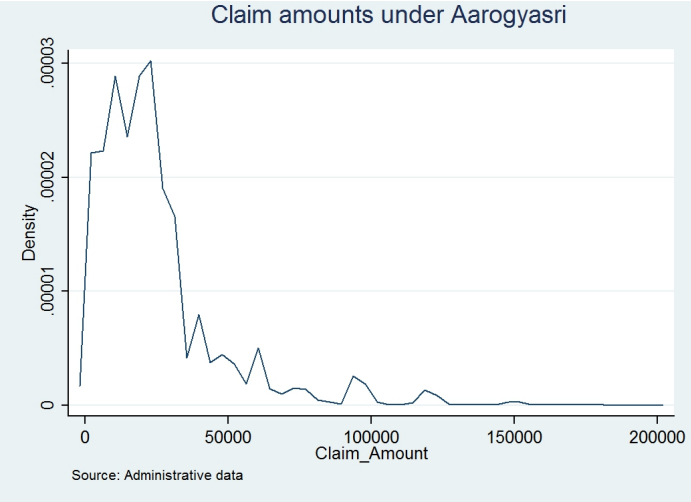
Data

- Complete administrative data of all insurance claims
- Date, amount, hospital and procedure for each claim
- Gender, age, social identity and location (village/urban ward) of every claimant with household and claimant identifiers
- Coverage from 2007 to 2013
- $N_i = 2,125,121$ individual observations
- $N_v = 30,061$ villages
- $N_g = 6$ backward castes, minorities (mainly Muslims), scheduled castes, scheduled tribes, other castes, and others;
- $N_t = 24$ quarters (6 years)
- Collapsed to caste-village-quarter cells
- $N_{vgt} = 4,328,784$ cells

Data

- Administrative data
    - Complete census (no sampling problems)
    - No self-reporting bias
    - Low measurement error
    - Very little missing data

- No health or welfare outcomes
- Limited information on individual characteristics
- No information on non-claimants

Summary statistics
Individual dataset

Variable	Observations	Mean	Std. Dev.
Age	2125121	39.54	18.53
Gender is Male	2125121	0.558	
Backward caste	1111476	0.523	
Other caste	426,655	0.201	
Scheduled Caste	314,965	0.148	
Scheduled Tribe	80,418	0.038	
Minorities	182,502	0.086	
Others	9,105	0.004	
Preauthorization amount	2125118	26680.12	25888.25
Claim amount	2125118	24496.02	24758.64

Summary statistics

Collapsed village-caste panel dataset

Variable	Mean	Std. Dev.	Min	Max
First time claims	0.31	1.54	0	442
Total claims	0.49	2.52	0	678
First time claim amount (in Rs.)	9317	46846	0	11139867
Total claim amount (in Rs.)	11943	60838	0	15264079
Other group claims	2	7.49	0	978
Other group claim amounts (in Rs.)	59716	179443	0	21732924
Other group claims in *Mandal*	69	118	0	2346
Other group claim amounts in *Mandal* (in Rs.)	1669342	2766922	0	47733616
Urban groups	0.12	0.33	0	1
No. of Observations		4328784		

Evaluating Aarogyasri

- No convincing program evaluation of Aarogyasri
- Very little data on health status, especially for tertiary diseases
- Use household survey data from AP (Out-of-Pocket survey)
    - Households that used Aarogyasri for at least one in-patient procedure in last year
    - Households with in-patient treatment in the last year, but did not use Aarogyasri
- Do Aarogyasri users and non-users have systematically different in-patient and out-patient healthcare expenditures?

Aarogyasri and healthcare expenditure

	In-patient expenses	Out-patient expenses
Used Aarogyasri	-21591.6***	-1079.5*
	(1849.8)	(524.6)
No. of Observations	2609	639
R Squared	0.13	0.08

Main specification

$$y_{vgt} = \beta_0 + \beta_1 Y_{vgt-1} + \beta_2 \sum_{-g} Y_{vt-1} + \beta_3 \sum_{-v} Y_{gt-1} + \beta_4 \sum_{-g,-v} Y_{t-1} + \phi_{vg} + \omega_{sgt} + \epsilon_{vgt}$$

$$(1)$$

y_{vgt}	**First time** claims by group g in village v in quarter t
Y_{vgt-1}	All claims by group g in village v in quarter t
$\sum_{-g} Y_{vt-1}$	All claims by other groups in village in previous quarter
$\sum_{-g,-v} Y_{t-1}$	All claims by other groups in other villages in same subdistrict in previous quarter
ϕ_{vg}	Group-village fixed effect
ω_{sgt}	Group-subdistrict-quarter fixed effect
ϵ_{vgt}	Unobservable characteristics, clustered at district level

Main results

	(1)	(2)	(3)	(4)	(5)	(6)
Claim, own group$_{t-1}$	0.19**	0.19**	0.19**			
	(0.07)	(0.08)	(0.07)			
Claim, oth groups$_{t-1}$		0.0084	0.0084			
		(0.01)	(0.01)			
Claim, same group in sub-dist.$_{t-1}$			0.00020			
			(0.00)			
Claim, oth groups in sub-dist.$_{t-1}$			-0.000051			
			(0.00)			
Claim amount, own group$_{t-1}$				0.17*	0.17*	0.17*
				(0.08)	(0.08)	(0.08)
Claim amount, oth groups$_{t-1}$					0.014***	0.014***
					(0.00)	(0.00)
Claim amount, same group in sub-dist.$_{t-1}$						0.00044
						(0.00)
Claim amount, oth groups in sub-dist.$_{t-1}$						-0.00010
						(0.00)
Average	.31	.31	.31	9316.92	9316.92	9316.92
No. of Observations	4146486	4146486	4146486	4146486	4146486	4146486
R Squared	0.11	0.11	0.11	0.046	0.048	0.048

Peer influence by disease - A

	Poly trauma	Cardio	Nephro	Onco	Pedia	Neuro	ENT	Pulm
Same proc$_{t-1}$	0.033*** (0.001)	0.032*** (0.003)	0.029*** (0.002)	0.024*** (0.002)	0.021*** (0.003)	0.013*** (0.001)	0.011*** (0.001)	0.008*** (0.001)
All other procs$_{t-1}$	0.028*** (0.002)	0.045*** (0.007)	0.016*** (0.002)	0.031*** (0.001)	0.352*** (0.045)	0.009*** (0.003)	0.010** (0.005)	0.119*** (0.033)
N adj. R-sq	4146486 0.030	4146486 0.028	4146486 0.024	4146486 0.02	4146486 0.186	4146486 0.008	4146486 0.017	4146486 0.054
Same proc $\neq$ All other procs	No	Yes	Yes	Yes	Yes	No	No	Yes

Peer influence by disease - B

	Ortho	General	Plastic	Opthal	Gastro	Critical	Endocr	OB Gyn	
Same proc$_{t-1}$	0.008***	0.006**	0.004***	0.003***	0.003***	0.001***	0.001***	0.001	
	(0.0004)	(0.002)	(0.0004)	(0.0003)	(0.000)	(0.000)	(0.000)	(0.001)	
All other procs$_{t-1}$	-0.025***	0.073***	-0.028***	-0.020***	-0.028***	-0.036***	-0.021**	0.033***	
	(0.002)	(0.010)	(0.003)	(0.002)	(0.003)	(0.003)	(0.011)	(0.004)	
N	4146486	4146486	4146486	4146486	4146486	4146486	4146486	4146486	
adj. R-sq	0.009	0.008	0.005	0.004	0.004	0.003	0.003	0.001	
Same proc ≠ All other procs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	

Utilization of private hospitals

	(1)	(2)	(3)	(4)
Claims at pvt. facilities, own group$_{t-1}$	0.14**	0.14**	0.12**	0.12**
	(0.07)	(0.07)	(0.05)	(0.05)
Claims at pvt. facilities, oth groups$_{t-1}$		0.0074	0.0057	0.0073**
		(0.00)	(0.01)	(0.00)
Claims at pvt. facilities, same group in sub-dist.$_{t-1}$		0.00096	0.0011	0.0020
		(0.00)	(0.00)	(0.00)
Claims at pvt. facilities, oth groups in sub-dist.$_{t-1}$		0.000040	0.000098	0.000055
		(0.00)	(0.00)	(0.00)
Claims at pub. facilities, own group$_{t-1}$			0.098***	0.096***
			(0.03)	(0.03)
Claims at pub. facilities, oth groups$_{t-1}$				-0.0071
				(0.01)
Claims at pub. facilities, same group in sub-dist.$_{t-1}$				-0.0049***
				(0.00)
Claims at pub. facilities, oth groups in sub-dist.$_{t-1}$				0.000068
				(0.00)
Average	.24	.24	.24	.24
No. of Observations	4146486	4146486	4146486	4146486
R Squared	0.055	0.056	0.063	0.063

Utilization of public hospitals

	(1)	(2)	(3)	(4)
Claims at pub. facilities, own group$_{t-1}$	0.16** (0.07)	0.15** (0.06)	0.12*** (0.04)	0.12*** (0.04)
Claims at pub. facilities, oth groups$_{t-1}$		0.017*** (0.00)	0.014*** (0.00)	0.013*** (0.00)
Claims at pub. facilities, same group in sub-dist.$_{t-1}$		0.0033* (0.00)	0.0035** (0.00)	0.0045*** (0.00)
Claims at pub. facilities, oth groups in sub-dist.$_{t-1}$		-0.00023** (0.00)	-0.00016 (0.00)	-0.000035 (0.00)
Claims at pvt. facilities, own group$_{t-1}$			0.057*** (0.02)	0.055** (0.02)
Claims at pvt. facilities, oth groups$_{t-1}$				0.0020 (0.00)
Claims at pvt. facilities, same group in sub-dist.$_{t-1}$				-0.0015** (0.00)
Claims at pvt. facilities, oth groups in sub-dist.$_{t-1}$				-0.00013** (0.00)
Average	.08	.08	.08	.08
No. of Observations	4146486	4146486	4146486	4146486
R Squared	0.063	0.067	0.092	0.092

Location effects

- Place-based policies have large effects on social welfare

- Theory unclear on the direction or size of peer $\times$ location effects

  - Urban vs. Rural location: Density promotes information flows among social connections? Or formal program information more readily available?
  - Village amenities (Primary health facilities): Greater supply of screened patients in local facilities? Or local facilities substitute for tertiary care?
  - Household amenities (Teledensity, wealth): Better communications facilitate information exchange? Household resources complement information from social connections?

- Integrate village/ward and household amenities data from Census 2011 and examine interacted effects

Location effects: Urban vs. Rural

	(1)	(2)	(3)
Claim, own group$_{t-1}$	0.069***	0.064***	0.068***
	(0.01)	(0.01)	(0.01)
Claim, own group$_{t-1}$ × $Urban$	0.24***	0.25***	0.24***
	(0.04)	(0.05)	(0.04)
Claim, oth groups$_{t-1}$		0.014***	0.014***
		(0.00)	(0.00)
Claim, oth group$_{t-1}$ × $Urban$		-0.015**	-0.015**
		(0.01)	(0.01)
Claim, oth groups in sub-dist.$_{t-1}$			-0.00024**
			(0.00)
Claim, oth groups in sub-dist.$_{t-1}$ × $Urban$			0.00023
			(0.00)
Claim, same group in sub-dist.$_{t-1}$			0.0035***
			(0.00)
Claim, same group in sub-dist.$_{t-1}$ × $Urban$			-0.0040***
			(0.00)
Average	.31	.31	.31
No. of Observations	4146486	4146486	4146486
R Squared	0.15	0.15	0.15

Location effects: Village Amenities

	(1)	(2)	(3)	(4)
Claim, own group$_{t-1}$	-0.0090*	-0.021***	-0.00090	-0.042***
	(0.00)	(0.01)	(0.00)	(0.01)
Claim, oth groups$_{t-1}$	0.010***	0.010***	0.0098***	0.0095***
	(0.00)	(0.00)	(0.00)	(0.00)
Claim, oth groups in sub-dist.$_{t-1}$	0.000026	0.000036	-0.0000072	0.000021
	(0.00)	(0.00)	(0.00)	(0.00)
Claim, own group$_{t-1}$ × Public health facility	0.057***			0.029***
	(0.01)			(0.01)
Claim, own group$_{t-1}$ × Private health facility		0.067***		0.039***
		(0.01)		(0.00)
Claim, own group$_{t-1}$ × Access to market			0.060***	0.042***
			(0.01)	(0.01)
No. of Observations	2961066	2960928	2961066	2960928
R Squared	0.0022	0.0024	0.0024	0.0030

Location effects: Household Amenities

	(1)	(2)	(3)	(4)
Claim, own group$_{t-1}$	0.036***	0.039***	0.029**	0.011
	(0.01)	(0.01)	(0.01)	(0.01)
Claim, oth groups$_{t-1}$	0.014***	0.014***	0.014***	0.014***
	(0.00)	(0.00)	(0.00)	(0.00)
Claim, oth groups in sub-dist.$_{t-1}$	0.000021	0.000016	0.000011	0.000024
	(0.00)	(0.00)	(0.00)	(0.00)
Claim, own group$_{t-1}$ × Mobile	0.038***			0.027***
	(0.01)			(0.01)
Claim, own group$_{t-1}$ × Radio		0.033***		0.023***
		(0.01)		(0.01)
Claim, own group$_{t-1}$ × Richer			0.041***	0.025***
			(0.01)	(0.01)
No. of Observations	3308826	3308826	3308826	3308826
R Squared	0.014	0.014	0.014	0.015

Discussion

- We predict teritary care demand with system-wide and population-wide data in a setting where NCDs are increasing rapidly

- Large literature on peer effects in healthcare adoption (products, behavior) or outcomes (for ex. obesity)

- We find peer healthcare use strongly predicts subsequent first-time utilization

- External validity
    - Selective program implementation $\rightarrow$ Study full program
    - Preferences over risk, treatment $\rightarrow$ Large, population wide data
    - Hospital type affects treatment $\rightarrow$ 600+ govt, private facilities
    - Range of health conditions $\rightarrow$ All major tertiary diseases in pop., 900+ procedures

Thank you!

Summary of results

- Unit increase in utilization by own caste in village $\rightarrow$ 0.19 new claims (base is 0.31)

- Unit increase in claim amounts by own caste in village $\rightarrow$ claim amounts by 0.17

- Other castes in same village have small effect (0.012)

- Out of village connections in same subdistrict have no effect

- Peer utilization facilitates shift towards private hospitals

- Peer influences stronger among men

- Location effects: Stronger peer influences in
    - Urban areas
    - Villages with more health facilities
    - Villages with better market access
    - Wealthier villages
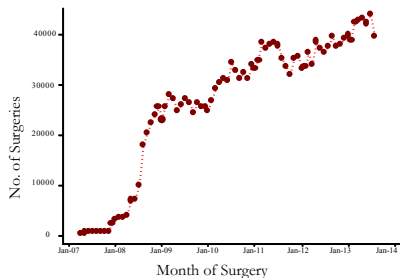   - More teledensity

Empirical challenges

Sampling

1. Random sampling underestimates network effects $\rightarrow$ Census of network
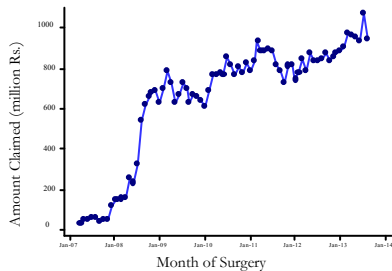2. Non-random sampling yields biased network effects $\rightarrow$ Census of network

Scale

3. Pilot programs yield lower take up $\rightarrow$ Study full program
4. Imprecise estimates from small samples $\rightarrow$ 85mm pop $\rightarrow$ 4.3 mm obs

Aarogyasri utilization

Surgeries per month

Claim amount per month

Source: Administrative data.

Aarogyasri and healthcare expenditure

$$exp_{is} = \gamma_0 + \gamma_1 Aarogyasri_{is} + \gamma_2 \mathbf{Z}_{is} + subdistrict_s + \varepsilon_{is}$$

exp_{is}	In-patient and out-patient healthcare expenditure
$Aarogyasri_{is}$	Household used Aarogyasri for major disease
$\mathbf{Z}_{is}$	Household characteristics
$subdistrict_s$	Subdistrict fixed effect

Comparing OOP survey and NSS

	National Sample Survey		OOP Survey	
	Mean	Std. dev.	Mean	Std. dev.
Household size	3.87	1.72	3.98	1.52
Religion: Hindu	0.92	0.27	0.89	0.31
Religion: Muslim	0.05	0.23	0.05	0.21
Religion: Others	0.02	0.15	0.06	0.25
Caste: Scheduled Caste	0.20	0.40	0.22	0.42
Caste: Scheduled Tribe	0.07	0.26	0.16	0.36
Caste: Others	0.73	0.45	0.62	0.49
BPL Card	0.94	0.24	0.98	0.14
No. of Observations	3925		5753	

Note: NSS data for Andhra Pradesh only.

Differences between users and non-users

	Treatment under Aarogyasri Mean	S.D.	Treatment outside Aarogyasri Mean	S.D.	Difference
Rural	0.87	(0.34)	0.87	(0.34)	0.001
Hindu	0.87	(0.34)	0.87	(0.34)	-0.005
Scheduled Caste	0.21	(0.41)	0.22	(0.41)	-0.005
Scheduled Tribe	0.15	(0.36)	0.15	(0.36)	0.006
NREGA job card	0.64	(0.48)	0.66	(0.48)	-0.018
More than one acre land	0.13	(0.34)	0.15	(0.34)	-0.015
Own house	0.90	(0.30)	0.90	(0.30)	-0.007
Energy for lighting: Electricity	0.66	(0.47)	0.65	(0.47)	0.015
Energy for cooking: LPG	0.35	(0.48)	0.37	(0.48)	-0.026*
Farm equipments					
Bullock carts	0.10	(0.30)	0.11	(0.30)	-0.005
Tractors	0.02	(0.13)	0.03	(0.13)	-0.008
Power tillers	0.02	(0.14)	0.02	(0.14)	-0.004
Water pumps	0.10	(0.30)	0.10	(0.30)	0.001
Other farm equipments	0.59	(1.54)	0.59	(1.54)	-0.001
Total farm equipments	0.80	(1.87)	0.81	(1.87)	-0.011
Animal assets					
Cows / buffaloes	0.66	(1.21)	0.67	(1.21)	-0.007
Poultry	1.32	(2.54)	1.30	(2.54)	0.025
Goat / sheep	0.96	(4.00)	0.71	(4.00)	0.248
Total animal assets	2.54	(4.95)	2.37	(4.95)	0.171
Number of households	2277		2271		

Falsification test with shuffled connections

	(1)	(2)	(3)	(4)	(5)	(6)
Claim, own group$_{t-1}$	0.000094 (0.00)	0.000094 (0.00)	0.000094 (0.00)			
Claim, oth group$_{t-1}$		-0.0000053 (0.00)	-0.0000052 (0.00)			
Claim, same group in sub-dist.$_{t-1}$			-0.000025 (0.00)			
Claim, oth groups in sub-dist.$_{t-1}$			-0.0000031 (0.00)			
Claim amount, own group$_{t-1}$				0.000071 (0.00)	0.000071 (0.00)	0.000071 (0.00)
Claim amount, oth group$_{t-1}$					0.000072 (0.00)	0.000072 (0.00)
Claim amount, same group in sub-dist.$_{t-1}$						-0.000013 (0.00)
Claim amount, oth groups in sub-dist.$_{t-1}$						0.000010* (0.00)
Average	.31	.31	.31	9316.92	9316.92	9316.92
No. of Observations	4146486	4146486	4146486	4146486	4146486	4146486
R Squared	0.00000008	0.00000008	0.000002	0.00000002	0.0000002	0.000001