Using Gossips to Spread Information: Theory and Evidence from Two Randomized Controlled Trials

Banerjee, Chandrasekhar, Duflo, Jackson (2017)

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Outline

Introduction

- Seeding information for individuals is broadly used by policymakers and businesses even when broadcasting is available (Gmail, marketing campaigns, microcredit)
- But people tend to have poor knowledge of their networks (Breza et al 2017).
- This paper reports 2 RCTs on seeding information using individuals nominated as good spreaders (*gossips*)
- This elicitation is more efficient than seeding using proxies such as 'leaders', 'geography', 'degree'. People seem to be better at nominating central nodes than expected.
- Can be explained by a model where people simply keep a count of "how often they hear pieces of gossip" originating from specific nodes.

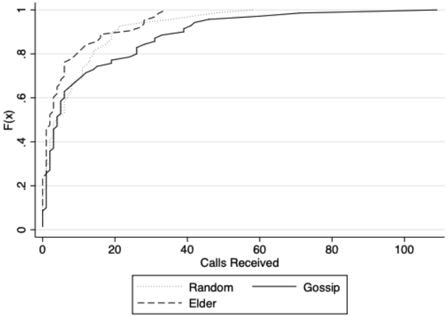
Karnataka RCT: Cell phone and Cash Raffle

- Seeded information on a cell phone company promotion which granted people participation in a non-rivalrous chance to win either a cell phone or cash
- 213 villages in the state of Karnataka randomly partitioned into three different treatment:
  1. Random Seeds
  2. Elders
  3. Gossips

  For Gossips - *"If we want to spread information to everyone in the village about tickets to a music event, drama, or fair that we would like to organize in your village or a new loan product, to whom should we speak?"*
- Outcome of interest - number of unique households that called.

Karnataka RCT: Results

- Distribution of calls in the gossip villages clearly stochastically dominates that in the elder and random villages.



- "Atleast 1 gossip seed" leads to a 65% increase relative to random seeding.
- Gossip seeds perform significantly better than elder seeding as well.

Haryana RCT: Immunization

1. Was the Karnataka RCT setting relevant? What if the information that was to be circulated were actually vital?
2. Highly policy relevant RCT conducted in 521 villages in state of Haryana. Information about immunization camps for children.
3. 4 broad treatment groups (6 seeds in each village)
   - Random seeds
   - Gossip seeds
   - Trusted seeds
   - Trusted gossip seeds
4. Gossip nominations focused purely on transmission of relatively unimportant information and does not raise any concerns about trust.
5. Outcome of interest - "Number of children in a village-month who got immunized against a set of diseases."

Haryana RCT: Immunization

1. Gossip seeds
   "Who are the people in this village such that when they share information, many people in the village get to know about it?"
2. Trusted seeds
   "Who are the people in this village, both within and outside of this neighborhood, that you and many villagers trust?"
3. Trusted gossip seeds
   "Who are the people in this village, both within and outside of this neighborhood, such that when they share information, many people in the village get to know about it? [...] Among these people, who are the people that you and many villagers trust? "

Results

- 25% - 30% increase in uptake of vaccinations across the board from gossip seeding. (measles coverage always been an issue across India)
- Trusted and Trusted gossip seeds show no significantly different effect from random seeding (or gossips) — "there was no gain from explicitly trying to identify trustworthy people, even for a decision that probably requires some trust.".
- In some villages, there was additional seeding through SMS blast (33% or 66% HH).
- SMS blasts did not lead to greater adoption as compared to seeding information with just a few seeds. Banerjee et al. (2023)
- Akbarpour et al. (2017) require - (1) No complex contagion, (2) high density, (3) sufficiently large T, and (4) number of seeds grow w/o bound.

Results

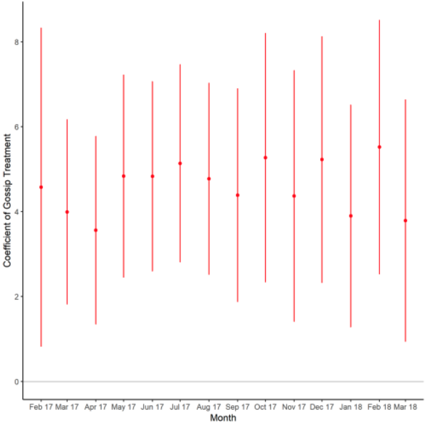


FIGURE 3. Effect of the "gossip" treatment on the number of children who attended an immunization session by month in the Haryana Immunization RCT.

A Model of Network Communication

- Villagers seem to do a good job nominating good spreaders of information.
- A society of n individuals that are connected via a directed and weighted network with adjacency matrix $\mathrm{w} \in [0,1]^{n\times n}$
- Hearing matrix: $\mathrm{H}(\mathrm{w}, T) = \sum_{t=1}^{T} \mathrm{w}^t$.
- Network gossip heard by j is defined by $NG(\mathrm{w}, T)_j = H(\mathrm{w}, T)_j$
- Diffusion centrality: $DC(\mathrm{w}, T) = \mathrm{H}(\mathrm{w}, T) \cdot 1 = \sum_j H(\mathrm{w}, T)_j$
    1. if $T = 1$, diffusion centrality is proportional to out degree centrality
    2. if $T \to \infty$ and $\lambda_1(\mathrm{w}) > 1$, the limit is proportional to the eigenvector centrality

A Model of Network Communication

Theorem

$\sum_j cov(DC(\mathrm{w}, T), NG(\mathrm{w}, T)_j) > 0$

Theorem

If $\lambda_1(\mathrm{w}) > 1$ *and* w *is aperiodic, then as* $T \to \infty$ *every individual* j*'s ranking of others under* $NG(\mathrm{w}, T)_j$ *converges to be proportional to diffusion centrality,* $DC(\mathrm{w}, T)$*, and hence according to eigenvector centrality.*

Do Individuals Nominate Central Nodes?

Some insights from a rich network dataset from 33 Karnataka villages; network data for 12 different types of interactions

1. The distribution of diffusion centrality of nominated individuals first order stochastically dominates the distribution of leaders and not leaders ▸ Show CDFs
2. Diffusion centrality predicts nomination better than degree centrality, leadership status, and geographic centrality ▸ Show Table
3. Percentile of network gossip j,i predicts nomination even after accounting for individual fixed effects ▸ Show Table
4. Even after controlling for hitting a high DC seed, hitting a gossip still increases the number of calls received ▸ Show Table

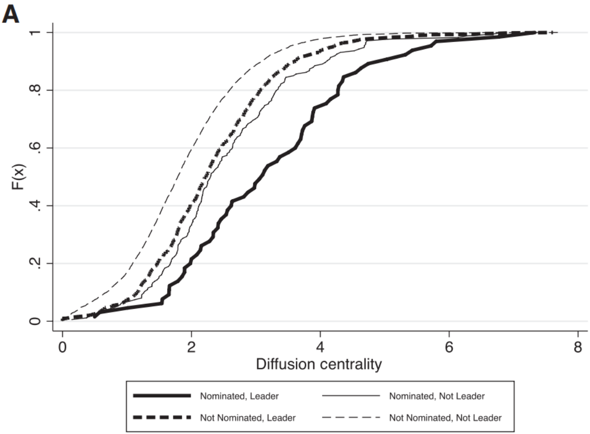
Conclusion

- RCTs find that nominated individuals are better at spreading information than other individuals, including village elders
- A simple information diffusion model explain how naive agents can find out who the central individuals are by simply counting gossip
- Empirically, villagers are indeed nominating central individuals. Data provides some support to the counting gossip hypothesis
- Limitations:
  1. Paper focuses only on transmission of information; in other settings, trust may be relevant
  2. Empirical evidence is limited to societies with roughly a thousand people

Thank You

Thank you for your attention!

CDFs (event)



	population share
nominated, leader (event)	0.01
not nominated, leader (event)	0.11
nominated, not leader (event)	0.03
not nominated, not leader (event)	0.86

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Table 7

TABLE 7
Factors predicting nominations

	(1) Event	(2) Event	(3) Event	(4) Event	(5) Event	(6) Event
Diffusion centrality	0.642	0.354	0.567	0.606	0.374	0.607
	(0.127)	(0.176)	(0.091)	(0.085)	(0.206)	(0.085)
Degree centrality	−0.039				−0.020	
	(0.101)				(0.101)	
Eigenvector centrality		0.283			0.281	
		(0.186)			(0.186)	
Leader			0.535			
			(0.301)			
Geographic centrality				−0.082		
				(0.142)		
Observations	6,466	6,466	6,466	6,466	6,466	6,466
Post-LASSO						✓

	(1) Loan	(2) Loan	(3) Loan	(4) Loan	(5) Loan	(6) Loan
Diffusion centrality	0.560	0.431	0.578	0.624	0.339	0.560
	(0.122)	(0.130)	(0.081)	(0.075)	(0.170)	(0.122)
Degree centrality	0.070				0.088	0.070
	(0.086)				(0.084)	(0.086)
Eigenvector centrality		0.219			0.231	
		(0.138)			(0.138)	
Leader			0.623			
			(0.288)			
Geographic centrality				−0.115		
				(0.089)		
Observations	6,466	6,466	6,466	6,466	6,466	6,466
Post-LASSO						✓

Table 8

TABLE 8

Does network gossip differentially predict nominations?

	(1) Nominated	(2) Nominated	(3) Nominated	(4) Nominated	(5) Nominated	(6) Nominated
Percentile of network gossip j, i	0.256	0.245	0.348	0.356	0.068	0.080
	(0.090)	(0.105)	(0.049)	(0.057)	(0.030)	(0.032)
Observations	665,301	665,301	665,301	665,301	665,301	665,301
Dep. var mean	0.382	0.382	0.382	0.382	0.382	0.382
Respondent FE		✓		✓		✓
Rankee FE					✓	✓
Flexible controls for DC			✓	✓		

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Table 9

TABLE 9
Calls received by seed type

	(1) Calls received	(2) Calls received	(3) Calls received	(4) Calls received / Seeds	(5) Calls received / Seeds	(6) Calls received / Seeds
At least 1 gossip	6.645	5.574		1.637	1.370	
	(3.867)	(4.119)		(0.949)	(0.992)	
At least 1 elder	0.346	0.0566		0.245	0.173	
	(3.602)	(3.576)		(0.926)	(0.912)	
At least 1 high *DC* seed		3.663	5.183		0.916	1.312
		(2.494)	(2.383)		(0.623)	(0.649)
Observations	68	68	68	68	68	68
Control group mean	5.586	5.586	5.719	1.353	1.353	1.402
At least 1 gossip = At least 1 elder (pval.)	0.260	0.340		0.310	0.400	
At least 1 gossip = At least 1 high *DC* seed (pval.)		0.730			0.720	
At least 1 elder = At least 1 high *DC* seed (pval.)		0.420			0.480	

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