The Social Network Effects of Drone Strikes

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IDSS
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Background

Drone strikes have become a mainstay of U.S. military strategy

- Since 2002, the U.S. has carried out **over 6000 confirmed** drone strikes in Yemen, Pakistan, Afghanistan, and Somalia

- The impact and effectiveness of strikes remain unclear and subject to significant debate (Carney 2012, Byman 2013, Townsend 2017, Hudson et al. 2011, Cronin 2013)
  - Supporters: disrupt terrorist networks by **surgically** removing key figures
  - Critics: extrajudicial killing, civilian casualties, and increased militant sympathies
- Crucially, arguments on both sides suffer from a **lack of available data**

- **Open question:** Do drone strikes disrupt civilians and their communities and, if so, are these disruptions limited to the immediate strike region?

Objective

Identifying the effects of strikes is of paramount importance

- Identify and measure the impact of strikes on individuals and communities
- Provide a foundation for improved, data-driven policy

Conflict resolution

- Role of strikes in modern conflict, where civilians play a key role
- Contemporary strategies for conflict prevention and resolution

(Condra and Shapiro 2012, Kolenda et al. 2016, Schutte 2017, Berman et al. 2018)

Economic implications

- Economic cost of conflict is high: lower output, investment, and growth
- Forced migration and damaged infrastructure

(Alesina et al. 1996, Abadie and Gardeazabal 2003, Eckstein and Tsiddon 2004, Collier and Duponchel 2013)

Dataset details

Call detail records provide high temporal and spatial resolution

- Utilize over 12 billion call detail records (CDRs) to study 74 U.S. drone strikes in Yemen between 2010 and 2012

Time	**Unique ID**		**Tower ID**		**Duration**
Start of Call	Caller	Recipient	Caller	Recipient	(seconds)
6/13/12 7:57:12	34331363	30002125	3995	623	1139
6/13/12 7:57:13	20918574	38389599	1373	1290	10
6/13/12 7:57:13	39496809	146551	3338	1401	32

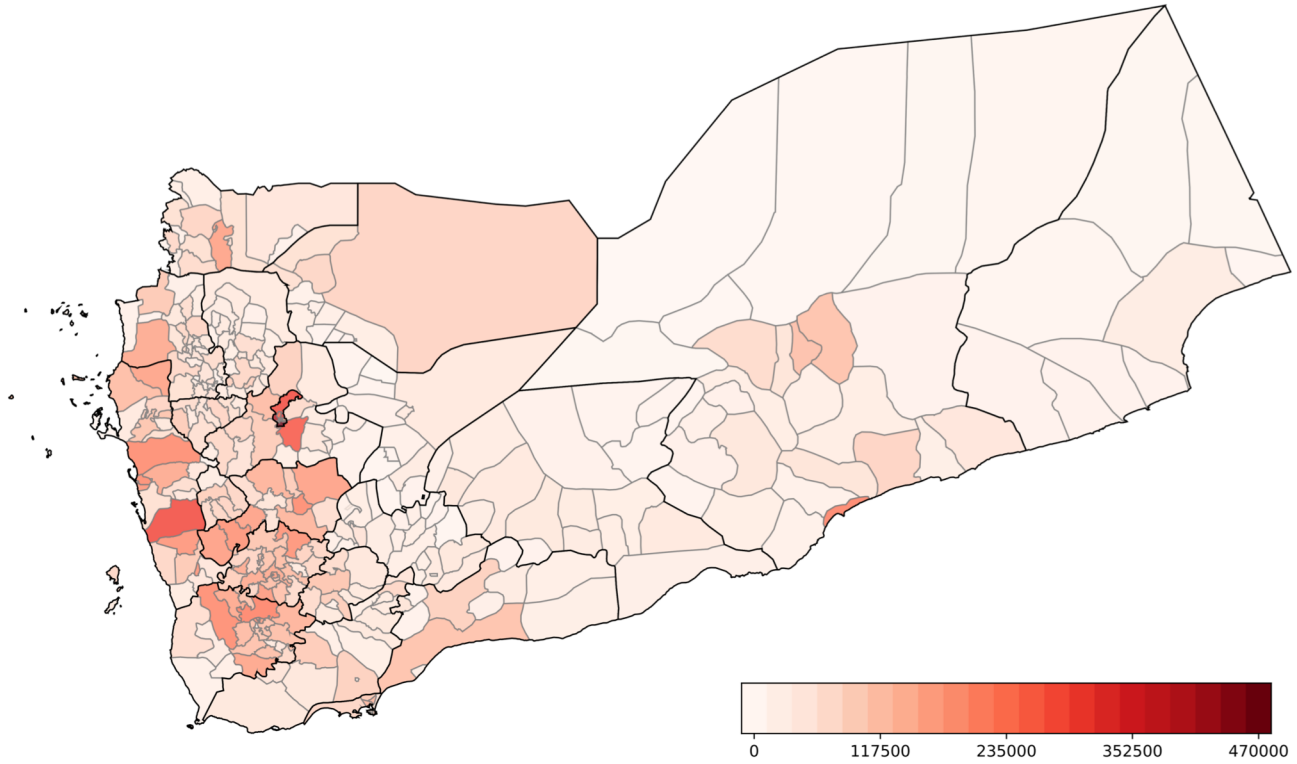
Table 1: An example of three calls from the call record dataset.

- Drone strike data was compiled by the Bureau of Investigative Journalism and New America from media reports. It includes dates, approximate locations and times
- Assume strikes are exogenous shocks and confirm potentially confounding events do not take place at the same time and location

Data in context: Yemen

The CDRs cover a large fraction of the cellphone-using population

- Yemen had a population of around 23 million in 2010
- 49% of the population used cellphones while internet penetration was only 12%



2010 district-level population

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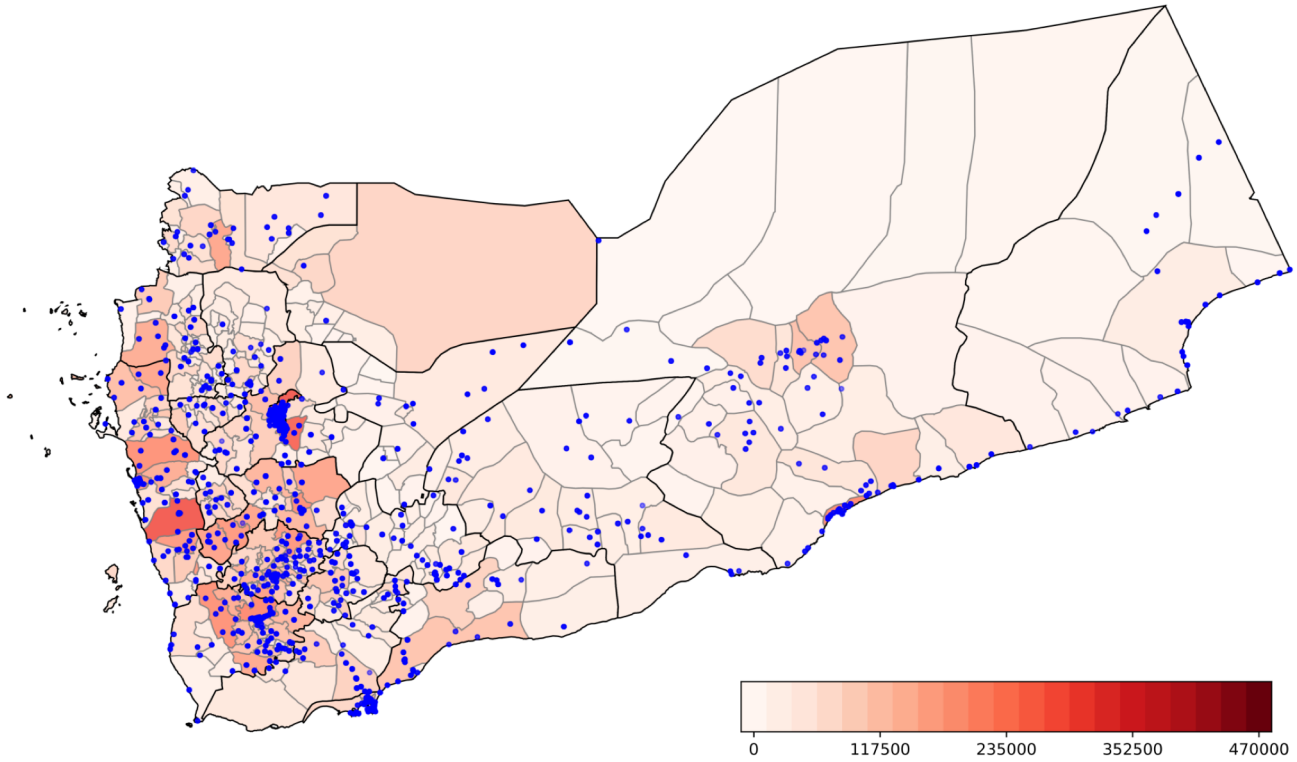
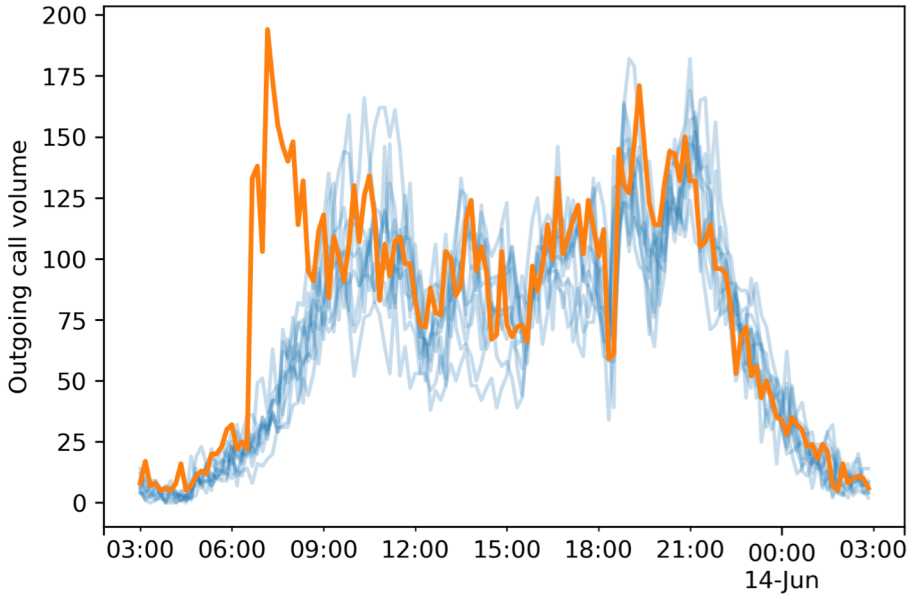


2010 district-level population
with cell tower locations

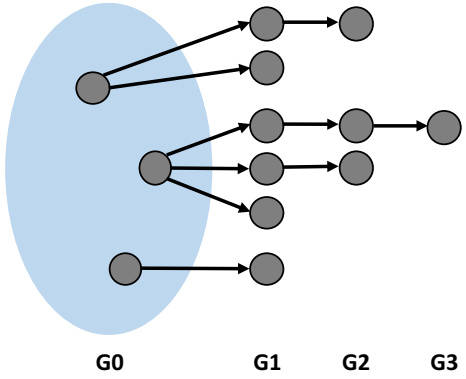
Call volume around strikes

Previous work has shown call volume spikes in the vicinity of violent events

- Do calls made by proximal individuals propagate?
- Define proximal individuals as individuals within 15 miles / 24 km of the reported strike locations who make a call during the periods of elevated call volume

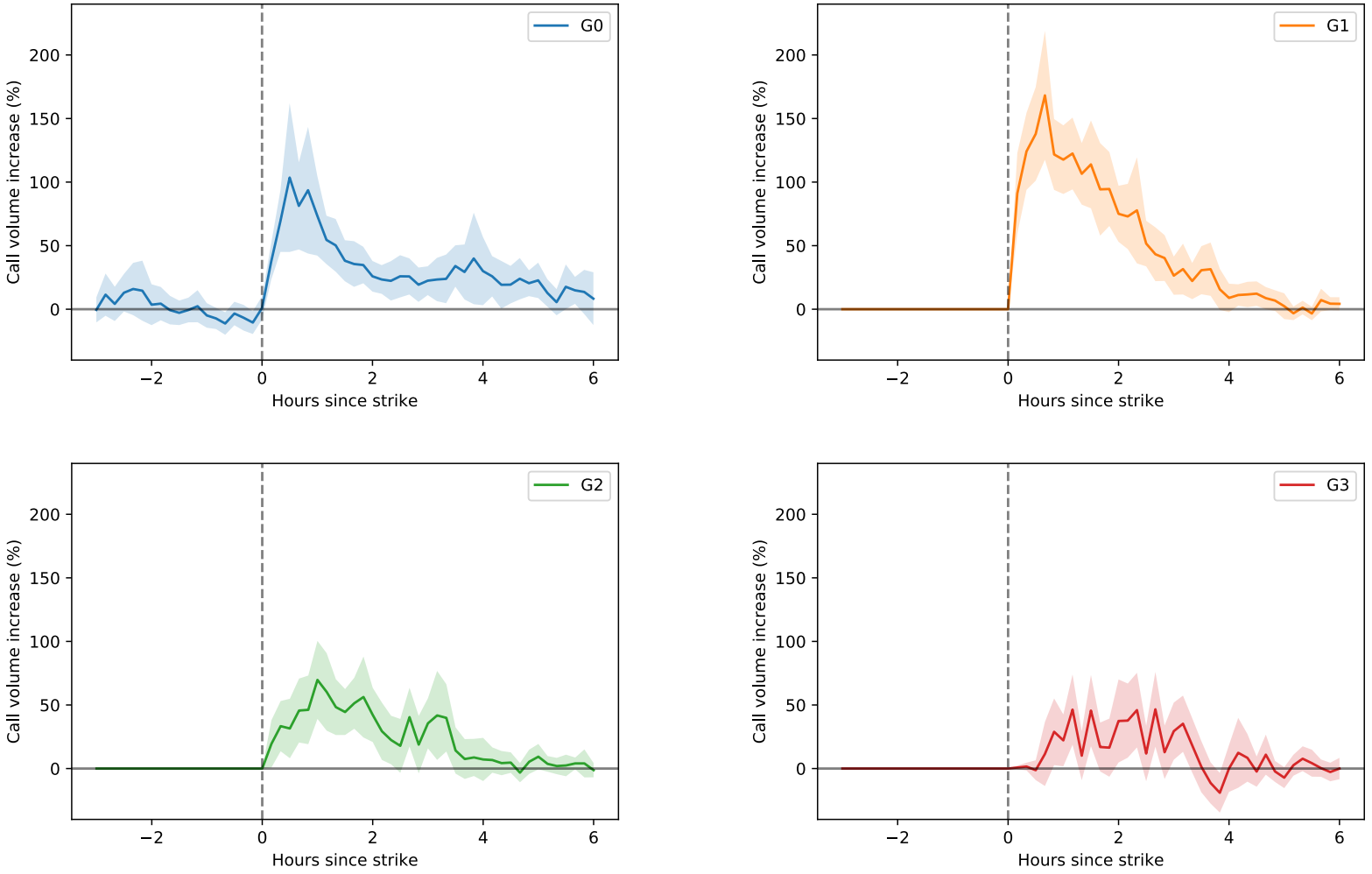


Call volume around a drone strike
in Azzan on June 13, 2012



Emergence of calling cascades

G0-G3 call volume increases, as contacted individuals call their contacts

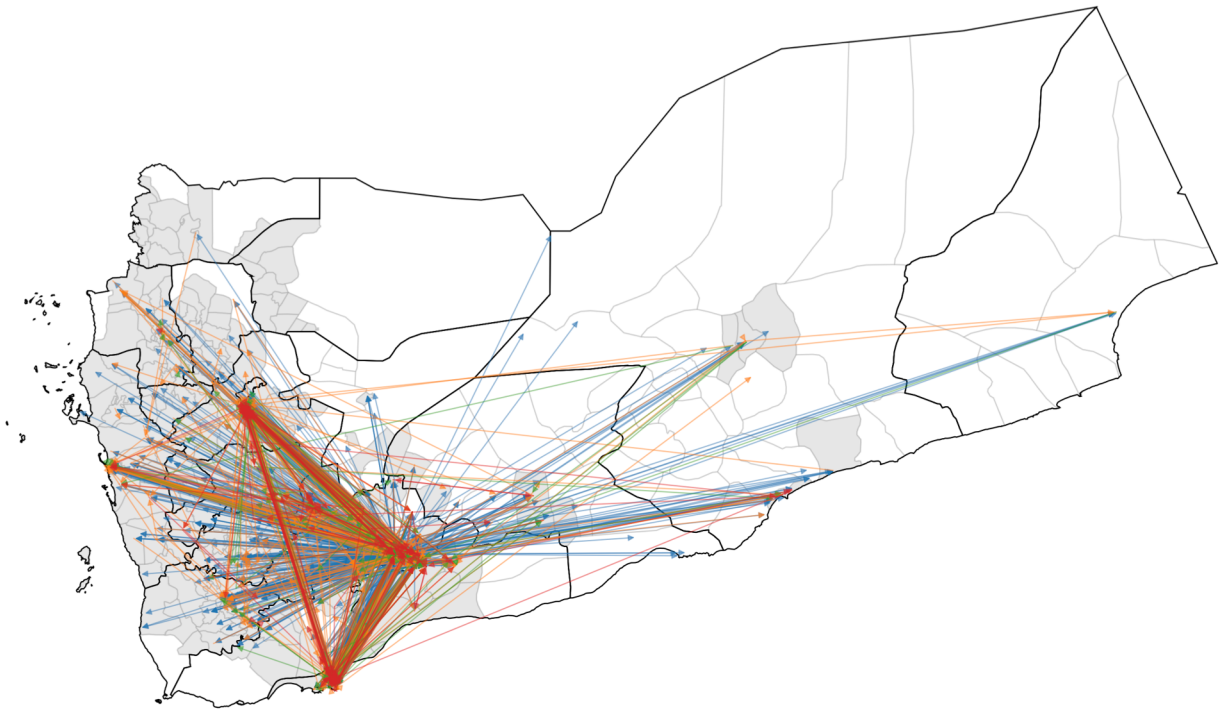


Average call volume increase by generation of caller

Emergence of calling cascades

Call branches originating near strikes spread through the social network

- For each strike and each generation of caller, regress the number of calls made by individuals on the strike day and baseline days on an indicator variable for the strike day
- At a 5% level, 96% of strikes are significant through G1, 62% through G2, and 31% through G3

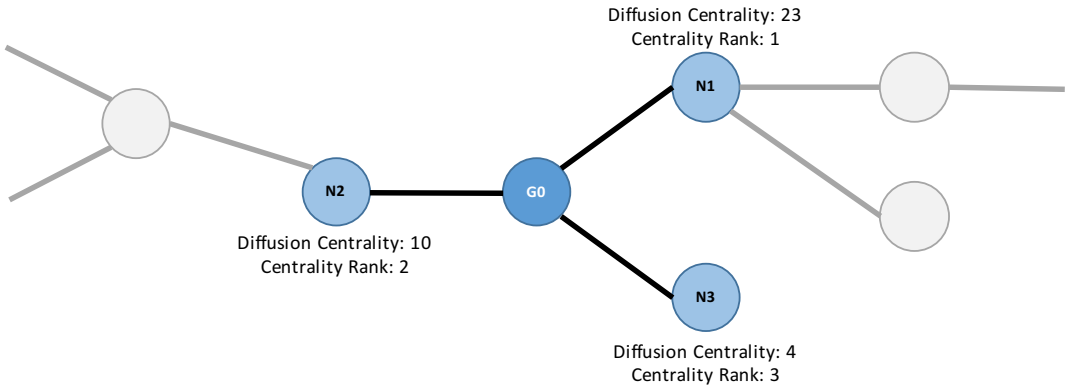


Call branches formed after a drone strike in Bayda on March 9, 2012

Shifts in calling patterns

Who do proximal individuals choose to call after strikes?

- We construct the underlying social network using 30 days of calls before each strike, allowing us to determine each proximal individual's baseline list of contacts
- Rank contacts along different metrics including their frequency of communication with the proximal individual, their home location proximity, and their diffusion centrality

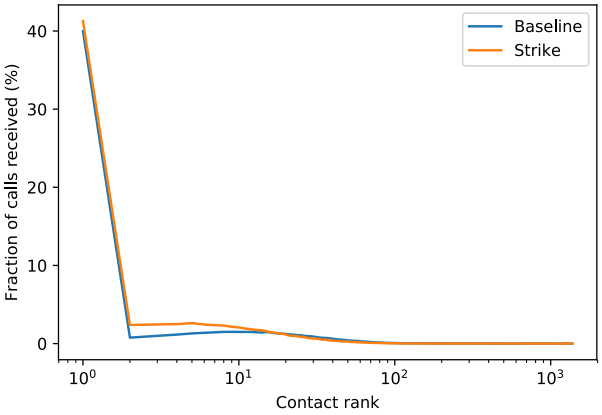


Example of ranking the contacts (N1-3) of a proximal individual (G0) by their centrality

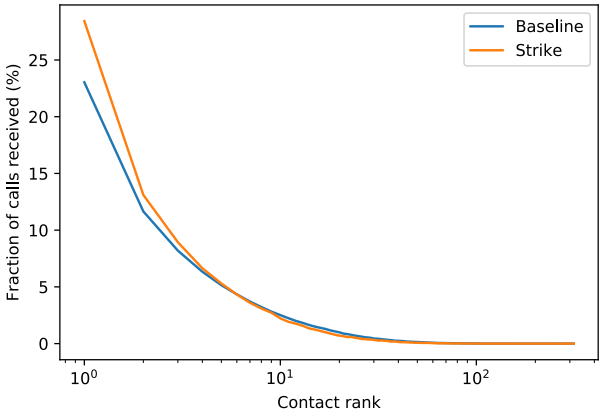
Shifts in calling patterns

Proximal individuals call their important contacts more frequently after strikes

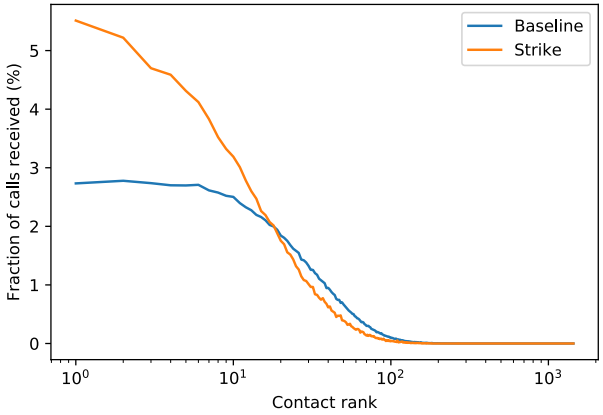
- Both after strikes and during the baseline period, the majority of calls are made to important rank 1 contacts across the three different metrics
- All three shifts are statistically significant at a 5% level using a Kolmogorov-Smirnov test



Contacts ranked by home location proximity



Contacts ranked by freq. of communication



Contacts ranked by diffusion centrality

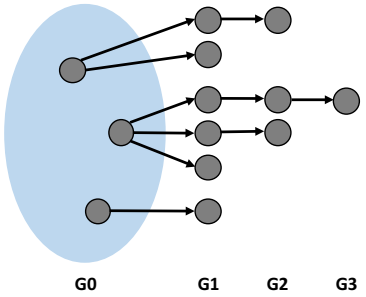
Shifts in calling patterns

Central individuals originate larger cascades

- Use the number of people that call a node on Eid al-Fitr in 2011 and 2012 as instruments
- **Relevance:** number of people who call each node during 2011 Eid is 0.51 correlated with centrality and the number of people who call each node during 2012 Eid is 0.48 correlated
- **Exclusion:** Sargan over-identification test p-value of 0.43 fails to reject the null of exogeneity
- Branch size ranges from 2 to 73 (mean 2.9) and centrality from 0.4 to 13,819.1 (mean 196.6)

		Centrality	R^2 / **NObs**
Branch size on	Beta	0.00318	7.3%
G0 centrality	T-Stat	(26.66)	74,960
Sub-branch size on	Beta	0.00251	8.7%
G1 centrality	T-Stat	(10.03)	36,124

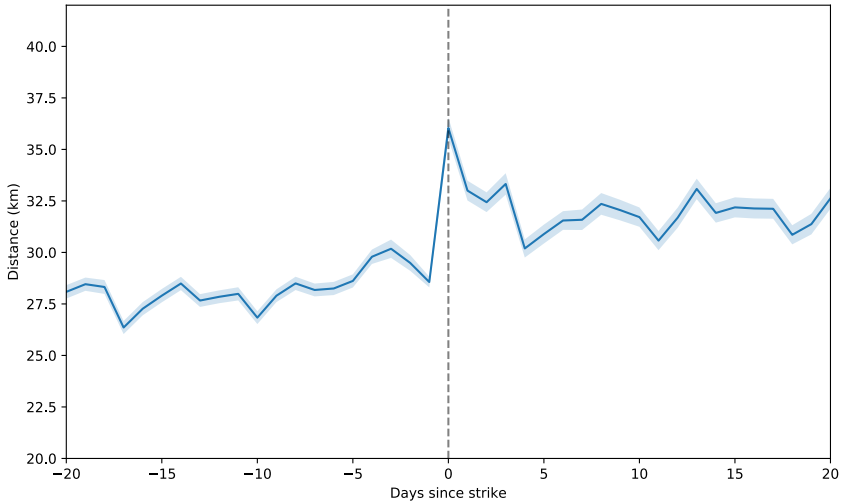
2SLS with het. robust SE



Mobility of proximal individuals

Daily distance travelled spikes sharply on strike days

- Location estimates from the CDRs allow us to analyze the physical reaction to strikes
- Average distance travelled increases 27% on strike days from the pre-strike mean
- 58% of strikes have statistically significant increases in mobility on strike days at a 5% level



Average daily distance travelled by proximal individuals

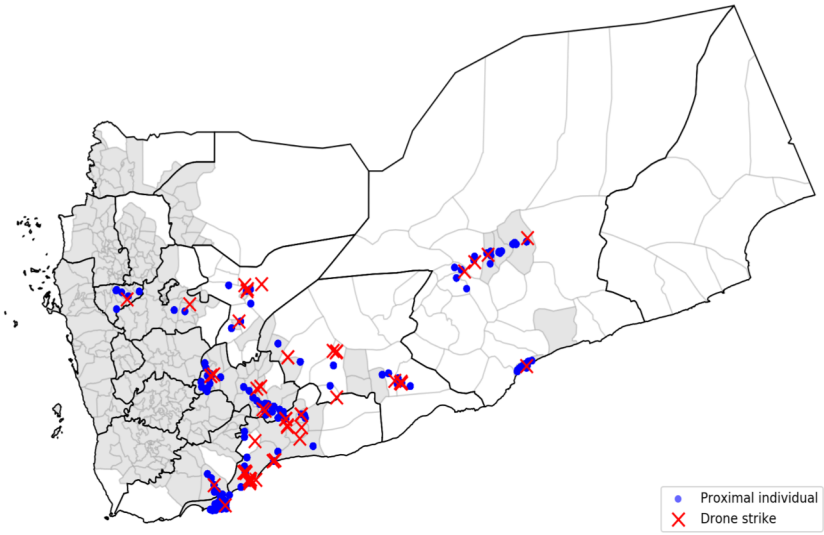
	Strike Day	R^2 / **NObs**
Beta	7.64	0.1%
T-Stat	(32.37)	1,743,890

Daily distance travelled by proximal individuals (in km) regressed on a binary indicator for strike days, using strike FE and clustered SE by individual

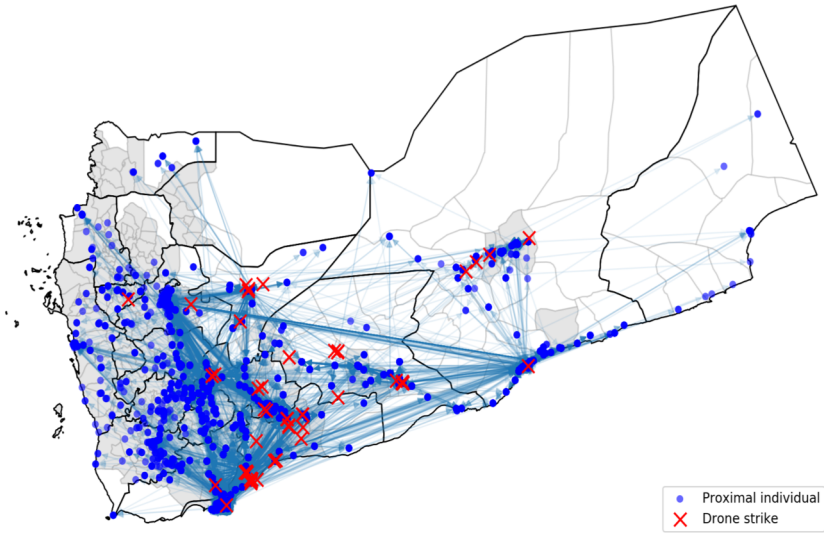
Mobility of proximal individuals

Several thousand people flee their hometowns after strikes

- 4519 proximal individuals who live within the strike region leave within the first 24 hours and remain away for at least 24 hours. 1046 do not return within a 30-day period
- 54% of those who flee end up near (within 5 miles / 8 km) a major city, 83% end up near the home of a contact, and 36% end up near the person they called after the strike



Locations of proximal individuals at time of strike



Locations of proximal individuals 24 hours after strike

Conclusions

- Findings highlight the presence of both communication diffusion and physical diffusion
- Drone strikes have a disruptive and widespread impact on civilians
- Impact is in contrast to prevailing political and military positions that strikes are surgical

Key implications

  - Diffusion facilitates the spread of information, opinions, and emotions
  - Disruption has the potential to shift civilian sentiments and loyalties

- Open questions remain of whether disruption increases or decreases militant recruitment and regarding the long-term strategic effects of strikes
- Since 2010, the conflict in Yemen has led to over 230,000 deaths, 4 million displaced, and a 42% fall in GDP