Information Operations Increase Civilian Security Cooperation

Konstantin Sonin[a,b,1,2] **and Austin L. Wright**[a,1]

[a]Harris School of Public Policy, The University of Chicago, 1307 E 60th St, Chicago, IL, 60637.; [b]Higher School of Economics, Moscow, 101200, Russia.

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Information operations are considered a central element of modern warfare, yet there remains little, if any, systematic evidence of their effectiveness. Using a geographic quasi-experiment conducted during Operation Enduring Freedom in Afghanistan, we demonstrate that civilians exposed to the government's information campaign resulted in more civilian security cooperation, which in turn increased bomb neutralizations. Results are corroborated with a nationwide survey and large-scale analysis of intelligence reports and counterinsurgent operations. The investigation demonstrates that information campaigns can lead to welfare-enhancing attitudinal and behavioral changes in an adversarial environment and can substantially improve battlefield outcomes.

Information operations | Counterinsurgency | Quasi-experiment

The U.S. military considers information and influence operations a central element of its strategy (1). "The battlefield is not necessarily a field anymore. It's in the minds of the people," noted Admiral Michael Mullen, Chairman of the Joint Chiefs of Staff, in 2010 (2). In Afghanistan, these operations have been used to inform civilians about dangers of roadside bombs, political reform, and peacebuilding programs. Yet, despite hundreds of millions of dollars spent on the information operations during the Operation Enduring Freedom, a 2012 RAND study reported that evidence on operational effectiveness is "mixed at best" (3). In 2018, another RAND report concluded that NATO countries lag behind its adversaries in the use of information operations (4). In the absence of a systematic evaluation of information operations' impact, the prevailing view has been that they do not have the desired effect, especially in the "enemy's territory". (See (5) on ineffectiveness of psychological operations and (6) on attitudinal consequences of military campaigns during the Vietnam war.)

We evaluate the effectiveness of information operations by conducting a micro-empirical case study of US military operations in a critical region held by Taliban forces until 2010. Following the state-of-the-art approach pioneered in (7), (8), and (9), we leverage quasi-random variation in radio signal penetration to estimate the impact of the US Marine's Radio-In-A-Box (RIAB) program in Garmser district. This variation yields a geographic quasi-experiment. We find large increases in civilian cooperation and bomb neutralization after the RIAB transmitter was activated, comparing areas that could have received messaging to those that did not have signal. These findings are corroborated with a nation-wide survey and investigation of military records and intelligence reports collected during Operation Enduring Freedom.

Substate conflicts are the main source of human loss and population displacement. Not surprisingly, the recent literature focuses on both origins and means of prevention (10–15). Our research demonstrates that targeted influence campaigns can lead to welfare-enhancing outcomes even in an adversarial environment. This contrasts with both (8, 16), in which propaganda reinforces the existing attitudes (anti-Semitic in (16), anti-Tutsi in (8)), and (9), in which the purpose of propaganda was different (pro-nationalist among Serbs), yet triggered a rise in ethnic hatred among affected Croatians. In (17), the government propaganda reduces the ethnicity salience. The central contribution of our investigation is that demonstrates information operations are able to shape attitudes even in contexts where messaging is least likely to be effective: areas of persistent insurgent control.

Results

We study the impact of radio messaging during the operation of Combat Outpost (COP) Rankel in Garmser district (Helmand

Significance Statement

The paper evaluates the impact of information operations during and after Operation Enduring Freedom in Afghanistan. Economists have established a causal relationship between propaganda and negative civilian behavior in prominent historical episodes such as the rise of Nazis in Germany and the Tutsi genocide in Rwanda. The effectiveness of targeted welfare-enhancing messaging in politically complex settings, such as a foreign occupation, is still an open question. We show that encouraging the civilian population to report roadside bombs, the deadliest weapon used in Afghanistan, has a significant positive effect on threat reporting and bomb neutralizations.

[1]K.S. and A.W. contributed equally to this work.

[2]To whom correspondence should be addressed. E-mail: ksonin@uchicago.edu.

province), from 2010 to 2011. The information operations that we study are concerned with roadside bombs. Improvised explosive devices (IEDs) remain the most deadly weapon used by insurgents in Afghanistan, killing thousands of civilians each year. The information campaigns coordinated by international forces were primarily composed of posters, radio addresses, and television advertisements detailing the dangers of roadside bombs and how civilians could report potential threats.

The study location is presented in Figure 1. On September 1, 2010, US forces established the Radio In A Box (RIAB) program at COP Rankel, which transmitted news about current events in the area as well as messages coordinated with community leaders encouraging civilian cooperation with local security forces. The messages highlighted the dangers of roadside bombs and other threats to civilians.

Transmission coverage, which decayed at roughly 17.5 kilometers, created a natural set of treatment and control villages for our study. The study site is introduced in Panel A. The transmission site is noted with a orange star. We construct an arbitrary grid matrix, which we use to identify settlements inside and outside of the radio tower exposure (Panel B/C).[*] We use this grid to collapse precisely georeferenced tips and combat activity data (Panel D).

Using the signal cutoff, we plot trends in civilian tips and bomb turn-ins for treated (green) and control (black) units for 180 days before and after COP Rankel was established (Figure 2 Panel A). We repeat this exercise for bomb neutralizations (net detonations) (Panel B). Prior to radio transmissions, daily activity in treated and control areas was very similar, with one exception (the August 2010 spearhead mission to clear and hold the location where COP Rankel was built). These trends suggest that civilian security cooperation and bomb neutralization activities were plausibly parallel across areas with and without exposure prior to tower construction, which makes our research design more credible. After transmissions begin, however, civilian cooperation and bomb clearances increase substantially in villages with radio access whereas settlements without access remain unaffected. This is consistent with our theoretical model of persuasion (see SI, "A Model of Information Operations").

We next produce regression-based estimates of the impact of messaging exposure using a standard difference-in-differences (DiD) approach. We include grid cell fixed effects to account for local geographic, political, and economic characteristics specific to village clusters that remain fixed over time. We also include time fixed effects to account for shocks that are common across the study region and vary over time. We estimate the following equation Eq. (1):

$$y_{gt} = \alpha + \beta_1 Post_t \times Exposure_g + \lambda g + \gamma t + \epsilon, \quad [1]$$

where y_{gt} is (1) the count of civilian tips and IED turn-ins and (2) the count of bomb neutralizations (net explosions) by grid cell and day. λ and γ represent grid cell and time fixed effects, which absorb the base terms $Post_t$ and $Exposure_g$. β_1 captures the change in tips and bomb neutralizations among the grid cells within the radio signal zone after the messaging begins (compared to control units outside the coverage zone).

The baseline estimates reveal large positive effects of radio-based information exposure on civilian cooperation (β_1 = .015, $p < .01$) and net bomb neutralizations (β_1 = .05, $p < .01$) (Figure 2 Panels C and D, left side). This is equivalent to a .167 standard deviation increase in cooperation and a .23 standard deviation increase in bomb clearances on average. A supplemental regression specification with spatial decay parameters confirm robustness of our main estimates and demonstrate that the effects of radio exposure attenuate to zero after approximately 17.5 kilometers (Panels C and D, right side).

In Supporting Information, we introduce sensitivity checks for these results (see Tables SI-1 through SI-4). First, radio transmissions could have coincided with a change in patrol intensity. To account for this, we georeference data on coalition patrol stations and calculate the proximity between villages and the nearest station, which we collapse by grid cell. Because this characteristic is fixed, proximity to the nearest patrol station is accounted for in our research design with grid cell fixed effects. However, we can allow the effect of patrol proximity to vary across time with the onset of radio messaging. This parameter (Post $\times$ Patrol Proximity) accounts for the potential correlation between messaging onset and changing patrol activity. Second, civilian cooperation and bomb clearances could be influenced by the intensity of local combat operations and insurgent detention operations. Importantly, variation in these operations may be partially explained by radio messaging. If this is the case, our estimated treatment effect is a bundle of direct effects of radio messaging as well as indirect effects via a positive externality of messaging (increased security operations). This does not invalidate our estimate, but it complicates interpretation. To address this concern, we account for lags (seven time periods) of these operations. Third, exposure to radio messaging may have been correlated with the allocation of local military development and reconstruction aid projects. Ex ante, it is unclear if information operations and aid delivery coincide with one another (complements) or are used as alternative strategies for influencing the civilian population (substitutes). We gather georeferenced data on 293 projects executed as part of the Commander's Emergency Response Program (CERP) that are initiated during our study period (across grid cells). Using this data, we estimate the daily amount of aid delivered to each grid cell. We sequentially add these parameters to our benchmark specification in Tables SI-1 through SI-4. The main effects are unchanged.

To assess our research design and the probability the main estimates could have occurred by random chance, we conduct randomization inference tests ($\times$1000) for each model

[*] This differs from (8), which uses an Irregular Terrain Model (ITM) to estimate radio propagation. We do this for several reasons. First, technical details about the COP Rankel device are sensitive (transmitter type, strength, and antenna height). Second, the terrain in the study area is not sufficiently variable to be used as a source of causal identification. These two features are core inputs for the ITM. Instead, we confirm extent of transmission signal with a field officer present at the study site.

(See Figure SI-1). The null hypothesis is evenly distributed around 0 ('no effect'). The results suggest the main results are highly unlikely to have occurred by chance ($p < .001$). Finally, we use a Wald Estimator to calculate the pass through effect of information operations on battlefield outcomes via civilian tips and IED turn ins (See Table SI-5). These results suggest a large effect via this mechanism, with each additional messaging-related tip associated with roughly four net bomb neutralizations. This estimate should be considered an upper bound on the mechanism effect, since messaging exposure may have lead to additional types of civilian cooperation that we do not observe in our data.

Discussion

The above results suggest that information operations can effectively increase civilian security cooperation, which leads to welfare-enhancing removal of roadside bombs. Overall, these findings have important implications for understanding whether information operations can be used to influence attitudes and behaviors even in a potentially adversarial environment, where message receivers may not support or trust the message sender. Importantly, evidence from this quasi-experimental design comes from a 'hard case': a remote context that was previously under insurgent control. Previous evidence suggests information can be weaponized as a means of reinforcing existing prejudices and inciting violence. The findings of our investigation suggest information campaigns can also be successfully used to engage citizens and reduce exposure to violence. More broadly, these results suggest that cost-effective interventions can be effective even in contexts where the risks associated with information sharing are substantial and the civilian population is distrustful of the intervening actor (in this case, coalition forces).

The study focuses on a single context, making a tradeoff between internal validity—the plausibility of identifying causal effects—and external validity—whether the estimated effects generalize more broadly. To assess the external validity of the core investigation, we introduce three additional investigations in Supporting Information. First, we gather data from two waves of proprietary nationwide military survey data, which include questions about exposure to counter-IED messaging as well as willingness to report roadside bombs. The survey data are part of the Afghanistan Nationwide Quarterly Assessment Research (ANQAR) platform, coordinated by the North Atlantic Treaty Organization (NATO). The survey is designed and fielded by a local Afghan firm.[†] The results of the survey analysis are provided in Supporting Information (See Table SI-6). The evidence suggests survey respondents were 10% more likely to report roadside bombs if they had been exposed to information operations in the prior six months. This finding is robust to a number of alternative specifications and is highly unlikely to be credibly driven by an unknown confounding variable (See Tables SI-7 and SI-8).

[†] See Figure SI-2 for an overview of cooperation, refusal, and non-response rates. Also see Table SI-9 for an overview of survey instruments.

Second, we geographically link the survey data with declassified military records, which include intelligence reports collected about reported threats from roadside bombs as well as combat activity (notably IED detonations, bomb neutralizations, weapons depot seizures, informant killings, and other trends in violence). We collapse the data by administrative district and survey wave period. In line with the main results, the second investigation demonstrates that civilian security cooperation increases as the percentage of the population exposed to messaging increases (See Figure SI-3).

Third, we construct a large-scale dataset tracking civilian cooperation and counterinsurgent outcomes at the district-by-week level. This approach allows us to examine the impact of cooperation on battlefield outcomes in the same district in the following week. We find strong evidence consistent with our natural experiment that tips about roadside bombs lead to increased bomb neutralization and weapon cache clearances (See Table SI-10). Additional evidence suggests a broader class of civilian cooperation, across a range of suspicious activity, also lead to increased safe house raids and detention of suspected insurgents. Taken together, these results help clarify the external validity of our finding in the geographic experiment.

It remains difficult to discern the mechanisms through which information operations can effectively influence behavior. In this investigation, we cannot tell whether the effectiveness of radio messaging was due to an information or persuasion channel. The content of messages included both details about how civilians could cooperate with security forces as well as persuasive content, intended to influence the public's perceptions of the use of violence generally and roadside bombs in particular. In this sense, however, the quasi-experiment we study is representative of information operations more broadly, which rarely provide details about how to engage government actors without also offering a rationale for why citizens should make demands.

Materials and Methods

In Supporting Information, we provide detailed information about the source material used in our analysis as well as the descriptive and regression specifications used in our main and supplemental analysis.

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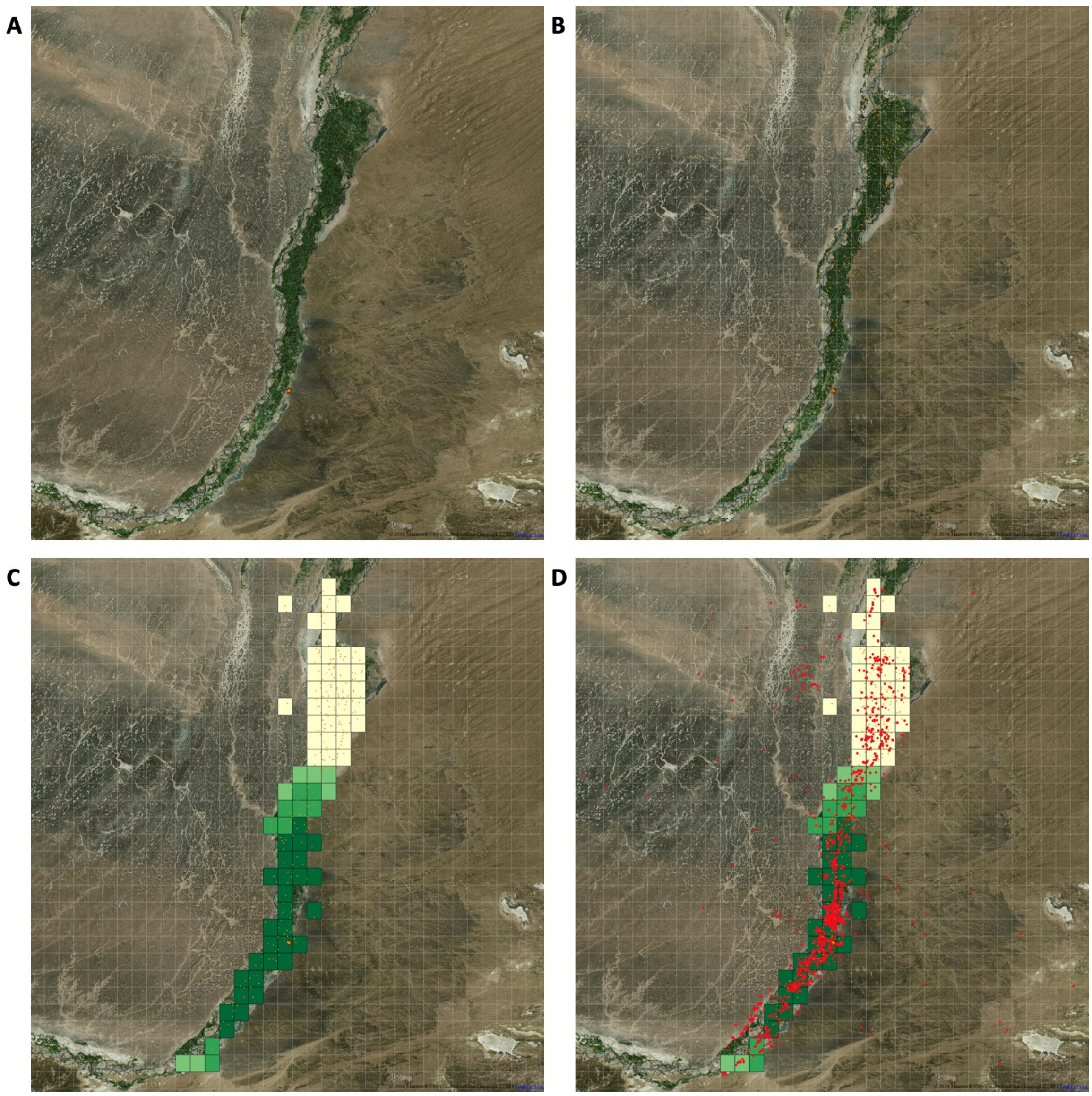


Fig. 1. Context: Study of radio messaging during COP Rankel operations, 2010-2011. (A) Garmser district, Helmand, Afghanistan. Orange star indicates location of COP Rankel radio transmitter. (B) 2.5 KM (.025 degree) grid cell layer used for analysis shaded by distance to radio transmitter. Populated settlements are noted with orange dots. (C) Color of grid cell indicates distance from radio site. Dark green indicates treatment zone (within approximately 17.5 KM (.175 degree) of radio site). Lighter shades of green indicate areas adjacent to cover (not exposed). (D) Red dots indicate combat and intelligence locations during sample period.

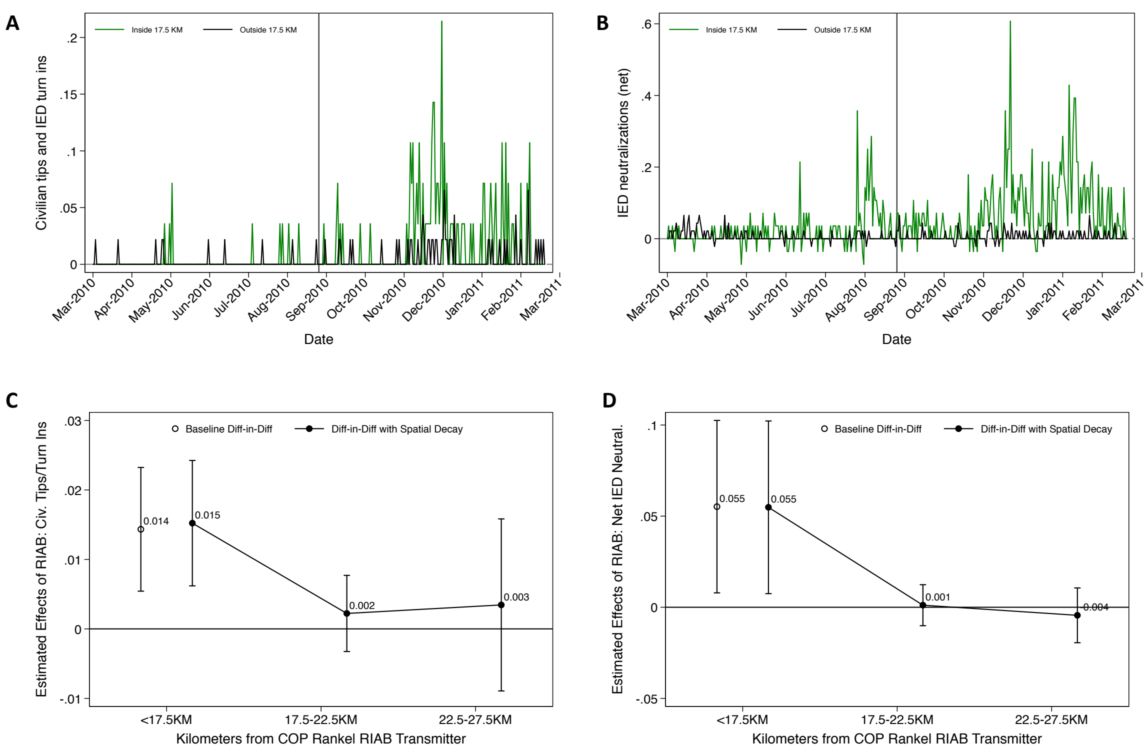


Fig. 2. Results: Study of radio messaging during COP Rankel operations, 2010-2011. (A) Daily time series (mean) of civilian tips and bomb turn-ins (by civilians) during 180 days prior to and following introduction of COP Rankel transmitter. Green trend line indicates cells within radio signal zone (treatment units; <17.5 KM); black indicates cells outside the signal zone. (B) Daily time series (mean) of bomb neutralizations (net explosions). (C) Two difference-in-difference (DiD) regression estimates of radio messaging impact on tips/turn-ins. Standard DiD estimate on left; spatial decay DiD on right. (D) DiD regression estimates of radio messaging impact on roadside bomb neutralizations (net explosions). Standard DiD estimate on left; spatial decay DiD on right. Consistent with model assumption, no effects detected for cells outside of signal zone in (C) and (D).

Supporting Information

Table SI-1. Estimated effect of radio messaging on civilian tips and turn ins, sensitivity analysis 1/2

Post × Radio Signal	0.0143***	0.0152***	0.0148***	0.0157***	0.0147***	0.0155***
	(0.00447)	(0.00453)	(0.00463)	(0.00484)	(0.00464)	(0.00488)
Post × 5KM Outside		0.00222		0.00219		0.00200
		(0.00275)		(0.00272)		(0.00280)
Post × 10KM Outside		0.00345		0.00329		0.00308
		(0.00621)		(0.00557)		(0.00566)
SUMMARY STATISTICS						
Outcome Mean	0.00655	0.00655	0.00655	0.00655	0.00664	0.00664
Outcome SD	0.0852	0.0852	0.0852	0.0852	0.0858	0.0858
MODEL PARAMETERS						
Grid Cell Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Post × Patrol Proximity	No	No	Yes	Yes	Yes	Yes
Close Combat Activity (lags)	No	No	No	No	Yes	Yes
Detained Insurgents (lags)	No	No	No	No	Yes	Yes
MODEL STATISTICS						
No. of Observations	26714	26714	26714	26714	26196	26196
No. of Clusters	74	74	74	74	74	74
R^2	0.0399	0.0399	0.0399	0.0399	0.0407	0.0408

Notes: Outcome of interest is civilian tips and turn ins. Relevant coefficient estimate is highlighted with gray bar (Post × Radio Signal). Additional parameters noted in table footer. Standard errors are clustered at the grid cell level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table SI-2. Estimated effect of radio messaging on civilian tips and turn ins, sensitivity analysis 2/2

Post × Radio Signal	0.0147***	0.0155***	0.0147***	0.0155***	0.0150***	0.0157***
	(0.00464)	(0.00488)	(0.00464)	(0.00488)	(0.00463)	(0.00486)
Post × 5KM Outside		0.00200		0.00205		0.00196
		(0.00280)		(0.00280)		(0.00283)
Post × 10KM Outside		0.00308		0.00312		0.00291
		(0.00566)		(0.00566)		(0.00561)
SUMMARY STATISTICS						
Outcome Mean	0.00664	0.00664	0.00664	0.00664	0.00664	0.00664
Outcome SD	0.0858	0.0858	0.0858	0.0858	0.0858	0.0858
MODEL PARAMETERS						
Grid Cell Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Post × Patrol Proximity	Yes	Yes	Yes	Yes	Yes	Yes
Close Combat Activity (lags)	Yes	Yes	Yes	Yes	Yes	Yes
Detained Insurgents (lags)	Yes	Yes	Yes	Yes	Yes	Yes
Military Aid (levels)	No	No	Yes	Yes	No	No
Military Aid (ln)	No	No	No	No	Yes	Yes
MODEL STATISTICS						
No. of Observations	26196	26196	26196	26196	26196	26196
No. of Clusters	74	74	74	74	74	74
R^2	0.0407	0.0408	0.0407	0.0408	0.0408	0.0408

Notes: Outcome of interest is civilian tips and turn ins. Relevant coefficient estimate is highlighted with gray bar (Post × Radio Signal). Additional parameters noted in table footer. Standard errors are clustered at the grid cell level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table SI-3. Estimated effect of radio messaging on IED neutralization (net detonations), sensitivity analysis 1/2

Post × Radio Signal	0.0552**	0.0548**	0.0537**	0.0534**	0.0518**	0.0513**
	(0.0237)	(0.0238)	(0.0222)	(0.0223)	(0.0222)	(0.0224)
Post × 5KM Outside		0.00113		0.00122		0.000707
		(0.00564)		(0.00608)		(0.00637)
Post × 10KM Outside		-0.00442		-0.00393		-0.00589
		(0.00754)		(0.00824)		(0.00957)
SUMMARY STATISTICS						
Outcome Mean	0.0227	0.0227	0.0227	0.0227	0.0230	0.0230
Outcome SD	0.238	0.238	0.238	0.238	0.239	0.239
MODEL PARAMETERS						
Grid Cell Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Post × Patrol Proximity	No	No	Yes	Yes	Yes	Yes
Close Combat Activity (lags)	No	No	No	No	Yes	Yes
Detained Insurgents (lags)	No	No	No	No	Yes	Yes
MODEL STATISTICS						
No. of Observations	26714	26714	26714	26714	26196	26196
No. of Clusters	74	74	74	74	74	74
R^2	0.0628	0.0628	0.0628	0.0628	0.0728	0.0728

Notes: Outcome of interest is IED neutralization (net detonations). Relevant coefficient estimate is highlighted with gray bar (Post × Radio Signal). Additional parameters noted in table footer. Standard errors are clustered at the grid cell level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table SI-4. Estimated effect of radio messaging on IED neutralization (net detonations), sensitivity analysis 2/2

Post × Radio Signal	0.0518**	0.0513**	0.0519**	0.0511**	0.0526**	0.0520**
	(0.0222)	(0.0224)	(0.0222)	(0.0224)	(0.0220)	(0.0222)
Post × 5KM Outside		0.000707		0.000250		0.000573
		(0.00637)		(0.00638)		(0.00651)
Post × 10KM Outside		-0.00589		-0.00633		-0.00646
		(0.00957)		(0.00957)		(0.00987)
SUMMARY STATISTICS						
Outcome Mean	0.0230	0.0230	0.0230	0.0230	0.0230	0.0230
Outcome SD	0.239	0.239	0.239	0.239	0.239	0.239
MODEL PARAMETERS						
Grid Cell Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Time Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Post × Patrol Proximity	Yes	Yes	Yes	Yes	Yes	Yes
Close Combat Activity (lags)	Yes	Yes	Yes	Yes	Yes	Yes
Detained Insurgents (lags)	Yes	Yes	Yes	Yes	Yes	Yes
Military Aid (levels)	No	No	Yes	Yes	No	No
Military Aid (ln)	No	No	No	No	Yes	Yes
MODEL STATISTICS						
No. of Observations	26196	26196	26196	26196	26196	26196
No. of Clusters	74	74	74	74	74	74
R^2	0.0728	0.0728	0.0728	0.0728	0.0728	0.0728

Notes: Outcome of interest is IED neutralization (net detonations). Relevant coefficient estimate is highlighted with gray bar (Post × Radio Signal). Additional parameters noted in table footer. Standard errors are clustered at the grid cell level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

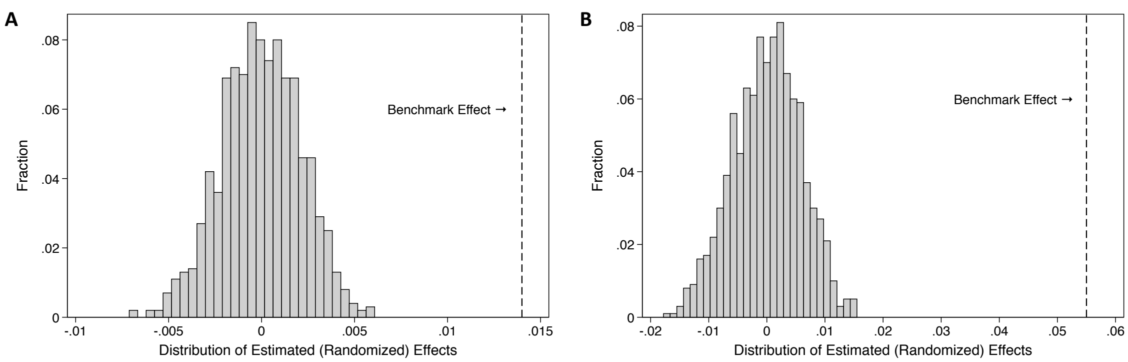


Fig. SI-1. Randomization inference used to assess validity of research design and probability main estimate occurred by random chance. Outcome variable is shuffled randomly 1000 times (for each analysis). Benchmark regression in Figure 2. Estimates are normally distributed around 0. (A) Analysis of civilian tips and IED turn ins, with randomly reshuffled data. Dashed line indicates estimated effect from main specification. Distribution indicates main result is highly unlikely to have occurred by random chance ($p < .001$). (B) Analysis of bomb neutralization (net detonations), with randomly reshuffled data. Dashed line indicates estimated effect from main specification. Distribution indicates main result is highly unlikely to have occurred by random chance ($p < .001$).

Table SI-5. IV estimates of pass through effect of radio messaging on bomb neutralizations via civilian IED tips and turn ins

	(1) Baseline IV Estimate
Civ. Tips/Turn Ins	3.857*
	(1.949)
SUMMARY STATISTICS	
Outcome Mean	0.0229
Outcome SD	0.238
PARAMETERS	
Unit Fixed Effects	Yes
Time Fixed Effects	Yes
IV SPECIFICATION	
Excluded Instrument	Post × Radio Exposure
MODEL STATISTICS	
N	26714
Clusters	74
Kleibergen-Paap F Statistic	10.30

Notes: Outcome of interest is IED neutralization (net detonations). Instrumental variable specification follows baseline DiD specification in Figure 2. First stage F statistic for excluded instrument reported in bottom row of table. Standard errors are clustered at the grid cell level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

A Model of Information Operations. There are two main requirements that any economic model of information operations should satisfy. First, the audience, which consists of strategic actors, should be rational about the interaction it participates in, i.e., to know that it is being influenced and how it is being influenced. Technically, the audience knows the *ex ante* distribution over the possible states of the world and the strategy used by the propagandist that commits to a signal that is conditioned on the state of the world. Second, the members of the audience should satisfy the incentive compatibility constraint for consuming information. That is, they should have a reason to consume information from the propaganda channel. Combining these two features, our theoretical model of information operations is a version of a standard Bayesian persuasion model ((18), (19); see (20) for a survey on empirical evidence on persuasion).

Setup. There is a government that commits to an information design and a unit continuum of rational agents who have heterogeneous costs of receiving information (e.g., listening to radio), and may use the transmitted information to chose the optimal action. For simplicity, we describe receiving information as listening to the radio and civilian cooperation as reporting IEDs. These phrases are used to ease interpretation of the model, but the conceptual foundation is broader.

For each agent $i \in [0, 1]$, the cost of listening to radio, ε_i, is uniformly distributed over $[0, 1]$. Agent i is deciding on whether or not to report IEDs to the local government office, and her willingness to do this depends on whether or not she considers the government friendly (f), which we use as a short cut for "willing to and effective at neutralizing threats to civilians", or unfriendly (u). If the government is friendly, then reporting IEDs brings the benefit of $v(R)$; if unfriendly, $v(R) - c$, where c is the cost of reporting to an unfriendly government. Not reporting to the unfriendly government brings the benefit of $v(N)$, while not reporting to the friendly government, $v(N) - a$, where a proxies the willingness to be helpful.

Agents are uncertain about the government friendliness. As it is standard in the Bayesian persuasion literature, the government commits to a signal $\widehat{g}$ that is conditioned on the state of the world. The common prior is $P(g = f) = \theta$.

We assume that in the absence of any information, agents perceive the government as insufficiently friendly, and prefer not to report. We focus on subgame-perfect Nash equilibria: the government chooses the signal to maximize the expected number of reports, and agents decide whether or not to listen to radio and then whether or not to report IEDs to maximize their expected utility.

Analysis. Without turning on radio, agent i has the following choice. The expected value of reporting is $\theta v(R) + (1-\theta)(v(R)-c) = v(R) - (1-\theta)c$; the expected value of not reporting is $\theta(v(N)-a) + (1-\theta)v(N) = v(N) - \theta a$. Given our assumption that agents choose not report without any additional information, $v(R) - (1-\theta)c \leq v(N) - \theta a$. Thus, the expected payoff of an agent absent any information is $v(N) - \theta a$.

(18) show that it suffices to focus on signals $\widehat{g}$ such that with $P(\widehat{g} = f|g = f) = 1$, $P(\widehat{g} = f|g = u) = \mu$, where $\mu in [0, 1]$. is the control parameter of the government. If agent i listens to the radio, then her posterior is

$$P(g = f|\widehat{g} = f) = \frac{\theta}{\theta + (1-\theta)\mu}.$$

Assuming that in equilibrium, agent i's actions correspond to the signals $\left(a_i\left(\widehat{g} = f\right) = R, a_i\left(\widehat{g} = u\right) = N\right)$, the incentive compatibility constraint implies that the level of bias the government introduces, μ, should satisfy

$$\mu \leq \frac{\theta(v(R) - v(N) + a)}{(1-\theta)(c - (v(R) - v(N)))}.$$

The expected payoff of an agent that has access to the signal is

$$(\theta + (1-\theta)\mu)v(R) - (1-\theta)\mu c + (1-\theta)(1-\mu)v(N). \quad \text{[SI1]}$$

For any μ, agent i listens to radio as long as the difference of the value of having access to information, (SI1), and the value of not having access, $v(N) - \theta a$, exceeds ε_i :

$$I_G(\mu) = (\theta + (1-\theta)\mu)(v(R) - v(N)) - (1-\theta)\mu c + \theta a.$$

Given our assumption about the distribution of costs, this is the number of those who listen to radio. The government is interested in maximizing the expected number of reported IEDs, which is $P(\widehat{g} = f)I_G(\mu)$. The equilibrium level of propaganda (the excess probability of the government-friendly signal) is given by

$$\mu^* = \frac{1}{2}\frac{\theta}{1-\theta}\frac{2v(R) - c - 2v(N) + a}{c - v(R) + v(N)}.$$

(21) considers a special case of $v(R) = c = 1 - q$,$v(N) = a = q$, and $\theta < q$. The equilibrium slant is

$$\mu^* = \frac{1}{2}\frac{\theta}{1-\theta}\frac{1-2q}{q},$$

the audience is $I_G(\mu^*) = \frac{1}{2}\theta$, and the expected number of reported bombs is $\frac{1}{4q}\theta$.

In the general case, the envelope theorem gives the following comparative statics:

(a) the equilibrium number of reports decrease with an increase in c, the cost of reporting to unfriendly government; in $v(N)$, the value of not reporting to an unfriendly government.

(b) the equilibrium number of reports increase with an increase in a, the regret of not reporting to a friendly government; in $v(R)$, the value of reporting to friendly government.

Supplemental Investigations.

Data Overview. Access to this survey platform, the Afghanistan Nationwide Quarterly Assessment Research (ANQAR), was negotiated between the host academic institution (University of Chicago) and the North Atlantic Treaty Organization (NATO). Data are collected quarterly, with approximately three months between sequential waves. For this study, we rely on waves 20 and 24, which are the two waves during Operation Enduring Freedom which collect reported exposure to counter-IED messaging (i.e., exposure to information operations). These waves correspond to May/June 2013 and 2014 respectively. The firm contracted to design and execute the survey is ACSOR. ACSOR is an Afghan subsidiary of the D3. ACSOR selects local (to survey region) enumerators. These enumerators are then trained in proper household and respondent selection, recording of questions, appropriate interview techniques, and secure use of contact information. The administrative district is the primary sampling unit (PSU) and districts are selected via probability proportional to size (PPS) systematic sampling. Due to population density, Kabul district is split into multiple urban areas. Among sampled districts, secondary sampling units (villages/settlements) are randomly selected from a sampling frame based on administrative records gathered from the Central Statistics Office. Enumerators use a random walk method to identify sampled households. Once households are selected, a Kish grid technique is used to randomize the respondent within each target household. Before administering each survey wave, ACSOR contacts local elders to secure access to sampled settlements.

In Figure SI-2, we introduce plots of important survey diagnostics, including refusal, non-contact, and cooperation rates for the waves where this data is available (from NATO via ACSOR). Notice that the refusal rate never exceeds 5%, the non-contact rate is always below 4%, and the cooperation rate is above 96% in the two waves exploited in this study (20/24). These rates suggest the survey participation was high, and stronger than most national surveys conducted in developed countries (including the United States and United Kingdom). In Table SI-9, we introduce question wording and the coding scheme used for the main analysis of the ANQAR data.

Then, we corroborate our survey findings with data on combat activity and intelligence reports drawn from declassified records provided by the U.S. Department of Defense. These data were collected as Significant Activities (SIGACTS) during Operation Enduring Freedom. Events were logged with a precise military grid identifier and time stamp (often precise to the minute). See (22) for additional details.

Reporting Roadside Bombs. We begin our supplemental investigation by comparing individuals who have and have not been exposed to counter-IED messages, including posters, radio addresses, and television advertisements. The outcome of interest is the willingness of civilians to report a roadside bomb to local security forces. We estimate this effect using the following equation

$$tips_i = \alpha + \beta messaging_i + \theta X_i + \epsilon \qquad \text{[SI2]}$$

where $tips_i$ is the respondent i's willingness to report roadside bombs and $messaging_i$ is an indicator for exposure to counter-IED messaging in the prior six months. β is the coefficient of interest, providing the difference in reporting due to messaging exposure. To account for potential confounding factors, X_i contains respondent-specific demographic characteristics and parameters to capture constant differences across administrative districts and between survey waves. Standard errors are clustered by administrative district and models are adjusted using sampling weights.

Table SI-6 presents these results. In Column 1, we introduce the simple bivariate correlation (BR) between messaging exposure and the willingness to report IED threats. β is large in magnitude, 17.2% ($p < .01$). To account for systematic differences in messaging frequency across the country and between survey waves, we added district and wave constants to Column 2, as well as demographic controls. If messaging, for example, is concentrated in some regions, we would expect β to decrease once we account for these systematic differences across districts. Indeed, β is smaller in magnitude (10.6%, $p < .01$). In Column 3, we account for village security conditions, which may influence both the likelihood of exposure to a government information campaign and willingness to report threats. In Column 4, we supplement this regression with measures of local security force patrol frequency, anti-government sentiments, and measures of armed actor territorial control over the respondent's community. β is stable and robust across these more demanding specifications.

In Table SI-7, we introduce several additional robustness checks of the baseline model specification introduced in Table SI-6. These include:

1. In Column 1, for reference, we replicate the baseline specification without additional covariates (Table SI-6, Column 4).
2. In Column 2, we directly address potential concerns about respondent comprehension of the survey. Enumerators were asked to collect information on the subject's level of understanding of the questions within the survey. We use this information to categorize the subject's comprehension. This could, in principle, influence the reliability of their responses to questions. We find no evidence that this is true.
3. In Column 3, we introduce a parameter that captures the degree of respondent comfort with the survey. This might also influence whether the subject gives truthful answers to the enumerator's questions. Again, we find no evidence that this parameter substantially influences our regression estimates.
4. In Column 4, we incorporate a measure of the number of individuals present during the interview. Subjects may be less likely to respond truthfully if they are interviewed with a large number of people around while their answers are being recorded. We account for this explicitly. Our coefficient estimate is statistically indistinguishable from the baseline model.

In Table SI-8, we introduce statistical bounds for our estimated treatment effects using the Oster coefficient stability test (23). This test reveals that the estimated effect remains at least 3.78% even under 'worst case scenario' assumptions about omitted variable bias.

Messaging Exposure and Military Data. We introduce a second supplemental investigation using intelligence reports about roadside bombs collected by security forces. To do this, we collapse our survey data by district-wave. This allows us to calculate the percentage of a district in a given survey period (wave) that reports exposure to the government's counter-IED campaign. We match this data with civilian reports of IED threats from our military intelligence records. We visualize the non-parametric relationship between messaging exposure and IED reports in Figure SI-3 Panel A. From 20% to 85% exposure, the impact on intelligence reports is linearly positive. From 85% to 100%, the relationship appears to decrease in magnitude. The effect, however, is indistinguishable from the median level of exposure (65%). We introduce estimates from the following equation

$$tips_{dw} = \alpha + \beta_1 messaging_{dw} + \beta_2 messaging^2_{dw} + \theta X_{dw} + \epsilon \qquad \text{[SI3]}$$

where $tips_{dw}$ is the sum of IED tips in district d in the six months prior to wave w. $messaging_{dw}$ and $messaging^2_{dw}$ capture the percentage of respondents (from 0 to 100) reporting exposure to government messaging and the square of this term. The square is added to capture the non-linearity suggested by Figure SI-3 (Panel A). X_{dw} varies by model. Standard errors are clustered by district.

The regression-based evidence in Figure SI-3 Panel B corroborates our survey evidence. In baseline model (black line), we account for trends in IED detonations and IED neutralizations (95% confidence intervals reported with dashed black lines). In a supplemental model (gray line), we account for the risks of sharing intelligence with local security forces using a measure of informant killings by rebels as well as broader trends in combat activity that might increase the supply of local security forces to collect intelligence (95% confidence intervals reported with gray lines). These results indicate a high degree of consistency in our finding exposure to information operations increases actual civilian cooperation.

The Pass-Through Effect in a Nationwide Study. Now we consider whether the pass through effect from the natural experiment (the impact of tips on battlefield outcomes) can be replicated in a large-scale, nationwide study. In Table SI-10 Columns 1-4, we introduce estimates from the following equation

$$y_{dt} = \alpha + \beta_1 tips_{dt-1} + \mu_d + \eta_t + \gamma X_{dt} + \epsilon \qquad \text{[SI4]}$$

where y_{dt} is the number of counterinsurgent actions in district d in week t. These actions include roadside bombs found and cleared (Column 1), weapon caches neutralized (Column 2), tactical safe house raids (Column 3), and potential combatants captured and detained (Column 4). $tips_{dt-1}$ is the sum of intelligence reports collected in a given district in the week prior to t. In Columns 1 and 2, $tips_{dt-1}$ specifically indicates tips about IED threats. In Columns 3 and 4, $tips_{dt-1}$ includes all tactically relevant tips. μ_d is a district fixed effect; η_t denotes a week-of-year fixed effect; X_{dt-1} is a vector of district-week specific control variables, including trends in tips and combat activity. Standard errors are clustered by district.

We find consistent evidence that intelligence reports lead to meaningful changes in battlefield outcomes. Columns 1 and 2 indicate civilian tips are associated with an increase in the number of bombs and weapon caches neutralized in the following week. Columns 3 and 4 suggest similar increases in safe house raids and insurgent detention following tactically relevant tips from civilians.

Table SI-6. Impact of psychological messaging exposure on civilian's willingness to provide tips about deployed roadside bombs

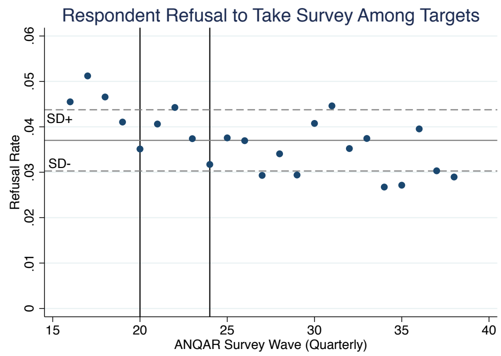
	(1) Basic Model	(2) Baseline Model w. Fixed Effects + Demo. Controls	(3) Baseline Model w. Village Security	(4) Baseline Model w. Political and Security Controls
Messaging Exposure	0.172***	0.106***	0.106***	0.0936***
	(0.0328)	(0.0147)	(0.0148)	(0.0150)
SUMMARY STATISTICS				
Outcome Mean	0.482	0.482	0.482	0.482
Outcome SD	0.500	0.500	0.500	0.500
PARAMETERS				
District + Wave Fixed Effects	No	Yes	Yes	Yes
Demographic Controls	No	Yes	Yes	Yes
Village Insecure	No	No	Yes	Yes
Police Patrols Weekly	No	No	No	Yes
Govt. going Wrong Direction	No	No	No	Yes
Terr. Control (Govt./Ins./Mixed)	No	No	No	Yes
MODEL STATISTICS				
N	24620	24620	24620	24620
Clusters	339	339	339	339

Notes: Outcome of interest is willingness to report insurgents planting IEDs. Unit of analysis is individual survey respondent. Baseline models include administrative district fixed effects (using ESOC boundaries), survey wave fixed effects, and demographic controls (age, education, gender, ethnicity, socio-economic status). See table notation for additional details. Standard errors are clustered at the district level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

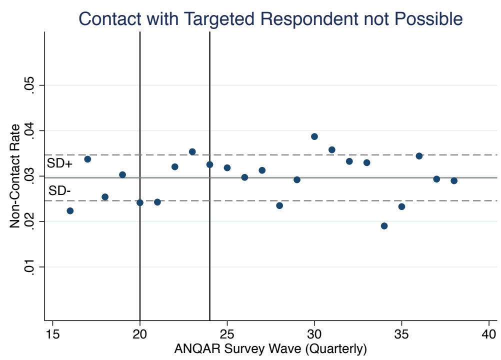
Table SI-7. Impact of psychological messaging exposure on civilian's willingness to provide tips about deployed roadside bombs, accounting for potential survey effects [Robustness Checks for Table SI-6]

	(1) Baseline Model	(2) Baseline Model w. Survey Comprehension	(3) Baseline Model w. Survey Comfort	(4) Baseline Model w. Number Present During Survey
Messaging Exposure	0.0936***	0.0936***	0.0933***	0.0932***
	(0.0150)	(0.0150)	(0.0150)	(0.0150)
SUMMARY STATISTICS				
Outcome Mean	0.482	0.482	0.482	0.482
Outcome SD	0.500	0.500	0.500	0.500
PARAMETERS				
District + Wave Fixed Effects	Yes	Yes	Yes	Yes
Demographic Controls	Yes	Yes	Yes	Yes
Village Insecure	Yes	Yes	Yes	Yes
Police Patrols Weekly	Yes	Yes	Yes	Yes
Govt. going Wrong Direction	Yes	Yes	Yes	Yes
Terr. Control (Govt./Ins./Mixed)	Yes	Yes	Yes	Yes
Survey Effects				
Understood Survey	No	Yes	Yes	Yes
Comfortable w. Survey	No	No	Yes	Yes
Number Present	No	No	No	Yes
MODEL STATISTICS				
N	24620	24620	24620	24620
Clusters	339	339	339	339

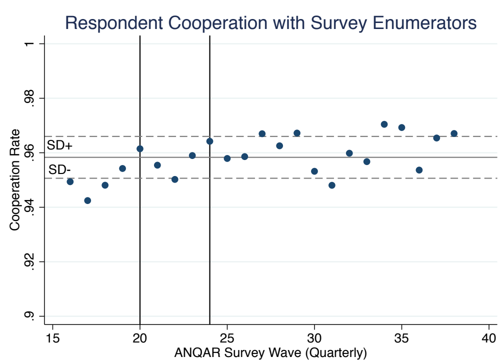
Notes: Outcome of interest is willingness to report insurgents planting IEDs. Unit of analysis is individual survey respondent. Baseline models include administrative district fixed effects (using ESOC boundaries), survey wave fixed effects, and demographic controls (age, education, gender, ethnicity, socio-economic status). See table notation for additional details. Standard errors are clustered at the district level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.



(a) Refusal rate



(b) Non-contact rate



(c) Cooperation rate

Fig. SI-2. ANQAR diagnostics during waves conducted by firm collecting Waves 20/24 survey data (ACSOR). Data on refusal, non-contact, and overall cooperation were shared with the authors by NATO. Authors' own calculations.

Table SI-8. Estimating treatment effect bounds using the Oster coefficient stability test

		Panel A: Baseline Regression Diagnostic Information	
		(1)	(2)
Treatment Variable	Outcome Variable	Baseline effect (Std. error), [R^2]	Controlled effect (Std. error), [R^2]
Messaging	IED Reporting	0.172*** (0.0328) [0.025]	0.0936*** (0.0150) [0.248]

		Panel B: Oster Coefficient Stability Test Results	
		(3)	(4)
Treatment Variable	Outcome Variable	Effect for R_{max} (($\beta_{R_{max}}$ - $\beta_{ctrl})^2$) [R_{max}]	Alt. Effect for R_{max} (($\beta_{R_{max}}$ - $\beta_{ctrl})^2$) [R_{max}]
Messaging	IED Reporting	0.0378 (.00311) 0.375]	3.172 (9.48) [0.375]

Notes: Bounds for treatment effects are estimated using the Oster coefficient stability test (23). R_{max} set at 1.5 (exceeds 1.3 threshold in (23)). Model specifications are drawn from least and most conservative main specifications. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table SI-9. Survey Instruments Overview

Variable	**Question**	**Coding** (= 1 if)
IED tips	If you knew that an IED had been planted, how likely would you be to report it to the local security forces?	Very likely
Messaging Exposure	In the last six months, have you seen or heard any signs, announcements, radio advertisements, or television advertisements about IEDs?	Yes
Force Effectiveness	Tell me, how capable are the Police of protecting your mantaqa? Are they very capable, somewhat capable, somewhat incapable, or very incapable?	Very capable
Govt. Avoid Harm	Do you think ANDSF does enough to prevent the killing or injuring of civilians? Do you think that ADNSF does a little to prevent killing and injuring of civilians? Or does ANDSF do nothing to prevent killing and injuring of civilians?	Insurgent (AGE)
Govt. Inst. Use	If you had a legal dispute, would you take it to an Afghanistan state court or a local Shura/Jirga?	Government
Support Reintegrat.	If an insurgent were to stop fighting against the government and wanted to rejoin society, would you welcome him back to your mantaqa?	Yes
Village Insecure	How is the security situation in your mantaqa? Is it good, fair, or bad?	Bad
Police Patrols Weekly	How often do you see the Police in your mantaqa? Is it every day, once a week, 2-3 times a month, once a month, less than once a month, or never?	At least weekly
Govt. going Wrong Direction	Generally speaking, do you believe the Government of Afghanistan is going in the right direction, the wrong direction, or is in the same place, not going anywhere?	Wrong direction
Terr. Control (Govt.)	Between the two, the Anti-Government Elements (Mukhalafeen-e dawlat) and the Government, who has more influence in your mantaqa now?	Govt.
Terr. Control (Ins.)	Between the two, the Anti-Government Elements (Mukhalafeen-e dawlat) and the Government, who has more influence in your mantaqa now?	Ins.

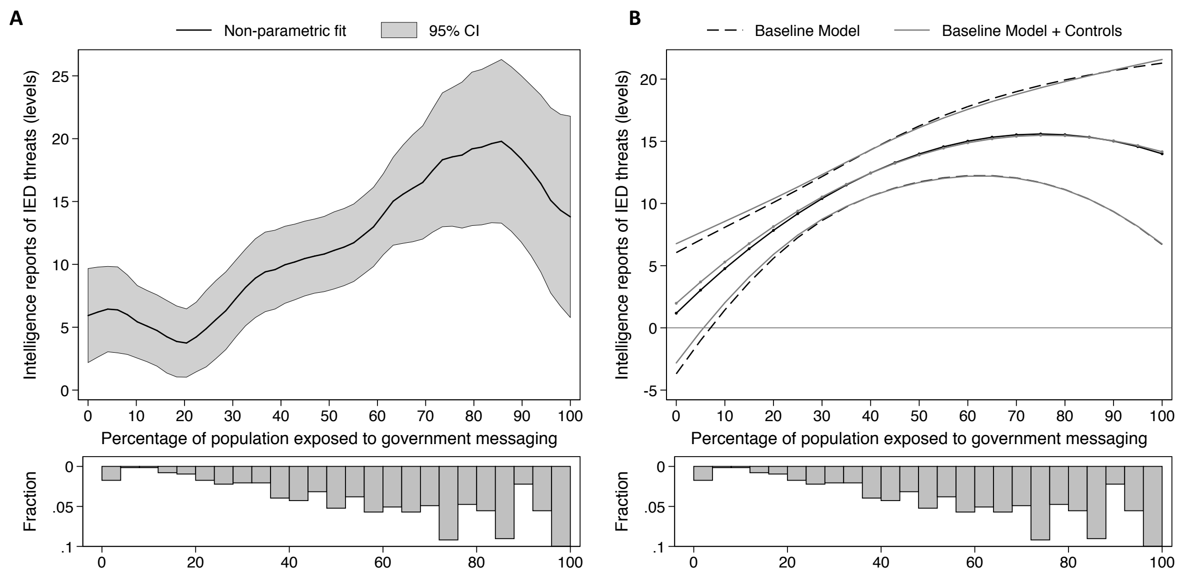


Fig. SI-3. Investigation of impact of information operations on field intelligence collected about roadside bombs. Data on intelligence records (SIGACTS) were declassified by the US Department of Defense and are calculated using the six month window prior to each survey wave (consistent with survey wording regarding messaging exposure). Data on messaging exposure is drawn from the ANQAR survey and calculated by district-wave as a percentage of the population reporting exposure. (A) Non-parametric estimates of relationship between aggregate psychological operations exposure and civilian tips about roadside bombs documented in military records. Histogram below plot. (B) Parametric regression estimates of impact of information operations on civilian collaboration with security forces. Black solid line indicates predicted values from non-linear regression with baseline control variables (black dashed lines indicate 95% confidence intervals). Gray solid line indicates predicted values from non-linear regression with baseline control variables and parameters accounting for intensity of insurgent combat operations (gray dashed lines indicate 95% confidence intervals). Histogram below plot.

Table SI-10. Impact of civilian tips on battlefield outcomes

	(1) Baseline Model Roadside Bombs Found/Cleared	(2) Baseline Model Weapon Caches Found/Cleared	(3) Baseline Model Tactical Safe House Raids	(4) Baseline Model Insurgents Captured and Detained
Tips about IED deployment, Lagged	0.0153**	0.0147***		
	(0.00777)	(0.00360)		
All Tactical Tips, Lagged			0.00289***	0.0421**
			(0.000849)	(0.0182)
SUMMARY STATISTICS				
Outcome Mean	0.236	0.0769	0.00689	0.0785
Outcome SD	1.187	0.583	0.106	0.491
PARAMETERS				
District Fixed Effect	Yes	Yes	Yes	Yes
Week Fixed Effect	Yes	Yes	Yes	Yes
IED Detonation Trends	Yes	Yes	Yes	Yes
Close Combat Trends	Yes	Yes	Yes	Yes
Remote Combat Trends	Yes	Yes	Yes	Yes
MODEL STATISTICS				
N	171936	171936	171936	171936
Clusters	398	398	398	398

Notes: Outcome of interest varies by column and is noted in each model heading: (1) roadside bombs found and neutralized (cleared); (2) weapon caches (depots) found and neutralized (cleared); (3) tactical safe house raids yielding actionable intelligence about insurgent operations; (4) insurgents captured and detained by security forces. In (1) and (2) the explanatory variable is the number of tips about IED deployment lagged by one week. In (3) and (4), we investigate the number of tactical tips (including all combat activity) lagged by one week. Unit of analysis is district-week from 2006 to 2014. Data on intelligence records and combat activity (SIGACTS) were declassified by the US Department of Defense. All models include district (unit) and week (time) fixed effects. See table notation for additional details. Standard errors are clustered at the district level and presented in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.