Online Appendix for
"Is the Phone Mightier than the Sword? Cell Phones and Insurgent Violence in Iraq"

June 6, 2014

Contents (listed in the order in which they are referenced in the main article)

A01. Figure: Cell phone-triggered IED

A02. Figure: Card advertising the tip line in Iraq

A card handed out by soldiers from the U.S. Army 3rd Infantry Division providing contact information for a government-run tip line. The card reads as follows:

> "Have you seen, heard or become aware of criminal activities or those hostile to Iraq? Do you wish you could do something about it? You can!! Talk anonymously and help your country by giving news about crimes or actions hostile to Iraq. Fulfill your duty to take care of your children, your loved ones and society. You may phone or text to this number: 07712477623. Give any information you want, no names needed. The way YOU can fight is by calling this number: 07712477623."

A03. Description of the expansion of Iraq's cell phone network

Since our analysis exploits the expansion of the network in Iraq to assess cellular communications' effects on violence, a close look at the micro-dynamics of network expansion is necessary and provides crucial background for our identification strategy. The following description is based on extended conversations with MEC Gulf, a consulting firm that advises cell phone companies on network expansion, as well as the chief technology officers for *Zain Iraq* and *Asiacell*, two of the three major telecommunications providers in Iraq. It represents a consensus view, though details varied across firms, over time, and between projects.

Development of the cellular communications network in Iraq was based on a phased approach in which firms first selected larger areas for expansion, and then chose specific sites for cell phone towers within these areas based on the practicalities of providing coverage at minimum cost. For both Zain and Asiacell, areas for expansion were selected on an annual basis (towards the end of each company's fiscal year) based on three core criteria: requirements to meet service standards in existing areas as usage picked up; demand for cell phone service (large population without service); and contiguity with pre-existing coverage areas. An area chosen for expansion would typically be a large town, such as Fallujah, which first received coverage in 2004, or a semi-rural area with a large number of small communities.

Once these larger areas were selected, the radio-frequency (RF) design teams would map out a coverage plan that met a number of criteria including minimizing the number of towers while maximizing coverage and backhaul capacity. Two factors made their task more challenging in Iraq. First, the network backhaul in Iraq—the transmission of signals from the tower to a switch and then back out to the appropriate tower—occurred mostly via microwave as the country had no fiber optic network. Towers were therefore placed more closely together than in other settings to avoid interference from the microwave signals between towers.[1] Second, the pervasive use of jammers in Iraq by both Coalition forces and civilians meant that the providers needed to broadcast a stronger signal to guarantee coverage inside buildings than would be the case in normal urban settings.

Taking these constraints into account, the RF design teams would identify search rings of approximately one block radius in a number of locations within the targeted areas. Within these rings, a site selection team would then identify two or three potential sites that were

[1] The microwave signals between towers are highly directional. If towers were placed too far apart, there would be interference in those signals between towers, as the beam from one tower to the other would spread beyond the width of the receiving antenna.

suitable for tower installation. These would typically be buildings that had a relatively unobstructed view, but at the same time could support the weight of a cell phone antenna and the supporting equipment (generator). Once a list of candidate buildings had been put together, the respective proprietor of the building or the landowner would be contacted regarding a possible lease by the site acquisition team. If a search ring were deemed to be in an inaccessible area, then the RF design team would typically need to identify new search rings for multiple towers, not just the one initially sited in an inaccessible area. Typically, it would take two to three months for the market research process of identifying target expansion areas, about a month for the RF design, and then another two to three months from the establishment of the initial search rings to the completion of the final site list with sites secured, leased and ready to build. The setup of towers themselves would take anything from a couple of days (for rooftop sites) to a few weeks (for ground towers in more rural areas).

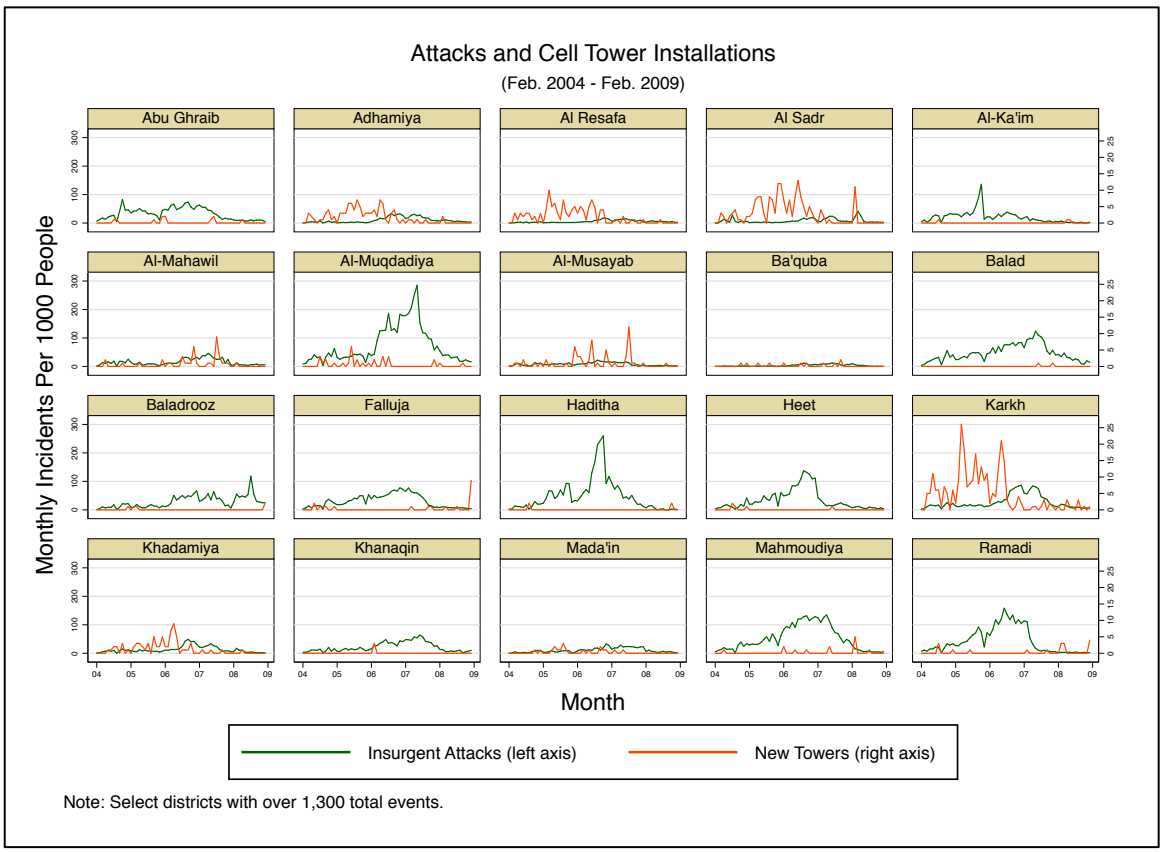
Figure 1 in the paper illustrates the expansion of the network graphically. Existing towers are shown in black, towers added in the respective year in red, and future towers in gray.

A04. Table: Descriptive statistics for the district-level data

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Panel A: Violence Variables					
SIGACTs / 100,000	3,780	13.21	34.92	0	481
Attacks / 100,000	3,780	12.04	32.82	0	453
Direct Fire / 100,000	3,780	3.25	10.26	0	156
IED Attempts /100,000	3,780	6.91	19.76	0	311
Sectarian Killings/100,000	3,780	1.79	6.63	0	170
Targeted Killings/100,000	3,780	0.648	4.74	0	170
Panel B: Control Variables					
New Towers	3,780	0.519	1.833	0	35
Total Towers Active	3,780	18.74	38.67	0	296
Population (1000)	3,780	327	320	11	1662
Proportion Sunni	3,780	0.243	0.355	0	1
Proportion Shia	3,780	0.742	0.371	0	1

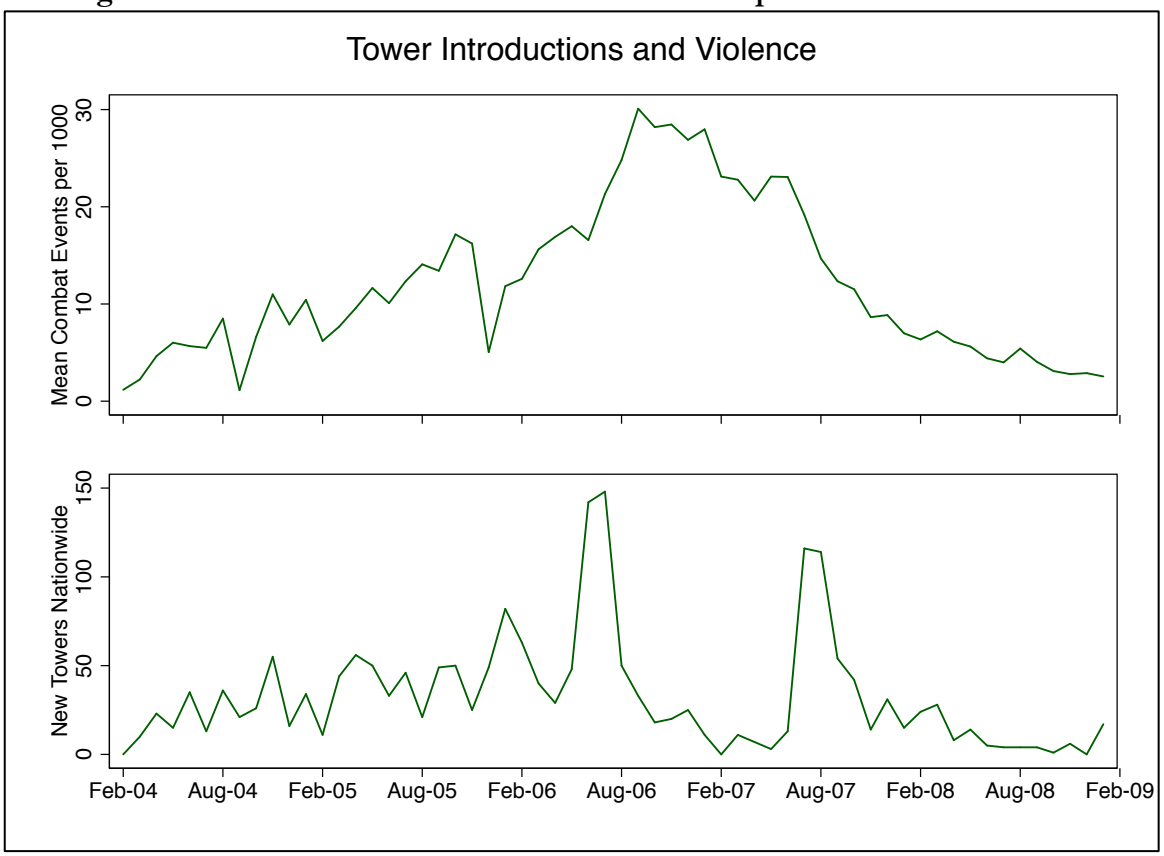
Notes: Unit of analysis for violence is district/month, February '04 – January '09. Violent events based on data on MNF-I SIGACT-III database. Civilian casualty data from Iraq Body Count collaboration with ESOC. Cell tower data provided by Zain Iraq. Population data from LandScan (2008) gridded population data and WFP surveys (2003, 2005, and 2007). Analysis restricted to 63 districts in which Zain operated during period under study.

A05. Figure: Patterns of violence and network expansion across Iraq's 20 most violent districts



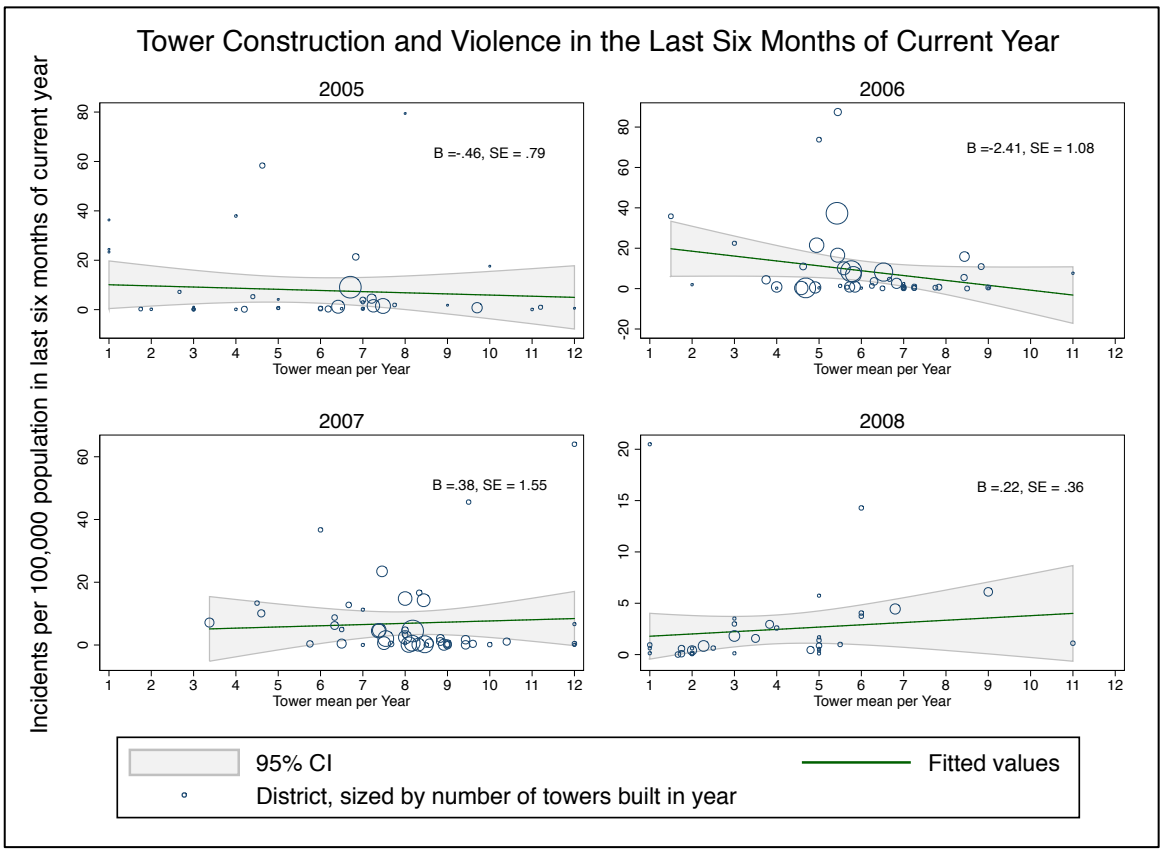
Note: Unit of analysis is the district month. Violence data are from MNF-I SIGACT-III database. Population data are from World Food Program Food Security and Vulnerability Analysis surveys fielded in 2004:I, 2005:II, and 2007:I. Data on cell phone tower installations provided by Zain Iraq. Tarmia dropped for scale reasons as it was major outlier on per-capita violence. Basrah dropped for scale as it had 35 towers installed in July 2006.

A06. Figure: National trends in violence and network expansion



Note: Unit of analysis is the month. Violence data are from MNF-I SIGACT-III database. Population data are from World Food Program Food Security and Vulnerability Analysis surveys fielded in 2004:I, 2005:II, and 2007:I. Data on cell phone tower installations provided by Zain Iraq.

A07. Figure: Relationship between Current Year Violence and Tower Construction at District Level



Note: Unit of analysis is the district. Violence data are from MNF-I SIGACT-III database. Data on cell phone tower installations provided by Zain Iraq. Population data from Landscan (2008) gridded population data.

A08. Table: Relationship between violence and average month of tower introduction

Panel 1: DV = Aggregate Violence in July-December of Previous Year	Panel 1A: Bivariate Regression	Full Sample	2005	2006	2007	2008
	July-December Violence	0.299	0.254	-0.937*	-1.034	1.561
		(0.55)	(0.38)	(0.48)	(2.36)	(1.45)
	Observations	177	44	49	48	36
	R-squared	0.00	0.01	0.09	0.01	0.04
	Panel 1B: Sect Fixed Effects					
	July-December Violence	0.219	0.283	-0.731	-0.250	-2.138
		(0.46)	(0.19)	(0.79)	(2.15)	(3.01)
	Observations	177	44	49	48	36
	R-squared	0.32	0.39	0.44	0.49	0.42
Panel 2: DV = Aggregate Violence in January-July of Current Year	Panel 2A: Bivariate Regression	Full Sample	2005	2006	2007	2008
	January-June Violence	0.662	0.143	-1.721*	0.663	0.969*
		(0.63)	(0.54)	(0.87)	(3.09)	(0.55)
	Observations	177	44	49	48	36
	R-squared	0.01	0.00	0.08	0.00	0.11
	Panel 2B: Sect Fixed Effects					
	January-June Violence	0.593	0.296	-1.342	2.015	-0.279
		(0.68)	(0.32)	(1.46)	(3.02)	(0.69)
	Observations	177	44	49	48	36
	R-squared	0.29	0.47	0.44	0.39	0.44
Panel 3: DV = Aggregate Violence in July-December of Current Year	Panel 3A: Bivariate Regression	Full Sample	2005	2006	2007	2008
	July-December Current Year Violence	-0.0707	-0.465	-2.413**	0.383	0.223
		(0.40)	(0.79)	(1.09)	(1.55)	(0.36)
	Observations	177	44	49	48	36
	R-squared	0.00	0.01	0.06	0.00	0.02
	Panel 3B: Fixed Effects					
	July-December Current Year Violence	-0.141	-0.157	-1.829	0.874	-0.614
		(0.32)	(0.40)	(2.01)	(1.56)	(0.81)
	Observations	177	44	49	48	36
	R-squared	0.29	0.56	0.47	0.36	0.40

Note: Robust standard errors in parentheses for all regressions, clustered by sectarian region for regressions with sect fixed-effects. Sect fixed effects account for distinct mean levels of violence in 9 Sunni/Kurd districts, 13 mixed districts, and 41 majority Shia districts. 75 of 252 district-years had no towers introduced and so are not included in regressions, representing 40 different districts of which 9 are predominantly Sunni or Kurdish, 7 are mixed, and 24 are predominantly Shia. Constants not reported. *** p<0.01, ** p<0.05, * p<0.1.

A09. Table: Descriptive statistics for the tower-level data (15-day periods)

Variable	Observations	Mean	Std. Dev.	Minimum	Maximum
Panel A: Violence Variables – Full Sample					
SIGACTs	29,744	8.94	15.20	0	224
Direct Fire	29,744	3.60	7.15	0	127
Indirect Fire	29,744	0.40	1.89	0	50
IEDs	29,744	4.09	7.39	0	127
Panel B: Tower Areas Characteristics – Full Sample					
Area (km²)	1,859	88.7	118	50	449
Proportion New	1,859	0.13	0.28	0	1
Population	1,859	354,041	308,394	0	1,445,185
Proportion Urban	1,859	0.92	0.27	0	1
Proportion Sunni	1,859	0.22	0.26	0	1
Proportion Shia	1,859	0.78	0.26	0	1
Panel C: Violence Variables – Less than 50% New					
SIGACTs	26,368	9.87	15.77	0	224
Direct Fire	26,368	4.00	7.46	0	127
Indirect Fire	26,368	0.44	1.99	0	50
IEDs	26,368	4.50	7.68	0	127
Panel D: Tower Areas Characteristics – Less than 50% New					
Area (km²)	1,648	67.40	81.67	49.9	449
Proportion New	1,648	0.03	0.08	0	0.49
Population	1,648	394,147	303,957	3,770	1,445,185
Proportion Urban	1,648	0.97	0.19	0	1
Proportion Sunni	1,648	0.22	0.24	0	1
Proportion Shia	1,648	0.78	0.24	0	1
Panel E: Violence Variables – More than 50% New					
SIGACTs	3,376	1.68	5.77	0	78
Direct Fire	3,376	0.53	2.15	0	33
Indirect Fire	3,376	0.12	0.76	0	17
IEDs	3,376	0.89	3.04	0	42
Panel F: Tower Areas Characteristics – More than 50% New					
Area (km²)	211	255.4	200.2	49.9	449
Proportion New	211	0.87	0.16	0.50	1
Population	211	39,113	68,149	0	496943.00
Proportion Urban	211	0.54	0.50	0	1
Proportion Sunni	211	0.25	0.38	0	1
Proportion Shia	211	0.74	0.38	0	1

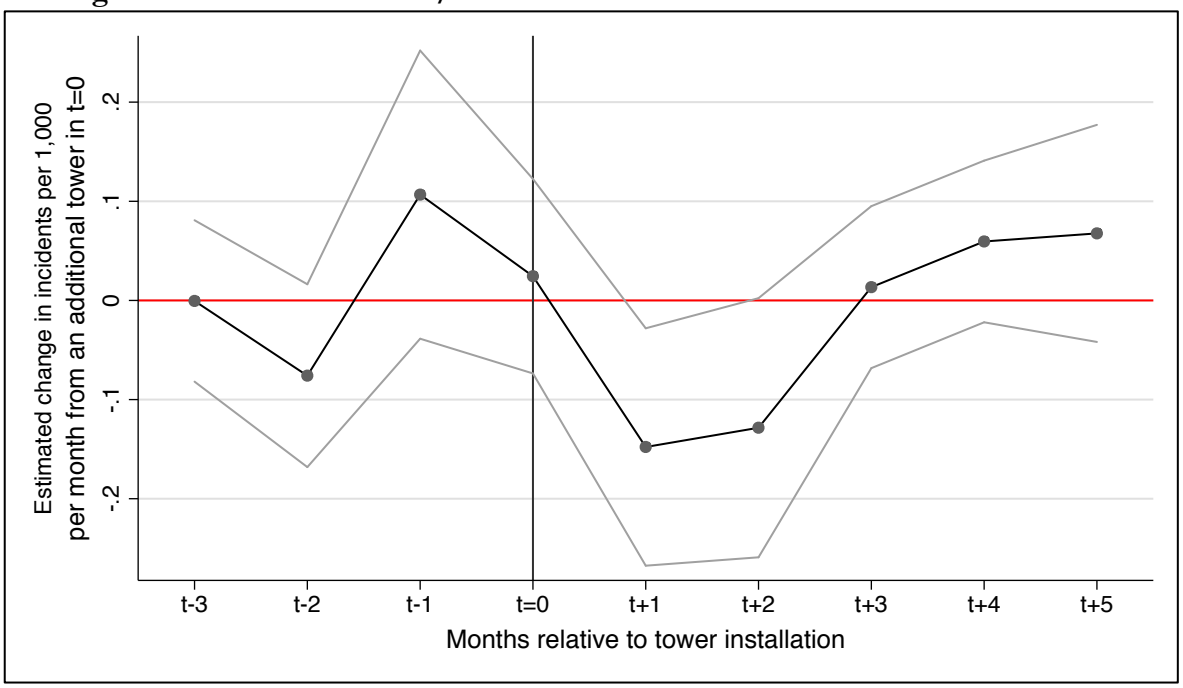
Notes: Unit of analysis for violence is tower/15-day period. Tower coverage areas created by a 4km radius around cell phone towers in urban areas and 12km radius in rural areas. Violent events based on data on MNF-I SIGACT-III database. Cell tower data provided by Zain Iraq. Population data from LandScan (2008) and gridded population data. Includes only towers with at least 8 periods before and after onair date.

A10. Table: Regression results with spatial lag

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable:	FD of SIG /100,000						
Lagged FD of Tower Count	-0.0719	-0.0812	-0.108*	-0.140**	-0.0841	-0.0916	-0.180*
	(0.048)	(0.049)	(0.056)	(0.069)	(0.054)	(0.056)	(0.097)
Existing Tower Count	0.0384***	0.0379***	0.0323***	0.0323***	0.0366***	0.0341***	0.0344***
	(0.0091)	(0.0090)	(0.0079)	(0.0080)	(0.0083)	(0.0080)	(0.0087)
Observations	3654	3654	3654	3654	3654	3654	3654
R-squared	0.09	0.10	0.12	0.12	0.10	0.12	0.14
Time FE	Half	Quarter	Month	Month	Sect X Half	Sect X Quarter	Province X Quarter
Space FE	No	No	No	District	No	No	No
First Differences	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Analysis restricted to 63 districts in which Zain Iraq operated during period under study. Robust standard errors, clustered at the district level in parentheses. Spatial lags are total of given variable in neighboring districts, Each model's fixed effects are noted. Estimates which are significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***). Violent events based on data on MNF-I SIGACT-III database. Cell tower data provided by Zain Iraq. Population data from LandScan (2008) gridded population data and WFP surveys (2003, 2005, and 2007).

A11. Figure: Duration of District/Month Effects



Notes: Coefficient estimates and 90% confidence interval from estimating equation 1 on various leads and lags of changes in SIGACTs per 1,000 population. Analysis restricted to 63 districts in which Zain Iraq operated during period under study. Robust standard errors, clustered at the district level calculated. Violent events based on data on MNF-I SIGACT-III database. Cell tower data provided by Zain Iraq. Population data from LandScan (2008) gridded population data and WFP surveys (2003, 2005, and 2007).

A12. Checking for omitted variable bias in the tower-level results

To enhance our confidence that our results are not driven by omitted variables we use temporal and geographic placebo tests. Table A12A below places the number of new towers introduced in the next month on the RHS (the lead difference) and Table A12B places the number of towers introduced in neighboring districts on the RHS (the spatial lag of the lagged difference). None of the coefficients are significant in the differenced specifications, providing additional confidence that the combination of differencing and fixed effects in Table 1 properly identify the impact of tower construction at the district-month level.

Table A12A. Temporal Placebo Test of Impact of Increased Cell Phone Coverage on Total Attacks

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable:	FD of SIG /100,000	FD of SIG /100,000	FD of SIG /100,000	FD of SIG /100,000	FD of SIG /100,000	FD of SIG /100,000	FD of SIG /100,000
Lead FD of Tower Count	0.0148	0.00348	0.0728	0.0948	-0.00794	-0.0351	-0.115
	(0.048)	(0.052)	(0.064)	(0.081)	(0.050)	(0.053)	(0.10)
Observations	3654	3654	3654	3654	3654	3654	3654
R-squared	0.01	0.02	0.07	0.07	0.05	0.07	0.09
Time FE	Half	Quarter	Month	Month	Sect X Half	Sect X Quarter	Province X Quarter
Space FE	No	No	No	District	No	No	No
First Differences	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Analysis restricted to 63 districts in which Zain Iraq operated during period under study. Robust standard errors, clustered at the district level in parentheses. Each model's fixed effects are noted. Estimates which are significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***). Violent events based on data on MNF-I SIGACT-III database. Cell tower data provided by Zain Iraq. Population data from LandScan (2008) gridded population data and WFP surveys (2003, 2005, and 2007).

Table A12B. Geographic Placebo Test of Impact of Increased Cell Phone Coverage on Total Attacks

Dependent Variable:	(1) FD of SIG /100,000	(2) FD of SIG /100,000	(3) FD of SIG /100,000	(4) FD of SIG /100,000	(5) FD of SIG /100,000	(6) FD of SIG /100,000	(7) FD of SIG /100,000
Lagged FD of Tower Count in Neighboring Districts	-0.158	-0.185	-0.217	-0.285	-0.126	-0.106	-0.236
	(0.14)	(0.19)	(0.25)	(0.34)	(0.16)	(0.16)	(0.42)
Observations	3654	3654	3654	3654	3654	3654	3654
R-squared	0.01	0.02	0.12	0.12	0.04	0.07	0.07
Time FE	Half	Quarter	Month	Month	Sect X Half	Sect X Quarter	Province X Quarter
Space FE	No	No	No	District	No	No	No
First Differences	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Analysis restricted to 63 districts in which Zain Iraq operated during period under study. Robust standard errors, clustered at the district level in parentheses. Each model's fixed effects are noted. Estimates which are significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***). Violent events based on data on MNF-I SIGACT-III database. Cell tower data provided by Zain Iraq. Population data from LandScan (2008) gridded population data and WFP surveys (2003, 2005, and 2007).

A13. Checking for the direct impact of violence on future tower construction

While we argued that there should be little impact of violence on future tower construction given that the cell phone providers reported insurgent violence did not interfere with tower construction, violence might impact tower construction in less direct ways. The providers reported that the main source of month-to-month delays in tower construction arose from the need to secure clear title to properties before building. Past sectarian violence, which is weakly correlated with insurgent attacks ($\rho = .203$), clearly drove population movements which likely made it harder to secure clear title to desired tower locations, thereby delaying tower construction. If that dynamic introduced bias into our estimates we should find that controlling for various kinds of sectarian violence alters the results. Table A13 shows this is not the case. Panel (A) reports the core specification of columns (6 and 7) from table (2), Panel (B) controls for total sectarian violence in a number of ways, and Panel (C) controls for targeted killings by sectarian organizations. None of the controls significantly alter our estimates of the impact of cellular coverage, providing additional confidence in the estimates in Table 1.

Table A13. Impact of Increased Cell Phone Coverage on Total Attacks controlling for Past Sectarian Violence

Dependent Variable: First Differences in SIGACTs/100,000	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Panel A: Core Specifications		*Panel B: Controls for Total Sectarian Violence*			*Panel B: Controls for Targeted Killings by Sectarian Militias*		
Lagged FD of Towers	-0.116**	-0.151**	-0.143**	-0.137*	-0.166**	-0.146**	-0.144**	-0.167**
	(0.056)	(0.070)	(0.070)	(0.069)	(0.072)	(0.071)	(0.071)	(0.073)
FD of Sectarian Violence	0.0259	0.0260	0.00946	-0.0392		0.0273	-0.0307	
	(0.031)	(0.031)	(0.048)	(0.051)		(0.045)	(0.061)	
Lagged FD of Sectarian Violence			-0.0347	-0.112		0.00724	-0.0797	
			(0.047)	(0.072)		(0.055)	(0.098)	
Second Lag FD of Sectarian Violence				-0.114			-0.117	
				(0.069)			(0.084)	
Sectarian Violence 3-Month Lagged Moving Average Lag					-0.143**			-0.209
					(0.066)			(0.15)
Observations	3717	3717	3717	3654	3654	3654	3654	3654
R-squared	0.28	0.28	0.31	0.01	0.01	0.03	0.06	0.07
Time FE	Month	Month	Month	Month	Month	Month	Month	Month
Space FE	No	District	District	District	District	District	District	District
Sectarian FE	Yes	Yes	2 Lags	3 Lags	Lagged Moving Avg.	2 Lags	3 Lags	Lagged Moving Avg.
First Differences	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

Notes: Analysis restricted to 63 districts in which Zain Iraq operated during period under study. Robust standard errors, clustered at the district level in parentheses. Each model's fixed effects are noted. Estimates which are significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***). Violent events based on data on MNF-I SIGACT-III database.

A14. Checking for changes in insurgent effectiveness caused by cell phone coverage

Another possibility, that insurgents trade quality for quantity when coverage increases, does not impact the validity of our net reduced form estimates, but does raise the issue of what the results imply. If cell phone coverage allows insurgents to be more effective with fewer attacks, then the policy implications of our findings are the opposite of what a more straightforward interpretation would suggest. The question is thus whether enhanced coverage allows insurgent to substitute quantity for quality at rates that should call into question the assessment that fewer attacks indicate a harder operating environment for insurgents.

Unfortunately, checking for such substitution is not possible at the district-month level, as the SIGACT data do not include information on the consequences of attacks. What we can do is check whether there is substantial variation in the correlation between attack rates and casualty rates at the provincial level using the iCasualties.org data which give monthly figures for U.S. forces killed by province.[2] It turns out there is very little change over time in that relationship. The bivariate monthly correlation between total attacks and casualties is quite high, .61 for the entire period, and remains similarly strong by year, ranging from .51 in 2005 to .80 in 2007. Once we account for regional differences by using province fixed effects in a regression framework, the conditional correlation between casualties and total attacks is positive but statistically insignificant and does not change over time.[3] This consistency is hard to square with strong substitution effects, making us relatively confident that the reduced form relationship we identify shows that increased coverage makes it harder for insurgents to conduct attacks.

[2] For various tabulations of the data see www.iCasualties.org. We thank Radha Iyengar for providing these data in a readily usable Stata file.

[3] Formally, we allow the slope of the casualty-incident relationship to vary by year using interaction terms and find no statistically meaningful slope shifts by year.

A15. Table: District-level results dropping district/months with high coverage

Dependent Variable: Attacks/100,000	(1) All Attacks	(2) Direct Fire	(3) Indirect Attacks	(4) IED Attempts	(5) IEDs Cleared / Total Attempts
Panel A: Dropping districts once coverage reaches 75th percentile of coverage					
Tower First Differences	-0.31**	-0.14**	0.031*	-0.17**	0.0022
	(0.14)	(0.069)	(0.016)	(0.081)	(0.0089)
Observations	2741	2741	2741	2741	1011
R-squared	0.09	0.04	0.10	0.06	0.02
Panel B: Dropping districts once coverage reaches 50th percentile of coverage					
Tower First Differences	-0.49**	-0.27**	0.094**	-0.22	0.0062
	(0.22)	(0.12)	(0.045)	(0.13)	(0.017)
Observations	1830	1830	1830	1830	480
R-squared	0.10	0.07	0.12	0.07	0.06

Notes: Analysis restricted to 63 districts in which Zain operated during period under study. Robust standard errors, clustered at the district level in parentheses. All results include month and district fixed effects. Estimates which are significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***). Column (5) calculated only for period after September 2006 when data distinguish successful and failed IED attacks.

A16. Table: District-level results by attack type and sectarian region

Dependent Variable: Attacks/100,000	(1) All Attacks	(2) Direct Fire	(3) Indirect Attacks	(4) IED Attempts	(5) IEDs Cleared / Total Attempts
Panel A: Mixed Areas					
Tower First Differences	-0.251	-0.0836	-0.0007	-0.133	0.0096
	(0.19)	(0.077)	(0.0068)	(0.091)	(0.011)
Observations	580	580	580	580	580
R-squared	0.30	0.24	0.35	0.25	0.10
Panel B: Kurdish/Shia Areas					
Tower First Differences	-0.00960	-0.00668	0.00144	0.0237	-0.0010
	(0.058)	(0.027)	(0.0074)	(0.020)	(0.005)
Observations	2436	2436	2436	2436	1134
R-squared	0.10	0.08	0.10	0.04	0.04
Panel C: Sunni Areas					
Tower First Differences	-2.259*	-0.877**	0.133	-1.048	-0.0612
	(1.07)	(0.39)	(0.13)	(0.71)	(0.034)
Observations	638	638	638	638	297
R-squared	0.23	0.10	0.21	0.21	0.12
Panel D: Mixed and Sunni Areas Combined					
Tower First Differences	-0.496	-0.158	0.0130	-0.315*	-0.0035
	(0.29)	(0.12)	(0.015)	(0.16)	(0.012)
Observations	1218	1218	1218	1218	567
R-squared	0.18	0.08	0.16	0.15	0.04

Notes: Analysis restricted to 63 districts in which Zain operated during period under study. Robust standard errors, clustered at the district level in parentheses. All results include month and district fixed effects. Estimates which are significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***). Column (5) calculated only for period after September 2006 when data distinguish successful and failed IED attacks.

A17: Table: Impact of Introducing Cellular Communications for Tower Areas Dropping Intermediate Areas.

Panel A: Dropping Areas Between 10% and the Threshold – Counterfactual Excludes Towers Adding Between 10% and Threshold									
Coverage Threshold for `New' Towers	(1) 10%	(2) 20%	(3) 30%	(4) 40%	(5) 50%	(6) 60%	(7) 70%	(8) 80%	(9) 90%
Post	-0.068	-0.13	-0.14	-0.16	-0.14	-0.15	-0.16	-0.16	-0.17
	(0.20)	(0.20)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)	(0.21)
*Post*New*	-1.07***	-0.99***	-0.98**	-0.74**	-0.83**	-0.78**	-0.80**	-0.79**	-0.71*
	(0.32)	(0.38)	(0.41)	(0.36)	(0.34)	(0.36)	(0.37)	(0.38)	(0.43)
Observations	29,744	28,192	27,600	27,328	26,848	26,416	26,176	25,968	25,424
Number of Towers	1,859	1762	1725	1708	1678	1651	1636	1623	1589
R-squared	0.75	0.75	0.75	0.75	0.74	0.74	0.74	0.74	0.74
Panel B: Dropping Areas Between 0% and the Threshold – Counterfactual is Excludes Towers Adding Any New Coverage									
Post	0.11	0.020	0.0037	-0.028	-0.0026	-0.012	-0.016	-0.022	-0.042
	(0.25)	(0.25)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)	(0.26)
*Post*New*	-1.37***	-1.30***	-1.29***	-1.03**	-1.13***	-1.08**	-1.13***	-1.12**	-1.05**
	(0.36)	(0.42)	(0.46)	(0.42)	(0.40)	(0.42)	(0.43)	(0.44)	(0.50)
Observations	24,528	22,976	22,384	22,112	21,632	21,200	20,960	20,752	20,208
Number of Towers	1533	1436	1399	1382	1352	1325	1310	1297	1263
R-squared	0.75	0.75	0.75	0.75	0.73	0.73	0.73	0.73	0.73

Notes: Unit of analysis is tower areas for 15-day periods in relative time from tower onair date. Coverage areas created by a 4km radius around cell phone towers in urban areas and 12km radius in rural areas. Robust standard errors, clustered at the tower level in parentheses. All specifications include tower fixed effects. Estimates significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***). Violent Events based on data on MNF-I SIGACT-III database. Cell tower data provided by Zain Iraq. Population data from LandScan (2008).

A18. Table: Tower-level results by attack type and period

Dependent Variable:	(1) All Attacks	(2) Direct Fire	(3) Indirect Fire	(4) Total IED Attempts
Panel A: Excluding towers built 8/06 to 7/07				
Post	-0.69***	-0.41***	-0.094**	-0.18*
	(0.21)	(0.11)	(0.04)	(0.10)
*Post*New*	-0.52	-0.069	0.15**	-0.47***
	(0.32)	(0.17)	(0.06)	(0.14)
Observations	22144	22144	22144	22144
R-squared	0.72	0.61	0.34	0.76
Panel B: Dropping 2008				
Post	-0.38**	-0.28***	-0.056	-0.16*
	(0.18)	(0.1)	(0.04)	(0.09)
*Post*New*	-0.67*	-0.17	0.094*	-0.28**
	(0.36)	(0.19)	(0.05)	(0.13)
Observations	28208	28208	28208	28208
R-squared	0.79	0.69	0.31	0.82

Notes: Unit of analysis is tower areas for 15-day periods in relative time from tower onair date. Coverage areas created by a 4km radius around cell phone towers in urban areas and 12km radius in rural areas. New towers are those whose catchment is at least 20% new coverage. Robust standard errors, clustered at the tower level in parentheses. All specifications include tower and quarter fixed effects. Estimates significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***).

A19: Geographic Spillovers into 4km Ring Around Coverage Areas

Panel A: Baseline Displacement Model – No Controls for Attacks within Coverage Area					
Coverage Threshold for `New' Towers	(1) 10%	(2) 30%	(3) 50%	(4) 70%	(5) 90%
Post	-0.41 (0.42)	-0.57 (0.39)	-0.66* (0.38)	-0.68* (0.37)	-0.73** (0.36)
*Post*New*	-1.88*** (0.53)	-1.70*** (0.56)	-1.36** (0.56)	-1.46** (0.58)	-1.28** (0.62)
Observations	29,744	29,744	29,744	29,744	29,744
Number of Towers	1,859	1,859	1,859	1,859	1,859
R-squared	0.82	0. 82	0. 82	0. 82	0. 82
Panel B: Controlling for Attacks within Coverage Area					
Post	-0.41 (0.42)	-0.41 (0.33)	-0.45 (0.32)	-0.45 (0.31)	-0.48 (0.31)
*Post*New*	-1.88*** (0.53)	-0.86* (0.49)	-0.71 (0.45)	-0.88* (0.47)	-0.78 (0.53)
Observations	29,744	29,744	29,744	29,744	29,744
Number of Towers	1,859	1,859	1,859	1,859	1,859
R-squared	0.83	0.88	0.88	0.88	0.88

Notes: Unit of analysis is 4-km wide ring around tower areas for 15-day periods in relative time from tower onair date. Coverage areas area a 4km radius around cell phone towers in urban areas and 12km radius in rural areas. So the ring runs from 4-8km in urban areas and from 12-16km in rural ones. Robust standard errors, clustered at the tower level in parentheses. All specifications include tower and quarter fixed effects. Estimates significant at the 0.05 (0.10, 0.01) level are marked with at ** (*, ***).