Vaccines on the Move and the War on Polio

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The Spread of Diseases, a Global Health Cost

- The spread of diseases causes economic, social, and political disruption (Correia, Luck, and Verne, 2022)
- The movement of people and low vaccination rates facilitate the spread (Greenwood, 2014)

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How vaccination policies can reach the hard-to-reach populations?

This Paper

What impacts do IDPs inflows have on polio incidence in host districts?

Setting: internal displacement from the conflict in Pakistani FATA in 2008

Strategy: in a difference-in-differences, comparing new polio cases ...

- before and after 2008 + in districts closer and farther away from the conflict

Policy evaluation: vaccination program throughout IDPs' migration route

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Preview:

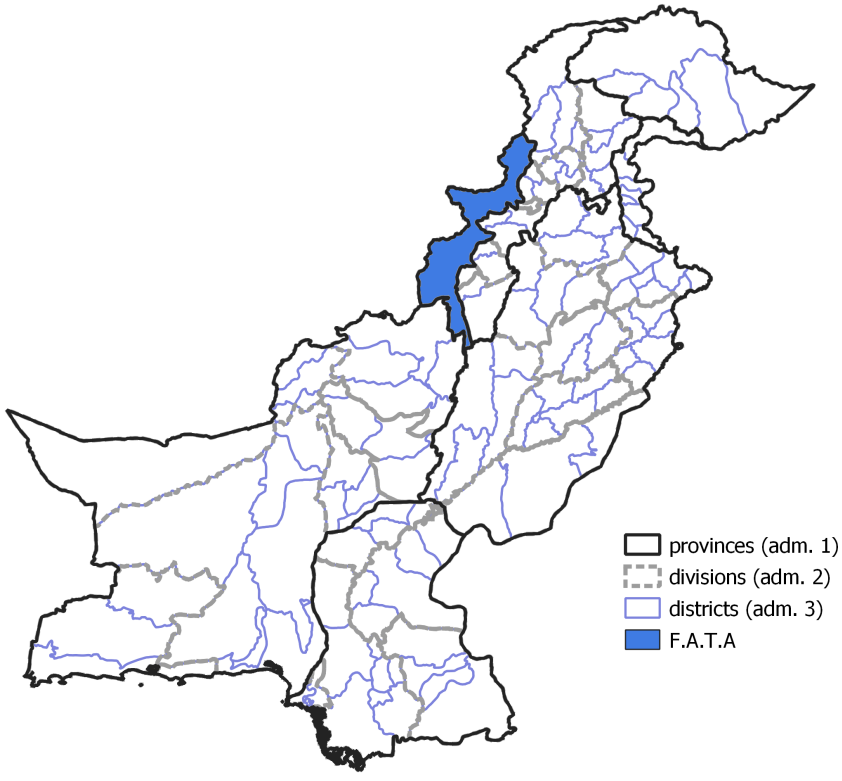
- $\uparrow$ IDPs inflow; $\uparrow$ new polio cases
- IDP children less likely to be vaccinated
- policy $\uparrow$ IDP children vaccination by 12.6% ($\rightarrow$ polio cases $\downarrow$) Contribution

This Presentation

1. **Setting**
2. Data & Methodology
3. Main Results
4. Policy Evaluation
5. Conclusion

FATA, Conflict-affected Region

Figure 1. Administrative division, Pakistan



- 64% of households are poor
- 97% lives in rural areas
- 99% speaks the Pashto language
- part of the historical *Pashtunistan*

Since 9/01, FATA-Pakistani region an scenario of conflict "against" the Taliban

Jump in Conflict = ↑ Displacement

* In 2008, a jump in conflict intensity → IDP crisis (45% of population fled)

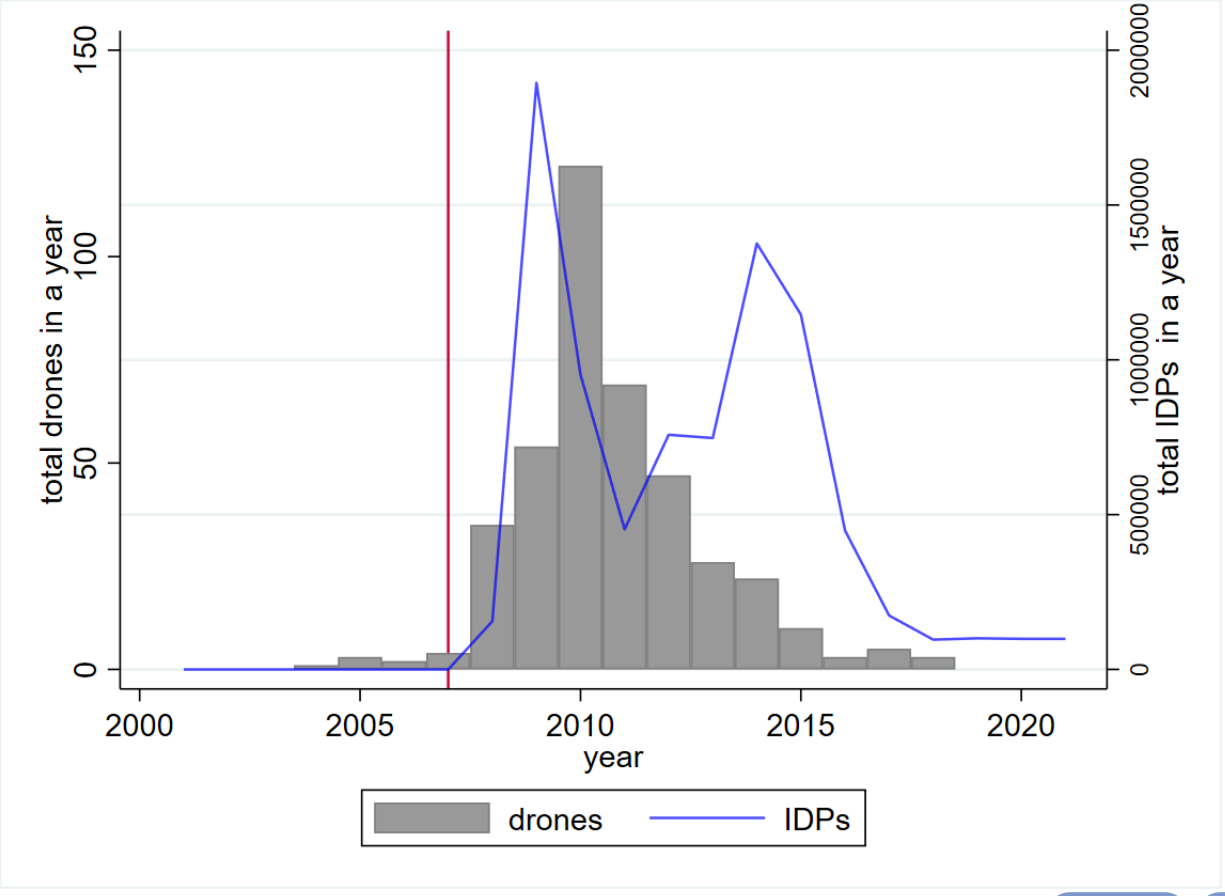


Figure 2. Total drone strikes and IDP population (2000-2022) Source: UNHCR drones attacks

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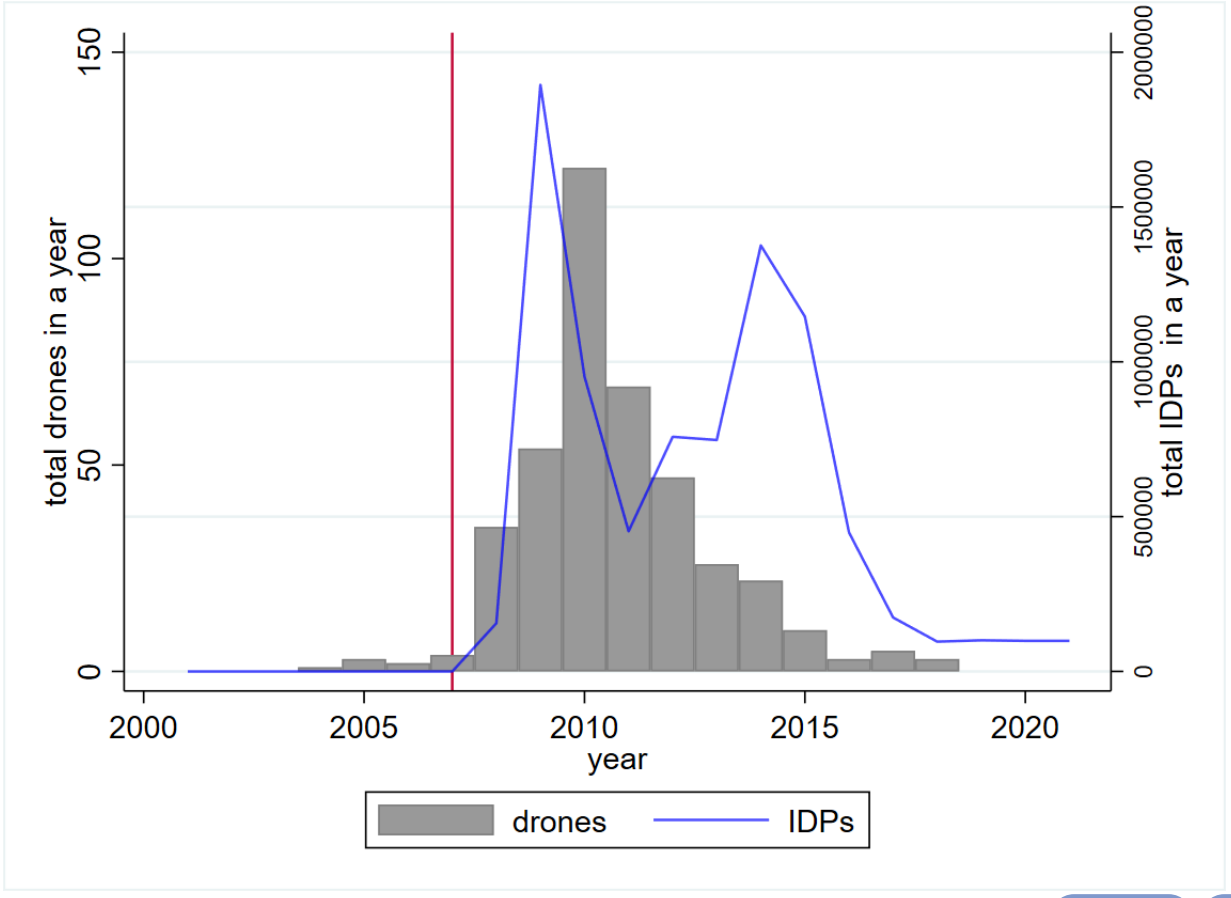

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IDP destinations (1) relatively close to FATA, (2) 90% in communities

Polio, an Infectious Viral Disease

- spread through person-to-person contact (fecal-oral or saliva route)

Figure 3. Polio transmission. Source: WHO Surveillance

- 25% of infected people have major symptoms (breathing, paralysis, etc.)

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- Polio status has changed in Pakistan:
  - 1,147 cases in 1997 (22% globally) to 28 in 2005
  - after 2007, 100 cases per year Plot

Vaccines Prevent Polio Spread

- 1st oral polio dose shortly after birth
- door-to-door visits as main vaccination strategy
  - target all children up to age 5, free of charge

Figure 4: Health workers vaccinating children against polio. Source. UNICEF

- Full vaccination coverage was 50.6 % in 2006–07, and 68.3 % in 2017–18

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Data

1. **Polio incidence at district-month level**
   - new polio cases and vaccination campaigns (2001-2022)
   - from the Global Polio Eradication Initiative in Pakistan

2. **Polio immunization at individual level**
   - vaccination, health-seeking behaviour, and migration (2006-2018)
   - from the Demographic Health Survey: 2006/07, 2012/13 and 2017/18

3. **Geo-localized conflict data**
   - drone location and death tolls from the New America (2004-2022)

4. **Displaced Population Inflows at the province-year level**
   - total IDPs and demographic characteristics from UNHCR (2008-2020)
   - + district level data for 2008

Two Sources of Variation

What impacts do IDP inflows have on polio incidence in host districts?

Difference-in-Differences comparing new polio cases...

1. Yearly variation: before and after the IDP crises in 2008
2. Distance variation: in districts closer and farther away from FATA border
   - closer districts $\rightarrow$ higher share of IDPs in a year Evidence

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Threat: districts receiving a higher and lower IDP share ...

- similar cultural/economic/political characteristics
- only the IDP inflow should change

Equation

Comparable Sample: districts in Pashtunistan

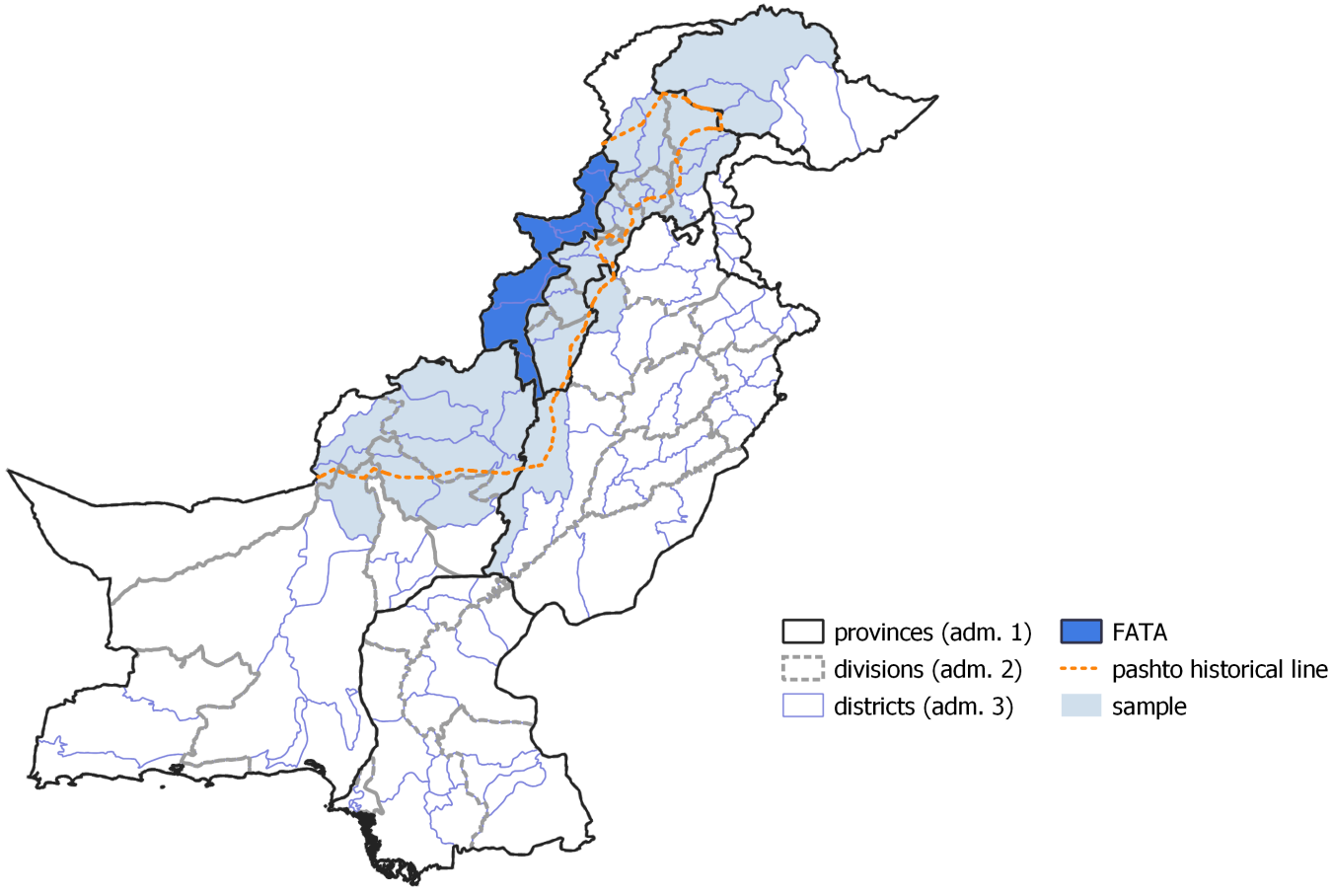

Figure 5. FATA and *Pashtunistan*. Source: UNHCR

Distance not correlated with economic, political, or cultural characteristics Show

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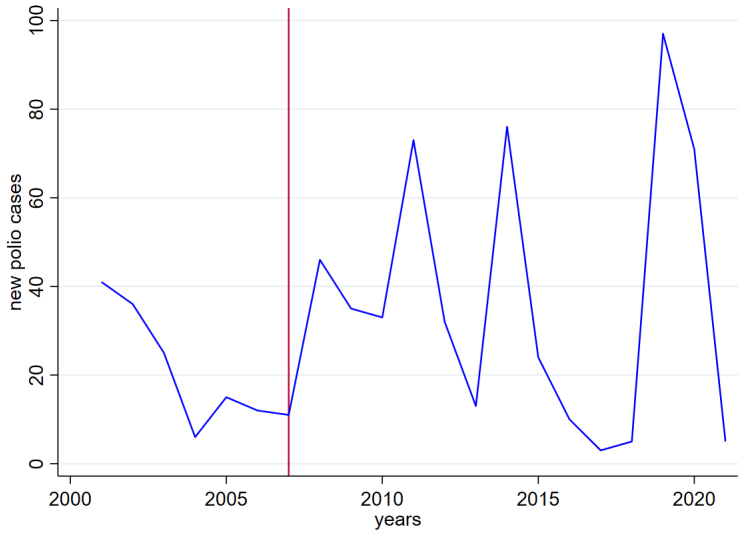
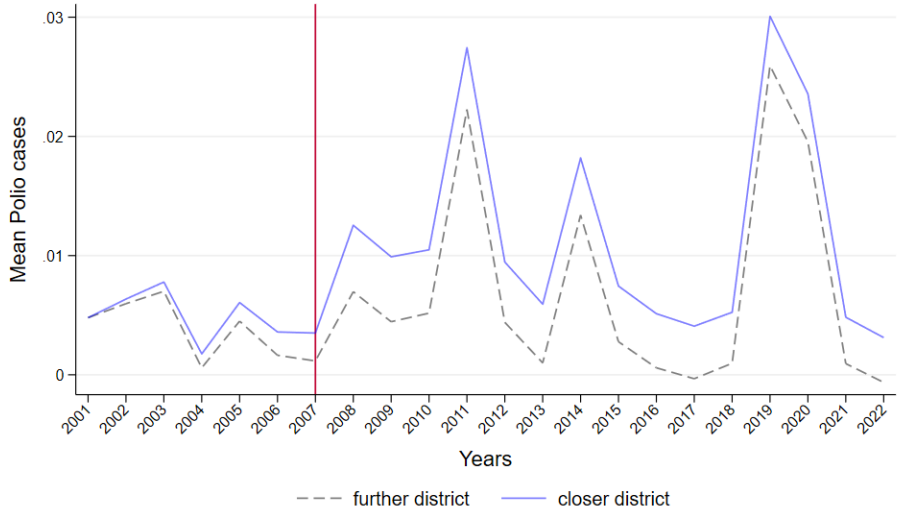
Raw Data: Increase in New Polio Cases...

Figure 6. Total polio cases in a year

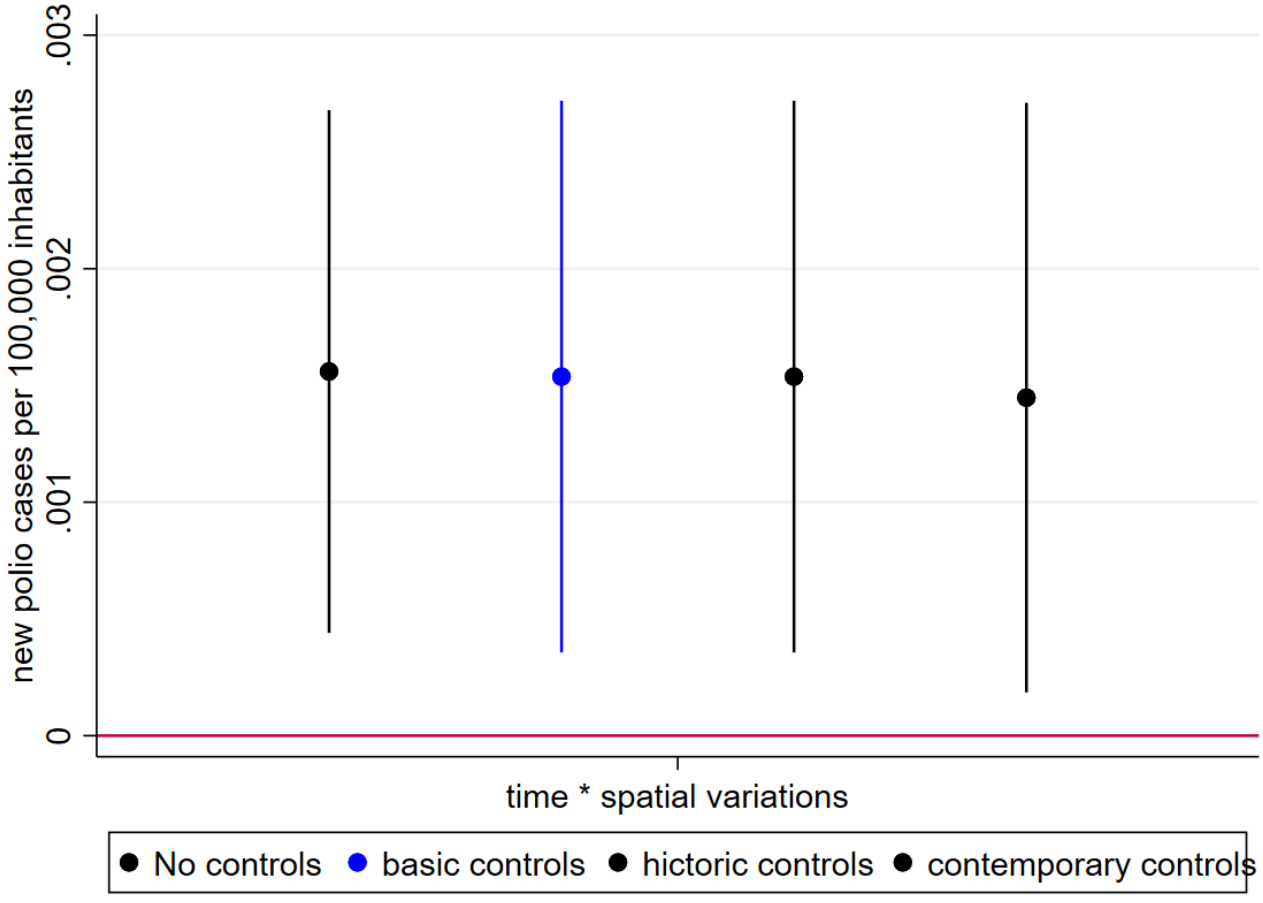




... after 2008 in closer compared to further districts

IDP Inflows Increase New Polio Cases

Figure 6. Effects on new polio cases per 100,000 inhabitants Table



– effects corresponds to a 30% of the mean incidence Surveillance

Threats to Identification

- ✓ Parallel trends Show
- ✓ Balance sample Show
- ✓ Conflict effect Show
- ✓ Afghan refugees Show
- ✓ Migration out-flows Show
- ✓ Polio vaccine mistrust Show

...more Checks

- ✓ Falsification test Show
- ✓ Alternative outcomes Show
- ✓ Sample definition Show
- ✓ Alternative specification Show
- ✓ Reverse causality Show

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Permanent Transit Vaccination program (PTPs)

- Launched in April 2012 by the GPEI
- Targets High-Risk Mobile Populations (nomads, IDPs, refugees, etc)
- Permanent vaccination spots across major population transit points
  - e.g. major roads, bridges, bus stops, borders, etc used by FATA-people
- Health workers are trained, adult males, and belongs to the community
- 1.7 million children vaccinated in 2018 (UNICEF, 2019)

Spatial exposure to PTPs

Data: vaccination points location for a subset of districts (6/39 districts)

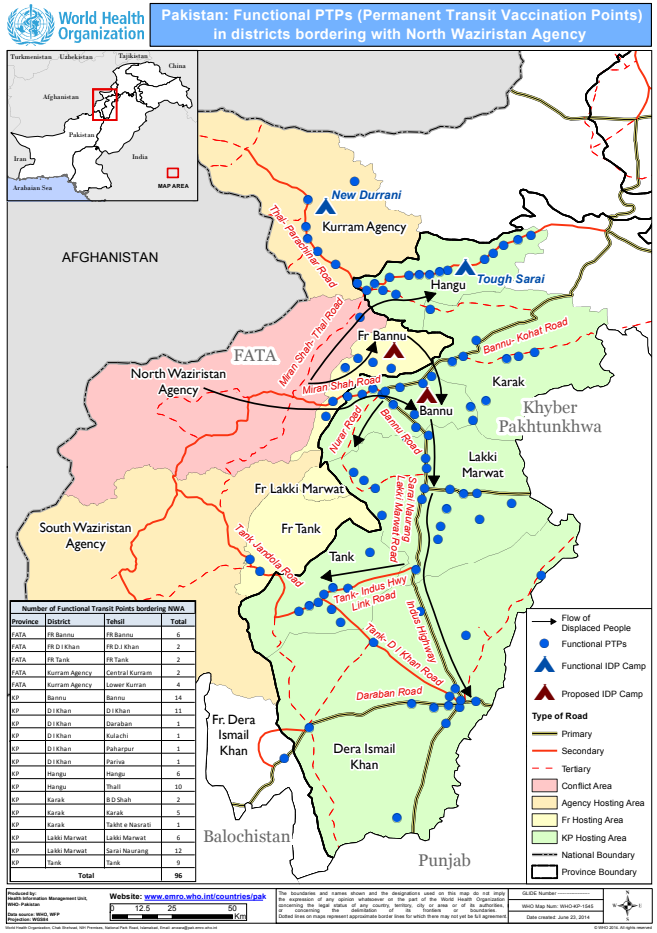

Figure 6: Permanent Transit Points (PTPs) location. Source. WHO

Approach: # PTPs (in districts and a 10km buffer from hh location)

Before policy: IDP children less likely to be vaccinated

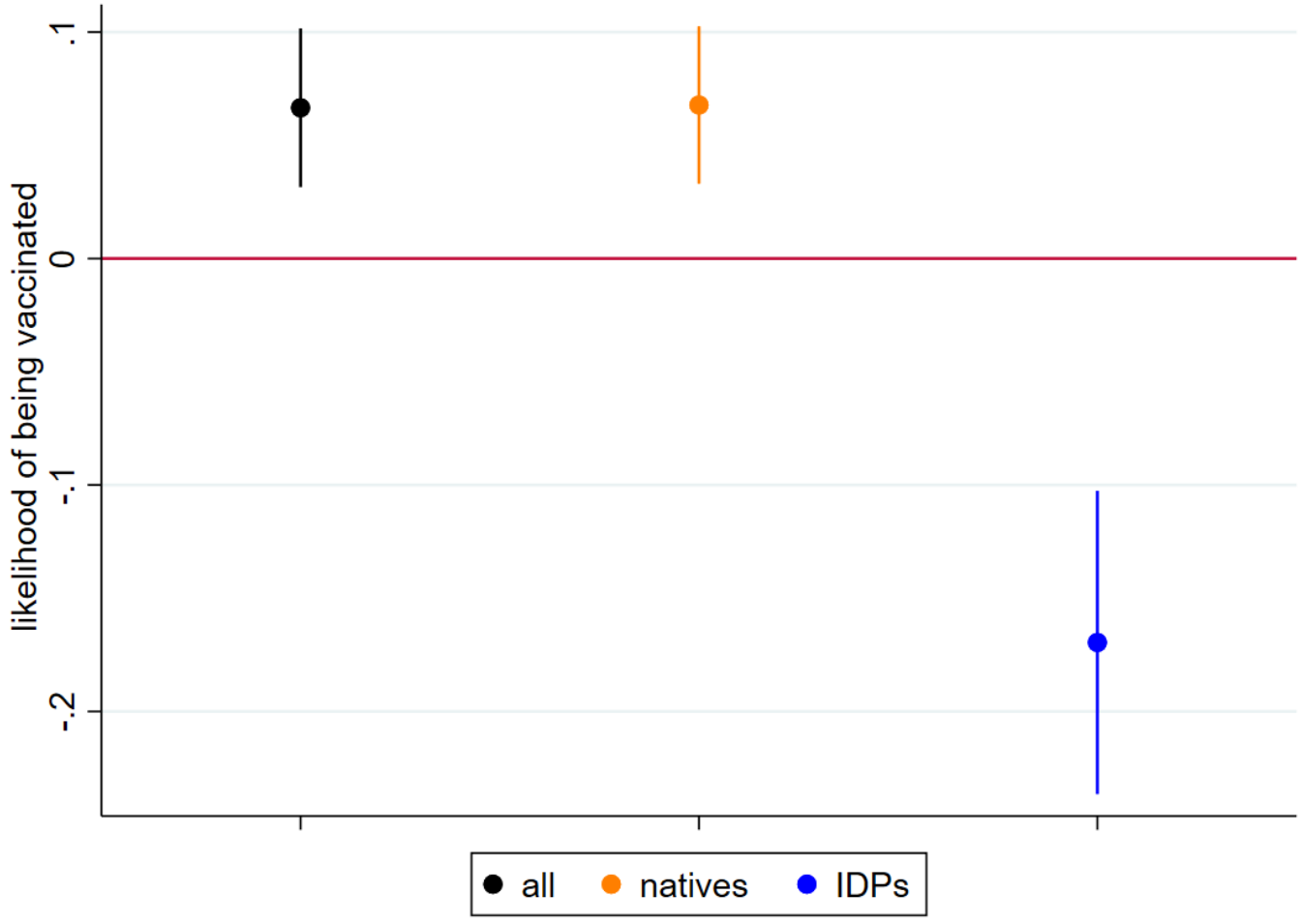

Figure 7: Vaccination within districts, children born before vs after 2007

Table Other mechanisms

After policy: vaccines ↑ among IDPs children

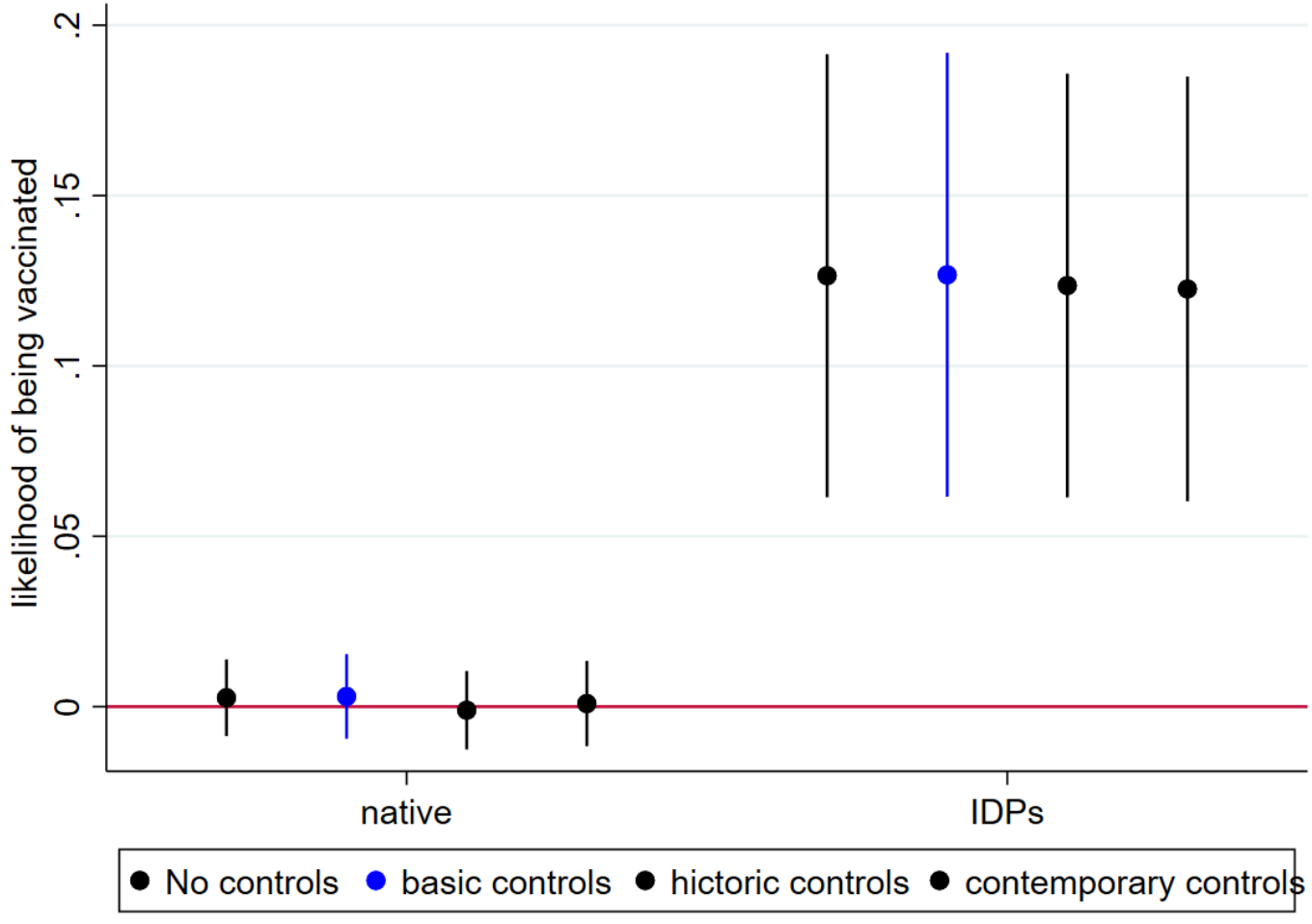

Figure 8: Number of PTPs and polio vaccination Table

After policy: polio cases "mitigation"

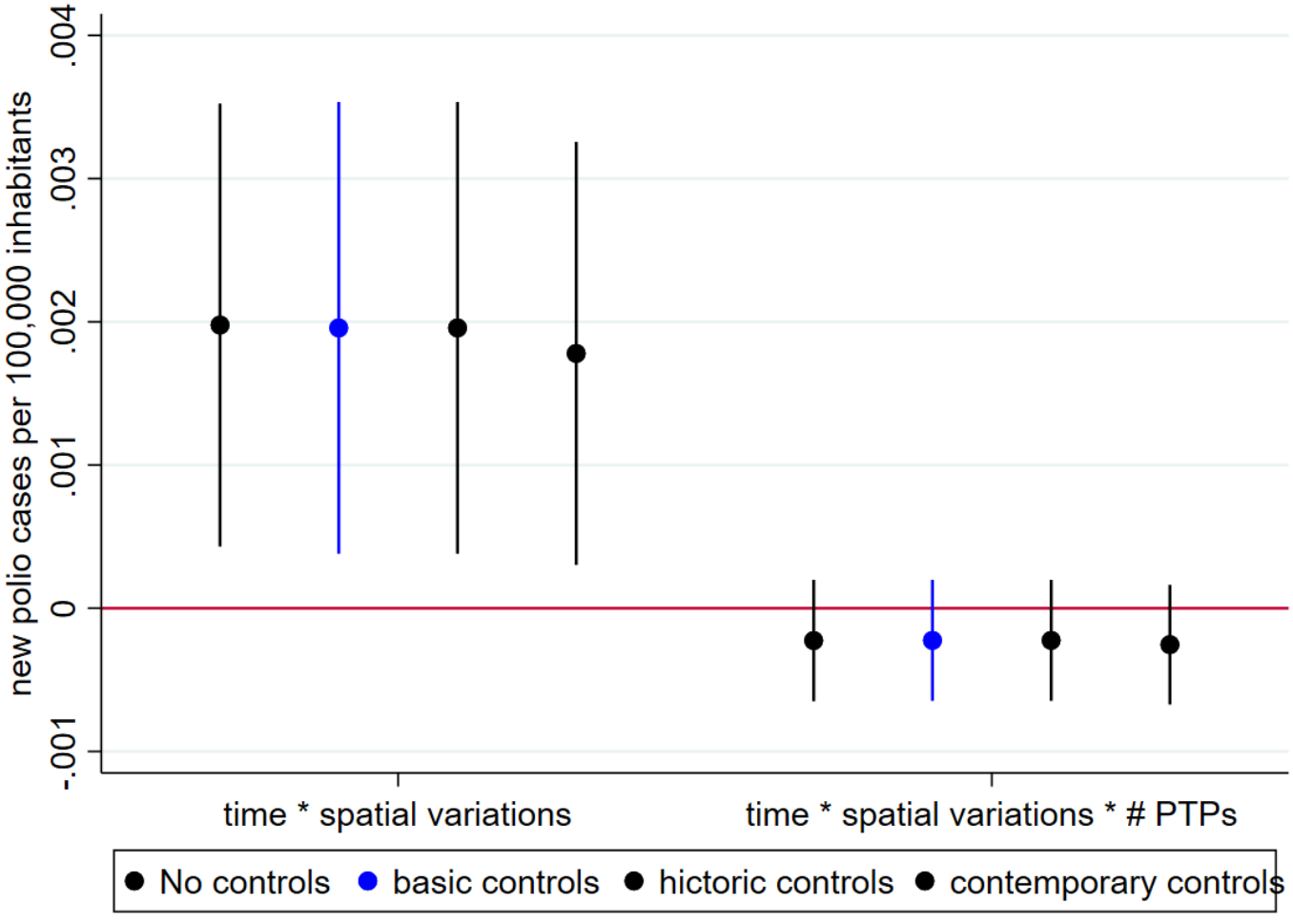

Figure 9: Number of PTPs and new polio cases Table

PTPs policy "success"?

- PTPs seems to succesfully target IDP children
- $\uparrow$ the likelihood of IDPs being vaccinated by 86% the mean
- Why? OPEN QUESTION!
  - 90% of IDPs in host communities $\rightarrow$ access to IDPs?
  - Supply in vaccines?
  - Community-engagement $\rightarrow$ trust $\uparrow$?
  - Vaccination timing (before arriving to host districts)?

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Takeaways

- IDP inflow $\uparrow \rightarrow$ new polio cases $\uparrow$ in host districts by a 30%
- Vaccinating children before they arrive to host com. mitigate the impacts
- Education and health implications for children (Kim,2024; UNICEF, 2023)
- Findings extend beyond Pakistan (e.g., Malawi, Mozambique, and Gaza)

My warmest thank you! l.munoz-blanco@exeter.ac.uk

Appendix

Contributions to the Literature

- **Consequences of forced displacement in host communities**
  (Ibanez, Rozo and Urbina, 2021; Baez, 2011; Montalvo and Reynal-Querol, 2007)

  Contribution: Setting (internal displacement + polio + endemic country)

- **Determinants of infectious diseases incidence**
  (Martinez-Bravo and Stegmann, 2021; Adda, 2016; Oster, 2012)

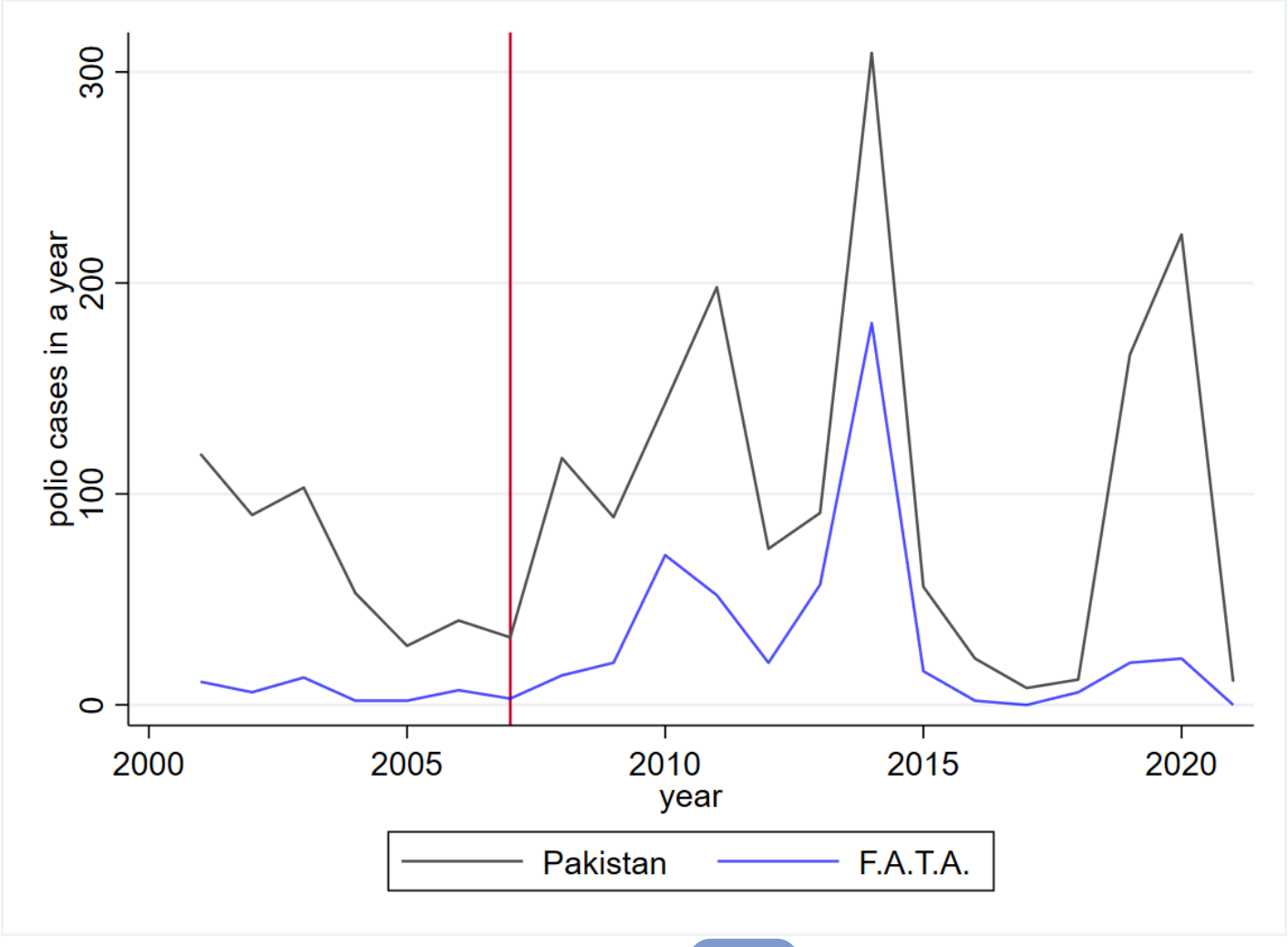
  Contribution: An unexplored angle of research (internal displacement)

  + In the future: Evaluating *Vaccinating children on the move* program

Back to Talk

An increase in polio cases after 2007

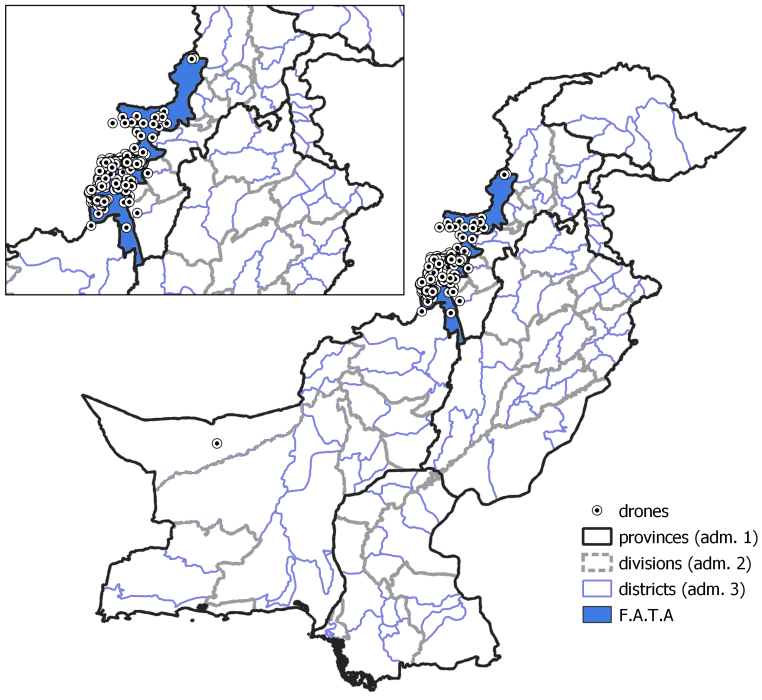
Figure A.1 New polio cases in a year (2001-2022) Source. GPEP



Source. WHO

Back

98% of drones striked in FATA



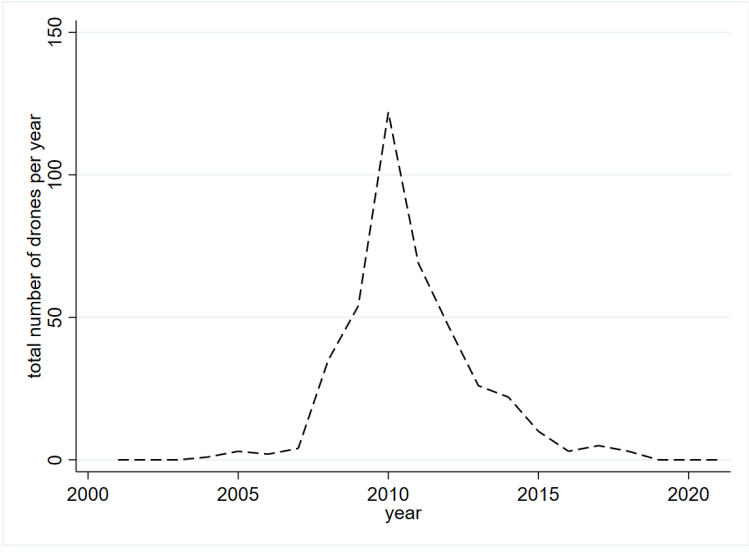
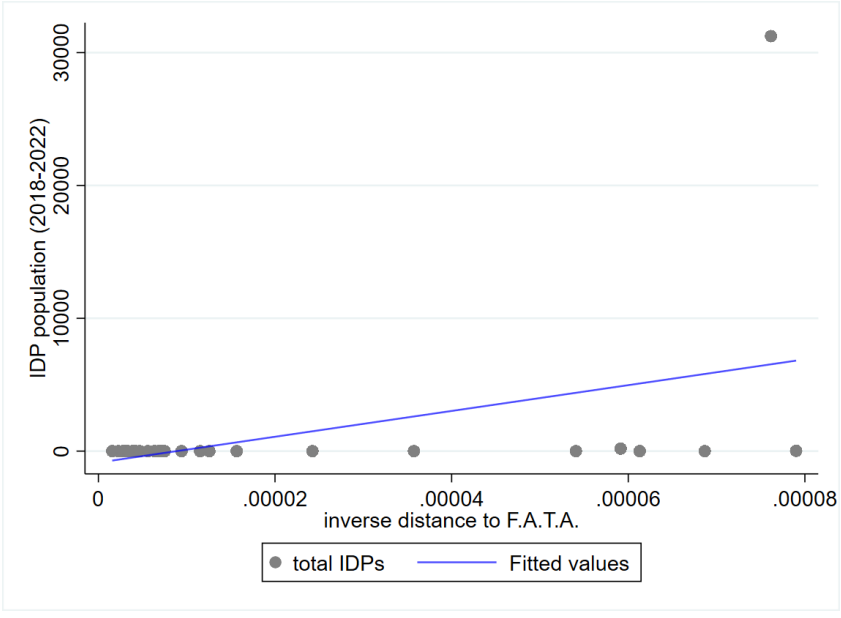


Figure A.2 U.S. Air and Drone Strikes in Pakistan (2001-2022). Source. New America

Predicted IDP inflow



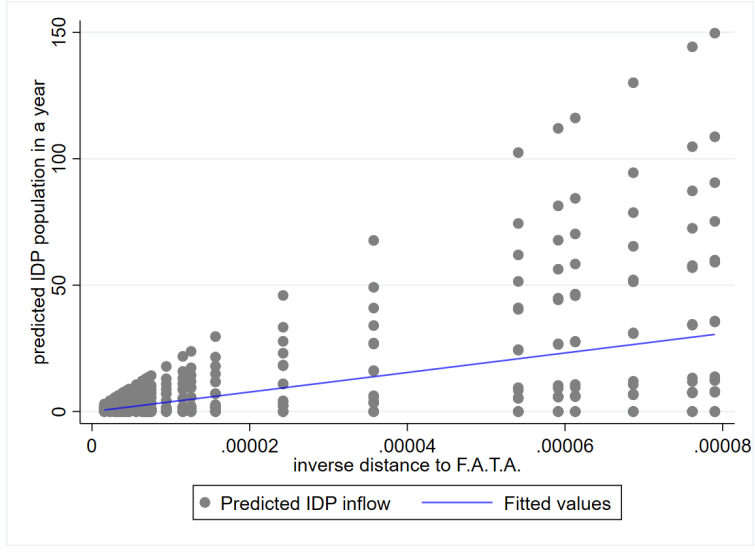


Figure A.3 Relationship between IDP inflow measures. Source. UNHCR

IDP inflows are positively correlated to inverse distance to FATA

Back to Talk

DiD: Time + Spatial exposure variation

Panel dataset at month-district: district d in province p in year t and month m

$$Y_{d,tm} = \beta_0 + \beta_1 IDPCrisis_t * PredictedInflow_{d,t} + \beta_2 X_{d,t} + \gamma_d + \delta_{tm} + \epsilon_{d,tm} \quad (1)$$

- $IDPCrises_t$ 1 from t equal to 2008 (beginning IDP crisis), 0 otherwise
- $PredictedInflow_{d,t} = IDPinflow_t * \frac{1}{DistFATA_d}$
  - $IDPinflow_t$ is the total annual newly IDPs
  - $\frac{1}{DistFATA_d}$ the inverse distance of district d to FATA
- $Y_{d,tm}$ the number of new cases per 100,000 inhabitants (in 2017)
- γ_d district, δ_m year-month fe, $X_{d,t}$ covariates, $\epsilon_{d,tm}$ district-level clusters

Back

IDP Inflows Increase New Polio Cases

Table 1: Effect of IDP inflow on new polio cases per 100,000 inhabitants

	(1)	(2)	(3)	(4)	(5)
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00139**	0.00156***	0.00154**	0.00154**	0.00154**
	(0.00061)	(0.00055)	(0.00058)	(0.00058)	(0.00064)
N	8713	8713	8713	8713	8713
District FE	No	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
Number of districts		34	34	34	34
Mean 2001-2022	0.005	0.005	0.005	0.005	0.005

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Back

– effects corresponds to a 30% of the mean incidence Surveillance

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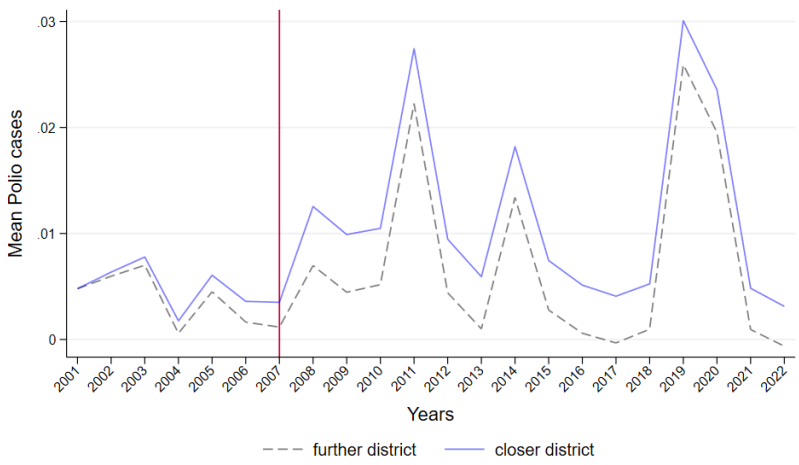
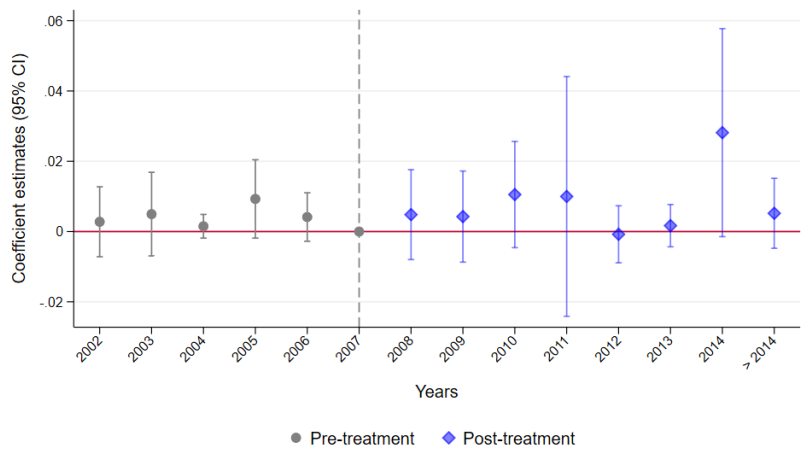
- effects corresponds to a 30% of the mean incidence Surveillance
- **Key identification assumption**: parallel trends Show

Closer vs further districts

Closer districts = districts whose territory falls entirely in Pashtunistan

Figure A.4 Effect of IDP inflows on polio incidence, by year since treatment





– Suggestion of parallel trend before 2007 Back

Balanced sample

Table A.1: Differences in characteristics between closer and further districts, 1998

	Mean further	Mean closer	Diff (2) - (1)
polio cases	0.004	0.005	-0.001
	(0.029)	(0.035)	(0.001)
polio campaigns	0.686	0.702	-0.000
	(0.464)	(0.457)	(0.000)
night light	6.233	7.831	0.430
	(2.957)	(5.841)	(0.992)
electricity sh	0.714	0.838	0.000
	(0.155)	(0.126)	(0.000)
roof sh	0.262	0.219	0.000
	(0.088)	(0.068)	(0.000)
wall share	0.575	0.470	-0.000
	(0.165)	(0.190)	(0.000)
water sh	0.255	0.308	-0.000
	(0.083)	(0.078)	(0.000)
petrol cooker sh	0.072	0.111	0.000
	(0.062)	(0.118)	(0.000)
Observations	2,268	1,008	3,276

	Mean further	Mean closer	Diff (2) - (1)
own house share	0.821	0.807	0.000
	(0.062)	(0.086)	(0.000)
N. members in hh	10.451	11.540	0.000
	(1.492)	(0.871)	(0.000)
N. children under 5	0.289	0.301	0.000
	(0.025)	(0.017)	(0.000)
literate sh	0.283	0.270	-0.000
	(0.046)	(0.038)	(0.000)
primary education sh	0.161	0.153	0.000
	(0.030)	(0.026)	(0.000)
Muslim sh	0.995	0.993	0.000
	(0.002)	(0.003)	(0.000)
Pashto sh	0.650	0.816	-0.000
	(0.362)	(0.207)	(0.000)
Observations	2,268	1,008	3,276

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Back to Talk

– IDP households' conditions get worst

No effect from conflict

Table A.2: Controlling for terrorist and drone attacks

	(1)	(2)	(3)	(4)	(5)
	Panel A: controlling for terrorist attacks				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00095	0.00120**	0.00119**	0.00119**	0.00118**
	(0.00060)	(0.00049)	(0.00052)	(0.00052)	(0.00057)
	Panel B: controlling for drone attacks				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00139**	0.00157***	0.00155**	0.00155**	0.00155**
	(0.00061)	(0.00055)	(0.00057)	(0.00057)	(0.00063)
N	8713	8713	8713	8713	8713
District FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	34	34	34	34	34
Mean Y	0.007	0.007	0.007	0.007	0.007

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Talk

Afghan refugees do not affect the results

Table A.3: Potential Afghan refugees effect

	(1)	(2)	(3)	(4)	(5)
	Panel A: controlling for total afghan refugees				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00139*	0.00159***	0.00157**	0.00157**	0.00157**
	(0.00071)	(0.00056)	(0.00059)	(0.00059)	(0.00065)
	Panel B: number of refugee camps fixed effects				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00139**	0.00156***	0.00154**	0.00154**	0.00154**
	(0.00061)	(0.00055)	(0.00058)	(0.00058)	(0.00064)
N	8713	8713	8713	8713	8713
District FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	34	34	34	34	34
Mean Y	0.007	0.007	0.007	0.007	0.007

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Talk

Minor out-migration

Table A.4: Potential international migration effects

	(1)	(2)	(3)	(4)	(5)
*IDP Crisis$_t$ * Predicted Inflow$_{d,t}$*	0.00114*	0.00156***	0.00154**	0.00154**	0.00154**
	(0.00059)	(0.00055)	(0.00058)	(0.00058)	(0.00064)
N	8713	8713	8713	8713	8713
District FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	34	34	34	34	34
Mean Y	0.007	0.007	0.007	0.007	0.007

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Talk

– the results remain constant

Other cofounders

Table A.5: Potential Taliban political support effects

	(1)	(2)	(3)	(4)	(5)
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00278***	0.00163***	0.00162***	0.00162***	0.00153**
	(0.00088)	(0.00055)	(0.00058)	(0.00058)	(0.00063)
N	8185	8185	8185	8185	8185
District FE	No	Yes	Yes	Yes	Yes
Year FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	34	34	34	34	34
Mean Y	0.007	0.007	0.007	0.007	0.007

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Talk

– IDP households' conditions get worst

Pakistan: Anti-vaccine propaganda event

Vaccines distrust

- 95% of polio cases in 2012-2016 in countries with armed conflicts involving between "Islamist organizations" and the state (Kennedy, 2017).
- The CIA got intelligence suggesting Bin Laden was hiding in Pakistan
- The CIA organized a fake vaccination campaign to get DNA from kids in the compound
- Public disclosure: Jul 2011
- The Taliban used this information to discredit vaccines $\rightarrow$ **Anti-Vaccine Propaganda**

theguardian

all opinion culture business lifestyle fashion environment tech travel

s americas asia australia africa middle east cities development

CIA organised fake vaccination drive to get Osama bin Laden's family DNA

Senior Pakistani doctor who organised vaccine programme in Abbottabad arrested by ISI for working with US agents

CIA organised fake vaccination programme in Abbottabad to try and find Osama bin Laden. Photograph: Md Nadeem/EPA

The CIA organised a fake vaccination programme in the town where it believed Osama bin Laden was hiding in an elaborate attempt to obtain DNA from the fugitive al-Qaida leader's family, a Guardian investigation has found.

Rule out hidden effects

Table A.6: Falsification tests

VARIABLES	(1) polio	(2) polio	(3) polio	(4) polio	(5)) polio
	PANEL A: Effects one year before treatment				
IDP Crisis$_{t,t0=2007}$ * *Host District*$_d$	0.00270	0.00268	0.00251	0.00251	0.00246
	(0.00329)	(0.00334)	(0.00338)	(0.00338)	(0.00344)
N	8713	8713	8713	8713	8713
N. of districts	34	34	34	34	34
Mean Y	0.007	0.007	0.007	0.007	0.007
	PANEL B: Non-pashtu districts counterfactual				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	-0.00157	0.00150	0.00162	0.00162	0.00164
	(0.00116)	(0.00157)	(0.00161)	(0.00161)	(0.00169)
N	19536	19536	19536	19536	19536
N. of districts	74	74	74	74	74
Mean Y	0.003	0.003	0.003	0.003	0.003
District FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Talk

Results hols with alternative outcomes

Table A.7: Alternative outcomes

	(1)	(2)	(3)	(4)	(5)
	Panel A: *Pr(new polio case) = 1*				
*IDP Crisis$_t$ * Predicted Inflow$_{d,t}$*	0.02199*	0.01599*	0.01641*	0.01641*	0.01626*
	(0.01092)	(0.00907)	(0.00947)	(0.00947)	(0.00935)
N	8713	8713	8713	8713	8713
	Panel B: polio cases per 100,000 inhabitants (1998)				
*IDP Crisis$_t$ * Predicted Inflow$_{d,t}$*	0.00247*	0.00252*	0.00254	0.00254	0.00325*
	(0.00111)	(0.00130)	(0.00147)	(0.00147)	(0.00150)
N	2904	2904	2904	2904	2904
District FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	34	34	34	34	34
Mean Y	0.010	0.010	0.010	0.010	0.010

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Talk

Results hold with alternative samples

Table A.8: Alternative sample

	(1)	(2)	(3)	(4)	(5)
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00173***	0.00146***	0.00146**	0.00146**	0.00132**
	(0.00061)	(0.00053)	(0.00056)	(0.00056)	(0.00059)
N	12409	12409	12409	12409	12409
District FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	48	48	48	48	48
Mean Y	0.006	0.006	0.006	0.006	0.006

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Talk

Alternative specification

Table A.9: Additional set of fixed effects

	(1)	(2)	(3)	(4)	(5)
	Panel A: province linear trends				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00139**	0.00150**	0.00150**	0.00150**	0.00136**
	(0.00061)	(0.00056)	(0.00059)	(0.00059)	(0.00061)
Prov. lin. trends FE	No	Yes	Yes	Yes	Yes
	Panel B: division linear trends				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00139**	0.00137**	0.00137**	0.00137**	0.00128**
	(0.00061)	(0.00063)	(0.00064)	(0.00064)	(0.00062)
Div. lin. trends FE	No	Yes	Yes	Yes	Yes
	Panel C: district linear trends				
IDP Crisis$_t$ * *Predicted Inflow*$_{d,t}$	0.00139**	0.00137**	0.00137**	0.00137**	0.00128**
	(0.00061)	(0.00063)	(0.00064)	(0.00064)	(0.00062)
N	8713	8713	8713	8713	8713
Dist. lin. trends FE	No	Yes	Yes	Yes	Yes
District FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	34	34	34	34	34
Mean Y	0.007	0.007	0.007	0.007	0.007

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Talk

No reverse causality

Table A.10: Potential reverse causality: post-crisis predicted inflow and pre-crisis yearly polio cases

	(1)	(2)	(3)	(4)	(5)
Polio Cases$_{d,tm\text{-}2001\text{-}2007}$	0.01166	0.01532	-0.02676	-0.02676	-0.02713
	(0.02591)	(0.02291)	(0.02415)	(0.02415)	(0.02483)
N	6480	6480	6480	6480	6480
Division FE	No	Yes	Yes	Yes	Yes
Year-month FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of divisions	14	14	14	14	14
Mean Y	0.009	0.009	0.009	0.009	0.009

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Talk

Before policy: IDP children less likely to be vaccinated

Table 2: Vaccination within districts, children born before vs after 2007 Back

	(1)	(2)	(3)	(4)	(5)
	Panel A: Cohort specification				
$Cohort_{08}$	0.05028*	0.05668***	0.06659***	0.05376***	0.06179***
	(0.02534)	(0.01831)	(0.01730)	(0.01789)	(0.01674)
	Panel B: Cohort specification, IDP heterogeneity				
$Cohort_{08}$	0.05150*	0.05854***	0.06780***	0.05565***	0.06302***
	(0.02545)	(0.01834)	(0.01716)	(0.01792)	(0.01658)
$Cohort_{08}$ * IDP	-0.18126***	-0.17568***	-0.16955***	-0.17523***	-0.17063***
	(0.03580)	(0.03277)	(0.03306)	(0.03350)	(0.03317)
N	13504	13504	13504	13504	13504
District FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	38	38	38	38	38
Mean Y	0.219	0.219	0.219	0.219	0.219

Other mechanisms

After policy: vaccines ↑ among IDPs children

Table 3: Number of PTPs and polio vaccination Back

	(1)	(2)	(3)	(4)	(5)
$Cohort_{08}$ * N. PTP_d	-0.00158	0.00262	0.00300	-0.00104	0.00092
	(0.00549)	(0.00573)	(0.00633)	(0.00587)	(0.00638)
$Cohort_{08}$ * N. PTP_d * IDP_i	0.12430***	0.12648***	0.12676***	0.12360***	0.12259***
	(0.03244)	(0.03315)	(0.03322)	(0.03170)	(0.03178)
N	1896	1896	1896	1895	1895
District FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	6	6	6	6	6
Mean Y	0.148	0.148	0.148	0.148	0.148

After policy: polio cases "mitigation"

Table 4: Number of PTPs and new polio cases

Back

	(1)	(2)	(3)	(4)	(5)
$IDP\ Crisis_t$ * $Predicted\ Inflow_{d,t}$	0.00118*	0.00198**	0.00196**	0.00196**	0.00178**
	(0.00060)	(0.00076)	(0.00078)	(0.00078)	(0.00073)
$IDP\ Crisis_t$ * $Predicted\ Inflow_{d,t}$ * $N.\ PTP_d$	-0.00025	-0.00023	-0.00022	-0.00022	-0.00025
	(0.00024)	(0.00021)	(0.00021)	(0.00021)	(0.00021)
N	1896	1896	1896	1895	1895
District FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
N. of districts	6	6	6	6	6
Mean Y	0.148	0.148	0.148	0.148	0.148

Immunised children shared: closer vs further districts

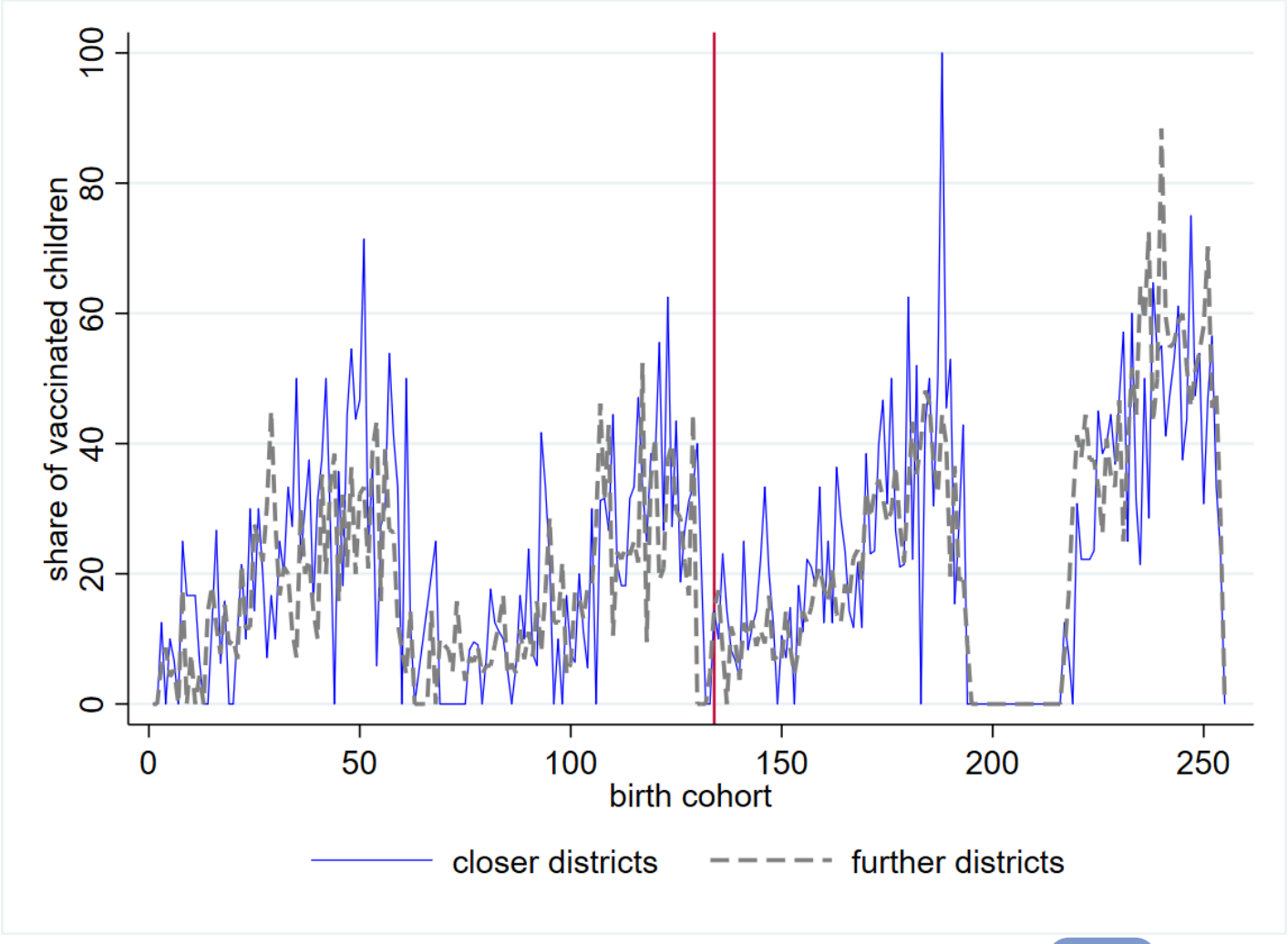


Figure A.5 Share of children vaccinated against polio. Source: DHS

Back

Complementary mechanisms

1. **Context-driven**: Does IDP inflow change services/facilities in communities?
   - $*$ $\downarrow$ water piped & $\downarrow$ head working Show
2. **Congested health services** Show

Back

IDP inflow worsen household conditions

Table A.11: Effect of IDP inflow on host communities households conditions

VARIABLES	(1) water piped	(2) toilet	(3) floor	(4) children	(5) members	(6) head working
			PANEL A: Average effect			
$IDPCrises_t$ * $PredictedInflow_{d,p,t}$	-0.089***	0.019	0.052**	-0.127*	-0.365	0.007
	(0.023)	(0.017)	(0.019)	(0.069)	(0.291)	(0.011)
			PANEL B: Heterogeneity IDP vs native children			
$IDPCrises_t$ * $PredictedInflow_{d,p,t}$	-0.091***	0.019	0.051**	-0.124*	-0.389	0.008
	(0.023)	(0.018)	(0.019)	(0.070)	(0.295)	(0.011)
$IDPCrises_t$ * $PredictedInflow_{d,p,t}$ * IDP	0.057**	-0.016	0.007	-0.087	0.766*	-0.030***
	(0.024)	(0.035)	(0.040)	(0.073)	(0.409)	(0.010)
Observations	13,544	13,544	9,570	13,544	13,544	13,519
Number of districts	38	38	38	38	38	38

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

– IDP households' conditions get worst

After treatment: household conditions ↓

Table A.12: Household conditions within districts, children born before vs after 2007

VARIABLES	(1) water piped	(2) toilet	(3) floor	(4) children	(5) members	(6) head working
			PANEL A: Average effect			
$Cohort_{08}$	-0.284***	0.577***	0.112***	-0.098	0.808*	-0.036**
	(0.051)	(0.042)	(0.040)	(0.082)	(0.404)	(0.018)
			PANEL B: Heterogeneity IDP vs native children			
$Cohort_{08}$	-0.282***	0.577***	0.112***	-0.110	0.750*	-0.036**
	(0.051)	(0.042)	(0.039)	(0.080)	(0.398)	(0.018)
$Cohort_{08}$ * IDP	-0.125**	-0.041	-0.095	0.946*	4.587***	0.012
	(0.054)	(0.111)	(0.102)	(0.550)	(1.001)	(0.044)
Observations	13,544	13,544	9,570	13,544	13,544	13,519
Number of disricts	38	38	38	38	38	38

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

– IDP households' conditions get worst

Before 2008: overcrowded households in closer districts

Table A.13: Households conditions between closer and further districts, before 2008

	Mean further	Mean closer	Diff (2) - (1)
Individual Charac.			
water piped	0.522	0.615	0.094
	(0.500)	(0.487)	(0.067)
toilet	0.311	0.456	0.158**
	(0.463)	(0.498)	(0.064)
floor	0.313	0.390	0.079
	(0.464)	(0.488)	(0.073)
television	0.352	0.485	0.139**
	(0.478)	(0.500)	(0.066)
watched tv	0.261	0.425	0.181**
	(0.439)	(0.495)	(0.072)
radio	0.437	0.488	0.040
	(0.496)	(0.500)	(0.039)
head working	0.112	0.072	-0.010
	(0.315)	(0.258)	(0.018)
Observations	4,043	2,290	6,333

	Mean further	Mean closer	Diff (2) - (1)
# children	2.597	3.073	0.467***
	(1.538)	(2.045)	(0.118)
# members	9.890	11.309	1.493**
	(5.442)	(6.494)	(0.685)
mother educ.	0.302	0.374	0.091
	(0.713)	(0.785)	(0.082)
diarrhea	0.137	0.146	0.017
	(0.344)	(0.353)	(0.021)
fever	0.219	0.252	0.034*
	(0.414)	(0.434)	(0.019)
head women	0.076	0.033	-0.049***
	(0.265)	(0.178)	(0.017)
urban	0.382	0.544	0.161
	(0.486)	(0.498)	(0.149)
girl	0.493	0.471	-0.027**
	(0.500)	(0.499)	(0.013)
Observations	4,043	2,290	6,333

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Back to Talk

IDP inflow ↑ health demand

Table A.14: Effects on health demand

VARIABLES	(1) doctor prenatal	(2) doctor prenatal	(3) doctor assistance	(4) doctor assistance
	PANEL A: IDP inflows variation across districts			
$IDPCrises_t$ * $PredictedInflow_{d,p,t}$	0.028*	0.028**	0.051***	0.051***
	(0.014)	(0.014)	(0.018)	(0.019)
$IDPCrises_t$ * $PredictedInflow_{d,p,t}$ * IDP		-0.006		0.004
		(0.027)		(0.018)
	PANEL B: Cohort variation within districts			
$Cohort_{08}$	0.308	0.308	0.438**	0.438**
	(0.261)	(0.262)	(0.209)	(0.209)
$Cohort_{08}$ * IDP		-0.011		0.044
		(0.044)		(0.038)
Observations	13,544	13,544	13,544	13,544
Number of districts	38	38	38	38

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Back to Talk

– Demand not driven by IDP households

IDP inflow also ↑ health supply

Table A.15: Effects of IDP inflow on polio vaccination campaigns

VARIABLES	(1) polio act.	(2) polio act.	(3) polio act.	(4) polio act.	(5) polio act.
$IDPCrises_t$ * $PredictedInflow_{d,p,t}$	0.100725***	0.032068	0.031307	0.056293***	0.043116***
	(0.009504)	(0.025081)	(0.024317)	(0.014158)	(0.011795)
Observations	10,296	10,296	10,296	8,976	6,516
Province FE	No	Yes	Yes	Yes	Yes
Time FE	No	Yes	Yes	Yes	Yes
Controls	No	No	Yes	Yes	Yes
Number of districts		39	39	34	38

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.1 Back to Talk

– Demand not driven by IDP households

Peak in terrorist attacks in 2014

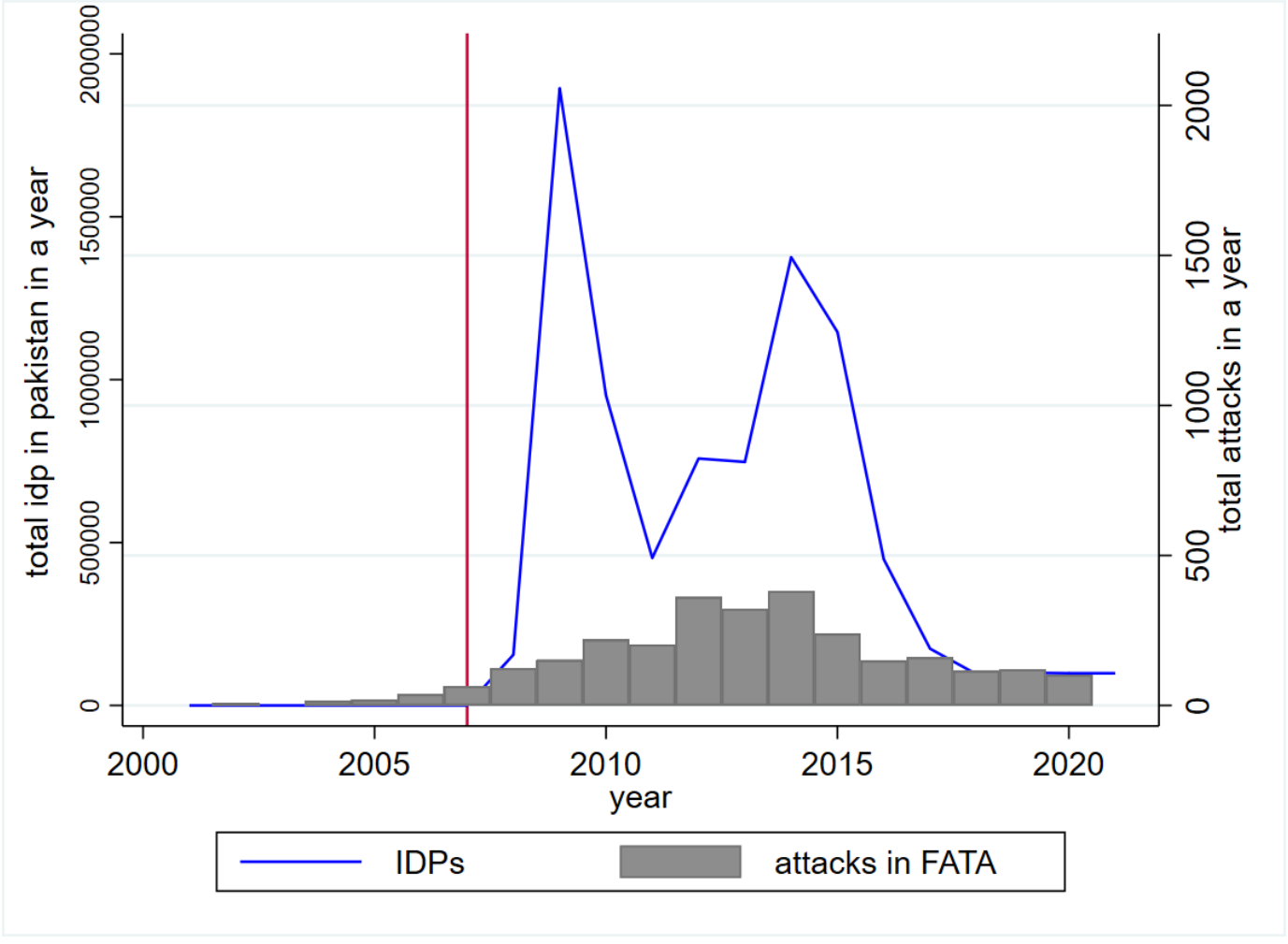


Figure A.6 Total terrorist attacks (2000-2022) Source: The Global Terrorism Database - G.T.D.

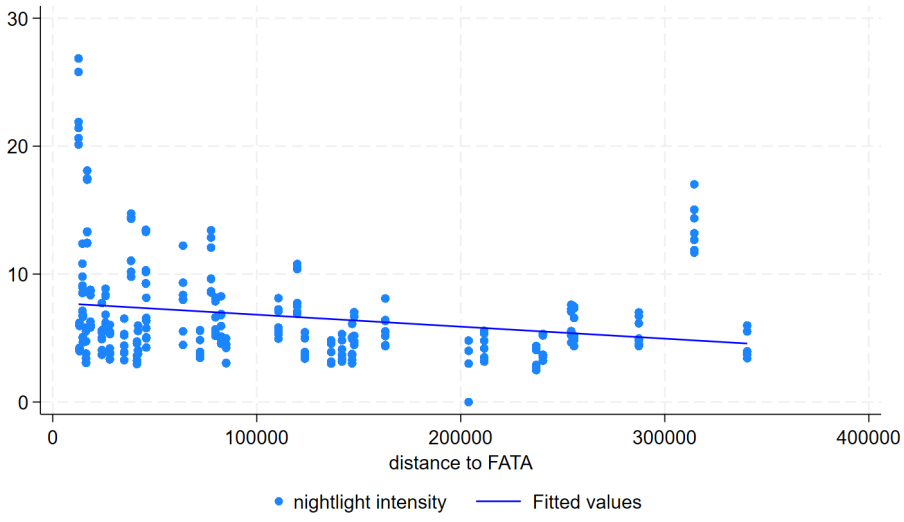
Back

Polio surveillance

Source: Global Polio Eradication Program Back set. Back res.

1. Acute Flaccid Paralysis Surveillance: 99% of samples are negative
2. Environmental Surveillance: 53 sampling sites
3. Testing Stool Surveys From Healthy Children (from high risk populations)

Characteristics stable across distance



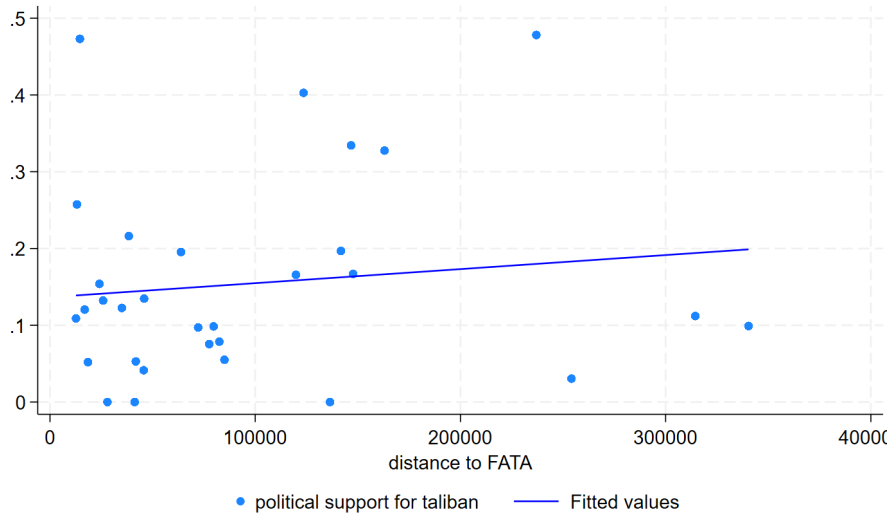


Figure A.7 Economic and political characteristics along distance to FATA. Back