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Syrian Refugee Inflows, Health-Care Access, and Childhood Vaccination in Turkey

Bilge Erten, Pinar Keskin, Miray Omurtak, and Ilhan Can Ozen

Abstract

This study explores the impact of the arrival of Syrian refugees in Turkey on access to health-care resources and subsequent changes in infectious disease rates among native children. Employing a distance-based instrument, it finds that native children living in regions that received large inflows of Syrian refugees experienced an increase in their risk of catching an infectious disease compared to children in less affected regions. In contrast, there is no evidence of significant changes in the incidences of noninfectious diseases such as diabetes, cancer, or anemia. The findings also reveal that the number of health-care professionals and hospital beds per capita declined in provinces that received large refugee inflows. This study also documents a decrease in native children's probability of being fully vaccinated in provinces that received large refugee inflows. Although contact with potentially infected refugees may increase disease spread among natives, the migration-induced supply constraints in health-care access may also worsen health outcomes in host countries.

JEL classification: F22, I12, J13

Keywords: refugees, forced migration, vaccination, infectious disease, children

1. Introduction

Armed conflicts and climate change forcibly displace millions of people worldwide every year. According to the UNHCR (2020), 82.4 million people experienced forced displacement in 2020, 26.4 million of whom live as refugees abroad. Developing countries host 86 percent of these refugees despite facing numerous resource constraints. Previous studies have documented that forced migration aggravates the disease burden in host countries because of the arrival of refugees with poor health (Montalvo and Reynal-Querol 2007; Baez 2011; Ibáñez, Rozo, and Urbina 2021). However, the increase in infectious

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diseases might also be driven by a decline in the availability of health-care resources, including health-care professionals or hospital beds per capita, which might induce a reduction in the utilization of preventative health-care services such as the vaccination of children and thereby increase the spread of infectious diseases.

This paper examines the impact of Syrian refugee inflows on the supply of health-care resources, the subsequent changes in childhood vaccination behavior, and the prevalence of infectious diseases among children in Turkey.[1] UNHCR (2021) reports that Turkey currently hosts the highest number of refugees in the world, as 3.7 million Syrian refugees are settled in Turkey.[2] Turkey has made significant improvements in its health-care system since the early 2000s, leading to an increase in the ratio of fully vaccinated children between ages 0 and 2 from 54 percent in 2003 to 81 percent in 2008 (Hacettepe University Institute of Population Studies 2004, 2009). However, the rapid population increase in refugee-receiving areas may have reduced access to health-care services, including vaccination of children, in the absence of adequate investments in the supply of health-care professionals and infrastructure.

We exploit the differential arrival of refugees after the outbreak of the Syrian civil war in March 2011 across Turkish provinces as an exogenous shock to native health outcomes in host regions to investigate this question. However, it is possible that the settlement of refugees across regions was not random. Following Del Carpio and Wagner (2016) and Erten and Keskin (2021), we use a weighted average of the travel distance between Syrian governorates and Turkish regions/provinces as an instrument to predict the location choice of refugees in the first stage of an instrumental variable (IV) model. This empirical strategy allows us to account for potential endogeneity in the timing and level of refugee arrivals across provinces in Turkey. The inclusion of region-specific time trends further ensures that the results are not driven by pre-existing trends in outcomes observed in a particular region, including southeastern Turkey, which received large refugee inflows.

Our results show that native children living in regions that received large inflows of Syrian refugees experienced an increase in their risk of catching an infectious disease compared to children in less affected regions.[3] In contrast, there is no evidence of significant changes in the incidences of noninfectious diseases, such as diabetes, cancer, or anemia. At the same time, we find that the number of health-care professionals and hospital beds per capita decreased in provinces that received large refugee inflows compared to provinces that received fewer refugees. Although the Turkish government invested heavily in the supply of doctors, nurses, and midwives in host regions, these investments did not fully offset the decline in per-person availability of health-care resources driven by the rapid increase in the local population.

We then examine whether the reductions in access to health-care providers affect the use of preventative health-care services such as the vaccination of children. Our findings reveal a significant decline in the vaccination of children in provinces that received a higher share of refugees compared to less affected provinces. These reductions in childhood vaccination might have further contributed to increases in the spread of vaccine-preventable diseases in affected regions.

Examining alternative channels through which refugee inflows might impact native children's health outcomes, we find no evidence of a significant impact of refugee inflows on mothers' time spent with children. Altogether, we conclude that although contact with potentially infected refugees might increase disease spread among natives, the migration-induced supply constraints in health-care access may have also worsened health outcomes in Turkey.

1 For the purposes of our study, we focus on childhood infectious diseases, such as measles and diphtheria, that can be avoided by the implementation of affordable interventions such as adequate systems for immunization and health care.

2 In March 2011, the violent response of the Bashar al-Assad regime to peaceful civil protests triggered a destructive civil war in Syria, which rapidly spread across several regions of this country. As a result, more than 6.3 million people have fled their homeland, migrating to bordering countries such as Turkey, Lebanon, and Jordan.

3 We focus on health outcomes of native children since we do not have information on refugee children over time in our data sets.

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This paper makes several contributions to the existing literature. First, it is closely related to studies examining the public-health consequences of hosting large refugee populations in communities. For example, Ibáñez, Rozo, and Urbina (2021) find that higher refugee inflows from Venezuela to Colombia are associated with an increase in the incidence of vaccine-preventable diseases, including chickenpox and tuberculosis. Similarly, Baez (2011) reports increasing incidences of diarrhea and fever as well as increased childhood mortality in northwestern Tanzania after it was flooded by more than 500,000 refugees from Burundi and Rwanda. Both of these papers attribute the increase in the incidence of infectious diseases to direct transmission from the refugee population that arrives in the host country with a high disease prevalence from their war-torn countries.

This paper differs from these studies by examining the potential mechanisms driving the increased prevalence of infectious diseases in host regions, with a particular focus on the availability of health-care services. Specifically, it highlights the role of supply constraints stemming from overburdened health clinics, hospitals, and health-care providers as an unanticipated flow of migrants seek health-care services in the host country. Indeed, the pandemic-related service closures have led to substantial reductions in utilization of health-care services by children and young people even in developed countries (Bell et al. 2020; Chanchlani et al. 2020). UNICEF (2021) reports that the pandemic interrupted vaccination campaigns worldwide, resulting in 23 million children not receiving basic childhood vaccines.

One study closely related to ours is Aygün, Kirdar, and Tuncay (2021), who focus on the effects of refugee inflows on mortality rates for different age groups, but did not find any evidence of a significant impact. Although an examination of potential effects on these extreme outcomes is important, investigating the effects on the prevalence of infectious diseases in early childhood—regardless of whether they result in childhood mortality—is crucial for several reasons. As shown in previous studies, improved early-life health care and the completion of childhood vaccines have significant later life impacts on cognition, earnings, and health risks during adulthood. For instance, Bleakley (2003) examines the impact of eradicating malaria in the United States, Bharadwaj, Løken, and Neilson (2013) and Bütikofer, Løken, and Salvanes (2019) focus on the impacts of early-life health interventions, and Bloom, Canning, and Shenoy (2011) and Driessen et al. (2015) examine the effects of childhood vaccinations on school attendance and cognition. Thus, possible changes in vaccination rates and infectious disease prevalence in early childhood in response to refugee inflows may exert a wide range of indirect impacts on the host country in the long run.

Finally, this paper relates to a growing body of empirical work on the effects of Syrian refugee inflows on the labor markets (Del Carpio and Wagner 2016; Ceritoglu et al. 2017; Aksu, Erzan, and Kırdar 2022), housing markets (Tumen 2016; Balkan et al. 2018), educational systems (Tumen 2019), political outcomes (Altındağ and Kaushal 2021), domestic violence (Erten and Keskin 2021), and other outcomes in Turkey.[4] Despite using a similar identification strategy, this paper is the first to document the effects of refugee inflows on infectious disease prevalence and childhood vaccination in Turkey.

Overall, our findings have several policy implications as we explain in more detail in the conclusion. First, increased investments in health-care resources in areas with greater concentration of refugees in host countries are crucial. Second, a related policy implication is the implementation of widespread vaccination campaigns that cover all vaccine-preventable diseases for refugee and native children. These campaigns should also include investments in new vaccination sites in host communities with large refugee populations. Designing early action plans on these fronts may help combat the potential spread of infectious diseases, which might have long-lasting effects on human capital accumulation of children.

4 For overviews of the broader literature on the effects of refugee inflows on host countries, see Becker and Ferrara (2019) and Maystadt et al. (2019).

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In the Background section, we provide information on the Syrian refugee inflows to Turkey. Our Data section discusses the data and the identification strategy we employ in our analysis. The following section presents the empirical results, and the last section concludes the paper.

2. Background

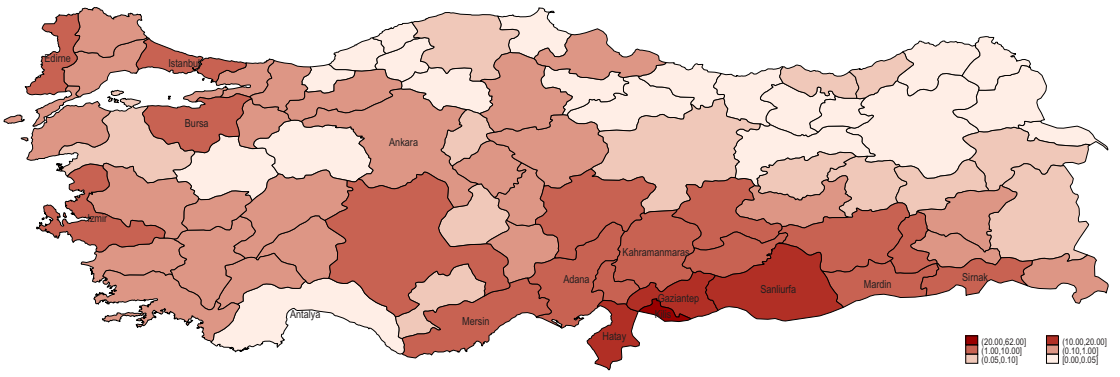
Starting in March 2011, protests in Syria inspired by Arab Spring events called for the removal of President Bashar al-Assad. These protests were violently suppressed by Syrian troops (Slackman 2011). Following this suppression, civil unrest grew and expanded into an international conflict including various armed groups and countries. As a result, 6.7 million Syrians were internally displaced, and approximately 6.6 million people have fled Syria since 2011 (UNHCR 2021). Among those who have fled, 3.6 million currently live in Turkey and compose approximately 5 percent of Turkey's population (UNHCR 2021). This significant increase in population took place over a short period of time: the number of refugees rose steadily from 145,000 at the end of 2012 to 1.5 million by the end of 2014 (see fig. S2.1 in the supplementary online appendix). Furthermore, the spatial distribution of refugees varied across provinces. As shown in fig. 1, in some provinces bordering Syria, refugee-to-native population ratio reached 61 percent by the end of 2014, while many other provinces experienced a far smaller inflow.

Syrian refugees predominantly originate from northwestern Syria, where the conflict began. The largest shares of refugee outflows originated from Aleppo (36 percent), Idleb (21 percent), al-Raqqah (11 percent), Lattakia (9 percent), and Hamah (8 percent) (DGMM 2013). In a survey implemented by the Directorate General of Migration Management of Turkey (DGMM), the majority of refugees (close to 80 percent) reported lower transportation costs as the main reason they chose to migrate into Turkey instead of other countries (DGMM 2013).

In October 2011, the Turkish government enacted a temporary protection regime, which provided a range of rights and services to Syrian refugees in Turkey, including free access to education, health services, social assistance, and freedom of movement within Turkey. In addition, Syrian refugees were assured of no forced return, which allowed the refugees to legally cross the Turkish border without the fear of deportation.

Since the beginning of their arrival, the Turkish government offered generous health-care coverage to the Syrian refugees upon their registration with the local authorities in each province. Registered Syrian refugees were immediately given temporary protection status, which allowed them to receive medical

Figure 1. Share of Syrian Refugees in the Turkish Population (in Percent), 2014



Source: Data on native population come from the Turkish Statistical Institute. Estimates on province-level refugee populations in 2014 come from the Ministry of Interior. The aggregate counts of the number of refugees are obtained from the United Nations High Commissioner of Refugees (UNHCR).
Note: The figure plots the ratio of the Syrian refugee population to the province native population in Turkey in 2014.

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care as needed (ORSAM 2015). Refugees who lived in camps had free access to health-care facilities in the camp, but if more comprehensive treatment was needed, they were sent to nearby public hospitals.[5] Refugees living outside the camps also had free access to health-care services.[6] The hospitals in border provinces were reported to offer approximately 30 percent to 40 percent of their services to Syrian refugees, which creates capacity constraints and leads to delays in service delivery (ORSAM 2015).

The Turkish Ministry of Health in collaboration with UNICEF and WHO carried out several health campaigns targeting the refugee population. One of these campaigns was a polio mop-up vaccination campaign from 2013 to 2015.[7] In the five cities with the highest refugee concentrations—namely, Mardin, Hatay, Kilis, Sirnak, and Sanliurfa—both Syrian and Turkish children aged 0–59 months were vaccinated against polio. In six other cities with Syrian refugee camps, only Syrian children were vaccinated against polio. In 2014, the campaign was extended to Syrian children in Istanbul, targeting all children in districts with large refugee populations (UNICEF 2014). This campaign was specifically designed to vaccinate children against polio and did not cover other diseases. In 2017, another vaccine campaign was launched, targeting refugee children under the age of five with the goal of completing the vaccines that they had missed (Turkish Medical Association 2019).

3. Data and Empirical Methodology

Data

We combine two types of data in our empirical analysis: (a) province-level data on refugee inflows to Turkey, number of health-care professionals, number of hospital beds, and trade volume with Syria and (b) individual-level data on childhood vaccination, disease prevalence, and socioeconomic outcomes.

Data on Refugee Inflows, Health-Care Professionals, Hospital Beds, and Trade

The information on the number of refugees in Turkish provinces was obtained from two sources. First, UNHCR (2022) provides data on the number of total Syrian refugees in Turkey on a monthly basis from 2011 to the present.[8] Second, following Altindag, Bakis, and Rozo (2020), we combine the estimates on province-level refugee populations in 2014 released by the Ministry of Interior with the aggregate counts from the United Nations High Commissioner of Refugees (UNHCR) to estimate refugee numbers in each province.[9] For all 81 provinces in Turkey, we obtain the share of refugees in a particular province by

5 The Syrian refugees were initially located in 25 refugee camps in the southeastern region of the country near the Turkish–Syrian border. However, as the civil war became a humanitarian crisis, the number of individuals seeking refuge in Turkey rapidly exceeded the capacity of these camps. In 2017, camps were hosting approximately 7 percent of the refugee population, and the majority of refugees have moved and resettled across the provinces of Turkey (European Commission 2018).

6 The share of private care in Turkey is relatively small compared to the public sector. For example, 18 percent of doctors' consultations occurred in the private sector in 2015 (TOBB 2017). Migrant health centers that provide primary care were opened in cities with large refugee populations to reduce the burden on public hospitals. These centers employed some Syrian doctors and other health-care professionals in addition to the Turkish ones. By 2017, there were approximately 50 of these centers and this number has increased to 185 as a part of a joint effort between Turkey and the EU (Ekmekci 2017; Ministry of Health of Turkey 2022). Despite these efforts, it has been reported that many Syrian refugees tend to bypass primary health care in these centers and seek care at the hospital level (UNHCR 2018). By 2022, over 100 million in- and outpatient care services had been provided to Syrian refugees (Ministry of Health of Turkey 2022).

7 A key reason for targeting polio was that 35 cases of polio were confirmed in Syria in 2013. Syria was polio-free prior to the civil war. Turkey has been polio-free since 1998, and the vaccination campaign was successful in preventing an outbreak.

8 Note, however, that there are several missing observations in the data set.

9 For the months where refugee numbers were not updated, we use linear interpolation to fill the gaps. For annual analyses, we use the end of the year refugee numbers. Since the geographic allocation of Syrian refugees in Turkey is stable over

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dividing the number of registered refugees by the total province population. Since refugees may move into other provinces or out of the country after their registration, the figures released by the UNHCR reflecting the number of registered refugees in each province are likely to include some degree of measurement error.

Figure 1 illustrates the geographical distribution of Syrian refugees using the share of refugee inflows in the province population across Turkey in 2014. The provinces with the highest refugee-to-native population ratios are Kilis (61 percent), Hatay (15 percent), and Sanliurfa (13 percent), which are all located on the Turkish–Syrian border. Provinces farther from the border have generally received fewer refugees relative to their population. Istanbul, Izmir, and Ankara are the three largest cities in Turkey and are centers for economic activity. Hence, they also have relatively high refugee ratios. The average share of refugee inflows in the native population across Turkey was approximately 2 percent in 2014.

We use two additional sources of data to construct our instrument. First, we use data on the population of each Syrian governorate in 2011, prior to the civil war, from the Syrian Central Bureau of Statistics. Second, we utilize Google Maps to calculate the travel distance between each governorate in Syria and each province in Turkey. Note that there are six border crossings between Turkey and Syria: two in Hatay and one each in Gaziantep, Kilis, Mardin, and Sanliurfa. Syrian refugees used different border crossings depending on their home governorates and their destination provinces in Turkey. We take the shortest travel path between two locations to calculate our distance measure. Due to the open-door policy in Turkey toward Syrian refugees, Syrian refugees had no reason to use illegal pathways to enter the country.

Moreover, we use data on the trade volume between each Syrian governorate and 81 Turkish provinces provided by the Turkish Statistical Agency to control for economic linkages between these regions.

Finally, we use data on the number of health professionals and hospital beds provided by the 2008–2016 Health Statistics Yearbooks. These data are published annually by the Turkish Ministry of Health. The data include aggregate figures from private and public sectors.

Data on Vaccination, Disease Prevalence, and Related Outcomes

We use two sources of individual-level data. First, we use four rounds of the Turkish Demographic and Health Surveys (TDHS) conducted in 2003, 2008, 2013, and 2018.[10] Second, we use five rounds of the Turkish Health Surveys (THS) conducted every two years from 2008 to 2016. We will describe these data sources next and present summary statistics.

The TDHS data are nationally representative household surveys that provide information on demographics and health outcomes for women and children, including the vaccination of young children. More specifically, it asks women whether their children aged between 0 and 3 have been vaccinated against certain diseases. This data set also captures in which of the 81 provinces the respondent lives.

Panel A of table 1 presents descriptive statistics for the demographic characteristics and vaccination outcomes of children using the 2003–2018 TDHS data. Section I of Panel A shows that the average age of children was 1.2, and approximately half of them were girls. It also provides information on mothers' characteristics, including their education, whether they speak Turkish, the type of area they live in (rural vs. urban), and age. The mothers average age was 28.3, approximately 28 percent of them live in a rural

time (Altindag, Bakis, and Rozo 2020), we use the 2014 allocation shares to estimate province-level refugee counts over time. Also note that the Ministry of Interior, Presidency of Migration Management (2022)'s DGMM—the Turkish migration authority—provides annual data on the number of registered refugees at the national level between 2011 and 2022. The refugee counts here largely overlap with the UNHCR numbers in the period after 2013, but they underestimate the count in 2011–2013.

10 Note that in the 2018 TDHS, the information on province of residence is not directly provided. Instead, we use the information provided on the migration history for each woman and assign her last province of migration as the province of residence. For women who do not report a migration history, we use their childhood province as the province of residence.

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Table 1. Summary Statistics

	Pre-war period (2003–2008)	Post-war period (2013–2018)	Whole period (2003–2018)				
	Mean	Mean	Mean	SD	Min	Max	Obs.
Panel A: 0–3-year-old children in 2003–2018 TDHS							
I. Demographic variables							
Child age	1.32	1.00	1.20	0.97	0.00	3.00	9,261
Female	0.48	0.50	0.49	0.50	0.00	1.00	9,261
Mother:							
Completed primary school	0.53	0.30	0.44	0.50	0.00	1.00	9,261
Completed secondary school	0.10	0.22	0.15	0.35	0.00	1.00	9,261
Completed high school	0.13	0.21	0.16	0.37	0.00	1.00	9,261
Completed a level above high school	0.07	0.15	0.10	0.30	0.00	1.00	9,261
Non-Turkish speaker	0.07	0.03	0.05	0.23	0.00	1.00	9,261
Rural	0.31	0.23	0.28	0.45	0.00	1.00	9,261
Age	27.74	29.11	28.27	5.68	15.00	48.00	9,261
II. Vaccination outcomes							
Number of vaccines	5.72	6.47	6.01	2.47	0.00	8.00	9,261
Hepatitis B completed	0.57	0.74	0.64	0.48	0.00	1.00	8,487
Diphtheria, pertussis, tetanus completed	0.66	0.73	0.69	0.46	0.00	1.00	8,539
Tuberculosis completed	0.87	0.90	0.88	0.32	0.00	1.00	9,206
Measles completed	0.66	0.65	0.66	0.47	0.00	1.00	9,071
	Pre-war period (2008–2010)	Post-war period (2012–2016)	Whole period (2008–2016)				
	Mean	Mean	Mean	SD	Min	Max	Obs.
Panel B: 0–6-year-old children in 2008–2016 THS							
I. Demographic variables							
Child age	3.18	3.11	3.13	1.9	0	6	14,771
Female	0.50	0.49	0.49	0.50	0	1	14,771
Household head completed:							
Primary school	0.39	0.33	0.35	0.48	0	1	14,771
Secondary school	0.09	0.12	0.11	0.31	0	1	14,771
High school	0.17	0.18	0.17	0.38	0	1	14,771
Above high school	0.10	0.15	0.13	0.34	0	1	14,771
II. Disease outcomes							
Infectious diseases	0.09	0.10	0.10	0.29	0	1	14,740
Upper respiratory diseases	0.35	0.37	0.37	0.48	0	1	14,747
Lower respiratory diseases	0.08	0.09	0.09	0.28	0	1	14,747
Cancer	0.00	0.00	0.00	0.03	0	1	14,771
Diabetes	0.00	0.00	0.00	0.04	0	1	14,762
Diarrhea	0.26	0.31	0.29	0.45	0	1	14,746
Anemia	0.10	0.09	0.09	0.29	0	1	14,667

Source: Turkish Demographic Health Surveys data (Panel A) can be accessed through the DHS website (https://dhsprogram.com/data). Turkish Health Surveys data (Panel B) can be accessed through the Turkish Institute of Statistics website (https://www.tuik.gov.tr/Home/Index) with permission.

Note: The table presents the means, standard deviations, minimum and maximum values, and the number of observations for children aged 0–3 years in the 2003–2018 TDHS in Panel A, and from the 2008–2016 THS for children aged 0–6 years in Panel B. The variables are described in the supplementary online appendix.

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area, 5 percent do not speak Turkish (i.e., the interview was conducted in Kurdish, Arabic, or another language), and 26 percent have completed high school or above.

Section II of Panel A in table 1 provides summary statistics for vaccination outcomes. We observe that the total number of vaccines received by children increased from 5.72 in the pre-war period to 6.47 in the post-war period.[11] We examine whether a child completed the three doses of the hepatitis B and the diphtheria, pertussis, tetanus vaccines as well as if they received a single dose of the tuberculosis and measles vaccines. We focus on the completion of three doses for the hepatitis B and the diphtheria, pertussis, tetanus vaccines since having completed all doses of vaccines is considered a good measure of the strength of immunization and is therefore frequently used in the literature and by organizations such as the Global Alliance for Vaccines and Immunizations (GAVI) (Arevshatian et al. 2007; GAVI 2015). In Section II of Panel A in table 1, we observe slight increases in the national percentages of children who were fully vaccinated against individual diseases, with the exception of measles. As shown in table S2.1 in the supplementary online appendix, tuberculosis and measles require one dose of vaccine each, while hepatitis B and diphtheria, pertussis, and tetanus vaccines require three doses to be completed. In all surveys combined, 88 percent of children had completed the tuberculosis vaccine, nearly 64 percent of children had completed the hepatitis B vaccine, 69 percent had completed the diphtheria, pertussis, and tetanus vaccines, and 66 percent of children had completed the measles vaccine.[12]

The THS data are also nationally representative household surveys, providing rich information on health outcomes, including disease prevalence among children. In particular, the THS data provide information on whether children aged 0 to 6 have experienced different infectious and noninfectious diseases in the past six months. For our purposes, we confidentially obtained information on 26 regions from the THS data.[13]

Panel B of table 1 presents summary statistics for the disease prevalence among 0- to 6-year-old children using the 2008–2016 THS data. Section I indicates that the average age of children was 3 years, and approximately half of them were girls. It also provides information on the educational attainment of the household head. Section II provides summary statistics on the prevalence of diseases among children. In the pre-war period from 2008 to 2010, approximately 9 percent of children had experienced an infectious disease within the past six months, and this value increased to 10 percent in the post-war period from 2012 to 2016. Similarly, the prevalence of other infectious diseases, such as upper and lower respiratory diseases, exhibited an increase of approximately 1 to 2 percentage points. A similar marked increase at the national level was not observed for cancer, diabetes, or anemia, with diarrhea being the only exception.

Identification

We compare children's outcomes in locations that are exposed to larger refugee inflows with those in locations that are less exposed to these inflows before and after the Syrian civil war began. However, the resettlement of refugees is a potentially endogenous decision. In particular, refugees may decide to settle in provinces with growing labor markets and better health infrastructure, which would result in a spurious negative correlation between refugee inflows and infectious disease prevalence. Hence, ordinary least squares (OLS) would underestimate the effects of refugee inflows on the health outcomes of

11 For consistency, we exclude the polio vaccine from our analysis, since its dosage and application method changed during our sample period.

12 Generally, the average vaccination rates for the first doses of vaccines or one-dose vaccines range from approximately 85 to 90 percent (with the exception of the measles vaccine), while those for second doses are lower, and those for the third doses are the lowest, at 64 to 67 percent, despite the fact that children should receive the third doses of these vaccines when they turn 6 months old, as shown in table S2.1.

13 In Turkey, the regions are classified into five geographical regions (West, South, Central, North, and East) reflecting differences in socioeconomic development levels and demographic conditions within the country. In addition, 12 (NUTS1) and 26 (NUTS2) statistical regions are assigned according to EU regulations.

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children. However, it is also plausible that refugees settle in smaller cities with lower cost of living and potentially worse health infrastructure. In that case, the OLS estimates may be upward biased. Moreover, the settlement decisions of refugees may be affected by a range of other factors, including ethnic or religious networks, differences in local policies, and potential overcrowding in areas close to the border. In addition, the measurement error in province-level refugee inflows is likely to create attenuation bias in the OLS estimates.

We use an IV approach following previous literature (Card 2001; Del Carpio and Wagner 2016; Erten and Keskin 2021) to address these issues. In particular, we estimate the following specification at the 26 region level using the 2008–2016 THS data:

$$Y_{irt} = \beta(R/Pop)_{rt} + \gamma X_{irt} + \sigma Z_{rt} + \delta_r + \delta_t + \epsilon_{irt},$$

where Y_{irt} is the outcome for child i in region r in year t; $(R/Pop)_{rt}$ is the number of refugees as a share of the region native population in year t; X_{irt} represents the individual-level controls, including child's age, gender, and indicator variables for the educational attainment of the household head; Z_{rt} represents the region-level, time-varying controls, including the trade volume of each region with Syria and the baseline trade volume interacted with a time indicator (both in logs); δ_r represents the region fixed effects; and δ_t represents the year fixed effects. In addition, we include 12 region-specific time trends and 12 region–year fixed effects in separate regressions to control for unobserved regional time trends.[14] Since the Syrian civil war began in 2011, the number of Syrian refugees prior to 2011 in any region of Turkey is zero. We cluster standard errors at the region level to account for serial correlation in outcomes within regions.

We estimate a similar specification at the 81-province level using the four rounds of TDHS data over 2003–2018, comparing children's vaccination outcomes in provinces more affected by the Syrian refugee inflows to less affected provinces before and after the civil war began. At the individual level, we control for the child's age, gender, and month of birth, whether the mother lives in a rural area, whether her mother tongue is Turkish, and indicator variables for her educational attainment. At the province level, we control for the trade volume of each province with Syria and the baseline trade volume interacted with a time indicator (both in logs). Following Aygün, Kirdar, and Tuncay (2021), we include 5 region-specific linear trends and 5 region–year fixed effects in separate regressions to account for unobserved regional trends.[15]

In addition, we examine the effects of refugee inflows on health-care resources by estimating the following specification at the 81-province level using data from the 2008–2016 Health Statistics Yearbooks published by the Turkish Ministry of Health:

$$Y_{pt} = \beta(R/Pop)_{pt} + \sigma Z_{pt} + \delta_p + \delta_t + u_{pt},$$

where Y_{pt} is a health-care resource outcome in province p in year t; $(R/Pop)_{pt}$ is the number of refugees as a share of the province native population in year t; Z_{pt} represents the province-level, time-varying controls, including the trade volume between each province and Syria and the baseline trade volume interacted with a time indicator (both in logs); δ_p represents the province fixed effects; and δ_t represents the year fixed effects. We cluster standard errors at the province level to account for serial correlation in outcomes within provinces. Similarly, following Aygün, Kirdar, and Tuncay (2021), we include 5 region-specific linear trends and 5 region–year fixed effects in separate regressions to account for unobserved regional trends.[16]

14 Note that since the geographic information in the THS data is at the level of 26 regions, it cannot be matched to the 5-region classification in which some regional borders cross through 26 regions.

15 In the supplementary online appendix, we also present more saturated models using 26 region-specific linear trends, 26 region–year fixed effects, and 26 region time-varying province GDP and unemployment rates, in separate regressions.

16 In the supplementary online appendix, we present more saturated models using 26 region-specific linear trends, 26 region–year fixed effects, and 26 region time-varying province GDP and unemployment rates, in separate regressions.

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Following Del Carpio and Wagner (2016) and Erten and Keskin (2021), our instrument exploits the fact that the travel distance from the Syrian governorate from which refugees depart to each province in Turkey where they settle is an important predictor of where they settle. The instrument for the refugee inflows at any point in time for each province in Turkey is calculated as follows:

$$\mathrm{IV}_{pt} = \sum_{s} \frac{1}{\tau_{sp}} \pi_s R_t,$$

where τ_{sp} is the travel distance from each Syrian governorate s to a Turkish province p, π_s is the share of the Syrian population in each governorate s in 2011 (pre-war),[17] and R_t is the number of registered Syrian refugees in Turkey in year t (measured in thousands).[18] Since there are 13 origin governorates in Syria and 81 Turkish provinces, this results in 1053 origin–destination pairs for use as an instrument to predict the location choices of the refugees in the first stage of our IV model.[19] Additionally, since the number of registered Syrian refugees in Turkey takes the value of zero in years prior to 2011, the instrument also takes the value of zero for these years. We construct a region-level instrument using the same expression, with the only difference being the use of 26-region-level data to calculate distance between Turkish regions and Syrian governorates.

Our empirical framework includes region/province fixed effects to account for any time-invariant heterogeneity across regions/provinces and year fixed effects to control for any macroeconomic shocks at the national level. Our instrument thus relies on variation within regions/provinces observed before and after the Syrian civil war began. In addition, the inclusion of trade volumes at the regional level accounts for the potential disruption of trade linkages between Turkey and Syria due to the Syrian civil war. Moreover, we use specifications that include the interaction of the baseline trade volume with time to control for the differential effects of baseline economic linkages between regions over time. The latter might be important if regions with initially stronger economic linkages with Syria face a greater or weaker change in their health outcomes for reasons that are unrelated to refugee inflows from Syria. Finally, any time-invariant characteristics of regions, such as distance to the border or initial economic development, are already controlled for using region fixed effects.

4. Effects of the Syrian Refugee Inflows

Infectious and Noninfectious Disease Prevalence

We begin by testing whether the prevalence of infectious diseases changed in response to Syrian refugee inflows, and we also examine whether the noninfectious disease prevalence changed as a placebo check. Table 2 provides the first-stage regression results. Column (1) regresses the share of Syrian refugee inflows in the region population on the distance instrument while controlling for region and year fixed effects. Column (2) controls for region-level trade volume with Syria, and Column (3) adds baseline trade volume with Syria interacted with the year fixed effects. Finally, Columns (4) and (5) separately account for 12 region-specific linear trends and 12 region–year fixed effects. The findings indicate a strong positive correlation, implying that the Turkish regions closer to more populated Syrian governorates received more refugee inflows. The *F*-statistics are far greater than 10, indicating that the instrument strongly predicts the share of refugees in the region population.

17 The total population by governorate in 2011 according to civil affairs records is released by the Syrian Arab Republic Central Bureau of Statistics.

18 The choice of a distance-based instrument is in line with the previous literature focusing on *gravity models of migration*. These models are based on the intuition that as the distance between two locations increases, the migration flows between them decrease. However, as the overall population size increases in these locations, we observe larger numbers of people moving between them (Anderson 2011).

19 We treat Damascus and Rif-Dimashq as a single governorate.

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Table 2. First-Stage Regression Results

	Dependent variable: Share of refugees in the region population				
	(1)	(2)	(3)	(4)	(5)
Distance instrument	0.015***	0.015***	0.015***	0.015***	0.015***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Observations	14,771	14,771	14,771	14,771	14,771
F-statistic	220.3	223.8	315.2	706.2	746.3
Region and year fixed effects	x	x	x	x	x
Log trade volume	—	x	x	x	x
Baseline trade × year fixed effects	—	—	x	x	x
12 region-specific linear trends	—	—	—	x	—
12 region–year fixed effects	—	—	—	—	x

Source: Data for the instrument and refugee shares come from the Turkish Ministry of Interior, Turkish Statistical Institute, Syrian Arab Republic Central Bureau of Statistics, Google Maps, and the UNHCR. Turkish Health Surveys data can be accessed through the Turkish Institute of Statistics website (https://www.tuik.gov.tr/Home/Index) with permission.

Note: Data for the instrument and refugee shares are matched to the 2008–2016 THS at the 26-region level. The regressions report OLS estimates from regressing the distance instrument on the share of Syrian refugee inflows in the region population. All specifications control for 26 region and year fixed effects. Column (2) adds the 26 region-level trade volume with Syria, and Column (3) controls for baseline trade volume in 2008 with Syria interacted with year fixed effects. Columns (4) and (5) add 12 region-specific linear time trends and 12 region–year fixed effects, respectively. Standard errors are clustered at the 26-region level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Table 3 presents the estimates of the impact of refugee inflows on disease prevalence in Turkey. The IV estimates reported in the first row of table 3 indicate that the children located in regions that received large refugee inflows experienced an increase in their probability of catching an infectious disease compared to those in less affected regions. The magnitude of the estimated coefficient implies that a 1-standard-deviation increase in the refugee share results in a 3.2-percentage-point (0.021 × 1.534) increase in the probability of having an infectious disease, corresponding to a 32 percent increase relative to the mean value.[20]

Moreover, we observe similar increases in the incidences of highly infectious upper and lower respiratory diseases.[21] The IV estimates in the second and third rows of table 3 indicate that a 1-standard-deviation increase in the refugee share leads to 1.9 and 1 percentage point increases in the incidences of upper respiratory and lower respiratory diseases, respectively. These values correspond to 5 and 10 percent increases relative to the mean values.

In contrast, we find no evidence that refugee inflows had a significant impact on the incidences of other diseases. The remaining IV estimates in table 3 reveal no evidence of consistently significant changes in the prevalence of cancer, diabetes, diarrhea, or anemia in regions that received large refugee inflows compared to less affected regions.[22] This result is not surprising because cancer, diabetes, and anemia are noninfectious diseases, and while diarrhea is an infectious disease, it is not vaccine preventable, and its transmission mostly occurs through drinking water and food, with person-to-person transmission being much less common.[23]

Table S2.3 provides a placebo check using pre-treatment data from 2008 to 2010 and assigning the 2016 values for the refugee share and the instrumental variables for each province to the 2010 data. The IV estimates indicate no evidence of a significant effect on any outcomes with the exception of anemia,

20 In table S2.2, we provide the reduced-form estimates, which are consistent with our IV estimates.

21 We note that some respiratory diseases, such as pneumococcus and tuberculosis, are preventable by vaccines.

22 Only in the case of diarrhea, one out of five specifications show a marginally positive significant coefficient, while all the other specifications are insignificant and most are indistinguishable from zero.

23 See, for example, Nelson and Williams (2014).

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Table 3. Effects of Refugee Inflows on Infectious and Noninfectious Disease Prevalence

	OLS					IV				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Infectious diseases										
Refugee share	1.055***	1.052***	1.188***	1.436***	1.431***	1.209***	1.209***	1.301***	1.527***	1.534***
	(0.266)	(0.252)	(0.267)	(0.226)	(0.146)	(0.200)	(0.188)	(0.227)	(0.225)	(0.150)
Observations	14,740	14,740	14,740	14,740	14,740	14,740	14,740	14,740	14,740	14,740
Outcome mean	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Upper respiratory diseases										
Refugee share	0.443*	0.435*	0.593**	0.882***	0.759***	0.539**	0.536*	0.641**	1.112***	0.884***
	(0.219)	(0.233)	(0.273)	(0.251)	(0.267)	(0.274)	(0.293)	(0.322)	(0.289)	(0.249)
Observations	14,747	14,747	14,747	14,747	14,747	14,747	14,747	14,747	14,747	14,747
Outcome mean	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37	0.37
Lower respiratory diseases										
Refugee share	0.386*	0.383*	0.482**	0.289	0.285**	0.570***	0.570***	0.643***	0.485**	0.408**
	(0.204)	(0.197)	(0.215)	(0.175)	(0.119)	(0.172)	(0.172)	(0.177)	(0.204)	(0.176)
Observations	14,747	14,747	14,747	14,747	14,747	14,747	14,747	14,747	14,747	14,747
Outcome mean	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Cancer										
Refugee share	0.001	0.001	−0.002	−0.005	−0.006	−0.004	−0.004	−0.007	−0.010	−0.011
	(0.005)	(0.005)	(0.008)	(0.014)	(0.012)	(0.007)	(0.007)	(0.009)	(0.014)	(0.013)
Observations	14,771	14,771	14,771	14,771	14,771	14,771	14,771	14,771	14,771	14,771
Outcome mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diabetes										
Refugee share	0.007	0.006	0.008	−0.005	0.001	0.010	0.010	0.012	−0.001	0.002
	(0.013)	(0.014)	(0.017)	(0.021)	(0.019)	(0.015)	(0.016)	(0.018)	(0.021)	(0.018)
Observations	14,762	14,762	14,762	14,762	14,762	14,762	14,762	14,762	14,762	14,762
Outcome mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diarrhea										
Refugee share	−0.003	−0.005	−0.129	0.246	0.298	0.053	0.052	−0.012	0.328	0.423*
	(0.253)	(0.244)	(0.259)	(0.212)	(0.181)	(0.240)	(0.230)	(0.238)	(0.275)	(0.238)
Observations	14,746	14,746	14,746	14,746	14,746	14,746	14,746	14,746	14,746	14,746
Outcome mean	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29	0.29
Anemia										
Refugee share	−0.196	−0.199	−0.103	−0.010	−0.109	−0.138	−0.139	−0.078	0.068	−0.040
	(0.137)	(0.128)	(0.156)	(0.122)	(0.138)	(0.145)	(0.135)	(0.159)	(0.126)	(0.141)
Observations	14,667	14,667	14,667	14,667	14,667	14,667	14,667	14,667	14,667	14,667
Outcome mean	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09	0.09
Region and year fixed effects	x	x	x	x	x	x	x	x	x	x
Individual characteristics	x	x	x	x	x	x	x	x	x	x
Log trade volume	—	x	x	x	x	—	x	x	x	x
Baseline trade × year fixed effects	—	—	x	x	x	—	—	x	x	x
12 region-specific linear trends	—	—	—	x	—	—	—	—	x	—
12 region–year fixed effects	—	—	—	—	x	—	—	—	—	x

Source: Data come from the 2008–2016 Turkish Health Surveys which can be accessed through the Turkish Institute of Statistics website (https://www.tuik.gov.tr/Home/Index) with permission.

Note: Columns (1)–(5) report OLS estimates from using the share of Syrian refugee inflows in region population as an explanatory variable. Columns (6)–(10) report IV estimates from instrumenting the share of Syrian refugee inflows in region population by the distance instrument. All specifications control for 26 region and year fixed effects, as well as the individual characteristics, including the child's age, gender, and indicator variables for the educational attainment of the household head. Columns (2)–(5) and (7)–(10) also control for 26 region-level trade volume, and Columns (3)–(5) and (8)–(10) control for the interaction of the baseline trade volume in 2008 with year dummies. Columns (4)–(5) and (9)–(10) add 12 region-specific linear time trends and 12 region–year fixed effects, respectively. The variables are described in the supplementary online appendix. Standard errors are clustered at the 26-region level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

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Table 4. Effects of Refugee Inflows on Health-Care Professionals and Hospital Beds

	OLS					IV				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Doctors per capita										
Refugee share	−0.442***	−0.443***	−0.436***	−0.409***	−0.392***	−0.656***	−0.656***	−0.662***	−0.564***	−0.520***
	(0.081)	(0.082)	(0.084)	(0.090)	(0.090)	(0.204)	(0.204)	(0.217)	(0.191)	(0.184)
Observations	891	891	891	880	880	891	891	891	880	880
Outcome mean	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45	1.45
Midwives per capita										
Refugee share	−0.234***	−0.235***	−0.239***	−0.268***	−0.278***	−0.194***	−0.193***	−0.196***	−0.217***	−0.245***
	(0.019)	(0.019)	(0.021)	(0.022)	(0.025)	(0.064)	(0.064)	(0.068)	(0.071)	(0.073)
Observations	891	891	891	880	880	891	891	891	880	880
Outcome mean	0.81	0.81	0.81	0.80	0.80	0.81	0.81	0.81	0.80	0.80
Nurses per capita										
Refugee share	−0.520***	−0.519***	−0.457***	−0.445***	−0.443***	−0.546***	−0.547***	−0.437**	−0.517***	−0.510**
	(0.116)	(0.114)	(0.090)	(0.096)	(0.103)	(0.198)	(0.196)	(0.184)	(0.200)	(0.204)
Observations	891	891	891	880	880	891	891	891	880	880
Outcome mean	1.80	1.80	1.80	1.79	1.79	1.80	1.80	1.80	1.79	1.79
Hospital beds per capita										
Refugee share	−0.265*	−0.266*	−0.321***	−0.482***	−0.479***	0.096	0.098	0.030	−0.232	−0.192
	(0.141)	(0.138)	(0.117)	(0.112)	(0.125)	(0.360)	(0.359)	(0.349)	(0.319)	(0.347)
Observations	891	891	891	880	880	891	891	891	880	880
Outcome mean	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53	2.53
Region and year fixed effects	x	x	x	x	x	x	x	x	x	x
Individual characteristics	x	x	x	x	x	x	x	x	x	x
Log trade volume	—	x	x	x	x	—	x	x	x	x
Baseline trade × year fixed effects	—	—	x	x	x	—	—	x	x	x
5 region-specific linear trends	—	—	—	x	—	—	—	—	x	—
5 region–year fixed effects	—	—	—	—	x	—	—	—	—	x

Source: Data come from the 2008–2018 Health Statistics Yearbooks published annually by the Turkish Ministry of Health.

Note: Columns (1)–(5) report OLS estimates from the share of Syrian refugee inflows in the province population as an explanatory variable. Columns (6)–(10) report IV estimates from instrumenting the share of Syrian refugee inflows in the province population by the distance instrument. All specifications control for province and year fixed effects. Columns (2)–(5) and (7)–(10) also control for province-level trade volume, and Columns (3)–(5) and (8)–(10) control for the interaction of the baseline trade volume in 2008 with year dummies. Columns (4)–(5) and (9)–(10) add 5 region–year fixed effects and 5 region-specific linear time trends, respectively. The variables are described in the supplementary online appendix. Standard errors are clustered at the province level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

which has a negative and significant coefficient estimate for the first specifications. However, this effect disappears once we control for 12 region–year fixed effects. Overall, these results indicate that pre-trends in infectious disease outcomes are unlikely to drive our estimates. Moreover, we include the time-varying GDP and unemployment rate measured at the 12-region level to control for changes in local economic conditions during our sample period. Table S2.4 shows that our estimates are robust to adding these additional control variables. Finally, our results are robust to excluding regions with the highest shares of refugee inflows and to excluding highly populated provinces from the sample, as shown in tables S2.5 and S2.6.

Health-Care Professionals and Hospital Beds

In this section we examine whether Syrian refugee inflows had a significant impact on the number of health-care professionals and hospital beds per capita at the province level. The per capita values are calculated by dividing the number of health-care professionals and hospital beds by the total population, including natives and refugees, in each province. Table 4 presents the estimates of the impact of refugee inflows on health-care resources in Turkey. Columns (1)–(5) provide the OLS estimates, while Columns (6)–(10) provide the IV estimates. The IV estimates in Columns (6)–(10) for the first four outcomes are all negative and significant. Thus, provinces that received a larger share of refugee inflows experienced a decrease in the numbers of doctors per capita, midwives per capita, and nurses per capita compared to less exposed provinces. However, we find no evidence of a significant impact on the number of hospital beds per capita. These results are similar to Aygün, Kirdar, and Tuncay (2021), who also report

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significant declines in the number of doctors per capita and midwives per capita, an imprecisely estimated but large decline in the number of nurses per capita, and no significant effects on the number of hospital beds per capita. The magnitude of the IV estimate in the first row of Column (10) with a full set of controls indicates that a 1-standard-deviation increase in the refugee share results in 0.06 fewer doctors per person (0.108×0.520), corresponding to a 4 percent decrease relative to the mean value.[24,25] Similarly, a 1-standard-deviation increase in the refugee share leads to 0.03 fewer midwives per person and 0.06 fewer nurses per person. These effect sizes correspond to a 3 percent decrease in the number of midwives per person and a 3 percent decrease in the number of nurses per person.[26]

We also examine whether these effects are driven by the number of health professionals or the total population, and table S2.8 presents estimates of the effects of Syrian refugee inflows on the number of health professionals and hospital beds in each province. For ease of interpretation, we take the natural logarithm of the dependent variables. The IV estimates indicate that the numbers of doctors, midwives, nurses, and hospital beds increased in absolute terms in provinces that received a larger share of refugee inflows, suggesting that the government increased investments in these health resources. However, these increased investments were not sufficient to maintain constant ratios of these health resources to the province population since the province population is growing due to large refugee inflows. As a result, we observe a decrease in health resources in per capita terms in more affected regions as reported in table 4.

As a placebo check, in table S2.9, we restrict the sample to the pre-treatment period from 2008 to 2011 and assign the 2016 values of the refugee share and instrument variables for each province to 2011 data. The IV estimates reported in Columns (4)–(6) indicate no evidence of a significant pre-trend in these outcome variables observed prior to the arrival of Syrian refugees.[27]

We conduct three robustness checks to test the sensitivity of our health-care resource estimates to alternative sample specifications. First, we include the 26 region GDP and unemployment rate, and separately add 26 region-specific linear trends and 26 region–year fixed effects in alternate specifications to account for time-varying changes in local economic conditions and unobserved regional trends over time. Table S2.10 reports these results, which are consistent with our main estimates. The only difference is that we observe a significant decrease in the number of hospital beds per capita in specifications that separately include 26 region-specific trends and 26 region–year fixed effects. Second, we exclude Gaziantep, Adiyaman, and Kilis, which constitute the Gaziantep NUTS2 region that received the largest number of Syrian refugees as a share of its population, to test whether our results are sensitive to their exclusion. The results reported in table S2.11 are consistent with our primary estimates. Finally, we exclude Istanbul, Ankara, and Izmir, which are the most populous cities with large labor markets and a good health infrastructure, to test whether potential sorting of refugees into these provinces affects our results. The results presented in table S2.12 are consistent with our main estimates.

Taken together, these results indicate that although the number of health professionals increased in regions that received larger shares of refugees, this increase was not sufficiently large to offset the decrease in the per capita availability of health professionals in more affected provinces. As a result, the host provinces that received a disproportionate inflow of refugees experienced a potential shortage of doctors, nurses, and midwives, as well as of hospital beds per person, relative to less affected regions.

24 Note that the standard deviation of the refugee share in the province population varies by the sample period.

25 In table S2.7 we also provide the reduced-form estimates, which are consistent with our IV estimates.

26 We also note that the magnitudes of the IV estimates are quite close to the OLS estimates, suggesting that the endogenous sorting of the refugees based on local health infrastructure does not play a significant role in this context. Indeed, while the IV estimates slightly differ from the OLS estimates, the Durbin–Wu–Hausman test suggests that the OLS estimates are consistent at any conventional significance level for all variables in table 4.

27 Only in the case of nurses per capita, we observe one significant coefficient out of five estimates, and it is in the opposite direction to the main estimates reported in table 4.

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Table 5. Effects of Refugee Inflows on Vaccination Outcomes

	OLS					IV				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Number of vaccines										
Refugee share	−0.642	−0.675	−0.765	−2.980**	−2.310**	−2.436*	−2.371*	−2.977*	−8.246***	−6.345**
	(0.568)	(0.550)	(0.599)	(1.257)	(1.119)	(1.397)	(1.386)	(1.667)	(2.961)	(2.620)
Observations	9,261	9,261	9,233	9,233	9,233	9,261	9,261	9,233	9,233	9,233
Outcome mean	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86	5.86
Hepatitis B completed										
Refugee share	−0.055	−0.061	−0.082	−0.435***	−0.333**	−0.239	−0.235	−0.392	−1.290***	−1.048**
	(0.123)	(0.113)	(0.116)	(0.150)	(0.134)	(0.210)	(0.211)	(0.280)	(0.500)	(0.454)
Observations	8,488	8,488	8,462	8,462	8,462	8,488	8,488	8,462	8,462	8,462
Outcome mean	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62	0.62
Diphtheria, pertussis, and tetanus completed										
Refugee share	−0.302**	−0.316***	−0.325***	−0.548***	−0.429**	−0.789**	−0.781**	−0.865**	−1.410***	−1.260**
	(0.117)	(0.105)	(0.104)	(0.174)	(0.174)	(0.314)	(0.310)	(0.342)	(0.467)	(0.510)
Observations	8,541	8,541	8,514	8,514	8,514	8,541	8,541	8,514	8,514	8,514
Outcome mean	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67	0.67
Tuberculosis completed										
Refugee share	−0.205***	−0.213***	−0.232***	−0.372***	−0.292***	−0.284**	−0.284**	−0.387***	−0.652***	−0.533**
	(0.059)	(0.057)	(0.059)	(0.115)	(0.097)	(0.124)	(0.122)	(0.146)	(0.234)	(0.219)
Observations	9,210	9,210	9,182	9,182	9,182	9,210	9,210	9,182	9,182	9,182
Outcome mean	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87	0.87
Measles completed										
Refugee share	−0.242*	−0.245*	−0.257**	−0.456***	−0.394**	−0.792***	−0.786***	−0.884***	−1.495***	−1.505***
	(0.142)	(0.132)	(0.120)	(0.146)	(0.160)	(0.278)	(0.285)	(0.315)	(0.457)	(0.528)
Observations	9,074	9,074	9,046	9,046	9,046	9,074	9,074	9,046	9,046	9,046
Outcome mean	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Region and survey year fixed effects	x	x	x	x	x	x	x	x	x	x
Individual characteristics	x	x	x	x	x	x	x	x	x	x
Log trade volume	—	x	x	x	x	—	x	x	x	x
Baseline trade × survey year fixed effects	—	—	x	x	x	—	—	x	x	x
5 region-specific linear trends	—	—	—	x	—	—	—	—	x	—
5 region-survey year fixed effects	—	—	—	—	x	—	—	—	—	x

Source: Data come from the 2003, 2008, 2013, and 2018 Turkish Demographic Health Surveys data, which can be accessed through the DHS website (https://dhsprogram.com/data).

Note: Columns (1)–(5) report OLS estimates from the share of Syrian refugee inflows in the province population as an explanatory variable. Columns (6)–(10) report IV estimates from instrumenting the share of Syrian refugee inflows in the province population by the distance instrument. All specifications control for province and survey year fixed effects, as well as the individual characteristics, including the child's age, gender, month of birth indicator variables, and indicator variables for the mother's educational attainment, whether she lives in a rural area, and whether her mother tongue is Turkish. Columns (2)–(5) and (7)–(10) also control for province-level trade volume, and Columns (3)–(5) and (8)–(10) control for the interaction of the baseline trade volume in 1998 with survey year dummies. Columns (4)–(5) and (9)–(10) add 5 region-specific linear time trends and 5 region-survey year fixed effects, respectively. The variables are described in the supplementary online appendix. Standard errors are clustered at the province level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Vaccination Outcomes

One of the potential consequences of declining access to health-care providers in regions that receive large refugee inflows is a reduction in preventative health-care behaviors, including the vaccination of children. In this section we proceed by testing the effects of Syrian refugee inflows on vaccination outcomes. Table 5 presents the estimates of the impact of refugee inflows on vaccination outcomes in Turkey. Columns (1)–(5) provide the OLS estimates, while Columns (6)–(10) provide the IV estimates. The IV estimates in Columns (6)–(10) are all negative and significant for all vaccination outcomes. Based on these results, children in provinces that received a larger share of Syrian refugees were less likely to be fully immunized than children in less affected provinces. The magnitude of the IV estimate in the first row of Column (6) implies that a 1-standard-deviation increase in the refugee share results in 0.43 fewer vaccines ($0.067 \times 6.345 = 0.43$) received by children, corresponding to a 7 percent decline compared to the outcome mean. Similarly, a 1-standard-deviation increase in the refugee share results in a 7-percentage-point decline in the probability of receiving three doses of the hepatitis B vaccine, an 8-percentage-point decline in the probability of receiving the three doses of the diphtheria, pertussis, and tetanus vaccine, a 4-percentage-point decline in the probability of receiving the tuberculosis vaccine, and a 10-percentage-point decline in

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the probability of receiving the measles vaccine. These effect sizes correspond to 11 percent, 13 percent, 4 percent, and 16 percent declines compared to the mean values.[28]

The reduction in vaccination rates following the declines in per-person access to health-care professionals is also consistent with evidence from previous studies. Anand and Bärnighausen (2007) examine the effect of the health-care worker density on the vaccination outcomes in 49 developing countries using Demographic and Health Surveys (DHS) data. They find that a higher density of nurses leads to an increased availability of vaccination services and a higher likelihood of a child being vaccinated.

As a placebo test, table S2.14 provides regression results by using pre-treatment data from the 2003 and 2008 TDHS and assigning the 2013 values for refugee share and the instrumental variables for each province to the 2008 data. The regression results from the fully controlled specification in Column (6) indicate no evidence of a significant impact of refugee inflows on vaccination outcomes prior to the arrival of refugees. These results also suggest that pre-trends in the outcome variables are unlikely to drive our estimates.

Moreover, table S2.15 shows that our estimates remain consistent after the inclusion of 26 region controls such as time-varying regional GDP and unemployment rate, 26 region-specific trends, or 26 region–year fixed effects. Finally, tables S2.16 and S2.17 show that we obtain consistent estimates when we exclude those provinces with the highest shares of refugee inflows and when we exclude highly populated provinces from the sample.

Time Use Changes

Since Syrian refugees were not legally authorized to work until 2016, most of them were employed informally at lower wages than native workers. In an earlier study, Erten and Keskin (2021) showed that because of their informal sector work, Syrian refugees predominantly displaced native women in the work force as opposed to native men, since native women were much more likely to work in informal sectors such as agriculture and in low-wage service industries. If women are less likely to work, this can have two opposing effects on their probability of vaccinating their children. On the one hand, mothers' income levels may decline, which may make it harder for them to bear the costs of vaccination. However, the negative income effect is unlikely to occur in this particular context, since all vaccination costs are fully covered by the government. On the other hand, when women are less likely to work, they may have more time available to bring their children to health clinics for vaccination.

Table 6 reports estimates for the effects of Syrian refugee inflows on women's time spent with their children. More specifically, we use the 2008, 2013, and 2018 TDHS data, which provide information on the types of childcare performed primarily by women within the household.[29] The results presented in table 6 provide no evidence of a significant change in women's performance of childcare activities inside or outside the home.

5. Conclusion

In this paper we study the impact of differential inflows of Syrian refugees across Turkish provinces following the outbreak of the Syrian civil war in 2011 on access to health-care resources and subsequent changes in infectious disease rates among native children in Turkey. Our findings show that native children living in regions that received large refugee inflows experienced an increase in their risk of catching an infectious disease compared to children in less affected regions. In contrast, we find no evidence of significant changes in the incidences of noninfectious diseases such as diabetes, cancer, or anemia.

28 Table S2.13 provides the reduced-form estimates, which are consistent with our IV estimates.

29 We note that these measures do not completely account for changes in the time allocated to childcare activities. Unfortunately, none of the data sources includes specific daily time allocation information for men or women.

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Table 6. Effects of Refugee Inflows on Time Use

	OLS					IV				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Time spent with children at home										
Refugee share	0.117	0.115	0.125	0.242*	0.160*	0.005	0.007	0.064	0.590**	0.139
	(0.095)	(0.095)	(0.095)	(0.132)	(0.094)	(0.170)	(0.168)	(0.151)	(0.258)	(0.141)
Observations	3,814	3,814	3,805	3,805	3,805	3,814	3,814	3,805	3,805	3,805
Outcome mean	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83	0.83
Time spent with children outside the home										
Refugee share	0.043	0.067	0.100	0.189	0.135	−0.288	−0.291	−0.101	0.243	−0.108
	(0.241)	(0.212)	(0.200)	(0.215)	(0.233)	(0.306)	(0.298)	(0.199)	(0.238)	(0.237)
Observations	4,088	4,088	4,074	4,074	4,074	4,088	4,088	4,074	4,074	4,074
Outcome mean	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63	0.63
Region and survey year fixed effects	x	x	x	x	x	x	x	x	x	x
Individual characteristics	x	x	x	x	x	x	x	x	x	x
Log trade volume	—	x	x	x	x	—	x	x	x	x
Baseline trade × survey year fixed effects	—	—	x	x	x	—	—	x	x	x
5 region-specific linear trends	—	—	—	x	—	—	—	—	x	—
5 region–year fixed effects	—	—	—	—	x	—	—	—	—	x

Source: Data come from the 2008, 2013, and 2018 Turkish Demographic Health Surveys data, which can be accessed through the DHS website (https://dhsprogram.com/data).

Note: Columns (1)–(5) report OLS estimates from the share of Syrian refugee inflows in the province population as an explanatory variable. Columns (6)–(10) report IV estimates from instrumenting the share of Syrian refugee inflows in the province population by the distance instrument. All specifications control for province and survey year fixed effects, as well as the individual characteristics, including the child's age, gender, month of birth indicator variables, and indicator variables for the mother's educational attainment, whether she lives in a rural area, and whether her mother tongue is Turkish. Columns (2)–(5) and (7)–(10) also control for province-level trade volume, and Columns (3)–(5) and (8)–(10) control for the interaction of the baseline trade volume in 1998 with survey year dummies. Columns (4)–(5) and (9)–(10) add 5 region-survey year fixed effects and 5 region-specific linear time trends, respectively. The variables are described in the supplementary online appendix. Standard errors are clustered at the province level. ***, **, and * denote significance at the 1, 5, and 10 percent levels, respectively.

Our results also indicate that although the Turkish government increased its allocation of health professionals to regions with large refugee inflows, this supply response did not fully offset the increases in the local population, leaving the affected regions with a lower doctor-to-patient ratio. The resulting decline in access to health-care resources might have led to a reduction in native children's probability of being fully vaccinated in more affected regions, further contributing to the spread of infectious diseases.

Our findings indicate that the arrival of Syrian refugees placed substantial pressure on health-care resources, reducing the per-person availability of health professionals in the more affected regions of Turkey. The resulting resource constraints have worsened child health outcomes in host communities by reducing children's probability of being fully immunized against infectious diseases.

Our study has several policy implications. First, addressing such serious health concerns requires greater investments in health-care resources. Because most of the host communities are financially and logistically constrained, international aid agencies play an important role in providing targeted investments to increase the supply of doctors, nurses, and other trained health-care workers—preferably those who speak the native language of forced migrants—in areas with the greatest concentration of refugees.

Second, another important policy implication of our study is the implementation of widespread vaccination campaigns to reduce the infectious disease burden. These campaigns might include investing in establishing additional vaccination sites in host communities with high refugee inflows. These improvements in capacity should be accompanied by information campaigns for effective messaging around the importance of vaccines. These vaccine campaigns should include not only refugee children but also native children who are affected indirectly through the overburdening of health-care resources.

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Finally, our study findings call for taking these actions as an immediate response by the native health authorities and international refugee agencies instead of waiting a considerable amount of time. The earlier investments in health-care resources and implementation of vaccination campaigns occur, the faster the spread of infectious diseases will be contained and the smaller the long-term negative consequences on health, cognition, and schooling outcomes.

Data and Code Availability

The Turkish Demographic Health Surveys are obtained from the Demographic and Health Surveys program. Their data availability policy prohibits the distribution of data to nonregistered users. However, interested researchers can access this data set by completing a form on https://dhsprogram.com/data. The Turkish Health Surveys can be accessed through the Turkish Institute of Statistics website (https://www.tuik.gov.tr/Home/Index) with permission. The final replication codes will be deposited in the Harvard Dataverse.

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