

## Characterizing the mobile phone use patterns of refugee hosting provinces in Turkey

**Citation for published version (APA):**

Frydenlund, E., Sener, M. Y., Gore, R., Boshuijzen - van Burken, C., Bozdog, E., & DeKock, C. (2019). Characterizing the mobile phone use patterns of refugee hosting provinces in Turkey. In *Proceedings of the Data for Refugees Challenge Workshop, 21 January 2019, Boğaziçi University, Istanbul, Turkey*. (pp. 469-583). Bogazici University. <http://d4r.turktelekom.com.tr/Content/Documents/d4r-proceedings.pdf>

**Document status and date:**

Published: 21/01/2019

**Document Version:**

Publisher's PDF, also known as Version of Record (includes final page, issue and volume numbers)

**Please check the document version of this publication:**

- A submitted manuscript is the version of the article upon submission and before peer-review. There can be important differences between the submitted version and the official published version of record. People interested in the research are advised to contact the author for the final version of the publication, or visit the DOI to the publisher's website.
- The final author version and the galley proof are versions of the publication after peer review.
- The final published version features the final layout of the paper including the volume, issue and page numbers.

[Link to publication](#)

**General rights**

Copyright and moral rights for the publications made accessible in the public portal are retained by the authors and/or other copyright owners and it is a condition of accessing publications that users recognise and abide by the legal requirements associated with these rights.

- Users may download and print one copy of any publication from the public portal for the purpose of private study or research.
- You may not further distribute the material or use it for any profit-making activity or commercial gain
- You may freely distribute the URL identifying the publication in the public portal.

If the publication is distributed under the terms of Article 25fa of the Dutch Copyright Act, indicated by the "Taverne" license above, please follow below link for the End User Agreement:

[www.tue.nl/taverne](http://www.tue.nl/taverne)

**Take down policy**

If you believe that this document breaches copyright please contact us at:

[openaccess@tue.nl](mailto:openaccess@tue.nl)

providing details and we will investigate your claim.

# Characterizing the Mobile Phone Use Patterns of Refugee Hosting Provinces in Turkey

Erika Frydenlund<sup>1</sup>, Meltem Y. Şener<sup>2</sup>, Ross Gore<sup>1</sup>, Christine Boshuijzen-van Burken<sup>3</sup>, Engin Bozdag<sup>4</sup>, Christa de Kock<sup>5</sup>

<sup>1</sup> Old Dominion University, USA

<sup>2</sup> Istanbul Bilgi University, Turkey

<sup>3</sup> Eindhoven University of Technology, The Netherlands

<sup>4</sup> 4TU Centre for Ethics and Technology, The Netherlands

<sup>5</sup> Stellenbosch University, South Africa

efrydenl@odu.edu

**Abstract.** We use coarse-grained mobile phone data from a large Turkish mobile phone provider and cross-reference this data with social media data and a qualitatively composed violent events list to explore the integration of refugees in Turkey. The data provides grounds for fruitful future research. It suggests that border communities with the refugee sending country have much different communications patterns than non-border communities. Additionally, proximity to refugee camps may increase negative sentiment on social media towards refugees, which we suggest may be a proxy for understanding ‘compassion fatigue.’ These findings provide directions for future research on integration.

**Keywords:** Integration, Twitter Sentiment, Syrian Refugees.

## 1 Background

As a host country, Turkey has the largest number of refugees in the world, where the vast majority live outside of camps in urban and peri-urban environments [1]. Since most of the millions of refugees live in urban areas, the impact of forced migration on integration and neighborhood relations is critical for maintaining safety and order. From a data perspective, what do “good” neighborhood relations look like? We use mobile phone data provided by a large mobile phone company in Turkey, in combination with Twitter sentiment analysis, and a set of violent events that occurred in Turkey in 2017 to explore the relationship between refugee and non-refugee communication, negative sentiments expressed on social media, and geography (proximity to refugee camps and the Syrian border). In particular, we focused on violent events hypothesizing that an increase in communication by both refugees and non-refugees after an attack is a proxy for both groups expressing concern over the incident; in other words, an increase in communications by both groups could signal some form of integration. However, an increase in communication by the host population alone prior to an event could signal lack of integration, as citizens organized prior to the attack. The data reveal patterns

about cultural use of mobile phones in after violent events, as well as link geography and negative social media sentiment.

From early on in the process of hosting so many Syrian refugees, Turkey has made great strides in attempting to provide the necessary social support to promote integration, or at least self-sufficiency, as integration is generally a long-term process. Turkey, as a host government, supported an education strategy that allowed large numbers of Syrians the chance to continue their education [2,3]. These strategies were not without their challenges [4], but given the exceptional number of Syrians entering Turkey, any avenues for education can provide a means for integrating newcomers linguistically and culturally.

Host communities can often experience some difficulties in the wake of a large influx of a new population. As far back as 2013 and 2014, border provinces such as Hatay reportedly experienced increased tensions as ethnic balances shifted in the wake of the Syrians fleeing into Turkey [5]. Even in this early phase of migration, historic cross border relations between Turkey's border communities and Syria that should make integration easier became strained under the pressures of long-term refugee hosting of such vast numbers of refugees [6, 7]. This has included the demands placed on the economy such as lower wages, competition over jobs, and higher housing prices [8]. These economic tensions affect both host and newcomer populations, giving rise to negative and xenophobic sentiments that can affect long-term integration strategies [9].

Though Turkey has been generous to the Syrian refugees, it has also been receiving a large number of individual asylum seekers from elsewhere, such as Iran, Iraq, Somalia, and Afghanistan. Syrians are given special protection as guests under Turkish law, but the same does not apply to others seeking asylum in or transit through Turkey who must each apply on a case by case basis [10]. It should be noted that in our data, we cannot distinguish between countries of origin. We assume, based on the number of refugees from Syria versus other countries who are given permission and access to rights in Turkey that the majority of 'refugees' in our dataset are of Syrian origin. Still, Syrians suffer from uncertainty of their status and future in Turkey, and though many citizens still broadly feel compassion for the humanitarian case of receiving refugees, the lived reality is putting pressure on many cultural differences and infrastructure challenges [11]. Many of these challenges are ones that Turkey cannot face alone as it attempts to accommodate changing residency and citizenship demands as well as the extreme burden placed on infrastructure and social institutions [12].

A report from the International Crisis Group (ICG) in 2016 that was built upon qualitative interviews collected along the Turkish border with Syria suggested that the length of stay experienced by Syrians has inhibited integration. The report indicates that part of the struggle with integration is language, which many Syrians did not attempt to overcome as they thought their stay in Turkey would be short. Many Syrians they interviewed did not have Turkish friends and worried about increasing segregation by job type, neighborhood of settlement, and language and culture differences [13].

Given the sensitivity of mobile phone data and the ability to uniquely identify individuals, the D4R Challenge took great strides to ensure anonymity and safe use of the data. As a consequence, it is very difficult to generalize about individuals' behaviors

or integration strategies. Thus, we must cross-reference the mobile phone data with other sources of data in order to draw some conclusions. We found that it was difficult to draw any conclusions about integration per se, so we concentrated our efforts on what could be proxy measures of integration or dis-integration. To accomplish this, we focused on violent attacks—where the refugees and non-refugees’ responses are a proxy for (dis)integration—as they have enormous negative consequences in terms of refugee integration. Violent events involving refugees demonstrate to the newcomers that they are not welcome and do not belong to the host society. To be able to formulate and implement any long-term integration program, the host society should first give refugees the message that they are welcome in their new country, including providing mechanisms for decreasing tensions between the host society and refugees. This research uses big data to understand whether mobile phone data can tell us something about how differently refugees and non-refugees respond via SMS and calls after a violent event that involved Syrian refugees, the largest refugee community hosted in Turkey. The premise of this study is that we may be able to understand how mobile phone usage correlates with other quantitative and qualitative data that characterizes certain locations in Turkey based on integration levels.

## **2 Methodology**

The study relies upon triangulation of mobile phone data, social media data from Twitter, and locations of refugee camps in reference to qualitatively relevant violent events that occurred in Turkey in 2017. The following section provides a summary of the study approach.

### **2.1 Ethical Considerations and Privacy**

Given the sensitive nature of mobile phone data, Turk Telecom highly anonymized the data and requested signed statements from all researchers to comply with the privacy policy before the research could be started. Privacy concerns were extremely important to our research team; therefore, in addition to the measures put in place by Turk Telecom, our research team set up a separate directive of principles by which to abide during the course of the study. The dataset provided by Turk Telecom (TTG) is anonymized and as a result it does not relate to an identified or identifiable natural person and the individuals are no longer identifiable. Per the data challenge, the only purpose of data processing under this project is scientific research which shall be proportionate to the aim pursued, respect the essence of the right to data protection, and provide for suitable and specific measures to safeguard the fundamental rights and the interests of the data subject. The team protocol put in place included sharing data internally only on a need-to-know basis. We accomplished this by ensuring that the data scientists could access the data and relied on them to provide aggregate measures and visualizations to advance the research agenda. The data was never shared with any third parties, was securely stored, and we used the data only for the intended purposes

of the challenge. All researchers agreed to these principles before we embarked on the study.

While big data presents an opportunity to see social phenomena in new ways, we are aware of the limitations of doing research with big data for crisis situations. Some researchers warn that this type of analysis can lead to surveillance and control, particularly among displaced populations [14, 15], and we took this challenge to heart. In addition to surveillance, big data presents a number of scientific challenges including ‘noisiness’ of data and selection bias (particularly of displaced and other marginalized populations) of who can own a mobile device or who participates on social media [15]. We cannot control what others do with the data, but we chose to pursue hypotheses that we felt best reflected the humanitarian spirit of the data challenge. The research presented here was guided by the ideal that big data may be able to reveal policies that are effective for integration or future avenues of research that assist refugees and host communities in coping with cohabitation.

## **2.2 Phone Data**

We exclusively used the coarse-grained mobility dataset which tracked anonymous individuals continuously throughout the course of 2017. This dataset represented 100,000 users (half refugee, half non-refugee identified based on their registration card needed to subscribe to a mobile phone line). This dataset included the province name, but not the exact location within the province, of the calls and texts that were recorded [16].

## **2.3 Social Media Data**

An increasing number of high-stakes decisions are now made based upon predictive models of publicly available sentiment data. The most common source for such predictions is currently Twitter due to its public nature [17], large userbase [18], and high accessibility by both academic and industry researchers [19]. Tweets, which are short text-based messages created by users of Twitter and posted to their online profiles, cover a wide variety of topics depending upon user preferences, and this diversity allows for the investigation of human behavioral patterns across many disciplines [20].

Sentiment is generally viewed as a desirable predictor in this type of modeling because of its simplicity of computation, its applicability regardless of text type, and its ability to reduce any length of text into a single numerical summary value. Specifically, one common challenge in the statistical modeling of text is a "p>N" scenario in which the number of words/variables exceeds the sample size. Various types of dimension reduction, which restructure large groups of variables into their hypothetically latent causes, are used to increase statistical power to detect meaningful relationships [21]. Sentiment analysis is arguably the most popular type of dimension reduction; it can be used to reduce any quantity of words to a single value representing a continuum ranging from highly positive to highly negative tone [22].

Given the sensitivity of linking Twitter data to the phone data, we took extra precautions to store the data and report our findings. Access to the raw data was strictly

limited to our team during the project period. The raw data set where the Twitter data and phone data are connected will be deleted after the project, leaving only the aggregate data, analyses, and measures that inform our findings and report. Our collection used Twitter's streaming API which provides low latency access to Twitter's global stream of Tweet data. The procedure adhered to Twitter's terms of use/service.

We collected geo-tagged tweets with locations inside Turkey for the year 2017 that referenced the following hashtags or phrases to cross-reference with our mobile phone data:

- #ÜlkemdeSuriyeliİstemiyorum
- #ulkemdesuriyeliistemiyorum
- #suriyelilersınırdışıedilsin
- #suriyelilerseçmendeğildir
- #SuriyelileriGeriGonderin
- "Suriyeli istemiyorum diye ırkçıysam ırkçının kraliyim bundan da gurur duyurım"
- #IDon'tWantSyriansInMyCountry
- #IDontWantSyriansInMyCountry
- #DeportSyrians

Note that these are all negative hashtags and phrases. Positive hashtags and phrases were more difficult to locate and are the subject of current ongoing investigation.

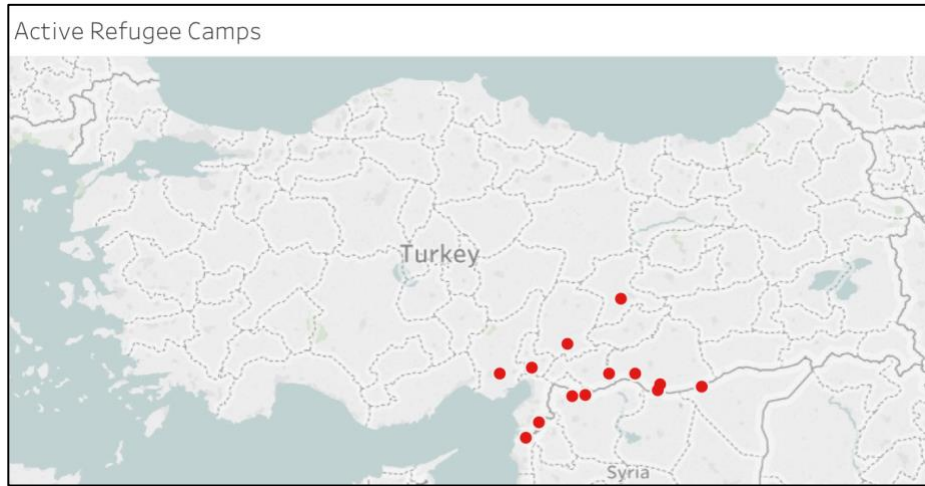
There are issues that must be addressed with how well a geo-tagged Twitter data set can represent the sentiment of a population. Only 15% of online adults regularly use Twitter, and 18–29 year-olds and minorities tend to be more highly represented on Twitter than in the general population. Furthermore, on Twitter, 95% of users never geo-tag a single tweet and only ~ 1% of users geo-tag the majority of the tweets they post. Also, the extent to which the individual 'tweeter' is represented in our Twitter corpus is biased. Very passive users (< 50 tweets per year) and very active users (> 1000 tweets per year) geo-tag a smaller percentage of tweets than moderate users (50–1000 tweets per year) [23]. Ultimately, these limitations mean that the Twitter data set which informed our study is a non-uniform subsample of statements made by a non-representative portion of the Turkish population.

## 2.4 Location Data

In order to get a sense of how close people were living to formal refugee settlements, as opposed to urban integration, we identified the location of refugee camps using data from the Humanitarian Data Exchange by UNHCR.<sup>1</sup> A map of these locations is shown in **Fig. 1**.

---

<sup>1</sup> <https://data.humdata.org/dataset/turkey-refugee-camps>



**Fig. 1.** Active Refugee Camp Locations in Turkey

## 2.5 Event Data

We compiled a list of 16 violent events related to refugees in Turkey during the study year of 2017. These events were gathered from various international and Turkish news sources and qualitatively determined to be relevant to the study of refugee integration in Turkey. For each event, we identified the city in which the violent event towards refugees took place. These events are located on the map (**Fig. 2**) with the descriptions in the table below (**Table 1**).



**Fig. 2.** Violent Incident Locations in 2017

**Table 1.** Violent Incidents by Date with Description

ID	Date	Description
1	27 February	Some local residents drove to an area where Syrians were living and lit their tents on fire and fired rifles in Adana Yuregir. <sup>2</sup>
2	18 March	After a fight between a group of Syrian teenagers and residents, 500 people came together and threw stones at the houses of Syrians in Denizli Saraykoy. <sup>3</sup>
3	5-6 April	Because of a rumor that a Syrian person hit a child, 300 people got organized and went into the neighborhood where Syrians live in Izmir Torbali District Pamukyazi. 500 Syrians had to leave the neighborhood. <sup>4</sup>
4	15 May	A group attacked the houses and workplaces of Syrian families in Mersin Akdeniz District Sevket Sumer Neighborhood. <sup>5</sup>
5	16 June	A fight occurred between Syrian workers and Turkish residents in Sakarya Hendek. <sup>6</sup>

<sup>2</sup> <http://www.milliyet.com.tr/adana-da-suriyeliler-ile-mahalle-sakinleri-adana-yerelhaber-1870768/>

<sup>3</sup>

[http://www.cumhuriyet.com.tr/haber/turkiye/702265/Saraykoy\\_de\\_gergin\\_gece\\_\\_Suriyeliler\\_3\\_kisiyi\\_dovdu.html](http://www.cumhuriyet.com.tr/haber/turkiye/702265/Saraykoy_de_gergin_gece__Suriyeliler_3_kisiyi_dovdu.html)

<sup>4</sup> <https://www.yeniakit.com.tr/haber/izmir-valiliginden-suriyeli-aciklamasi-299416.html>

<sup>5</sup> <http://www.hurriyet.com.tr/gundem/sosyal-medyada-orgutlendiler-dun-gece-saldirdilar-40459388>

<sup>6</sup> <https://www.cnnturk.com/turkiye/sakaryada-suriyeli-gerginligi-buyuyor-yaralilar-var?page=1>



ID	Date	Description
6	1 July	After a fight between Syrian and local teenagers, a group of locals got together in the evening and raided a Syrian family's house in Istanbul Uskudar Yavuzturk Neighborhood. <sup>7</sup>
7	3 July	Attempt to lynch Syrians in Ankara Demetevler because of rumors on social media. <sup>8</sup>
8	13 July	A group of people who were wearing masks raided the workplaces of Syrians in Adana Seyhan Mirzacelebi. <sup>9</sup>
10 <sup>10</sup>	20 August	After a fight between a group of Turkish residents and two Syrian men, a group of people who don't want Syrians in their neighborhood organized on social media and circled a building where Syrians were staying in Konya Karapinar. <sup>11</sup>
11	24 August	A mob convened in front of a house where Syrians were living in Sivas Istiklal Neighborhood. They wanted the Syrians to vacate the house. <sup>12</sup>
12	7 September	Two people on a motorcycle fired rifles on a street where Syrians are living in Konya Karatay Kerimde Neighborhood. <sup>13</sup>
13	21 September	In Urfa tension arose between Syrians who were registered at the adult education center and the parents of the children at a primary school sharing the space. Later in the day parents came to the school garden to protest the Syrians. <sup>14</sup>
14	22 September	After a fight between a group of Syrian teenagers and the owner of a bakery, a group of 600 people attempted to attack Syrians in Antalya Elmali. <sup>15</sup>
15	8 October	During the street wedding of a Syrian couple, residents of that street attacked the Syrians in Antalya Kepez Mehmet Akif Neighborhood. One Syrian died, and another was wounded. <sup>16</sup>

<sup>7</sup> <https://www.evrensel.net/haber/325186/uskudarda-suriyeli-ailenin-evine-saldiri>

<sup>8</sup> <http://www.hurriyet.com.tr/gundem/ankarada-suriyelilerle-vatandaslar-arasinda-gerginlik-40508566>

<sup>9</sup>

[http://www.cumhuriyet.com.tr/haber/turkiye/94361/Satirli\\_ve\\_maskeli\\_grup\\_Suriyelilerin\\_isyerlerini\\_basti\\_.html](http://www.cumhuriyet.com.tr/haber/turkiye/94361/Satirli_ve_maskeli_grup_Suriyelilerin_isyerlerini_basti_.html)

<sup>10</sup> Note: Incident number 9 was removed from the original dataset

<sup>11</sup> <http://www.hurriyet.com.tr/karapinarda-taciz-kavgasi-1-suriyeli-oldu-1-40556700>

<sup>12</sup> <http://www.hurriyet.com.tr/sivasta-suriyeli-gerginligi-40559616>

<sup>13</sup> <https://www.evrensel.net/haber/331758/konyada-suriyelilere-ates-acildi-2si-suriyeli-4-yarali>

<sup>14</sup> <https://www.evrensel.net/haber/333065/urfada-bir-okulda-suriyeli-siginmacilarla-gerilim-yasandi>

<sup>15</sup> <https://m.sondakika.com/haber/haber-antalya-elmali-da-suriyeli-gerginligi-10057266/>

<sup>16</sup> <http://www.milliyet.com.tr/dugun-sonrasi-laf-atma-kavgasinda-1-antalya-yerelhaber-2324578/>

ID	Date	Description
16	3 November	200 people who did not want Syrians in their neighborhood attacked the houses and workplaces of Syrians in Konya Karatay District Sems Tebrizi neighborhood. <sup>17</sup>

For each city in Turkey we tracked the average percent increase in the percentage of calls and texts from refugees and non-refugees following each violent incident (including the day of the event and two following days). Note a negative number reflects a percent decrease in calls and texts. The average refugee and non-refugee call/text number in the city is determined by looking at number of calls and texts sent by refugees / non-refugees in the city over the course of the year. We also computed the average for each city across all violent events.

### 3 Findings

**Table 2** summarizes the findings of the data analysis. Note, all are statistically significant correlations ( $p=0.00$ ) with weak+ to strong- effect sizes (0.25 – 0.80):

**Table 2.** Overall Data Analysis Findings

Finding	Effect Size
Calls and texts correlate closely with one another.	Strong
Changes in refugee communication and non-refugee communication within a city occurring before and after a specific violent event exhibit similar patterns that correlate with one another.	Strong
There is a lot of variation across all the cities in terms of refugee and non-refugee communication occurring at the time of a specific violent event.	N/A
Cities closer to where the event occur experience a larger increase in communication related to a violent event. This is true for refugees and non-refugees.	Moderate
Given a city and an event, there is more of an increase in refugee communication (calls and texts) than non-refugee communication. Statistically significant difference between the two populations.	N/A
Negative twitter sentiment correlates with increases in refugee and non-refugee communications.	Moderate
Negative twitter sentiment tracks correlates with proximity to violent events.	Moderate

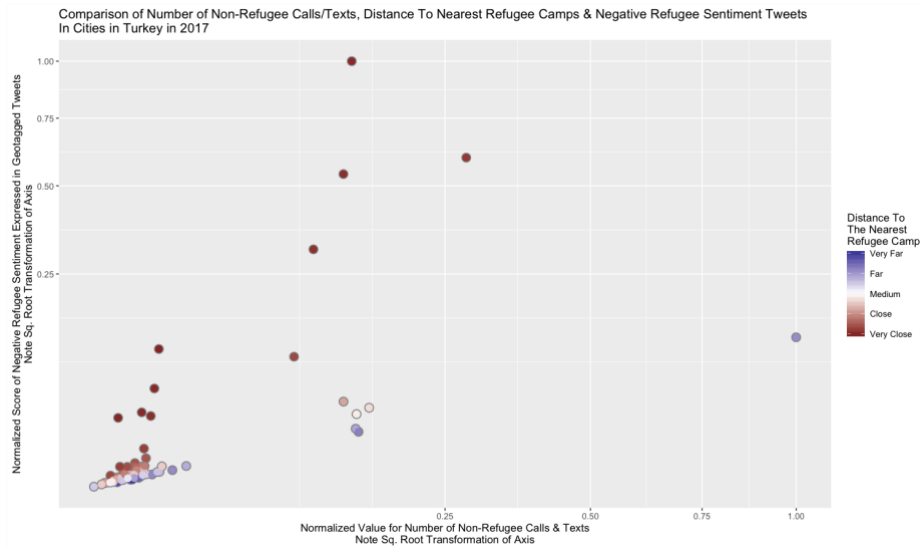
Violent events tend to occur more often in places where negative sentiment is expressed on Twitter. This is only one avenue of social media, expression, but there appears to be some relationship. This is not surprising as many of the events in the

<sup>17</sup> <http://www.hurriyet.com.tr/gundem/tehlikeli-gerginlik-200-kisiyle-saldirdilar-40633451>

violent incidents we covered were mobilized via social media such as Facebook. This indicates that there may be a way to monitor the risk of violent events between refugees and citizens through social media, but more research would be needed to know what type of error rate to expect from this type of monitoring. Refugees and non-refugees alike experience an increase in communication—both phone calls and SMS text messages—when they are close to a violent event in the dataset. Refugees tend to experience more of an increase in communication over non-refugees when faced with violent incidents related to Syrian refugees. This difference in communications patterns may be an indicator against integration. Members of the host society appear to be less interested in a violent incident against Syrians, where refugees are very affected and possibly transmit that concern through increased phone and SMS communications.

When looking at the distance of the area to the nearest refugee camp, we can see from **Fig. 3** that places very close to a refugee camp (in dark red) also tend to have a high number of calls by non-refugees (x-axis) and high frequency of negative sentiment tweets against refugees (y-axis). One thing to notice in the graph is that locations associated with both negative sentiment towards refugees on social media as well as a relatively high call volume around violent incidents tend to occur near refugee camps. This may coincide with intergroup contact theory in the integration literature that suggests more frequent contact leads to more integration [24]. Perhaps refugees who are somewhat isolated by living in camps do not interact as frequently with citizens as those who live in urban and peri-urban areas, leading to more negative sentiment. It should be noted here that most of the violent events we used did not occur near refugee camps (see **Fig. 1** and **Fig. 2**).

Since the vast majority of refugees do not live in camps, but rather in urban or peri-urban locations [1], it is not surprising that the events generally occurred around large cities rather than specifically near camps. Variation in the negative sentiment expressed on Twitter in Turkey correlates with a large number of non-refugees being somewhat close to a refugee camp. It seems that variation on negative Twitter sentiments is explained more by the proximity of the camp than the number of refugees in a city. This may suggest that urban and peri-urban based settlements, even though they generate occasional violent incidents, help to disrupt growing negative sentiments. In fact, as we can see near refugee camps around the world, large and prolonged settlements of refugees organized by governments and operated by NGOs can breed significant local hostilities. This gives some empirical evidence to support the growing practice of promoting self-settlement in urban areas, not just for economic reasons, but also to decrease hostile feelings towards refugees. While this does not speak to integration directly, it does indicate that the foundation of facilitating harmonious co-habitation by host and migrant populations is to promote self-settlement and urban/peri-urban solutions over camp-based solutions.

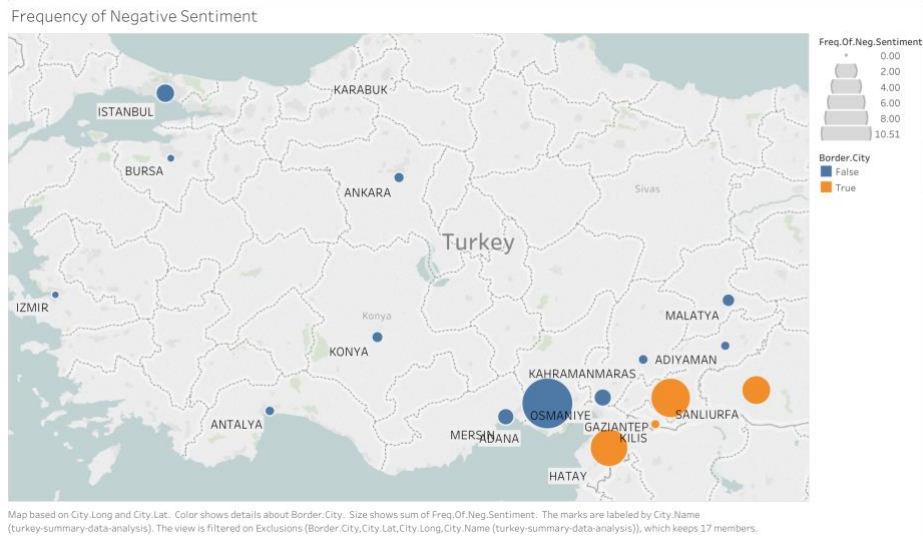


**Fig. 3.** Number of Non-Refugee Communication and Distance to Nearest Refugee Camp as related to Negative Refugee Sentiment Tweets 2017

This idea about proximity to refugee locations led us to a question about geographical dispersion of refugee populations and the possible differences between communication patterns of refugees and non-refugees. The 2018 ICG report on metropolitan areas makes a baseline assumption that “the potential for anti-refugee violence is highest in the metropolitan areas of Istanbul, Ankara, and Izmir where communities see Syrians as culturally different and resent their competition for low-wage jobs or customers, especially within the informal economy” [25]. The report contends that border communities are much more integrated because they have long done business across interstate lines and have cultural and linguistic ties that may not exist in other areas.

These findings are somewhat in contrast to what we found regarding negative Twitter sentiment and proximity to refugee camps—the vast majority of which are along the Syria/Turkey border. In our data, border provinces are more likely to express negative sentiments towards refugees on Twitter. These communities are both close to the border and home to Turkey’s refugee camps. These findings of negative sentiment are in keeping with the tensions between border inhabitants and Syrians who found themselves staying in Turkey far longer than they expected indicated by qualitative fieldwork conducted by ICG in 2016 [12]. It is not possible here to disaggregate the effects of those two factors from the negative Twitter sentiment. In other words, we cannot tell from the data available here whether negative sentiment is caused by proximity to the border, to the refugee camps, neither, or both. Comparing to **Fig. 2**, however, we can see that the violent incidents that occurred involving Syrian refugees corresponds roughly to the same locations that experience the most negative sentiment on Twitter. Note, those cities not included in **Fig. 4** registered very low (near or at zero)

negative Twitter sentiment with regards to the hashtags and phrases we used for this study. Future assessments should explore alternative hashtags that may be unique to particular regions or cities in Turkey.



**Fig. 4.** Frequency of Negative Sentiment (marker size indicates relative frequency) and proximity to border (orange indicates border province)

When comparing border provinces (shown in orange in **Fig. 4**) and non-border provinces, there is a statistically significant difference in the volume of calls conducted by refugees and non-refugees in the dataset. In total call volume, border communities experience a much higher call volume than non-border communities after a violent event involving Syrians in Turkey. These two phenomena are likely related, though we do not know the content of the calls and thus find correlation between the two events (incident and high call volume). Along the border, there is a smaller difference in the call volumes between refugees and non-refugees ( $p = 0.03978$ ), meaning, from the dataset, border communities have similar communications behavior between refugees and non-refugees after a violent event. These relationships do not hold for texts. This pattern could possibly indicate that both refugees and non-refugees care somewhat equally about the effects of a violent event involving refugees. What we cannot tell, however, is the tone or intention of the calls. It is not possible to know whether these calls were mobilizing xenophobic or integrative sentiment.

These conflicting findings, in comparison with the ICG report, require future investigation. While similar call patterns may support the hypothesis that border communities are more integrated—at least in as much as they culturally rely on phone calls to communicate after violent events—the increased negative sentiment towards refugees near camps and near border communities indicates some other underlying explanations. Further research is needed to pull apart the factors that may be influencing negative social media sentiment and the difference in communication patterns between

border communities and non-border communities and refugees and non-refugees. More must also be done to understand why the same relationships do not hold for texts. This finding suggests that perhaps texts and calls serve different sociological functions.

These findings point broadly toward areas that require deeper investigation. Our research suggests two particular findings. First, the assumption that border communities are more integrated than cities due to their historical connection with neighboring countries may not hold true when the number of refugees has increased so dramatically and remained for so long. Further research is needed to understand the dynamics between camp-based refugees in provinces that neighbor the refugees' country of origin and the 'compassion fatigue' described in so many refugee-related studies, including the ICG reports [12, 25]. Second, it appears there is a different culture for communication between border communities and non-border communities. In border communities, the similarity between refugees and non-refugees may indicate some amount of integration—at least in the cultural use of mobile phones. Our data showed that the difference in communication patterns between refugees and non-refugees becomes increasingly less pronounced the closer the province is to a refugee camp. More research is needed to understand how and why people use phones, particularly in situations of forced displacement and prolonged hosting of refugee communities. The data for this study cannot provide more insight into these cultural communication differences.

#### **4 Policy Implications**

This research opened up more questions than provided definitive answers that can inform policy decisions. We limit our policy recommendations to suggestions for future research. First, border cities appear to be able to inform our understanding of integration. This may be for both the positive and the negative, where 'compassion fatigue' erodes what was once a path to integration, and time and proximity lend themselves to inevitable co-evolution of cultural practices such as communication. Our data cannot provide specific solutions or policies regarding this aspect of integration, but it does point to the notion that more work must be done to understand these nuances of border life in the hopes that their experiences can inform integration practices throughout the host country.

Second, the study found that there are statistically significant differences in the call volumes of refugees and non-refugees after a violent event that involves Syrians in Turkey. While we cannot gauge the tone or intent of these communications, there is clearly communication about the event happening. This phenomena supports the notion that more mechanisms must be put in place to defuse tensions after a violent event in order to limit the erosion of progress to local integration strategies.

Third, our research suggests that fewer negative sentiments are expressed farther away from refugee camps, despite claims that urban centers are more likely to experience refugee violence. More research must be done to understand why this is. Our preliminary work seems to support the growing body of refugee literature that indicates urban and peri-urban settlements are not only good for economic growth and

opportunity, but also perhaps in dissolving some of the negative sentiment towards refugees. Again, our findings are based on data that are not representative of the entirety of Turkey or any one host community's experiences. The data suggests, however, that this may be an area that is worth investing in more research in the future, not just for the benefit of integration in Turkey, but also for extrapolating Turkey's urban host policies to other host states around the world.

## References

1. UNHCR. 3RP 2017 Progress Report. (2017). <https://data2.unhcr.org/en/documents/download/60340>
2. AFAD (Disaster and Emergency Management Presidency) Survey on Syrian Refugees in Turkey. (2013). <https://data2.unhcr.org/en/documents/download/40157>
3. Aras, B. and S. Yasun. The Educational Opportunities and Challenges of Syrian Refugee Students in Turkey: Temporary Education Centers and Beyond. (2016). IPC Mercator Policy Brief: <http://research.sabanciuniv.edu/29697/1/syrianrefugees.pdf>
4. Kirisci, K. and E. Ferris. Not Likely to Go Home: Syrian Refugees and the Challenges to Turkey- and the International Community. Turkey Project Policy Paper, Number 7. (2015). <https://www.brookings.edu/wp-content/uploads/2016/06/Turkey-Policy-Paper-web.pdf>
5. Çağaptay, S. The Impact of Syria's Refugees on Southern Turkey, Policy Focus 130, Washington Institute for Near East Policy. (2014). Washington DC. <http://www.washingtoninstitute.org/policy-analysis/view/the-impact-of-syrias-refugees-on-southern-turkey>
6. Dinçer, O.B., et al. Turkey and Syrian Refugees: The Limits of Hospitality. (2013). Washington DC and Ankara: Brookings Institution and International Strategic Research Organization: <https://www.brookings.edu/research/turkey-and-syrian-refugees-the-limits-of-hospitality/>
7. Kanat, K. B. and K. Ustun. Turkey's Syrian Refugees: Toward Integration. (2015). SETA Report: [http://file.setav.org/Files/Pdf/20150428153844\\_turkey%E2%80%99s-syrian-refugees-pdf.pdf](http://file.setav.org/Files/Pdf/20150428153844_turkey%E2%80%99s-syrian-refugees-pdf.pdf)
8. Tumen, S. The Economic Impact of Syrian Refugees on Host Countries: Quasi-Experimental Evidence from Turkey. *American Economic Review* 106(5): 456-460. (2016). <https://pubs.aeaweb.org/doi/pdfplus/10.1257/aer.p20161065>
9. Yildiz, A. and E. Uzgoren. Limits to Temporary Protection: Non-Camp Syrian Refugees in Izmir, Turkey. *Southeast European and Black Sea Studies* 16(2): 195-211. (2016). <https://www.tandfonline.com/doi/full/10.1080/14683857.2016.1165492?src=recsys>
10. Corabayir, M. The Evolving Approach to Refugee Protection in Turkey: Assessing the Practical and Political Needs. (2016). Transatlantic Council on Migration, A Project of the Migration Policy Institute: <https://www.migrationpolicy.org/research/evolving-approach-refugee-protection-turkey-assessing-practical-and-political-needs>
11. Erdoğan, M. *Türkiye'deki Suriyeliler: Toplumsal Kabul ve Uyum*, İstanbul: İstanbul Bilgi Üniversitesi Yayınları. (Syrians in Turkey: Social Acceptance and Integration Research). (2015). <https://data2.unhcr.org/en/documents/download/46184>
12. International Crisis Group. Turkey's Refugee Crisis: The Politics of Permanence. (2016). Europe report no. 241: [https://d2071andvip0wj.cloudfront.net/241-turkey-s-refugee-crisis-the-politics-of-permanence\\_0.pdf](https://d2071andvip0wj.cloudfront.net/241-turkey-s-refugee-crisis-the-politics-of-permanence_0.pdf)

13. İçduygu, A. Syrian Refugees in Turkey: The Long Road Ahead. Report. (2015). Migration Policy Institute. <https://www.migrationpolicy.org/research/syrian-refugees-turkey-long-road-ahead>
14. Fonio, C., & Boersma, K. Big data, surveillance and crisis management. In *Big Data, Surveillance and Crisis Management* (pp. 15-30). (2017). Routledge.
15. IOM. Bulletin, Issue No. 5. (February 2018). ISSN 2523-5060.
16. Salah, A.A., Pentland, A., Lepri, B., Letouzé, E., Vinck, P., de Montjoye, Y.A., Dong, X. and Dağdelen, Ö. (2018). Data for Refugees: The D4R Challenge on Mobility of Syrian Refugees in Turkey. arXiv preprint arXiv:1807.00523.
17. Public streams: Twitter developers. 6 February 2018 <<https://dev.twitter.com/streaming/public>>.
18. Second quarter letter to twitter shareholders. 6 February 2018. <<http://goo.gl/ihmm46>>.
19. Kwak, H, et al. What is twitter, a social network or a news media? Proceedings of the 19th International Conference on World Wide Web. ACM, (2010): 591–600.
20. Go, A, R Bhayani and L Huang. Twitter sentiment classification using distant supervision. Technical. (2009). Stanford.
21. Guyon, I and A Elisseeff. An introduction to variable and feature selection. *Journal of Machine Learning Research* 3(3). (2003): 1157–1182.
22. Pang, B and L Lee. Opinion mining and sentiment analysis. *Foundations and Trends in Information Retrieval* 2(2). (2008): 1–135.
23. Smith A, Brenner J. Twitter use 2012. Pew Internet & American Life Project. 2012.
24. Pettigrew, T. F. (1998). Intergroup Contact Theory. *Annual Review of Psychology*, 49(1), 65-85. doi:10.1146/annurev.psych.49.1.65
25. International Crisis Group. 2018. *Turkey's Syrian Refugees: Defusing Metropolitan Tensions*. Europe Report no. 248: <https://d2071andvip0wj.cloudfront.net/248-turkey-syrian-refugees.pdf>