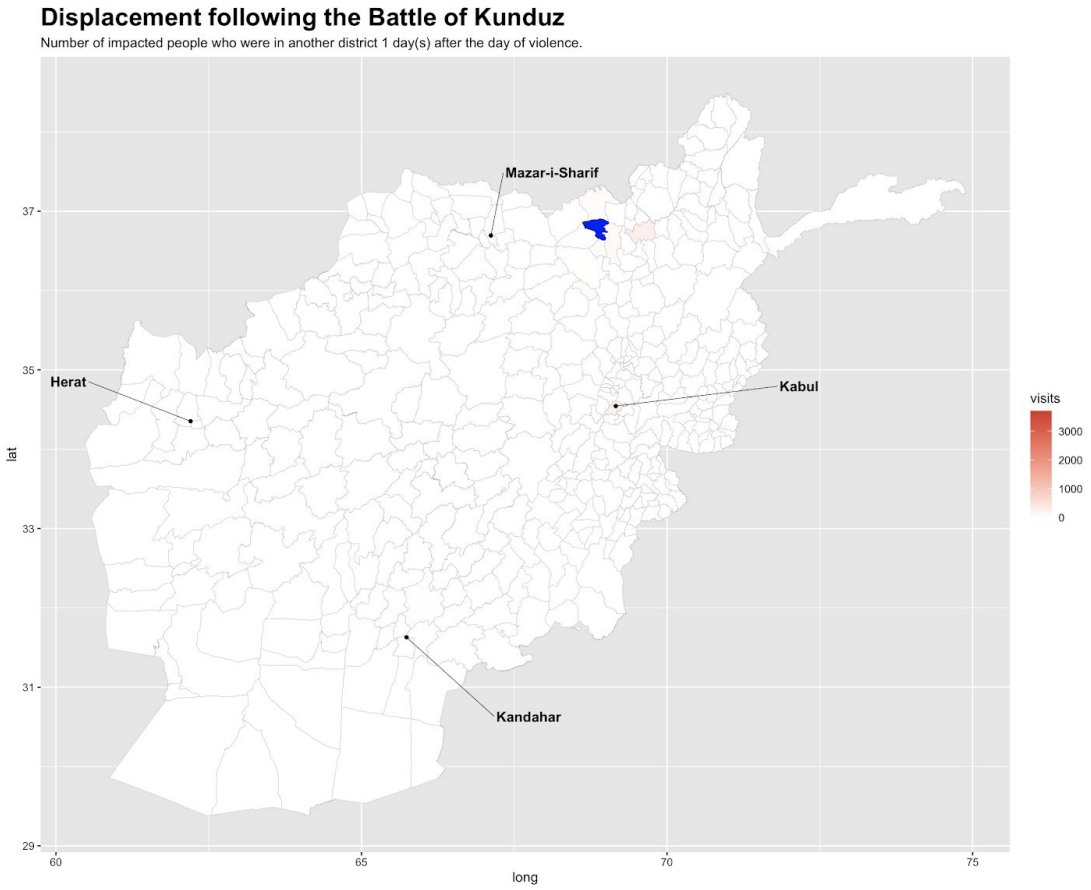
Maps Illustrating Migration Following the Battle of Kunduz

Maps:

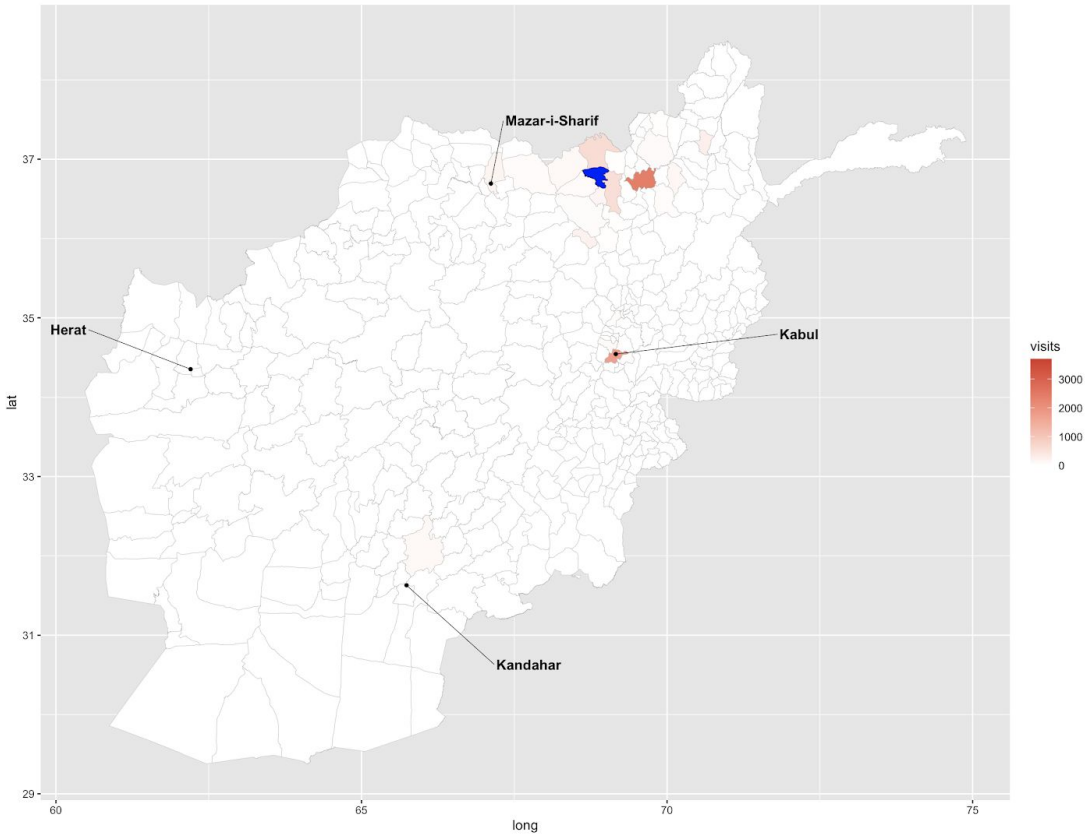
The maps below visualize migration 1, 5, 10, 15, 30, 45, 60, 75, 90, 105, and 120 days after the Battle of Kunduz.

Blue represents the district of Kunduz (id: 1401) where the violent event occured.



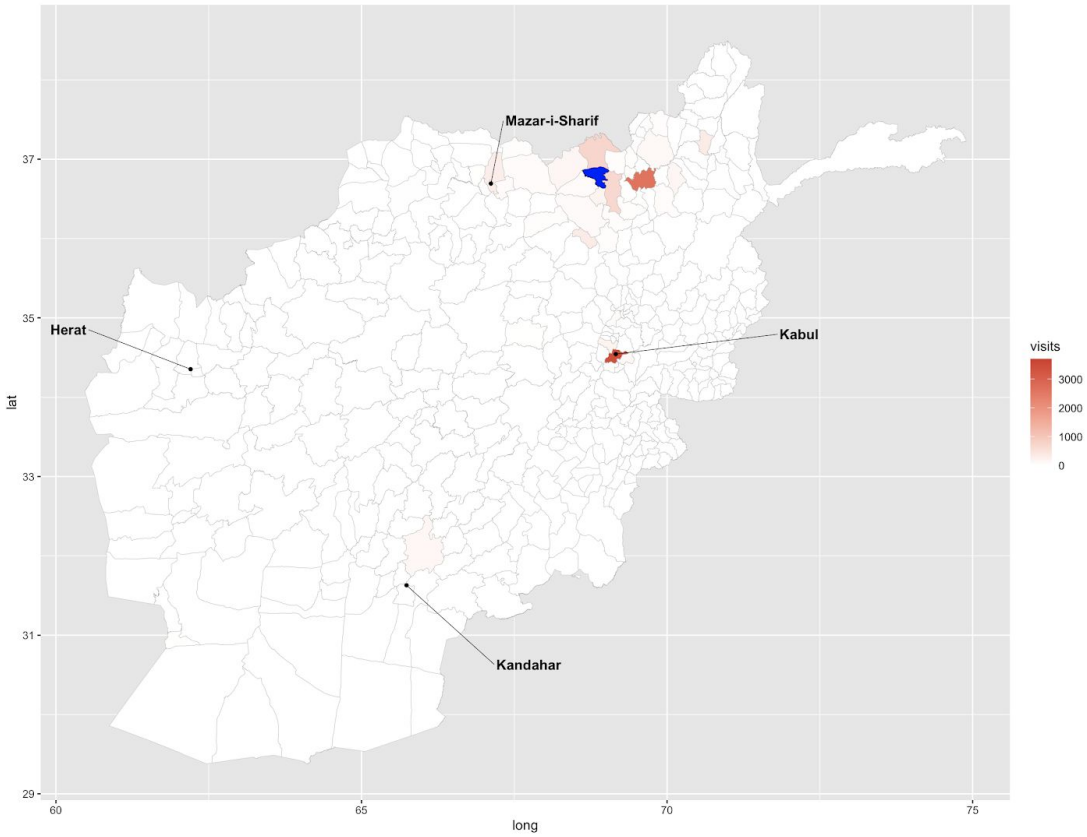
Displacement following the Battle of Kunduz

Number of impacted people who were in another district 5 day(s) after the day of violence.



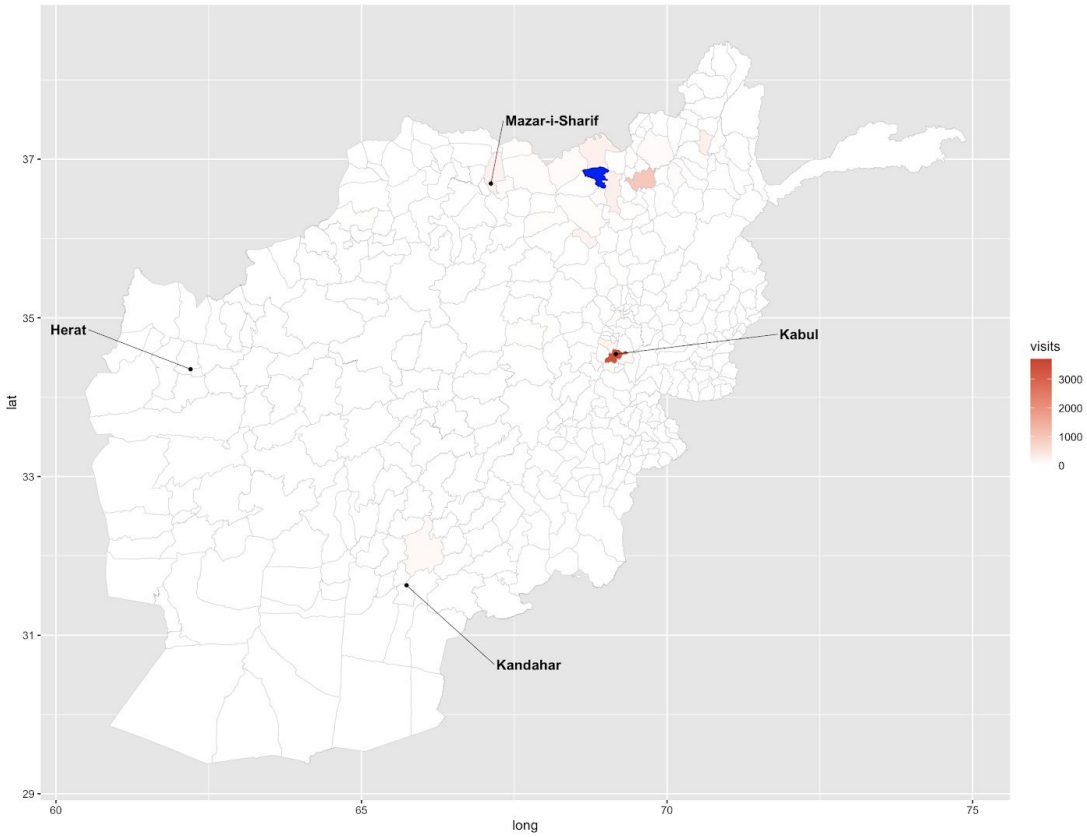
Displacement following the Battle of Kunduz

Number of impacted people who were in another district 10 day(s) after the day of violence.



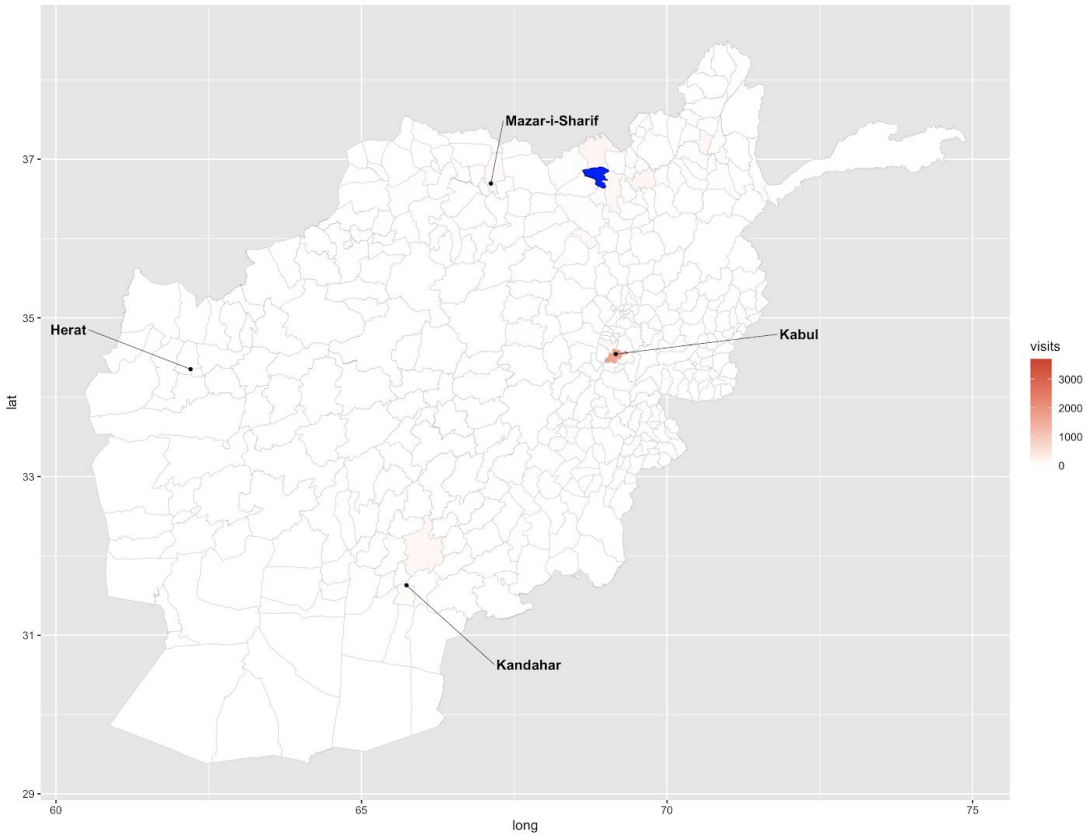
Displacement following the Battle of Kunduz

Number of impacted people who were in another district 15 day(s) after the day of violence.



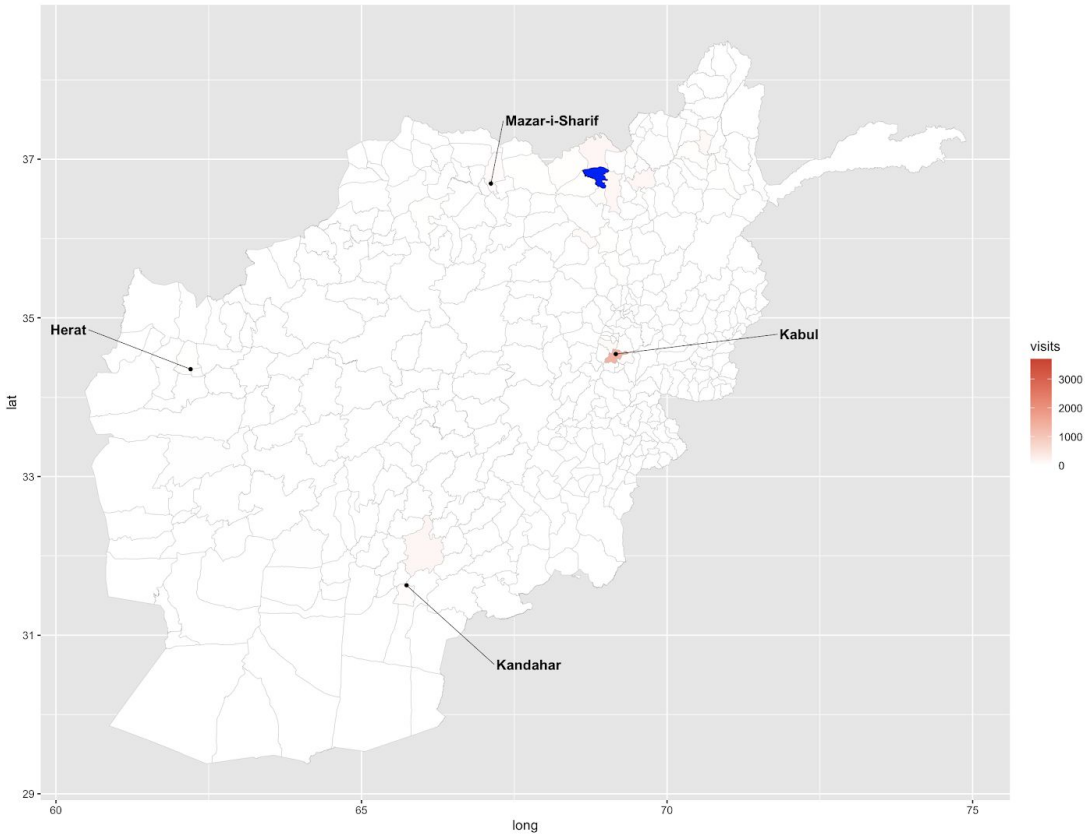
Displacement following the Battle of Kunduz

Number of impacted people who were in another district 30 day(s) after the day of violence.



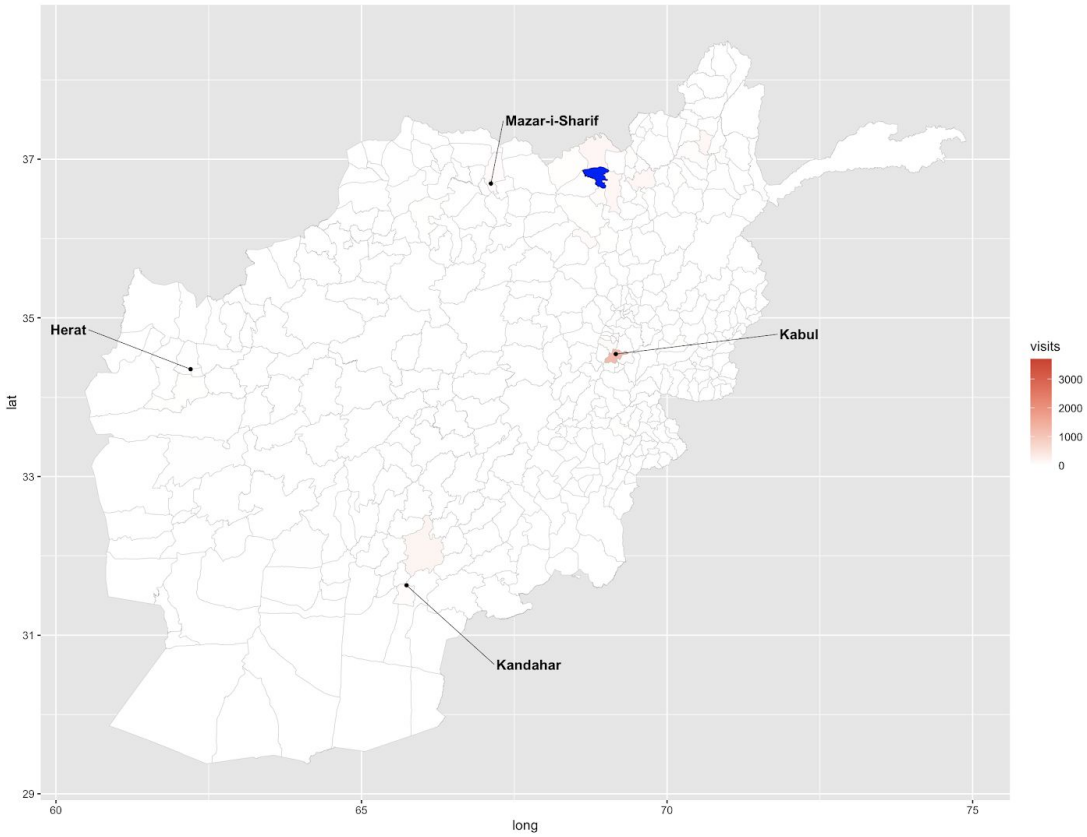
Displacement following the Battle of Kunduz

Number of impacted people who were in another district 45 day(s) after the day of violence.



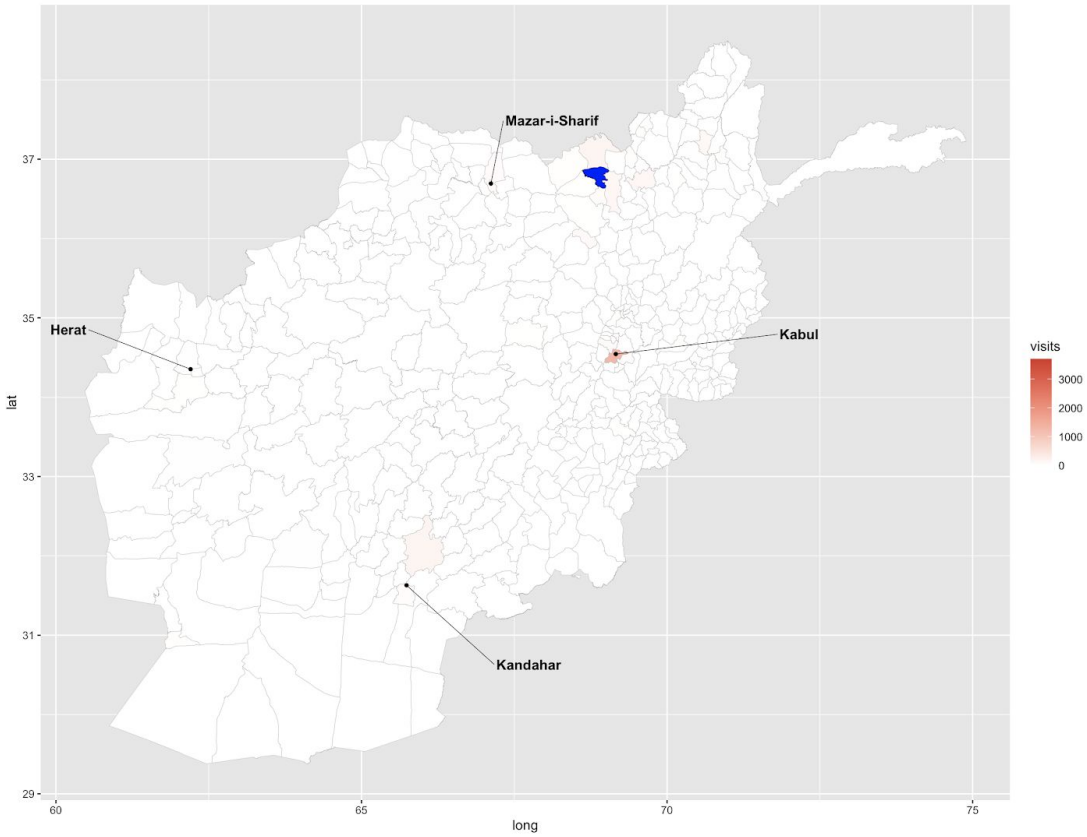
Displacement following the Battle of Kunduz

Number of impacted people who were in another district 60 day(s) after the day of violence.



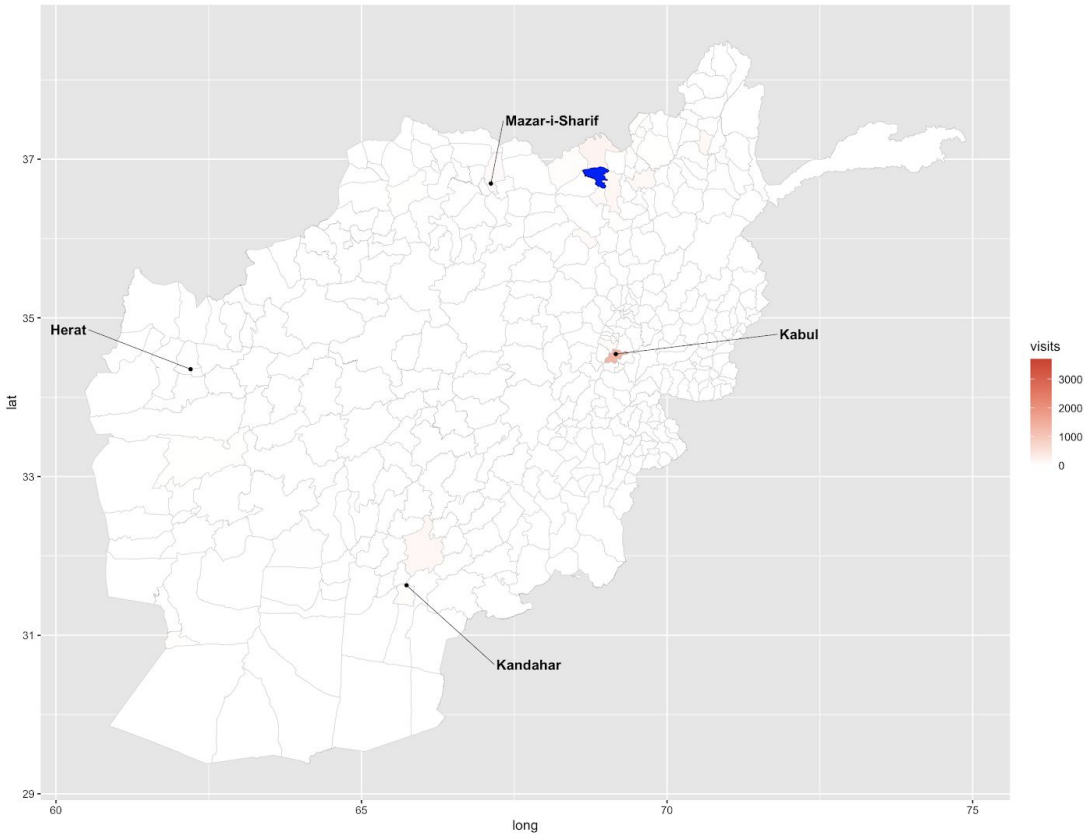
Displacement following the Battle of Kunduz

Number of impacted people who were in another district 75 day(s) after the day of violence.



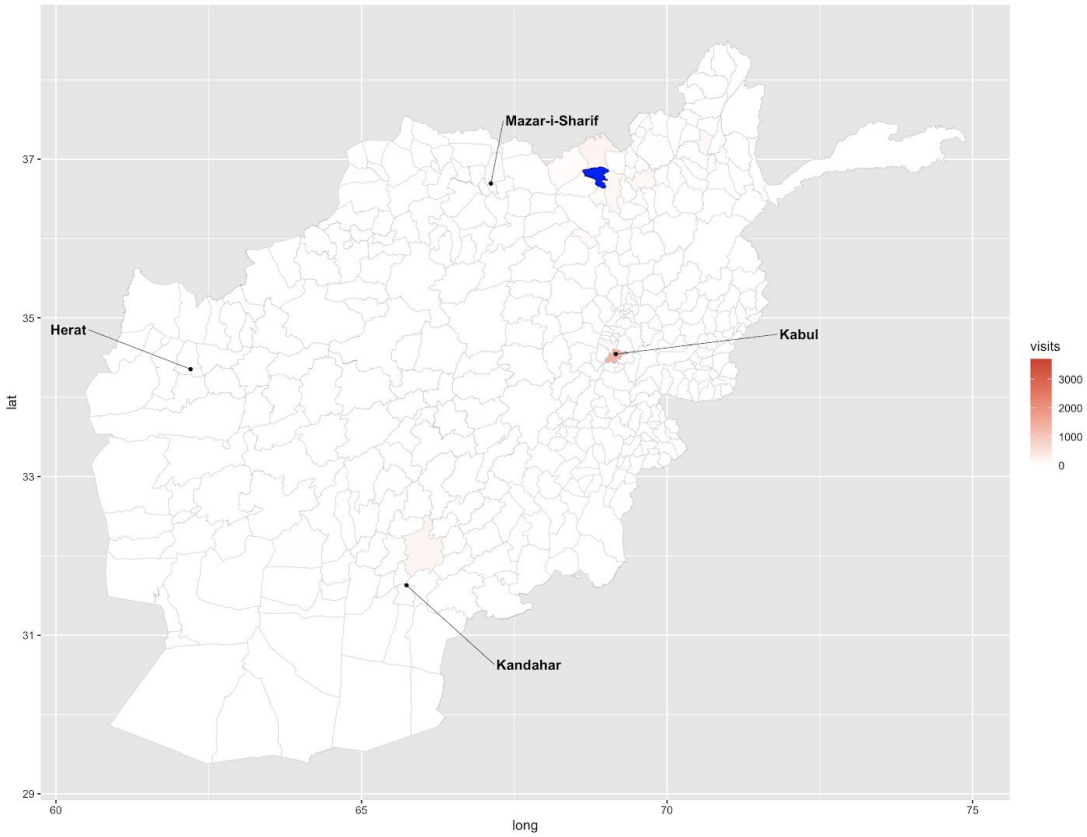
Displacement following the Battle of Kunduz

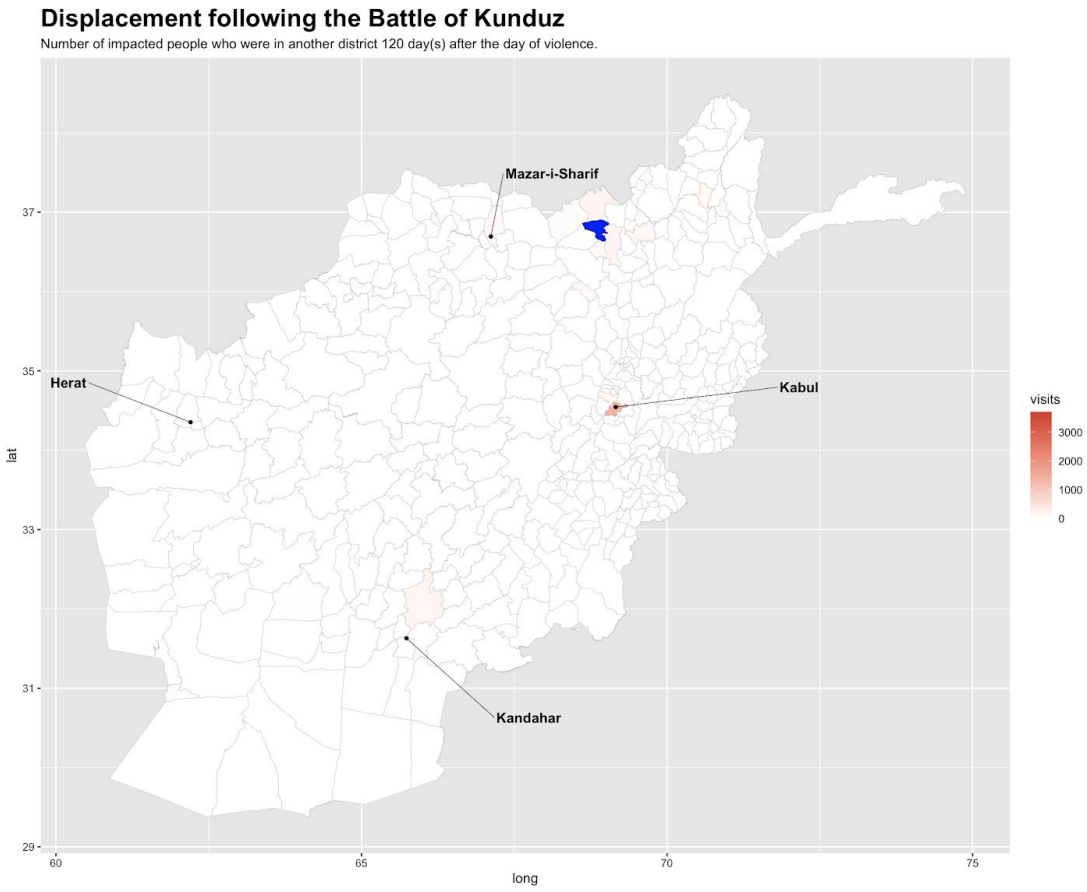
Number of impacted people who were in another district 90 day(s) after the day of violence.



Displacement following the Battle of Kunduz

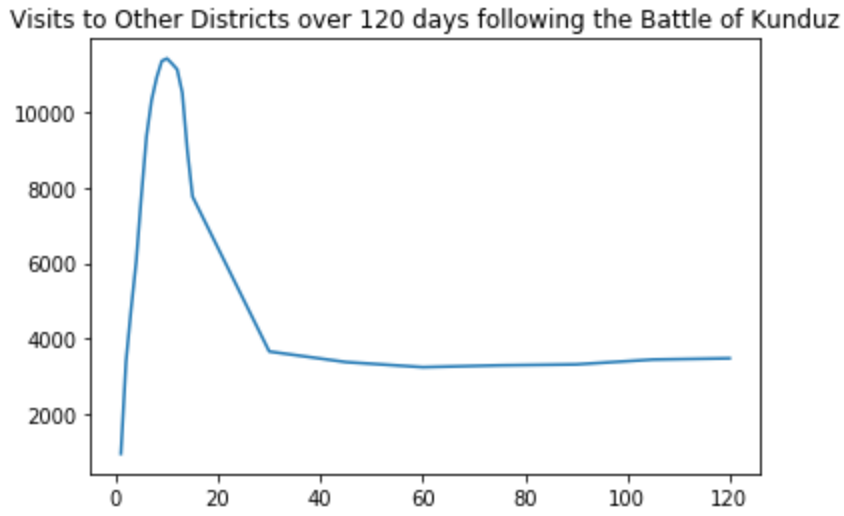
Number of impacted people who were in another district 105 day(s) after the day of violence.





Time Series Analysis:

Data Exploration step.



Summary of Individual Insights:

- Migration peaks around 10 days following the violent event.
- Between days 1-10, geographic proximity plays an important part in migration, as neighboring districts see the largest initial increase in “visits” from immigrants who were located in Kunduz prior to the violent event.
- After day 10, the district with the most migration is the Kabul Larger Area District. Though the province is visually small, it is the most populous Afghanistan district. As such, I hypothesis that many migrants may have connections that may be willing to provide temporary refuge (e.g. family and friends) until the violent event dies down or ends.
- I also hypothesize that the 10 day gap allowed many migrants to logistically plan to travel to Kabul, explaining why geographically closer districts saw an initial and higher increase in migration in the first 10 days and the Kabul district saw an increase in migration afterwards.
- Something important to notice that even though the District of Kabul has the highest population, other highly populated districts did not see much migration. Herat, with around one third the population of Kabul, had substantially less migration following the Battle of Kunduz. This implies that there might be another factor at play, other than the population at the destination district, which determines whether a migrant is likely to go there.
- After day 10, we see migration begin to reverse as visits decrease. I hypothesize that this is because the migrants begin to move back to their inferred homes in Kunduz as the violence dies down.
- The largest increase in migration in a single day was immediately after the event (between day 1 and day 2) with 2,441 increase in visits. Visits peaked on day 10 following the Battle of Kunduz with 11,414 Afghanistanis migrating to other districts.
- After 120 days, around 3,478 migrants did not go back to Kunduz and stayed in the districts they migrated to, which is 30.5% from the max total migration on day 10.

<u>Methodology:</u>

Data Aggregation:

- The Battle of Kunduz occurred on day 911, so I isolated migration 1, 5, 10, 15, 30, 45, 60, 75, 90, 105, and 120 days following the event.
- From the directory '/data/afg_anon/displacement_metrics/visits_per_district_day/', I measured visits where the origin_district was Kunduz (id: 1401) and the destination district was not Kunduz.

- Leveraged Matplotlib to create preliminary time series data to understand the total migration over time and max migration per k days.

Data Visualization:

- Initially used base R, but ran into a lot of issues, so I transitioned to using the ggplot2 package.
    - Per Xiao Hui's guidance, I learned that Umtiti has some issues with graphical R packages so I developed the visualizations locally.
- Took the aggregated data and developed a function that plotted a choropleth.
- The function isolated and plotted a choropleth for each district ID and the corresponding visits for that district ID given the k days that want to be analyzed. I ran the function every k_days (1, 5, 10, 15, 30, 45, 60, 75, 90, 105, 120).
- Added some additional information to improve readability.
    - Caption, blue colored Kunduz district, and populus Afghan cities.

Source Code and Programming Environment:

Code:https://github.com/eshaanmoorjani/afghanistan-urap-f20/tree/master/02_afghanistan_timeline_kunduz1401

Localhost3900:

http://localhost:3900/notebooks/02_afghanistan_timeline_kunduz1401/Kunduz%20Data%20Aggregation.ipynb

- Aggregation made with Jupyter Notebook, leveraging the NumPy and Pandas packages.
- Visualizations made with R, leveraging the following packages: rgdal, ggplot2, geojsonio, dplyr, broom, arules, arulesViz, mapproj, and ggrepel.