**Introduction**

In this document we seek to assess the relative COVID-19 accessibility of vaccination sites. Spatial accessibility is an important determinant for health equity. Due to the rapid nature of the vaccine rollout and unique supply line challenges posed by mRNA vaccine distribution, vaccine scarcity was a major problem at the beginning of the pandemic. We mapped COVID-19 accessibility both for adult and pediatric patients to see if there were any geographic areas of lower/higher coverage. We also wanted to see if transportation mode would be a concern. In particular, we wanted to assess if areas more reliant on public transit had public transit accessible

**Methods Summary**

A list of vaccination sites for King County was manually scraped via the VaccinateWA website. (https://vaccinelocator.doh.wa.gov/) We also identified sites that were eligible for giving doses of the Pfizer pediatric doses. King County tract TIGER/Line geography and ACS data was downloaded using the tigris R package. Driving and public transit times from tract centroids to vaccination sites were calculated using the R5R package.

Accessibility scores were then calculated using the enhanced two step floating catchment area technique (E2SFCA). Catchment populations were different based on adult (age 18 or older) versus pediatric (age 5-17) populations. E2SFCA were calculated for each tract for both personal automobiles and public transportation . Catchment weights for travel times were calculated using the NHTS data as described in the other document, and the scores were scaled by 10,000-fold for easier reading. A combined score () was calculated by using the percentage of households with no personal vehicles ( as follows:

These accessibility scores were then mapped and correlated with several tract-level demographic variables: percentage of households below the poverty line, percentage of each race/ethnicity, and population density. Correlation was done using Pearson’s r, but Spearman’s rho and Kendall’s tau resulted in similar findings. A sub-analysis of just the City of Seattle was also done, due to demographics and accessibility being significant different in city tracts compared to suburban tracts.

Note: Vashon Island was excluded from this analysis, because the minimal travel distance is approximately an hour via ferry. As a result, the island’s accessibility scores are very high outliers, because the vaccination sites serve a much smaller catchment area.

**Result Summary**

Overall accessibility was highest in the central city of Seattle and the near East Side suburbs (i.e. Bellevue, Redmond, Kirkland). Northern (e.g Mountlake Terrace, Shoreline) and southern (e.g. Kent and Renton) suburbs had less access, and the far eastern tracts of the county have much lower accessibility scores. We see the same general patterns between adult and pediatric access. Focusing on public transit access, we find that high access is only concentrated to the central city. This does correspond to where we see the neighborhoods with the highest proportion of people without access to a personal automobile. When correlated with census tract demographics the strongest correlation is between high access and high population density. All other correlations are weak, with there being a mild to moderate negative correlation for percent of White individuals and a mild positive correlation of percent of Asian individuals to vaccine access. Percent of households below poverty had very low correlations scores with vaccine access (all less than 0.2).

**Demographic Maps**

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**Adult Accessibility Scores**

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**Pediatric Accessibility Scores**

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**Correlation Plots**

Calendar

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Calendar

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**Discussion**

The accessibility analysis demonstrates that vaccine access is primarily localized in areas of high density in King County which include Central Seatle and Kirkland/Bellevue. This is most likely a function of the density of providers and the geography of the road systems and public transit network. The eastern most portion of the county by far has the least access. There aren’t any clear demographic trends looking at the correlation analysis. The negative correlation we see between percent White individuals and vaccine access most likely is being driven by the eastern, less urban tracts. Similarly, the positive percent Asian correlation likely is driven by many Asians living in the central city and the East Side of Lake Washington.

One natural question is do these vaccine access scores predict Briefly I have included maps from the KCPH vaccination dashboard of ZIP Code vaccination rates. The first is the % booster dose administered for age 12+. There is some evidence that the eastern most ZIP codes have lower rates of booster dose administration, but otherwise there are not any clear trends of booster dose administration being predicted by vaccine accessibility scores. The second is the % of children 5-11 who have completed their series. Here we see more evidence that areas with higher vaccine access scores have better rates of completing the series. To be clear, I have not done this analysis yet, so this is purely based on my eyeballing the two maps. However, since this is publicly accessible data, I could recalculate the VAS at the ZIP code level and do a spatial regression analysis to see if there is an association between access and vaccination uptake.

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