

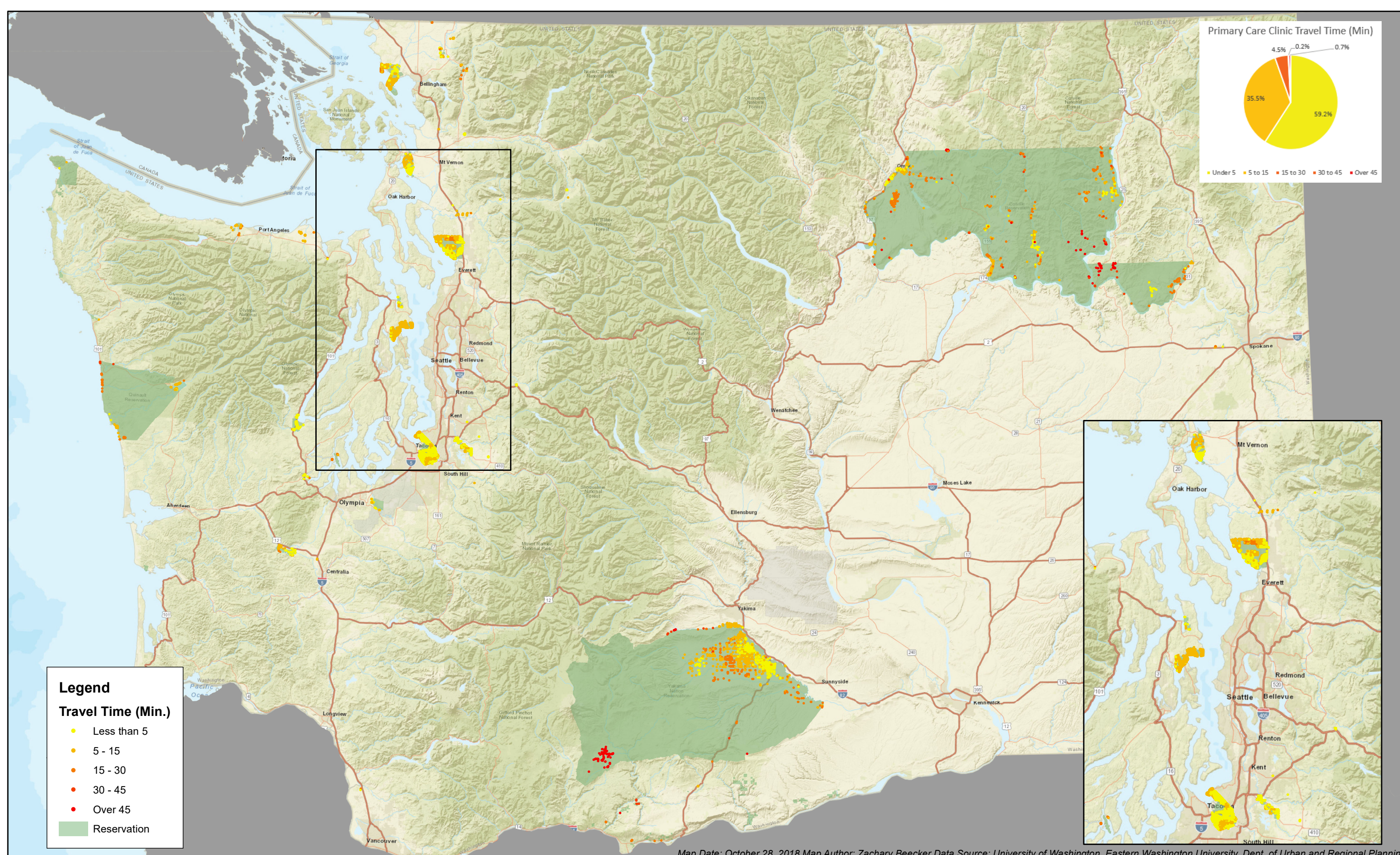
Mapping Healthcare Deserts: Identifying Areas of Limited Access in Washington State

Eastern Washington University, Department of Urban and Regional Planning, The Small Urban Regional Tribal Center on Mobility

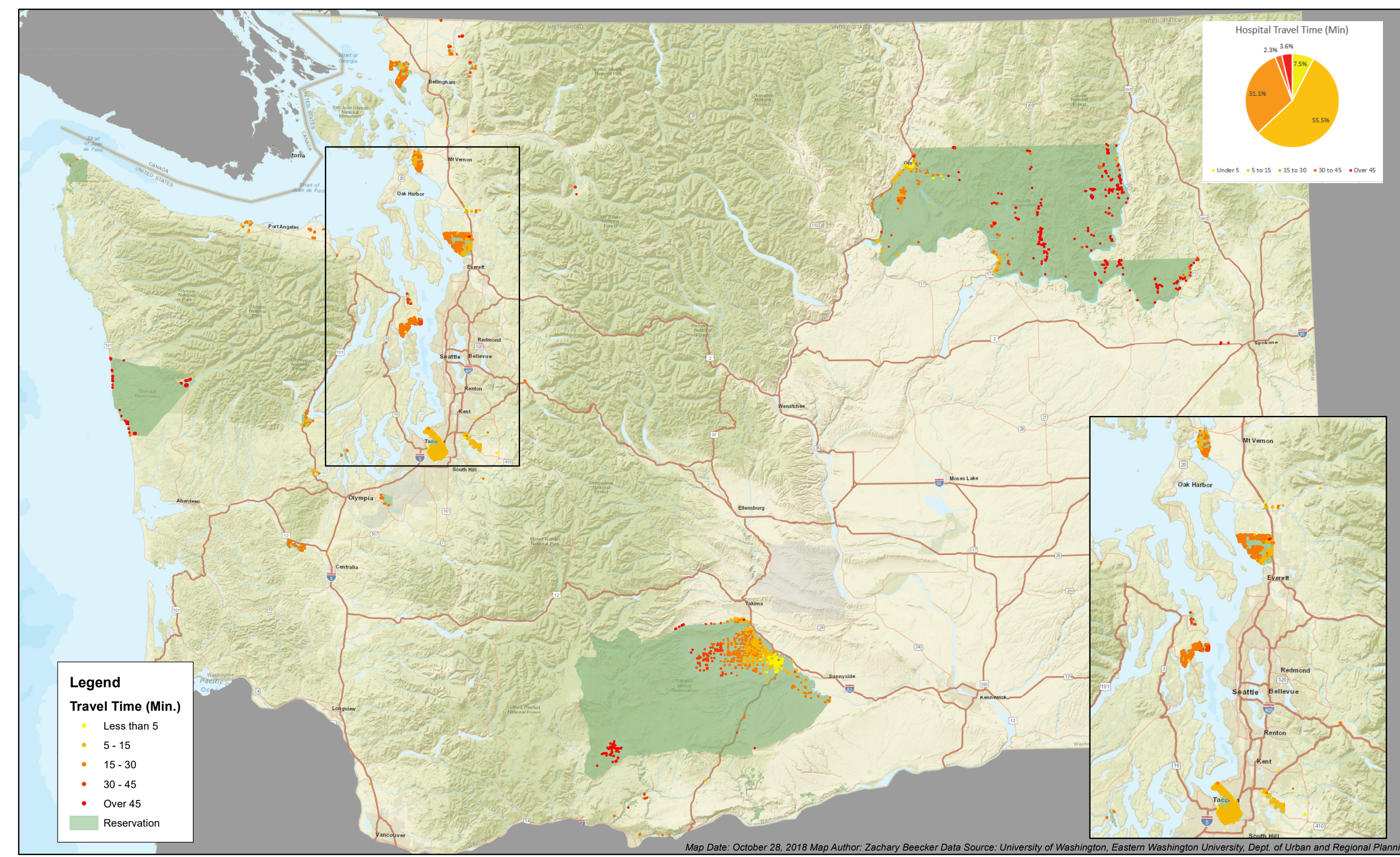
Zachary R Becker, MURP candidate, zbecker@eagles.ewu.edu
Jason Y. Scully, PhD, MUP, assistant professor, jscully@ewu.edu

Margo Hill, JD, MURP, assistant professor, mhill86@ewu.edu
Dick G. Winchell, PhD, FAICP dwinchell@ewu.edu

Richard A. Rolland, rrolland@rollandassociates.com



Travel Time to Nearest Primary Care Clinic from Residential Parcels on American Indian Reservations in Washington State



Travel Time to Nearest Hospital from Residential Parcels on American Indian Reservations in Washington State

Abstract
Health disparities among both rural and American Indian (AI) populations have been well documented (Jones, 2006), with rural communities seeing significantly lower health outcomes than urban populations. One of the possible factors that may affect these negative health outcomes is limited accessibility to healthcare resources. This research introduces the concept of “healthcare deserts” to describe the gap between rural and American Indian populations located within Washington State and levels of emergency medical services, primary care services, and specialty care services. Using GIS, we performed network routing queries from every residential parcel in the state of Washington to the following: nearest hospital; hospital with a cardiac center; hospital with an intensive care unit; hospital with access to kidney dialysis; nearest health clinic; health clinic with primary care; and the nearest free health clinic. These medical facilities were chosen based on observed and documented health disparities found in both rural and American Indian populations, as well as, concerns of equality in relation to accessibility to healthcare resources. The results provide an illustration of the perceived gaps in primary care, emergency health services, and gaps in access to specialized care for specific ailments that disproportionately affect AI populations.

This poster documents the first steps of a larger research project that looks to explore the concept of access and health care deserts at the parcel level within the entire state of Washington. The goal of this project is to provide a comparative analysis between rural, urban, and tribal lands within the state, providing both public health and planning professionals data that will assist in the identification of health care deserts in Washington State.

Methodology
The main tool used when constructing the data for this project was the Network Analysis Tool used on ArcMap 10.6. The type of analysis used was an OD Cost Matrix Analysis. Using the OD Cost Matrix Analysis instead of the Closest Facility Analysis was important in the development of this data due to the amount of unnecessary data, such as turn by turn directions, that the Closest Facility Analysis produces. This extra data production makes the process of analyzing network distances more difficult and can lead to out of memory errors while constructing data at such a large scale.
The network used to run the analysis was constructed by Street Map North America (ESRI, 2017). The parcel data for the residential parcels in Washington State was obtained through the Washington State Parcel Database Project, developed by the University of Washington Geographic Information Service at the School of Environmental and Forest Sciences. The locations of both hospitals and primary health care clinics in Washington State were provided by the Washington State Department of Health.

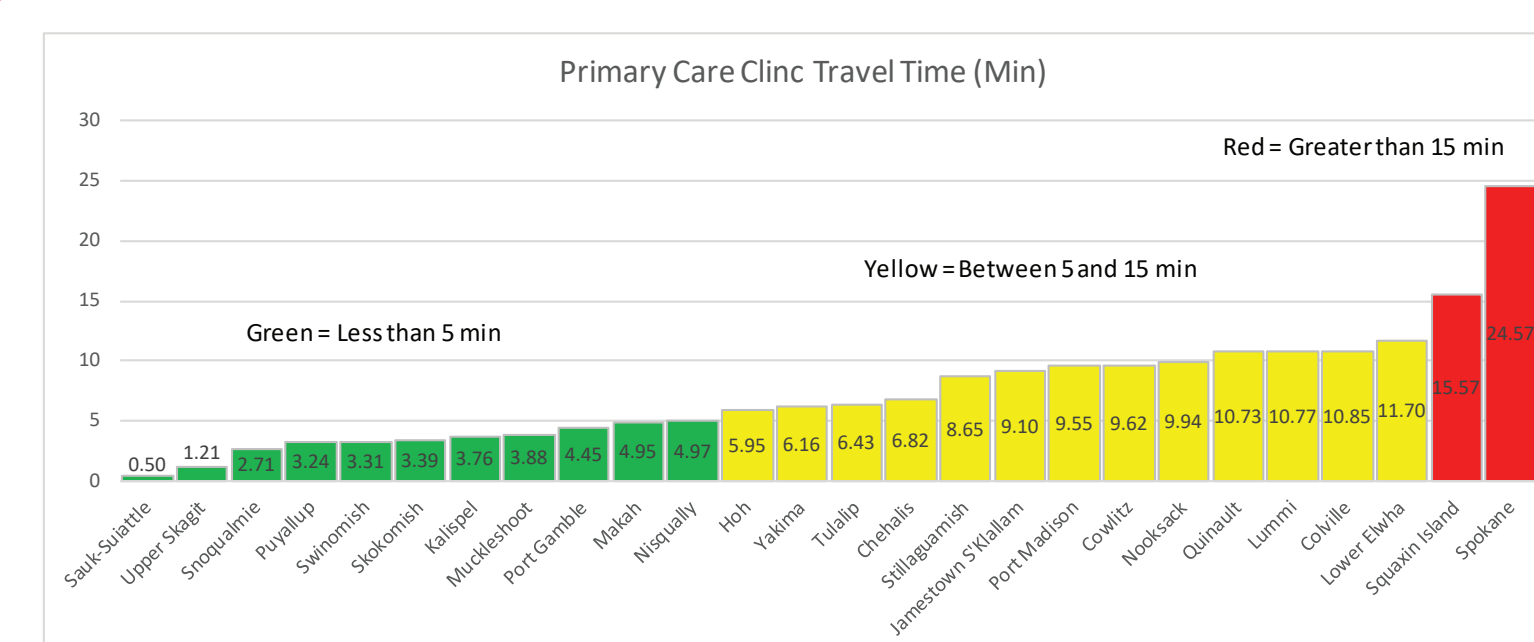


Figure 1: Travel Time Averages by Reservation: Primary Care Clinics

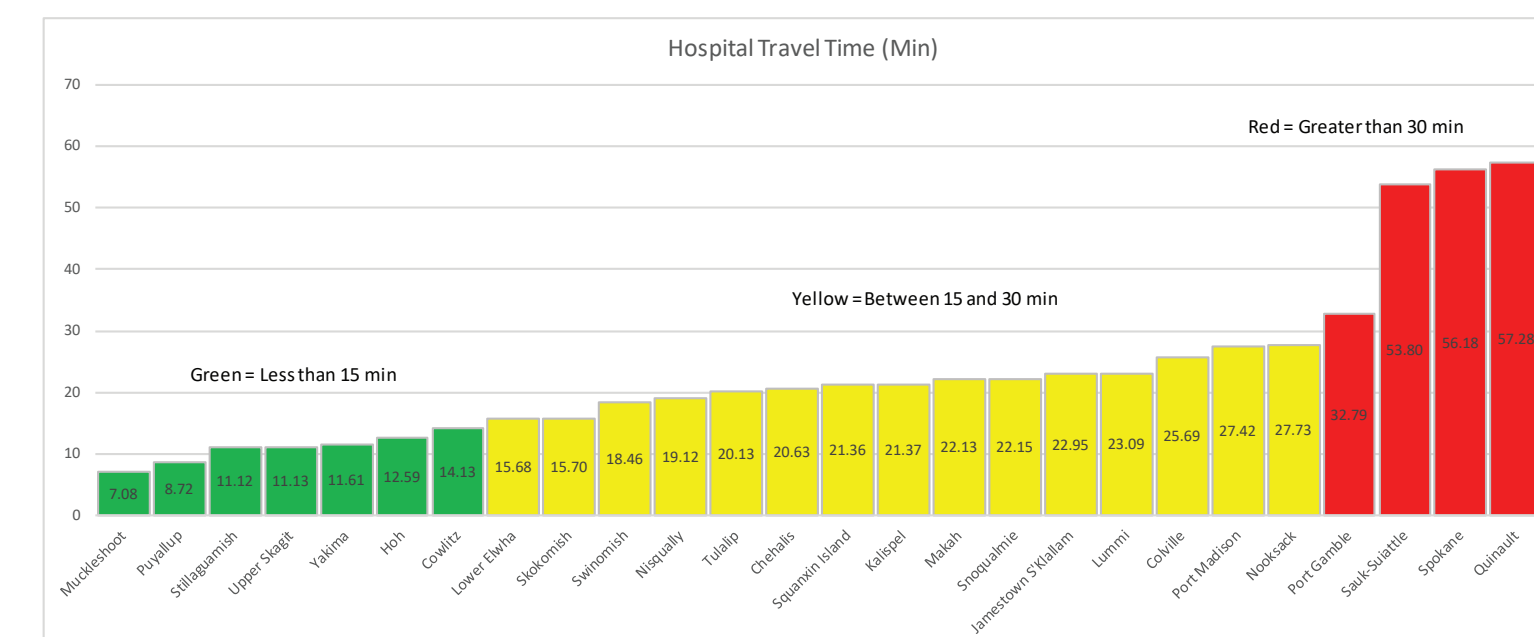


Figure 2: Travel Time Averages by Reservation: Hospitals

References
Jones, D. S. (2006). The persistence of American Indian health disparities. *American Journal of Public Health*, 96(12), 2122–34. <https://doi.org/10.2105/AJPH.2004.054262>
ESRI. (2017). Street Map North America [Computer software].

Results
The distribution of travel times amongst the reservations allowed for categorization of the reservation based on level of access. For hospital times, the reservations within a 15 minute drive include: Muckleshoot, Puyallup, Stillaguamish, Upper Skagit, Yakima, Hoh, and Cowlitz. Most of these reservations are located in, or close to metropolitan areas which allows them shorter travel times. Lower Elwha, Skokomish, Swinomish, Nisqually, Tulalip, Chehalis, Squaxin Island, Kalispell, Makah, Snoqualmie, Jamestown S’Klallam, Lummi, Colville, Port Madison, and Nooksack are all located between 15 and 30 minutes away from a hospital. These reservations tend to be located primarily more on the outskirts of metropolitan areas, or in the case of the Colville reservation, have their own hospital, but are large reservations with their populations widely dispersed. Lastly, the Port Gamble, Sauk-Suiattle, Spokane, and Quinalt reservations are all located over 30 minutes away from a hospital. These reservations, in general, are also larger reservations with widely dispersed populations, but are also located in more rural areas.

The distribution of travel times to primary health care clinics also allow for categorization. The Sauk-Suiattle, Upper Skagit, Snoqualmie, Puyallup, Swinomish, Kalispell, Muckleshoot, Port Gamble, Makah, and Nisqually reservations are all located within a five minute drive of a primary health care clinic. These reservations probably have their own healthcare clinic located next to their primary housing complex, or are located in metropolitan areas. The Hoh, Yakima, Tulalip, Chehalis, Stillaguamish, Jamestown S’Klallam, Port Madison, Cowlitz, Nooksack, Quinalt, Lummi, Colville, and Lower Elwha are located between 5 and 15 minutes away from a primary health care clinic. These reservations, again, in general, tend to be larger, which makes the drive to the clinic take a little more time. And finally, both the Squaxin Island and Spokane reservations are located between 15 and 30 minutes away from a primary health care clinic. These clinics are located in more rural areas, or in the case of Squaxin Island, on an island, and are fairly large, which causes the travel times to the area clinics to increase.

This data may provide useful to regional planners and public health professionals who are attempting to identify vulnerable populations in the state of Washington, and specifically American Indian reservations.

Acknowledgments
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Table 1: Primary Care Clinic and Hospital Analysis Data Averages

Reservation	Parcel Count	Primary Care Clinic				Hospital			
		Mean (MI)	SD	Mean (Min)	SD	Mean (MI)	SD	Mean (Min)	SD
Chehalis	146	3.78	1.43	6.82	2.41	14.93	1.22	20.63	2.09
Colville	1750	5.69	5.63	10.85	11.71	14.98	16.63	25.69	27.45
Cowlitz	2	5.65	5.94	9.62	8.71	10.76	0.03	14.13	0.07
Hoh	1	3.66	NA	5.95	NA	8.17	NA	12.59	NA
Jamestown S’I	50	5.06	2.45	9.10	4.70	14.58	2.70	22.95	2.72
Kalispell	3	1.84	1.15	3.76	1.68	12.57	12.83	21.37	21.25
Lower Elwha	41	5.84	1.58	11.70	3.40	9.11	2.18	15.68	3.42
Lummi	1848	5.32	1.88	10.77	4.03	13.34	1.44	23.09	2.73
Makah	2	2.56	2.04	4.95	4.03	13.21	0.04	22.13	0.10
Muckleshoot	627	2.02	0.95	3.88	1.85	3.94	2.10	7.08	3.54
Nisqually	83	2.63	0.65	4.97	1.26	11.60	0.48	19.12	1.00
Nooksack	77	6.33	5.41	9.94	7.36	15.93	5.04	27.73	8.84
Port Gamble	16	2.41	1.89	4.45	3.65	20.58	1.43	32.79	3.79
Port Madison	3289	5.19	0.86	9.55	1.37	17.16	2.05	27.42	4.26
Puyallup	15245	1.68	0.95	3.24	1.77	4.87	1.36	8.72	2.30
Quinalt	566	6.01	2.51	10.73	5.64	36.63	5.10	57.28	4.22
Sauk-Suiattle	30	0.21	0.81	0.50	1.89	30.07	6.55	53.80	12.11
Skokomish	184	2.26	0.91	3.39	1.11	10.66	1.05	15.70	1.41
Snoqualmie	5	1.21	0.23	2.71	0.61	14.39	2.38	22.15	4.15
Spokane	104	11.37	8.15	24.57	18.25	31.75	10.23	56.18	20.75
Squaxin Island	48	7.93	5.56	15.57	10.13	11.36	2.87	21.36	6.20
Stillaguamish	28	5.11	1.88	8.65	3.54	6.57	2.20	11.12	3.92
Swinomish	1491	1.80	1.14	3.31	1.87	11.57	1.45	18.46	2.69
Tulalip	4866	3.26	2.39	6.43	4.49	11.07	3.17	20.13	5.61
Upper Skagit	60	0.60	1.23	1.21	1.66	6.71	1.75	11.13	3.23
Yakima	5565	3.14	5.49	6.16	11.77	6.78	6.53	11.61	12.92
Total	36127	3.94	2.52	7.41	4.76	13.97	3.71	23.08	6.43

Limitations
Some of the major limitations of this project include the availability of parcel data for all of the reservations in Washington State. At the time the analysis was performed, parcel data was available for 26 of the 28 reservations in Washington State. The two reservations where data was not available were the Quileute reservation and the Shoalwater Bay reservation. Another limitation of this study included the processing power required to process the network distances using the OD Cost Matrix Analyst. The amount of available RAM greatly affected the amount of parcels able to process at once. This was resolved by packaging out the parcels and running the analysis using smaller parcel groups.