1. Introduction to Primary Care Access
   1. **The Importance of Primary Care**

In an effort to improve community health outcomes, access to primary care has been a priority of policy-makers as it is often the first step for the prevention and treatment of chronic diseases and other serious health conditions (Brown, Polsky, Barbu, Seymour, and Grande, 2016; Friedberg, Hussey, and Schneider, 2010). The positive association between access to primary care and health outcomes has been well established within the empirical literature (Kringos, Boerma, Zee, and Groenewegan, 2013; Chang, Stukel, Flood, and Goodman, 2011; Fields, Bigbee, and Bell, 2016; Gaglioti, Patterson, Bazemore, and Phillips, 2016). The 2016 study by Fields et al., found that higher primary care provider-to-population ratios were related to better health outcomes, including reduction in years of potential life lost, lower rates of poor and fair health, and a reduction in teen births. These results were consistent for both urban and rural counties, however they increased in magnitude with the level of rurality (Fields et al., 2016). Other recent studies have also found a positive relationship between increased levels of primary care physicians and better overall population health outcomes, including chronic health conditions, mortality, and obesity (Chang et al., 2011; Kringos et al., 2013; Gaglioti et al, 2016; Campbell, Ramirez, Perez, Roetzheim, 2003; Roetzheim, Ferrante, Lee, Chen, Love-Jackson, Gonzalez, Fisher, McCarthy, 2012).

In addition to decreasing health inequality, access to primary care plays an important role in slowing down the growth in health care costs (Kringos et al., 2013). Kringos et al. (2013) demonstrated this relationship through the analyses of the health care systems of thirty-one European Union countries. Their results showed that although increased primary care is not associated with a lower overall spending it is linked to a reduction in the growth of spending. When compared to these nations, the U.S. spends the highest share of Gross Domestic Product (GDP) on health care, accounting for 17.8% of GDP in 2015 (CMS, 2015; OECD, 2016). Total health care spending in the U.S. increased by 5.8 percent in 2015, reaching $3.2 trillion, and per capita spending increased 5.0 percent (Martin, Hartman, Washington, and Catlin, 2016). One of the main drivers of this growth has been the overutilization of health care services (Martin et al., 2016). In 2015, increases in the health goods and services contributed to 3.2 percent of the growth of per capita health care spending (Martin et al., 2016). This increase was driven by the utilization of health care goods and services (Martin et al., 2016). An increasing number of studies have shown a negative relationship between primary care and the utilization of health care services (Cabana and Jee, 2004; Kravet, Shore, Miller, Green, Kolodner, and Wright, 2008; Fung, Wong, Fong, Lee, Lam, 2015; Turbitt and Freed, 2016; Kringos et al., 2013). These studies have indicated that increased levels primary care physicians are associated with a reduction in hospital admissions, emergency care services, and surgeries (Cabana and Jee, 2004; Kravet et al., 2008).

To effectively reduce health care costs and increase health outcomes through primary care it is important to understand where current primary care access disparities may exist. A 2013 study of all primary care service areas, in the U.S., found that the on average an area had 87 primary care providers per 100,000 residents (Huang and Finegold, 2013). However, results like these may be misleading because they are measuring access at high levels of aggregation. And thus will not capture underlying health care disparities (Gentili, Isett, Serban, Swann, 2015, Wright and Ricketts, 2010; Mobley, Kuo, and Andrews, 2008). This could lead to either the over or underestimation of primary care accessibility within the area being analyzed because the level of access is being smoothed out over a large area. Gentili et al. (2015) demonstrated this smoothing effect in their study by comparing the health care accessibility and availability estimates of counties and their respective census tracts in both California and Georgia. They found that county level estimates tend to underestimate spatial access because they did not accurately account for different levels of accessibility within the county and thus spread out access over space. By only analyzing primary care access at higher levels of aggregation any disparities at the local level are being ignored. Most of the studies addressing primary access disparities have been at higher levels of aggregation, such as national, state, regional, and county. There have been few studies that have addressed and examined the potential disparities at the local level.

* 1. **Defining Spatial Accessibility to Primary Care**

Penchansky and Thomas (1981) defined access to care a having five components: availability (supply), accessibility (distance), affordability (cost), acceptability (patient preferences), and accommodation (hours of services). Affordability, acceptability, and accommodation have been the focus of most health care access research and account for the aspatial aspects of health care access. Availability and accessibility make up the spatial determinants of a populations level of primary care access. Availability is the number of physicians that serve a specified population and accessibility is the distance or time traveled by the patients to receive care.

Together the concepts of availability and accessibility make up the concept of spatial accessibility. DEFINITION. If a population has a high level of spatial accessibility they have a greater supply of primary care physicians within a reasonable travel distance, relative to geographically similar or neighboring populations. Spatial accessibility to primary care physicians is important because, as mentioned above, primary care access has been linked to positive health outcomes (Brown et al., 2016; Friedberg, Hussey, and Schneider, 2010).

* 1. **Selection of Study Area**

The study area of this study is the Seattle-Tacoma combined statistical area (CSA) in Washington State. WHAT COUNTIES ARE INCLUDED. The Seattle-Tacoma CSA was chosen as the setting for this study because in October 2016, Washington State received a five-year demonstration waiver from CMS. This waiver allows Washington State to transform its current Medicare system. Imitative I of the Medicaid Transformation incentives primary care providers to change how care is delivered. A goal within Initiative I is to ensure that primary care is provided at the local level statewide. This area also includes a mix of both urban and rural land and is relatively diverse when compared to other neighboring CSAs.

* 1. **Methodology**

I will identify the empirical methods, variables, and finding in recent research through an in-depth literature review of articles and white papers on health care, primary care access, and spatial accessibility. Previous research will help guide the choice of appropriate measures of spatial accessibility and empirical estimation. After completing a review of methods in calculating a spatial accessibility, I will choose the best method for the study and create the index along with map it for each census tract within the Seattle-Tacoma CSA.

To address the determinants of spatial accessibility an econometric model will be estimated. A series of spatial tests will be conducted to determine whether a spatial model is needed because of spatial relationships between observations.

* 1. **Value of Study**

Although there have been numerous studies on primary care access, spatial accessibility, and the benefits of primary care, few studies have analyzed the topics at lower levels of aggregation. The objective of this study is to estimate the spatial accessibility to primary care at the local level (census tract) within the Seattle-Tacoma CSA, while controlling for a populations demographic and socio-economic characteristics. This study will also control for the relationship between neighboring census tracts and how they impact each other’s accessibility.

1. **Literature Review**
   1. **Relationship between Planning and Public Health**
   2. **Primary Care Access**
   3. **Calculating Spatial Accessibility**
   4. **Aggregation and Modifiable Areal Unit Problem**
   5. **Empirical Model**
      1. **Spatial Spillovers**

A potential problem when measuring access over space that needs to be accounted for is the presence of spatial spillovers (Mobley, Root, Finkelstein, Khavjou, and Will, 2006). These spatial spillovers can come from both social and non-social factors. Social spatial spillovers are when neighborhoods have similar behavioral risk factors and health outcomes due to peoples influence over one another over space (Mobley, Root, Anselin, Lozano-Garcia, and Koschinsky, 2006). Non-social spatial spillovers may stem from the placement of physicians. These types of spillovers occur because one community’s investment in new health infrastructure may impact a neighboring community’s access. Both types of spatial spillovers occur because the boundaries of small geographic areas are not physically defined. Because of this there is nothing to prevent residents of one community from going to another community for health services. The presence of spatial spillovers can cause spatial autocorrelation, which if not accounted may lead to misleading estimates (Anselin, 2006).

* + 1. **Spatial Econometric Reasoning**
    2. **Spatial Lag and Spatial Error Models**

1. **Methodology**
   1. **Data: Socioeconomic and Demographic**
   2. **Data: Supply of Primary Care Physicians**
      1. **Mapping Primary Care Locations**
   3. **Spatial Accessibility Index**
   4. **Empirical Model**
2. **Results**
   1. **Primary Care Location Maps**
   2. **Empirical Results**
   3. **Applications to Planning and Public Health**
3. **Conclusion**
   1. **Discussion of Findings**
   2. **Discussion of Limitations and Future Research Opportunities**