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How useful are Primary Care Service Areas? Evaluating PCSAs as a tool for measuring Primary Care Practitioner access

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ABSTRACT

The appropriate delivery of primary care services, an important policy imperative in many developed nations, is contingent on defining appropriate geographies to which these services are delivered. Primary Care Service Area (PCSA) geographies have been created in some countries to facilitate primary care policy making and have been utilized in a large body of research. In spite of their extensive use across rural and urban settings, the usefulness of PCSAs has not been evaluated. In this study, for the first time we put PCSAs to the test by comparing them to another small area geography - Postal Areas, and by exploring their usefulness in measuring relationships between Primary Care Practitioner supply and use. We find while PCSAs are better than Postal Areas in measuring relationships between General Practitioner supply and visits by patients, this relationship shows some heterogeneity across areas.

1. Introduction

Primary care is a fundamental backbone of the healthcare system of a country. There is evidence that countries with stronger primary care systems perform better on a range of health outcomes (Starfield, Shi, & Mackinko, 2005). In many developed nations, in spite of increasing overall numbers of primary care doctors there remains a persistent geographic maldistribution (Shipman, Lan, Chang, & Goodman, 2011). Across jurisdictions, doctor to population ratios are a popular measure of geographic "potential access" (Andersen & Aday, 1978), with better ratios being related to better health outcomes (Chang, Stukel, Flood, & Goodman, 2011; Starfield et al. 2005). However, a number of issues have been raised with ratio measures computed for small-area geographic "containers" (Langford & Higgs, 2006) that use arbitrary and/or administrative boundaries. Foremost of these issues is the issue of reasonable travel. Patients do not stay confined within administrative boundaries and routinely travel or "cross borders" to access Primary Care Practitioners (PCPs)[1](Comber, Brunsdon, and Radburn 2011; Dulin et al. 2010; Goodman et al. 2003).

If a substantial fraction of patients travel between geographic areas for their primary care services then outcomes that are sensitive to primary care interventions and behaviours at these geographic areas are less likely to be associated with the supply of PCPs in the area. For example, a number of towns in rural Australia and the United States of America (USA/US) comprise a single postcode with a separate postcode for a large outlying rural catchment which the town serves. If the numbers of PCPs in the

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[1] Primary Care Practitioners are identified as General Practitioners (GPs) in the United Kingdom and Australia. In the United States they consist of family physicians, general practitioners, general internists, general paediatricians, and geriatricians.

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town were to increase, overall PCP to population ratios increase in the town postcode. However, there is no improvement in PCP to population ratios in the large outlying catchment, even though patients in the catchment now have better access to care through better PCP supply at the same travel distance.

To overcome this problem researchers have created purpose built catchments of "realised access" based on actual travel patterns of patients, such as Primary Care Service Areas (PCSAs) in the USA (Andersen & Aday, 1978; Goodman et al. 2003) in addition to sophisticated Geographic Information Systems (GIS) models of "potential access" (Andersen & Aday, 1978; Wang & Luo, 2005). The majority of people in a PCSA obtain their PCP care from within the PCSA in which they live (Goodman et al. 2003). Thus PCSAs are designed to be self-sufficient markets of primary care, that minimize patient border crossings that are more suitable than other geographies for mapping outcomes and behaviours that are sensitive to primary care interventions (Butler, Petterson, Phillips, & Bazemore, 2013; Shipman et al. 2011). While gravity or 2 Step Floating Catchment Area (2SFCA) potential access models can provide accurate individual level estimates of geographic access, policymakers are yet to become comfortable with the idea of individual or very small geographic area targeting of services, though this is likely to change in the future. Thus, while PCSAs have found widespread use in the policymaking arena, for example see (OORH., 2016); 2SFCA approaches are yet to see widespread policy applications (Wang 2014). In addition in the USA, PCSAs have found application in the study of a range of primary care relevant outcomes, behaviours and resources such as PCP supply. They have been used extensively in studying relationships between primary care workforce supply and various adverse outcomes such as the rates of hospitalisations for Ambulatory Care Sensitive Conditions (ACSCs) (Chang et al. 2011; Mobley, Root, Anselin, Lozano-Gracia, & Koschinsky, 2006). Following this lead PCSA geographies have been created in Switzerland (Busato & Künzi, 2008) and in Australia (Mazumdar, Feng, Konings, McRae, & Girosi, 2014a) from Postal Areas.

1.1. Primary care service areas: an optimal small area geography?

While PCSAs are theoretically an "optimal" small area geography for studying primary care service use and related outcomes, there is no empirical evidence supporting their superiority over other existing geographies such as postcodes/Zip Codes or US counties. While their design ensures greater self-sufficiency of PCP use relative to other geographies, there is considerable geographic heterogeneity in the extent to which PCSAs represent self-sufficiency (Goodman et al. 2003; Mazumdar et al. 2014a).

The heterogeneity in PCSAs reflects the underlying geographic variation in PCP service use. In densely populated urban areas, where a patient may choose from a basket of easily accessible PCPs, the patient may skirt the nearest PCP to visit a PCP further away. This creates overlapping geographies of PCP catchments (Stukel et al. 2013). If discrete boundaries are drawn around PCP catchments, these catchments are found to have very low Localization Indices (LI, a percent measure of self-sufficiency of PCP use within PCSAs) with a high number of patient "border crossings" (Roeger, Reed, and Smith 2010). In rural and remote regions, a rural town may house a few PCPs and serve a large catchment of sparsely populated areas. As the concepts of central place theory dictate, such areas would need to serve a large geographic "range" or catchment to generate the required threshold population to sustain a private general practice clinic.[2] Large travel distances mean that patients generally visit the closest PCP (Hays, Kearns, and Moran 1990), resulting in geographic catchments that are a non-overlapping tessellation with high LIs. Indeed, previous research has found that localization tends to decrease with increasing urbanity (Goodman et al. 2003; Mazumdar et al. 2014a). Nevertheless it is possible that some rural PCSAs have low LIs and vice versa.

Despite this heterogeneity in PCSA LIs it is common for researchers to treat all PCSAs on the same footing (Chang et al. 2011; Mobley et al. 2006). However, low localization and high border crossing rates in some PCSAs means that when relationships are studied using these PCSAs noise and/or bias are introduced into the testing process leading to the possibility of Type 1 or Type 2 errors.

Our research questions are then: firstly, do PCSAs provide a "better" means of measuring the relationship between PCP supply and PCP use than postcodes - the small area geography from which PCSAs have been built (Mazumdar et al. 2014a)? Secondly, how does the relationship between PCP supply and PCP use vary across different levels of localization, and in particular does better localization within PCSAs mean a stronger relationship between PCP supply at PCSAs and PCP use, independent of the effect of rurality?

1.2. Specific research goals

To address our first question we evaluate the superiority or otherwise of PCSAs in the state of New South Wales (NSW) Australia, over an existing small area geography - Australian postcodes or their spatialized equivalent - Postal Areas (POAs). POAs are built from existing smaller census geographies to approximate the boundaries of postcodes and an algorithm published by the Australian Bureau of Statistics (ABS) (Pink, 2011). PCSAs were built from POAs in Australia following the lead of US researchers (Goodman et al. 2003; Mazumdar et al. 2014a). We expect a 'better small area geography' to detect a stronger relationship (larger beta coefficients in a regression) between PCP supply and PCP use. While there is considerable debate in the literature on the actual *mechanism* of the relationship between PCP supply and PCP use, it is relatively well established that net of other factors greater PCP supply is associated with greater PCP use (Continelli, McGinnis, and Holmes 2010). A systematic review has also confirmed this relationship outside the realm of primary care in the context of physician/doctor supply and use (Léonard, Stordeur, and Roberfroid 2009). Thus, we test our first question by assessing whether there is a significant difference in the relationship between PCP supply and PCP use net of key confounders when PCP supply is measured at PCSAs or POAs.

Our remaining questions are exploratory in nature and relate to heterogeneity between PCSAs only. We wish to explore how the relationship between PCP density and PCP supply changes as PCSAs become more localized (Question 2) and whether this is affected by the rurality of PCSAs (Question 3). We expect stronger relationships between PCP density and PCP supply with increasing localization. However, as discussed earlier, localization is correlated with rurality. Rurality affects the likelihood of individuals visiting PCPs above and beyond the adjustments available in our model. For instance, there is evidence that rural residence is associated with attitude driven risk taking behaviours, a propensity for various agricultural work related injuries and exposure to risks such as skin cancer risk from increased outdoor work related sun exposure (Dixon & Welch, 2000). Rurality adjustment may take into account these unmeasured variables that could affect the outcome. Rurality thus confounds the relationship between localization at PCSAs and the effect of PCP density on PCP visits, and is adjusted for in our final analyses.

[2] Note that GP clinics in Australia, as in the USA are privately operated.