Geographic Information System Usability and Decision Support for Rural Health Policy

by

Jason Bond
BA, University of Calgary, 2003

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Supervisory Committee

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Abstract

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With the rising cost of health care, the debate about where each dollar is spent is putting increasing pressure on decision makers. Consequently, one of the biggest challenges of providing health care to rural populations, specifically, is determining which communities should receive funding to address access to services. Defining rurality in the context of health care is a challenge that governments and health care providers have struggled with for years. Each stakeholder in Canada’s health care system has developed different criteria for defining rurality to inform policy. Currently there is a gap in academic research exploring the benefits of applying Geographic Information Systems (GIS) in rural health care policy and program decision support. GIS can provide insight into rural health care accessibility by modeling and measuring the way patients seek medical treatment. This thesis seeks to explore usability mapping issues and identify how policy makers perceive rurality when presented with information displayed on a map.

Usability in this study influenced the perceived usefulness of the mapping tool. Overall study participants felt that mapping tools should be used as a form of decision support in rural health policy issues. Mapping was seen as tool to obtain quicker consensus among decision makers, to provide more context to rural issues in the study scenario, and used as
a platform which could potentially assist in the identification of new criteria used to
define rural health policy. In terms of usability, system usability design principles play a
key role in the success and adoption of mapping tools among rural health policy makers.
The study found that Google Earth’s software design violated Nielsen’s usability design
principles in the following categories: Help and Documentation, User Control and
Freedom, and Navigation. Despite these usability issues, participants found the mapping
tool to have three main advantages over the paper-based decision support, the tool
allowed them to: 1) gain a more complete picture of the surrounding communities; 2)
understand the proximity of health services; and 3) gain greater awareness of the
geography of the area.
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Dedication

For my son Cohen and my partner Bronwyn. Thank you for your love and support.
Chapter 1: Introduction

1.1 Introduction

Rural health care provision poses an important challenge to Canadian health care providers, policy makers, patients and taxpayers. Governments play a key role in recruitment and retention of physicians in rural areas through policies and programs. However, despite provincial programs that have been implemented across Canada by various health bodies to ensure rural communities have fair and equitable health care, some thought leaders still feel that governments are not doing enough in Canada: “If there is a two-tier medicine in Canada, it's not rich and poor, it's urban versus rural," reports Dr. John Wootton, Special Advisor on Rural Health to Health Canada” (Laurent, 2002). How to best address rural health care is a topic that is both politically sensitive and divisive.

Providing rural health care is truly different than urban health care. Rural communities face unique challenges. Patient demographics in rural communities differ from urban centers, for example, rural aboriginal communities have unique health care needs. The geography of rural communities also impacts service delivery and policy decisions – there is not necessarily ambulance service or 24-hour ER care. Geography has an impact on whether or not a community has a hospital or can attract highly educated caregivers (e.g. physicians). Physicians setting up practice in rural areas face the challenge of potentially earning less compared to urban doctors who are more likely to have steady stream of patients; as a result, attracting and retaining newly trained physicians to rural communities has financial and social impacts. The impact of these disparities has serious consequences: “Generally, rural Canadians have higher death rates,
higher infant mortality rates, and shorter life expectancies than do urban Canadians” (Rural Health Access). The Canadian Medical Association has also conducted studies which indicate there is evidence indicating that the care received in rural communities is different than that received in urban areas, which is negatively impacting the health of rural Canadians: “… There is a gradient in terms of health status, depending on how far away a community is from an urban metropolitan area. The farther away the community, the worse is the health status of the population” (Nagarajan, 2004).

Health policy makers have a mandate to ensure quality care is received by all citizens in Canada. The Canada Health Act stipulates accessibility rights of Canadians: “It is hereby declared that the primary objective of Canadian health care policy is to protect, promote and restore the physical and mental well-being of residents of Canada and to facilitate reasonable access to health services without financial or other barriers” (Canada Library of Parliament, 1995, p. 5). The Canadian Parliamentary Research Branch finding that rural Canadians have a higher mortality rate than those living in urban centers is, therefore, problematic when viewed through a lens focused on accessibility (Laurent, 2002).

One of the biggest challenges of providing rural health care is determining where and what communities should receive funding so that people who need the system get the most benefit. With the rising cost of health care, the debate about where each dollar is spent is causing increasing pressure on decision makers. For example, the British Columbian provincial government will spend approximately $100 million on physician incentives and benefits to attract and retain physicians in rural areas in 2012 (Physician Compensation 2012); this figure does not account for other health care spending in the
province, nor does it begin to highlight the health care dollars being spent by other
governments across the country. All health care budgets are limited. Consequently, rural
communities all work to demonstrate a need for additional support, often playing to
political sensibilities and challenging the definition of what is and is not “rural”.

1.2 Rural Health Care & Rurality

Patients, communities, physicians, and public representatives are always lobbying
for more government support in rural areas. As a result, governments face the challenge
of distributing a limited amount of taxpayer dollars to supply an unlimited demand. To
assist policy makers to evaluate the need of a community or population is to measure its
level of rurality, a commonplace ranking measure practiced by health funders. The term
“rurality” is used in rural health issues as it refers to the degree of how rural a community
is on a measureable scale (Wood, 2004). A rurality scale is often used to help health
policy makers identify and implement health programs and services, in the form of
monetary incentives, for communities with a high degree of rurality.

However, defining rurality in the context of health care is a challenge that
governments and health care providers have struggled with for years. Each stakeholder in
Canada’s health care system has developed different criteria for defining rurality.
Consequently, a community may be classified as nearly urban by one policy definition
and as highly rural by a different system’s definition.

How is rurality defined? The answer depends on where you look in Canada. For
example, the British Columbia definition uses twelve factors to determine rurality while
Ontario’s definition uses only three. Some definitions include population size while
others use distance to nearest hospital. Other definitions consider weather patterns, road
conditions, and life expectancy. The Society of Rural Physicians of Canada provides insight into the complexity of defining rural:

99.8% of Canada's 10 million square kilometers are rural by area. 31.4% of Canada’s population or roughly 9 million people live in predominantly rural regions. Towns under 10,000 account for 22.2% of the population, and yet they are served by only 10.1% of physicians. Canada's larger rural and regional centres 10,000 to 100,000 population constitute 15.9% of the population and have only 11.9% of the physician pool (The Society of Rural Physicians of Canada, 2012).

As such, the inevitable question that arises when discussing the rural definition is: “what is the acceptable standard that treats communities fairly and equitably?” The criteria selected to define rurality has a large impact on a community’s ability to gain access to programs that support physician recruitment and retention programming and funding.

Why do provinces and countries around the world have different definitions of what it means to be rural? What makes a community or population rural? Who is right? And why does each area have different factors?

First, we must understand the definition of “access” when measuring health care, as it contains several factors that are not related to geography; this gap is worth noting, as almost all governments have some criteria that are geography-based. Roy Penchansky defines access generally as “a concept representing the degree of fit between the clients and the system” (Penchansky, 1981). According to Penchansky there are five dimensions to access. The dimensions are summarized in Table 1 below.
Table 1 – Penchansky’s Dimensions of Access

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Definition</th>
<th>Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Availability</td>
<td>Adequacy of the supply of health care providers</td>
<td>Supply of physicians, dentists, hospitals, clinics</td>
</tr>
<tr>
<td>2) Accessibility</td>
<td>Relationship between the location of the supply and the location of the clients</td>
<td>Travel time, distance, cost and transportation resources</td>
</tr>
<tr>
<td>3) Accommodation</td>
<td>How providers are organized to accept clients</td>
<td>Appointment systems, hours of operation, walk-in facilities, telephone services</td>
</tr>
<tr>
<td>4) Affordability</td>
<td>Cost of services and insurance</td>
<td>Clients ability to pay</td>
</tr>
<tr>
<td>5) Acceptability</td>
<td>Client/providers’ view of characteristics toward one another (both perceived and real)</td>
<td>Age, gender, income level, ethnicity, facility type</td>
</tr>
</tbody>
</table>

Two of the dimensions of access, as defined by Penchansky, contain geographic components: 1) availability: “adequacy of the supply of health care providers” and 2) accessibility: “the travel time to practice locations” (Fortney, 2000, p. 174). In most rural criteria, defining accessibility as it relates to health care, geography is a critical component to forming the definition of “rurality”. If we are to develop a standardized
definition to solve “rurality” and health care challenges, decision makers need systems and decision support that utilizes spatial information that can be queried and modeled.

1.3 Geographic Information Systems (GIS)

Geographic Information Systems (GIS) can provide insight into accessibility by modeling and measuring the way patients seek medical treatment. GIS can be defined as "computer systems for the input, storage, maintenance, management, retrieval, analysis, synthesis, and output of geographic or location based information” (Boulos, 2004). GIS is a form of decision support that includes a wide range of capabilities from educating professionals and the public, to planning, monitoring and analyzing change (Boulos, 2004).

The use of GIS in the health care system has increased in the last decade. Examples of GIS’ current use in health care are in monitoring disease surveillance trends, health service facility planning, and route planning for improved emergency response times. GIS is being used for cost effectiveness analysis, population coverage estimates, as well as for resource planning within countries (Black, 2004). More and more health data is being collected and a lot of it can be “geo-referenced,” meaning that the data can be geographically referenced to a location point on earth (Boulos, 2004). Through spatial analysis, GIS can analyze existing health data to reveal spatial trends and patterns that aid in decision support. Driedger (2007) points out the need for improved analysis by stating: “Health services agencies tend to be data-rich, but information-poor” (p. 1). GIS can be used by health professionals to bridge the gap between data and information. However, GIS is still considered to be used with “relative infrequent[cy]” in health planning and
promotion (Driedger, 2007). Consequently, one could argue that there is an opportunity to take advantage of this technology to help problem-solve rural health care issues.

1.4 Statement of the Problem

There is a wealth of information around the world that looks at rural health care. However, studies that focus on GIS and related decision support for policy makers and health care planners regarding rurality and standardized access criteria are limited. Why does every Canadian province need its own set of unique rurality criteria? Are the circumstances so different to warrant these unique approaches? If governments are to spend money wisely and provide good value for taxpayer dollars we need to develop a fair and equitable definition to help inform decision makers as to a standard measurement of rurality and what is remote, rural, and isolated. A ubiquitous definition utilized by health policy makers could then form a reliable and unbiased decision support tool when dealing with community health issues. Mapping systems paired with health related data present an exciting new avenue for health policy makers as both a tool to define and to provide analysis. By placing everyone on the same playing field the decision making process will be more efficient, less controversial, and less subjective. Policy makers’ decisions should be based more on empirical evidence and less on who can provide the most persuasive argument.

1.5 Significance and Purpose of the Study

Currently there is a gap in academic research exploring the benefits of applying GIS in rural health care related to policy and program decision support. There are an overwhelming number of criteria used to define the term rurality. This study seeks to
understand how policy makers perceive rurality when presented with the information displayed on a map. Will new criteria emerge on a map? Will current rurality criteria become irrelevant or seem as significant?

1.6 Research Objectives

The objectives of this research are to:

- Explore factors that impact the definition of rurality and how health care funding is distributed
- Explore policy makers perceived usefulness and attitude towards rurality and mapping technology as a decision support tool
- Identify challenges to implementing mapping technology as a decision support tool from the policy maker’s perspective
- Identify mapping tool usability issues

1.7 Research Questions

Therefore, the questions this research seeks to answer are:

1. How will health policy makers react to their criteria on Google Earth (GIS light) software? Will new criteria emerge? Will their perception change?
2. What is the policy maker’s perceived usefulness of GIS as it pertains to administrating programs and addressing problems?
3. How should GIS tools be used in decision support to define rurality?

In order to explore the current definitions of rurality in health care a literature review was conducted to provide context of the current state of rurality.
2.1 Rurality and Health Care

Health policy makers are responsible for stewarding programs for urban and rural populations. However, providing health services to rural populations poses unique challenges for health care providers, which policy makers must recognize. To validate these concerns we can look to literature from the Royal New Zealand College of General Practitioners that outlines key obstacles physicians face while practicing in rural areas. First, the literature highlights how general practitioners in rural areas need to be a jack of all trades when it comes to providing health services: “Rural providers… require a greater diversity of skills, work more onerous call rosters, and face greater demands from the communities they serve” (Burton, 1999, p. 2). What this research suggests is that urban physicians have support from other general practitioners, specialists, and allied health care workers. Therefore, rural health service delivery will suffer as physicians without support and work life balance will often leave the community. For example, “In some rural areas, doctors are overworked and struggle to get time off for ongoing education, when sick, or needing holidays. Their quality of work may suffer and they may only have time for problems as they arise, neglecting areas such as prevention and health education” (Burton, 1999, p. 2). If health policy makers do not understand or address these unique rural challenges the health delivery problems often become further compounded.
The literature shows that this is a systemic issue that could have major consequences not only for physicians but for patients as well: “Many rural communities are having difficulty attracting and/or retaining health workers for long enough periods. Without continuity of care, patient confidence is eroded and quality is compromised” (Burton, 1999, p. 2). When health policy makers introduce mechanisms in the form of incentives and support programs “…rural general practices have stable health workers they are able to develop a deep knowledge of their communities and deliver a very good, cost-effective health service” (Burton, 1999, p. 2). Rural health policy makers have the responsibility of ensuring programs, policy, and funding work to stabilize health care delivery.

In addition to identifying key systemic challenges of being a rural physician, health policy makers need to also define and gauge the degree of how rural and isolated communities are to ensure that tax payer dollars are being spent in the right place at the right time as more communities demonstrate need than there are program funds to be spent. For example, rural health care challenges may be more severe in areas that have a greater degree of remoteness and isolation than areas that more closely resemble urban centres; however, a community that is neither urban nor isolated may still qualify for rural programming offered to the isolated community because a one-size fits all system has been developed for “rural” health care. Understanding the nuances of rurality will, therefore, help policy makers prioritize their spending and decision-making to address the aforementioned stabilization challenges facing rural physicians.
Interestingly, study after study highlights that there is no one universal or generally agreed upon definition of rurality for health policy makers to rely on to more consistently understand the unique circumstances and needs of rural populations. The literature has only recently begun to address the importance of forming a universal definition of “rurality” and the implications of the absence of such a definition. In 2002, a workshop that focused on health services and rurality identified the importance of gaining a better understanding and common definition of rural. The group documented twelve issues that could be better addressed by policy makers having a common definition of rurality. The top twelve items are:

- Provides standardization, and comparability across jurisdictions (such as regions and provinces) and time;
- Allows for the identification of similarities/commonalities within rural;
- If there isn’t a definition, then rural tends to be defined as a residual of urban;
- Allows for the identification of whom we are speaking about or speaking to;
- Assists in identifying health determinants, health status, health behaviours, health practices, and health care utilization regarding rural populations;
- Assists in fair and equitable allocation of resources (based on some of the factors noted above – e.g. a better understanding of health disparities would drive resource allocation);
- Facilitates interdisciplinary work;
- Facilitates the identification of smaller units of analysis than are currently available from organizations such as Statistics Canada;
- Provides a common understanding of rural, and consistency for decision-making and policy development;
- Provides a common understanding among stakeholders including lay people;
- Influences the types of data that are being collected (e.g. more specific information could be requested from national surveys); and
- Provides a common definition for identifying the common ground across rural regions and gives a stronger voice to program and policy development for rural Canadians.

(Heath, 2002, p. 12)

The workshop list shows that we first need to define who and what is rural, and to what degree, before we can work on planning and implementing rural solutions.

**Rurality and Health Care Funding Models**

The literature shows that jurisdictions in Canada and around the world are using rurality definitions to create funding formulas. Policy makers who steward taxpayer dollars are responsible for attracting and retaining physicians in remote regions. In order to create a fair and equitable process for incenting physicians, policy makers have developed their own criteria, which varies from region to region, to distribute incentives and benefits to rural areas in the form of additional health programs and/or funding.

“…[S]everal Canadian jurisdictions, New Zealand and Scotland have weighted capitation formulae that accommodate age, sex and socioeconomic characteristics, including those characteristic of rural or isolated populations” (Minore, 2008, p. 97). In absence of a common or more universally accepted definition of “rural” we end up with regions
reinventing the wheel to solve problems that may not be entirely unique to their population.

2.2 Decision Support Systems for Policymakers

With the complexity of health care in general, policy makers rely on a variety of decision support systems (DSS) to complete their work. According to a definition of DSS in the literature, “DSS are [Information Communication Technology] ICT tools that provide the mechanisms to help decision-makers and related stakeholders assess complex problems and solve these in a meaningful way (Shim et al. 2002). The rise of DSS has been facilitated by the increased knowledge capacity of organisations, brought about by improvements in data storage and information processing and reduced cost of software, licensing and hardware. Consequently, it is now more possible than ever before to make use of ICT-based DSS in health planning” (Gudes, 2010, p. 4). Importantly, the core outcomes that result from effective DSS include “1) policy-making, which entails making decisions to solve problems; and 2) technology, which uses computational problem solving tools” (Dur et al. 2009). The system is not intended to do the thinking, but rather enable the policy maker to make informed decisions faster: “The overall aim of DSS, without substituting decision-makers, is to improve the efficiency of the decisions made by stakeholders, optimising their overall performance and minimising judgemental biases” (Gudes, 2010, p. 5). As the literature reminds us, “The policy domain requires multi-faceted considerations, such as costs, benefits, time span, contingent effects of actions and stakeholder involvement” (Dur et al., 2009). With appropriate and effective DSS in place, health care policy makers have more information than ever to form their
thinking and reveal otherwise unseen opportunities or challenges. Some sources of information that can be input and extracted through DSS include:

- Vital statistics data from routine sources
- Local studies of stakeholder views and experiences
- Surveys
- Data from local health delivery agencies on the range of interventions currently implemented (for a particular health problem) and their outcomes, which can be compared with the programs evaluated in global reviews
- Local studies of similar programs
- Routinely collected program data

(Lewin et al., 2009, p. 12)

The emergence of these systems is particularly useful for discussions of rural health care policy, as this chapter of the thesis will explore shortly.

### 2.3 Impact of DSS

DSS is effective for more than just program and policy implementation. Health policy makers need to support decisions with solid evidence, in a transparent manner, and often are under tight timelines. DSS directly contributes to health planning in the following ways:

1. combine information, knowledge and skills from multiple stakeholders
   
   (Margerum 1999)
2. generate agreement over solutions (Innes & Booher 1999)
3. create sense of ownership over the outcomes (Mitchell 1997)
4. increase support for implementation (Mitchell & Hollick 1993)
5. open communication channels between participants (Buchy & Race 2001)
6. achieve mutual learning and personal growth from participants (Sager 1994; Healey 1997; Buchy & Race 2001)

7. increase democratisation of the decision-making process (Forester 1989; Sager 1994; Healey 1997).

(Gudes, 2010, p. 5)

The benefits of DSS are crucial for publicly funded health care delivery in countries including Canada, the United Kingdom, New Zealand and throughout Europe, where government spending is subject to political debate and public scrutiny.

2.4 GIS as DSS for Policy Makers

In the next section of this literature review, the researcher will discuss Geographic Information Systems (GIS). GIS are DSS tools that are not frequently used by health policy makers, but have been useful in some circumstances. GIS will be defined and examples of how GIS can be used in health care are provided in the next section of this chapter. The chapter concludes with a review of the current literature as it relates to barriers to using GIS as a tool for decision makers.

GIS can be defined as "computer systems for the input, storage, maintenance, management, retrieval, analysis, synthesis, and output of geographic or location based information" (Boulos, 2004). GIS is a form of decision support which includes a wide range of capabilities from educating professionals and the public, to planning, monitoring and analyzing change (Boulos, 2004). Some examples of current GIS use in health care are to analyze spatial patterns of disease, emergency planning, ambulance routing, assist patients in finding the nearest health services site, and to aid health providers in planning new health facility locations (Higgs, 2004). Other examples of GIS’ current use in health
care are in monitoring disease surveillance trends, health service facility planning, and route planning for improved emergency response times. However, GIS is still considered to be used with “relative infrequent[cy]” in health planning and promotion (Driedger, 2007).

GIS is a powerful decision support tool in that one has the ability to view many layers of data on a single map. For example, you can overlap a layer with the location of patients’ homes with a layer of hospital sites to see if there are geographical barriers to access such as mountains or lakes. GIS has the ability to process “core analysis algorithms such as buffering, overlay, proximity analysis, shortest path and raster1 cost-distance analysis” (Black, 2004, p. 1). Once the information has been processed by GIS, the user is left with a visualization tool to communicate the end results of analysis (Black, 2004, p. 2).

In terms of access, GIS allows for both spatial and non-spatial factors to be analyzed. Some examples of non-spatial factors, which can be mapped, are “age, sex, ethnicity, income, social class, education and language ability,” (Wang, 2005, p. 131) which are necessary for conducting a well-rounded evaluation of barriers to accessing health services. More and more health data is being collected and a lot of it can be “geo-referenced,” meaning that the data can be geographically referenced to a location point on earth (Boulos, 2004). Through spatial analysis, GIS can analyze existing health data to reveal spatial trends and patterns that aid in decision support. GIS is unique in that it can be used by health professionals to bridge the gap between data and information. Driedger

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1 raster data. Cell data arranged in a regular grid pattern in which each unit (pixel or cell) in the grid is assigned an identifying value based on its characteristics. http://www.extension.umn.edu/distribution/naturalresources/components/DD6097hr.html
(2007) points out the need for improved analysis by stating: “Health services agencies tend to be data-rich, but information-poor” (p. 1).

2.5 GIS as DSS for Health Policy Makers

The term “access” is frequently used in health care policy; however, GIS is a relatively new decision support tool that health informatics professionals can use to evaluate a range of accessibility issues. The objective of this literature review is to uncover the present challenges in GISs relating to rural accessibility issues in the context of health care. And further, to understand how GISs are being utilized by policy makers and other decision makers in the health care field.

The study selection consists of English language systematic reviews published between 1995 and 2015. Articles that focused on GIS technology were included. Articles that did not focus on the use of GIS in the health care context were excluded. PubMed, SpringerLink, and the International Journal of Health Geographics databases were searched for articles published between the aforementioned dates. The following search terms were used: GIS health access measurement, GIS health access literature review, GIS health services access spatial analysis, health services accessibility GIS, and health GIS accessibility health data. Very few articles met the inclusion criteria of being a systematic review. Despite the limited results, systematic reviews were pursued to research more credible aggregated evidence. The search resulted in ten articles that met the inclusion and exclusion criteria. The final ten articles were measured against Ammenwerth’s quality criteria for medical informatics research papers, obtained from the 2003 International Medical Informatics Association Yearbook (Table 3). A summary
of the articles included in this literature review can be seen in Table 4. Data abstraction took place under the following categories: article title, authors, publication date, number of reviewed articles, study objectives, area of health analyzed using GIS, country of study, GIS measurement technique, and study findings.

As seen in Table 4, GIS and accessibility issues are currently being used in many areas of health. Examples of GIS use include: health services planning, disease mapping, influenza rates, childhood leukemia rates, breast cancer rates, lung cancer mortality rates, infectious disease rates and diffusion rates of tuberculosis. These areas of health were analysed using a plethora of different GIS measurement techniques. Examples of some of the measurements techniques described in the papers include: minimum distance, travel cost, kernel density, buffering, overlay analysis, network analysis, and floating catchment area method.

Additionally, the literature includes studies completed internationally. The GIS literature were examined in countries as diverse as Bolivia and Japan, the United States and Czech Republic, among others. The health care systems in these countries differ depending on government and funding models. Given the global scope of this literature, finding commonalities among the use of GIS in these diverse contexts makes the results all the more relevant.

When considering Penchansky’s five dimensions of access, GIS users have an opportunity to focus on non-spatial factors such as affordability, accommodation, and acceptability. Despite the aforementioned challenges, GIS used in health presents a real opportunity for demonstrating how different spatial relationships can lead to different health outcomes. Graves states that “The ability to overlay data layers allows for
interpretation beyond that seen with traditional research and statistical methods” (Graves, 2008, p. 7). Higgs adds to this point by suggesting that “a logical extension to such [spatially related GIS] work is to explore the relationship between access factors and health outcomes and to examine the impacts of changes in service delivery” (Higgs, 2004).

Four common themes emerged in the literature as posing challenges to the use and adoption of GIS in health care: 1) integration of data; 2) understanding spatial analysis concepts; 3) complexity of GIS; and 4) different usage of the term “access”. The four challenges are detailed below and specific insights from selected articles have been included as supporting evidence; these challenges are also summarized in Table 2.

Table 2 - Challenges of GIS Used in the Context of Health

<table>
<thead>
<tr>
<th>Theme</th>
<th>Description</th>
</tr>
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<tr>
<td>Integration of Health Data into GISs</td>
<td>There are many different units and sources of health data that need to be integrated into GISs. Challenges take the form of aggregation/disaggregation of data and unifying spatial scales (Chung, 2004)</td>
</tr>
<tr>
<td>Understanding Spatial Analysis Concepts</td>
<td>“Research suggests that health planners may have a poor grasp of spatial concepts that underpin GIS and are confused by complex spatial analytical techniques” (McLafferty, 2003)</td>
</tr>
<tr>
<td>Complexity of GIS</td>
<td>There are many variables to consider when using GIS in the context of health. “Factors of health status are often interdependent and interrelated, creating a complex web of causation” (Graves, 2008)</td>
</tr>
<tr>
<td>Use of “Access”</td>
<td>There the term access has different definitions and can be used in different ways in the health context (Higgs, 2004)</td>
</tr>
</tbody>
</table>
Integration of Health Data into GISs

The first theme that emerged in the literature as posing a challenge to the use and adoption of GIS in health care is the integration of health data into GISs. All systematic reviews indicated that different types of health data contain geographic boundaries and measures that are hard to overlap and analyse. Chung summarized this point by stating, “data are often on different units, formats, and at different scales and from different sources” (Chung, 2004, p. 352). Different units of measurement refer to different levels of detail. For example, a GIS user may have data for small units of a population (i.e. regional) but health boundaries might not match the same unit area in which the population is defined (i.e. national). Some studies have overcome this problem by aggregating smaller units of data into larger units of data. However, it is more difficult to disaggregate units of data and few studies have documented doing so (Chung, 2004). Without standardized data, policy makers cannot harness the power of GIS to incorporate it into the big picture or combine the information to make decisions.

Understanding Spatial Analysis Concepts

The second theme that emerged in the literature as posing a challenge to the use and adoption of GIS in health care is the health professional’s understanding of spatial analysis concepts. There are many forms of spatial analysis used in GIS that health professionals are not always familiar with. The authors claim that some health professionals found it difficult to interpret spatial measurement methods and, therefore, found it harder to interpret the results of GIS analysis. Consequently, there is a need for more education regarding spatial analysis techniques where GIS is being utilized.
The use of specific GIS measurement techniques depends upon the scope and scale of the topic and area being measured (Higgs, 2004). The Higgs paper sums up this issue best by stating, “The choice of measure selected to examine spatial patterns in accessibility has to be considered in light of the particular service under consideration and different assumptions concerning travel behaviour to that service” (Higgs, 2004). Therefore, with GIS there are numerous ways to use health data for analysis that a health professional can rely on; however, without proper education and understanding of the tools, GIS cannot be fully effective. For example, distance from a patient to a hospital can be measured either by drive time, as the crow flies, which means to measure as a straight line between two points, or by numerous other methods; it is important to pick the method most appropriate for the service delivery need.

**Complexity of GIS**

The third theme that emerged in the literature as posing a challenge to the use and adoption of GIS in health care is that GIS itself is a complex tool. There are many variables to consider when using GIS to study health. Graves states, “factors of health status are often interdependent and interrelated, creating a complex web of causation” (Graves, 2008). In order to correctly make sense this “web of causation,” GIS users need to make use of the full extent of GIS capabilities.

The review found that GIS is not currently being used to its full potential. For example, the mode of transportation used when physically accessing health services was assumed to be by car and not by public transportation, bicycle, or by foot. Also, Higgs states, “A major assumption of many of these studies is that patients will use their nearest health facility” (Higgs, 2004). By making these kinds of broad assumptions, such as
using a single mode of transportation, GIS analysis only reveals a small part of the current state of accessibility.

**Use of Access**

The fourth and final theme that emerged in the literature as posing a challenge to the use and adoption of GIS in health care is the inconsistent use and definition of the commonly used term “access”. The use of the term “access” differed throughout each review. Availability and accessibility, which are the most spatially related components of access, were used most frequently. This reflects how GIS has not been utilized to its full extent. GIS users need to consider the assessment of non-spatial factors such as age, sex, and gender in order to achieve a well-rounded analysis.

**2.6 GIS and Usability Research**

Over the past several decades, innovations in mapping have made geographic systems more readily available for all kinds of people, both for personal and business tasks. Despite the growing prevalence of mapping software in our every day lives, little to no research has been conducted to understand how health policy professionals can interact with and utilize GISs that exist for decision support. In fact, according to research completed by Zafiri, the lack of research on GIS usability is pervasive:

There is lack of research into the way GIS is used at the workplace, in schools, and at home. Moreover, the context and use of GIS has changed dramatically since the studies of the early 1990s and, today, the common user is one of the million or so people across the globe who works daily with GIS software, or one of the tens of millions of users who uses public mapping sites – such as Google Maps or MapQuest – or uses digital geographical information in other forms, such as through Satellite Navigation Systems (Longley et al., 2001). We know very little about these users, and how to design systems for them in a way that ensures that GIS is used effectively, efficiently, and enjoyably. (Zafiri, 2008, p. 87)
Zafiri’s point “that we know very little about these users” is indicative of a larger gap facing the implementation of GISs in health care policy decision support. If the users aren’t understood, it will be difficult to develop and implement systems that can be used successfully by health care policy makers. Zafiri states further, “For example, while web mapping sites have been in existence since 1994 (Putz, 1994), to our knowledge Skarlatidou and Haklay (2006) is the first published study in which public mapping sites were compared in terms of their performance with users who are GIS novices” (Zafiri, 2008).

The few pre-existing studies on GIS and usability are already out-dated simply due to the constant evolution of the technology. For example, Zafiri explains:

…GIS itself has changed significantly. When Davies and Medyckyj-Scott (1996) conducted their research, GIS was mainly command-line driven and run on UNIX workstations, whereas current systems rely on Graphical User Interface (GUI), large databases, and the Internet (Zafiri, 2008, p. 87).

The changes in technology, combined with the gap in literature to understand the GIS user, demonstrate a need to examine GIS usability and the health policy user. To further demonstrate that need, Robinson speaks to the limited use and scope of health data analysis using GIS:

Geovisualization tools should positively augment health data analysis, but such tools are under-utilized in the health research community owing to lack of access to tool training, a lack of good examples that demonstrate the successful use of geovisualization (in journal publications or in other sources) and clumsy (or non-existent) mechanisms for collaborating with, and about, geovisualization tools and techniques (Robinson et al., 2011, p. 192).

Two recent studies have been conducted to examine GIS usability in health research. The first study, conducted by Zafiri, focuses primarily on the graphical user interface of GIS. Zafiri conducted a screenshot usability study that explored how a GIS
interface was used to carry out routine tasks. All of the study results were tabulated to calculate the percentage of the total screen area that was dedicated to the map and to other interface elements. Statistical analysis evaluated correlations between users’ demographic profiles and the image characteristics. The results “… demonstrated that it is possible, even with paucity of information, to learn about GIS users and their tasks” (Zafiri, 2008). The second study, conducted by Bhowmick, focuses primarily on a health atlas tool with the intent of understanding usability issues needing improvement for health policy makers’ needs. Bhowmick explains, “Our primary goals for distributed assessment of the PACA were to evaluate and improve the usability of the Atlas, evaluate its overall and tool-specific utility for public health professionals, and provide input to design of web maps and atlases for aggregate health data more generally” (Bhowmick et al., 2008, p. 17). The second study yielded 66 different usability issues. Three of the key findings from the Bhowmick study are: 1) the need to support a various types of information queries that are easily understood by the user 2) maps alone did not meet the needs of the user – they required additional support information in the form of tables in order to further understand the map 3) The ability to export mapping results was considered to be “essential” (Bhowmick et al., 2008, p. 17).

2.7 Discussion

There were a limited number of systematic reviews conducted in the topic area of GIS usability and its role in health policy. As a result, a limited number of articles are included in this review. As seen in Table 3, the articles included in this review scored well against the Ammenwerth assessment criteria. The lowest scoring question throughout all articles was with regard to reproducibility of the study. Articles lacked
detailed information, such as databases used in conducting the search, search terms, and inclusion/exclusion criteria.

According to the literature, GIS is currently being used across the spectrum of health care including: primary care access, emergency service planning, and resource allocation. Despite the current range of GIS use, however, McLafferty states that the “adoption of GIS has been very uneven” (McLafferty, 2003, p. 37). As previously stated, four common themes emerged as posing a challenge to the use of GIS in health care: integration of data in GISs, understanding spatial analysis concepts, complexity of GIS, and different usage of the term “access”. GIS is still not being used to the full extent of its capabilities and continues to be viewed as a system that simply produces maps (McLafferty, 2003). At present, GIS users need to move away from the use of broad assumptions when mapping health data. In order to harness the real power of GIS, users need to focus on making use of utilization data from the population in question instead of analysis made using general assumptions.

2.8 Current Research Gaps and Limitations

Health professionals need to view the results of analysis done with GIS with a critical eye. Spatial analytical techniques are not commonplace in health and wrong conclusions can be easily made if measurement techniques are not fully understood. Access is a loaded term consisting of different definitions that can be used in different health contexts. GIS was mentioned as an “emerging technology” in the literature in the context of analysing health in most of the review articles. The four main challenges of using GIS, as identified in this thesis, can be addressed with the study of how GIS as a decision support tool can be utilized in health care.
According to Buckeridge (2002), “A well-developed GIS has the potential to provide ready access to a wealth of health data, but design considerations for GIS in a community health context are largely unknown” (p. 1191). In response to the identified challenges of integrating GIS into the health care system, this literature review focuses on finding potential success factors of GIS in the health context. Research is needed to fill this gap to answer the aforementioned important research questions. GIS may contribute to how rural health care policy is implemented and also change how physicians and health care providers receive funding and incentives. At present, there is very little research in the field of GIS as a support tool for rural health policy makers. Policy makers continue to struggle with the definition of rurality and how to implement rural programs to the communities who need the most support and not who can present the most politically persuasive argument.
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<td>Sara L. McLafferty</td>
<td>B. Graves</td>
<td>G. Higgs</td>
<td>K. Chung, D. Yang, R. Bell</td>
<td>D. Moore, T Carpenter</td>
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<td>Study Objectives</td>
<td>analyzing health care need, access, utilization, planning, spatial decision support</td>
<td>GIS use in assessment of health care accessibility and health outcomes measuring: effectiveness and implications for health professionals</td>
<td>review the use of GIS-based measures in exploring the relationship between geographic access, utilization, quality and health outcomes</td>
<td>examine the use of GIS in health care,</td>
<td>Review spatial analytical techniques and modern geographical information systems, role of GIS in health research and epidemiology</td>
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<td>Area of Health analyzed using GIS</td>
<td>geriatric services, health services access for vulnerable populations, immunization rates, access to emergency medical services, emergency response planning</td>
<td>Lyme disease, teen pregnancy, breast cancer mortality by racial groups, AIDS prevalence, factors of a leptospirosis outbreak</td>
<td>primary and secondary health care, disease patterns, health service location planning</td>
<td>geocoding, physician compensation, birth weights, back problems, fall injury rates, diabetes, blood lead level, out-of-hospital myocardial infarction mortality, pancreatic cancer mortality, lung cancer, cardiopulmonary mortality</td>
<td>health services planning, disease mapping, influenza rates, childhood leukemia rates, breast cancer, lung cancer mortality rates, infectious disease rates, diffusion of tuberculosis, air pollution</td>
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<td>Geographic Location of GIS Analysis</td>
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<td>Canada, Rio de Janeiro, Scotland, United States,</td>
<td>Canada, New Zealand, United States, United Kingdom</td>
<td>Finland, United States</td>
<td>Czech Republic, France, Japan, Sweden, United States</td>
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<td>GIS Measurement Techniques</td>
<td>cluster analysis, kernel density, Euclidean distance, travel time, buffer zones, shortest path,</td>
<td>linear modelling, travel time</td>
<td>container, coverage, minimum distance, travel cost, gravity, buffering, overlay analysis, network analysis, floating catchment area</td>
<td>cluster detection, buffer zones, overlays, spatial autocorrelation, least squares analysis, logistic regression, shortest path</td>
<td>cluster detection, diffusion, interpolation techniques</td>
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<td>Study Findings</td>
<td>Major themes in GIS-based analysis in health care are: access to health care, geographic variation in utilization, GIS and health care delivery, locating health services, spatial decision support systems, and GIS and Homeland security</td>
<td>GIS is evolving and can be applied throughout the health care environment. Main benefits of GIS in relation to health are: data integration and decision support for complex questions</td>
<td>&quot;we have barely scratched the surface with regard to the use of GIS methods in accessibility studies but that new technologies such as the combination of GIS and Global Positioning Systems (GPS) have significant potential to address policy concerns regarding health inequalities that may partly arise through a lack of access to primary and secondary healthcare facilities</td>
<td>Identified four stages of GIS use: entering data into GIS, transforming data, spatial analysis, spatial statistical analysis</td>
<td>health researchers should consider the type of data available and what process will be reviewed when choosing a GIS statistical analytical technique</td>
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<td>The role of GIS for health utilization studies: literature review</td>
<td>Geographic Information Systems (GIS) for Health Promotion and Public Health: A Review</td>
<td>Catchments of general practice in different countries—a literature review Catchments of general practice in different countries—a literature review</td>
<td>Synthesizing qualitative and quantitative evidence on non-financial access barriers: implications for assessment at the district level</td>
<td>A review of rural and remote health service indexes: are they relevant for the development of an Australian rural birth index?</td>
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<tr>
<td><strong>Authors</strong></td>
<td>Gary Higgs</td>
<td>C.J. Nykiforuk, L. M. Flamang</td>
<td>Donald P. Allan</td>
<td>Thomas S. O’Connell, K. Juliet A. Bedford, Michael Thiede and Di McIntyre</td>
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<td><strong>Study Objectives</strong></td>
<td>Summarizing what is known from published research on the importance of geography on patterns of healthcare utilization, and in particular, on the gaps in current knowledge and how these could be addressed through the use of geo-spatial techniques such as GIS.</td>
<td>(a) to identify how GIS applications have been used in health-related research, including policy development, planning, monitoring, and surveillance and (b) to critically examine the issues, strengths, and challenges inherent to those applications.</td>
<td>(1) Conduct a literature review of peer reviewed papers (titles or abstracts) with any mention of GP catchments in relation to primary health care. (2) Identify from title or abstract, key words in relation to the term GP catchment that could facilitate further narrowing of the search; (3) to synthesize the articles into a number of broad themes in relation to the aims of the review.</td>
<td>Monitoring the impact of policy on assessment of non-financial access barriers</td>
<td>Review literature to identify indexes with planning remote healthcare services. Compare indexes to determine relevance of criteria in relation to the development and implementation of Australia’s National Maternity Services Plan.</td>
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<tr>
<td><strong>Area of Health analyzed using GIS</strong></td>
<td>Geographical factors on utilization patterns</td>
<td>1) disease surveillance, 2) risk analysis, 3) health access and planning, 4) community health profiling</td>
<td>Indicators and measures used to frame the scale of GP catchment areas.</td>
<td>Healthcare utilization and non financial access barriers</td>
<td>Healthcare planning / Maternity Services</td>
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<td><strong>GIS Measurement Techniques</strong></td>
<td>More research is needed to investigate the potential role of geography on utilization for a wider range of health measures in a range of settings. Research is also needed to examine the potential relationship between distance, utilization patterns and health outcomes building on recent research on the impact of such factors on survival rates for different cancer sites for example.</td>
<td>Researchers interested in advancing knowledge in health promotion must then endeavor to systematically examine contextual variables in a way that holds meaning and utility for both science and practice.</td>
<td>An analysis of catchment patterns of general practitioners should be considered as dynamic and multi-perspective. Geographic information systems provide opportunities to contribute valuable methodologies to study these relationships.</td>
<td>Two themes were identified: ethnicity; religion; physical accessibility; decision-making, gender and autonomy; and knowledge, information and education. Important findings, are inadequate for understanding non-financial access barriers in sufficient detail to develop effective responses. Qualitative research methods, while yielding qualitative research methods, are critical in filling this gap. From an equity perspective, communities with the lowest utilization levels should be prioritized and the access barriers specific to that community identified. It is, therefore, critical to develop approaches that can be used at the district level to diagnose and act upon access barriers if we are to pursue an equitable path to universal health coverage.</td>
<td>Socioeconomic variables are required that will reflect need for services particularly for isolated high needs populations. Themes identified which were considered relevant to the implementation of Australia’s maternity services plan: 1. population birth numbers; 2. various socioeconomic vulnerability measures that encompass service specific issues including indigenous; 3. isolation or distance from a service; 4. access to emergency care; 5. access to emergency care.</td>
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<td><strong>Study Findings</strong></td>
<td>A review of the literature has revealed a significant role for the use of GIS, especially when combined with statistical techniques such as multi-level modelling and regression analysis, to investigate the relative importance of geographical factors on utilization patterns.</td>
<td>A review of the literature has revealed a significant role for the use of GIS, especially when combined with statistical techniques such as multi-level modelling and regression analysis, to investigate the relative importance of geographical factors on utilization patterns.</td>
<td>Patient access to general practice health care services should be considered from a range of locational concepts, and not necessarily constrained by their place of residence.</td>
<td>Two themes were identified: ethnicity; religion; physical accessibility; decision-making, gender and autonomy; and knowledge, information and education. Important findings, are inadequate for understanding non-financial access barriers in sufficient detail to develop effective responses. Qualitative research methods, while yielding qualitative research methods, are critical in filling this gap. From an equity perspective, communities with the lowest utilization levels should be prioritized and the access barriers specific to that community identified. It is, therefore, critical to develop approaches that can be used at the district level to diagnose and act upon access barriers if we are to pursue an equitable path to universal health coverage.</td>
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Chapter 3: Research Approach

3.1 Methodology

In this chapter the researcher outlines the methodology used in this masters thesis research. According to Zafiri’s research, “[usability testing is] perhaps the approach used most often since its introduction in the 1980s…(Shneiderman, 1998; Dix et al., 2004). It is based on the principle of trialing prototypes, analysing data captured about the system and user performances (Lin et al., 1997)” (Zafiri, 2008, p. 90). In this thesis, the policy maker examines rural health policy issue scenarios. The study method was chosen to uncover policy makers’ perceived usefulness and attitude toward GIS, in the context of rural health care, when compared to the traditional methods of decision support. Usability methods were used to record verbalizations and computer screen data when working through the scenarios.

Three different data collection methods were used in the form of a demographic survey questionnaire, think aloud protocol when working through scenarios, and a semi structured interview. The study began with the participant being asked to complete a demographic questionnaire to collect background information on their demographics and familiarity with decision support tools, including GIS. Participants were asked to think aloud while they commented on the usability of data presented to them in traditional form and then when it was presented in a GIS application (Borycki et al. 2008). Participant verbalizations were audio recorded and the computer screens they viewed were also recorded as well. The last part of the study consisted of a semi-structured interview where participants were asked to answer questions about what the participant thought of the
usability of the GIS decision support tool and how the representation might have influenced their decision-making (Borycki, 2009).

In the next section of this thesis the researcher describes the participants.

### 3.2 Participants

Study participants were chosen based on their active role in providing decision-making and policy proposals toward rural health care in British Columbia. As Bowen states, “An ‘appropriate’ sample is composed of participants who best represent or have knowledge of the research topic” (2008, p. 140).

The inclusion criteria for the sample are:

- knowledge of or experience with health policy
- the ability to provide written and informed consent
- have familiarity with rural health issues
- experience as one of the following: student, educator, analyst, executive, or health professional

### 3.3 Recruitment

Study participants were recruited using the snowball sampling method. Atkinson defines and explains snowball sampling as: “A technique for finding research subjects. One subject gives the researcher the name of another subject, who in turn provides the name of a third, and so on” (Atkinson, 2001, p. 2). It was anticipated that participants with a background in rural health policy would be hard to access. Therefore, snowball sampling was also chosen because “…the main value of snowball sampling is as a method for obtaining respondents where they are few in number or where some degree of trust is required to initiate contact. Under these circumstances, techniques of ‘chain
referral’ may imbue the researcher with characteristics associated with being an insider or group member and this can aid entry to settings where conventional approaches find it difficult to succeed” (Atkinson, 2001, p. 3). This chain referral approach was useful for participants who would not normally have an interest in participating in a study without receiving correspondence and a referral from a respected colleague (Atkinson, 2001). Also, as an incentive to participate, participants were also given a $25 coffee card for participating as a gesture of appreciation of their time.

It was expected that between eight and fifteen participants would be engaged in the study. In the end, data saturation was reached with ten study participants. Data saturation entails bringing new participants continually into the study until the data set is complete, as indicated by data replication or redundancy. In other words, saturation is reached when the researcher gathers data to the point of “diminishing returns”, when nothing new is being added (Bowen, 2008, p. 140). Saturating data ensures replication in categories; replication verifies, and ensures comprehension and completeness (Bowen, 2008, p. 140).

Study participants were targeted in one of two ways. 1) Through direct referral from colleagues and policy workers, and 2) through an email list serves. Graduate office secretaries was contacted for permission to email list serves from the following faculties: the School of Health Information Science (HINF) Graduate List, HINF Alumni, UVic School of Public Health, Nursing, Public Administration. An email was sent by the email list administrator to assist with recruitment (see Appendix C). Participants were also asked to forward the email after they had finished participating in the study. Recruitment of study participants occurred until the data saturation had been reached.
3.4 Setting

The study took place in a University of Victoria Health Information Science building office. A conference room was setup with a large desk space with a computer and two chairs. Figure 1 below outlines the setting and how the interviewer was situated next to the participant to help guide the process.

Figure 1 - Study Setting

3.5 Procedure

The following section addresses the materials that used to conduct the study, how the task was prepared in advance of study participant arrival, and how the participant was prepared for the study. Once these procedures are described, this thesis also documents how the study data were collected and analyzed.
Material Checklist

The researcher reviewed the study material checklist before the study began. The researcher verified that all of the required materials were present. The study materials checklist was as follows:

- Study Procedure guide
- Consent form
- Pen
- Computer, monitor, keyboard, and mouse
- Active Internet connection
- Screen capture software
- Audio recording device
- Demographic questionnaire
- Traditional paper-based decision support samples
- USB stick with Google Earth decision support data
- Interview Guide
- Notepad for interview questions

Prepare Task

Once the checklist was complete the researcher logged onto the computer and opened Google Earth to prepare for the participant task. The appropriate electronic decision support materials were then loaded onto a Google Earth session (see Appendix F for a screenshot of a decision support system). The Google Earth system included the same rural criteria outlined in the paper decision support material. The user was then able to reference data on the surrounding communities and hospitals. The paper copy of the decision support material was sorted and placed on the table with the consent form and questionnaire. Next, the screen capture software was then loaded and cued to record the screenshots and audio of the study.
Prepare Subject

The subject was then invited into the room and seated at the desk. The researcher gave an overview of the entire study process and timeframe for which the study would take. The researcher then explained the consent form to ensure that the subject was clear that their participation was voluntary and ensured the participant understood how the data were being collected during the study and how the data would be used. The participant was then asked if he or she had any further questions that needed to be addressed before the study proceeded. If the participant did not wish to sign the consent form and/or did not wish to participate in the study, the study would not proceed and the participant would then be thanked for their time and would be free to leave the study room with no further questions. If the participant wished to proceed, the researcher obtained formal consent by asking for the participant’s signature on the consent form (Appendix D).

3.6 Data Collection

This section describes how data for this study was collected.

Demographic Questionnaire

The first part of the study consisted of the participant filling out a demographic questionnaire. The participant was asked to complete the questionnaire which took 5 to 10 minutes to complete. The questionnaire was used to gather background information so participants could be aggregated into groups or subgroups, based their backgrounds and experience, for data analysis and presentation of findings (See Appendix A for the demographic questionnaire).
After having completed the questionnaire the participants were asked review and comment on two scenarios that focused on the same rural issue. The first scenario consisted of paper-based decision support in which the participant reviewed an issue note about a rural community and was asked for feedback based on a letter and background material relating to the community (see Appendix E to review material). During the second scenario the participant viewed a Google Earth profile, which focused on the same rural issue note. The participant was also asked to view a GIS based report produced using GIS analysis and was asked for feedback using the think aloud protocol. The screen capture and audio recording helped the researcher to understand how the participant felt about the usability of the mapping software with respect to its usefulness and their satisfaction (Kushniruk & Borycki, 2006)

**Scenario 1 - Traditional Paper-Based Decision Support Materials**

At this point the researcher started the audio recording device. The participant was then asked to read a description of a role-play, in which the individual was positioned as a policy analyst who was responsible for making a recommendation about whether a specific community should or should not qualify for rural compensation benefits based on existing program criteria (provided as part of the role-play). The participant was then provided with paper-based decision support materials to consider – a rural issue note and supporting rural medical isolation point criteria. The participant was then asked to review the paper-based materials and comment on to how they perceived rurality and how the community in question may or may not be affected as a result of being situated in a remote area, informed solely by the paper-based decision support materials. Scenario 1 decision support material can be viewed in Appendix E.
Scenario 2 - Google Earth Walkthrough

The participant was then asked to use the same role-play and, rather than using paper-based decision support materials, consider the same scenario based on Google Earth decision support to inform his/her recommendation. The researcher then started the screen capture and audio recording software. The researcher demonstrated the health related decision support material on Google Earth. The participant was then asked to think aloud while using Google Earth. The participant was reminded to think of the rural scenario they were asked to read and was asked to verbalize their thoughts while thinking of what factors might relate to the rural scenario. The participant was then asked again to read the rural issue note and then view the Google Earth demo and decision support material and comment on to how they perceived rurality and how the community in question may, or may not, be affected as a result of being situated in a remote area. Once the tasks were complete, the researcher then turned off the screen capture software and began the semi-structured interview.

3.7 Interview

The interviewer conducted a semi-structured interview. The interview consisted of both closed and open-ended questions. Using the interview guide, the researcher asked the interview questions in sequential order. (The interview question guide can be found in Appendix B.) In some cases, the participant led the researcher to new topics that the researcher did not anticipate. In these instances, the researcher used interview probes to uncover and explore new rurality and GIS usability issues.

Once the interview was complete the researcher debriefed the participant on the anticipated completion date of the study and asked the participant if they would be
interested in a short summary of the study results once the study was concluded. The participant was then thanked for their time and expertise and asked if they have any follow-up questions before leaving the room.

3.8 Data Analysis

The demographic survey, think aloud process, and interview data were analysed as outlined in this section of the thesis.

Demographic Data Analysis

Descriptive statistics were used to show the aggregated results of the demographic survey data. Survey responses were analysed using mean, median, mode, standard variation, variance, and range. Survey data were also summarized visually using charts (Social Research Methods, 2013).

Think Aloud Data Analysis

Participants were asked to use the ‘think aloud’ method so that their interaction with the decision support material data could be captured during the two decision support scenarios. The audio recordings were transcribed so that it could undergo ‘protocol analysis’. Protocol analysis involves the researcher reviewing each audio transcript and making annotations for potential categories or themes (Li et al, 2012, p. 763). There were two types of categories: 1) predefined usability principles using Neilsen’s usability design principles; and 2) emergent themes coded by the researcher while reviewing the transcripts.

Initially the researcher reviewed the transcripts together so that “coding categories could be reviewed, compiled, and standardized” (Li et al, 2012, p. 763). The researcher then reviewed the corresponding screen capture data. The data were coded to discern
usability and workflow issues according to the themes that emerged from the protocol analysis.

**Interview Data Analysis**

Participant semi-structured interview data were also coded. The interview materials were analyzed to understand the participant’s responses, to “[gain] direct information from study participants without imposing preconceived categories or theoretical perspectives” (Hseih, 2005, p. 1279). In order to accurately understand the whole response and identify key categories, the researcher derived codes by highlighting participant comments to capture key thoughts or concepts (Hseih, 2005, p. 1279). Once the data were coded, the researcher then made “notes of his or her first impressions, thoughts and initial analysis” (Hseih, 2005, p. 1279). The outcome was the emergence of new codes that may not have previously been identified. At this point, “codes were then sorted into categories based on how different codes were related and linked. These emergent categories were used to organize and group codes into meaningful clusters” (Hseih, 2005, p.1279). According to Hseih, the number of clusters should not be so numerous that the codes begin to lack meaning.

**3.9 Ethics Approval**

An application for ethics review was approved by the University of Victoria’s Human Research Ethics Board. The study and invitation to participate did not take place until the ethics board had granted formal approval.
Chapter 4: Study Findings

4.1 Introduction

In this section of this thesis the study findings are reviewed. This chapter outlines the participant characteristics, findings from the survey, decision support tasks and semi-structured interviews. Excerpts from the participant interviews have been quoted to illustrate themes and the context of the research.

4.2 Study Participant Characteristics

This section provides an overview of the study participant characteristics. The results have been summarized from the participant demographic questionnaire. Overall, ten participants took part in the study. As shown in Figure 2 below, participant age was distributed across three categories. 40% of participants (n=3) fit into the under 35 years of age category. The remaining 60% of participants were evenly distributed across the 35 to 50 year old (n=3) and over 50 year old (n=3) age categories. Participant gender was distributed as shown in Figure 3 below. Female participants consisted of 60% (n=6) of the study participant population and males consisted of the remaining 40% (n=4). Figure 4 shows the distribution of work experience amongst study participants. Analysts made up the largest number of participants at 50% (n=5). The second largest group consisted of managers at 30% (n=3). Students and executives both consisted of 10% for each group. There were no participants in the study who had medical backgrounds.
Participants’ use of decision supports in the workplace varied. Reports were used the most within the workplace. 90% (n=9) of participants used reports (see Figure 5). The second form of decision support used by the majority of participants were databases.
80% (n=8) of participants used databases. Additional decision support tools used by participants, though with less commonality than the aforementioned supports, included interviews and surveys; each type of tool was used by 40% (n=4) of participants. Figure 6 shows the average number of years of experience participants had using decision support tools. Overall, participants reported an average experience with databases and reports at 9.4 and 8.6 years respectively. Surveys and interviews were found on average to be used less with 5.3 and 4.65 years experience on average amongst participants. Participants’ frequency of decision support usage was quite high overall. 70% (n=7) of participants used decision support tools on a regular daily basis while the remaining 30% (n=3) of participants used decision support tools on a weekly basis, as shown in Figure 7. Not all participants had experience using geographic information systems (see Figure 8). 60% (n=6) of participants had no experience with geographic information systems. The remaining 40% (n=4) had used geographic information systems.

Figure 5 - Decision Support Used in Participants Workplace
On average participants had 7.35 years experience in the area of administering Rural Health Care policy. Two participants had no experience in the Rural Health Care policy area. The participant with the most years experience of rural health care policy indicated they had 25 of years experience in the area.
4.3 Health Policy Makers Reaction to Google Earth (GIS light) software

This section of the research focuses on how health policy makers reacted to rural criteria on Google Earth software. It reviews whether or not the mapping tool influenced participants’ definition of rural. The research explores whether or not participants’ perceptions changed regarding Anytown, BC, with a particular focus on whether or not the participants considered the town to be more or less rural and remote after their experiences with the mapping tool. Following participation in the aforementioned research, participants were asked to discuss whether or not the mapping tool would impact the development of new criteria for decision support.

Participants were asked to elaborate on whether or not the mapping tool influenced their definition of rurality. 70% (n=7) of study participants found the mapping tool influenced their perception of rural when compared to the paper decision support material provided in this study, as shown in Figure 9. Participants’ understanding of rurality was most often deepened with the use of the mapping tool when compared to the paper decision support tool, as illustrated by the following quotes:

“The mapping really provides a greater understanding of … How do I put this? A great understanding of what communities are surrounding the community.”
(Participant 2, page 11)

“It deepened it.” (Participant 6, page 13)

“When I actually used the decision support paper-based tool I thought for sure [the community] was in the north but it was actually in the interior…."
(Participant 3, page 8)
Participants responded in the affirmative when asked what, if any, impact the mapping tools had on the development of new criteria for decision support. Figure 10 demonstrates that participants felt that mapping tools would have an overall positive impact on the development of new rural criteria. For example, Participant 1 stated:

“There’s definitely nuisances that can be seen in the mapping software that would have never been picked up in the paper-based.”

The response from Participant 1 is illustrative of the responses that came from study participants. Most participants anticipated that new criteria would emerge. Specific suggestions for new criteria did emerge. Potential emerging criteria is be discussed further in the next chapter of this thesis.

Participant responses led to the identification of several themes. Most often participants stated that the mapping tool’s impact would allow decision makers to come to a quicker consensus. Commonly, participants also indicated they saw how much more efficient an analyst’s work would be by using the mapping tool because of the ability to visualize information, therefore also facilitating easier decision making and/or analysis. Here are some quotes from data that illustrate this theme:
“It’s probably a lot easier to get them to arrive [at] a decision of where to put a new hospital.” (Participant 3, page 8)

“With enough time you can probably come up with new criteria or if someone was proposed it would probably be easier to visualize what is that new criteria getting at.” (Participant 4, page 13)

“People would probably be able to make a more informed decision quicker, which I think, yeah, streamline … a lot of that decision support or making it decisions.” (Participant 10)

“I think it might let us look into developing new criteria and maybe questioning our existing criteria and if it really makes sense…. I think transferring to the mapping tool lends ourselves to question our assumptions of the criteria a little bit better.” (Participant 8, page 8)

Participants were asked what, if anything, the mapping tool revealed when compared to the traditional paper-based decision support. Three common themes surrounding the use of the mapping tool emerged during participant interviews: proximity of surrounding communities, proximity of health services, and the geography of the area.

The first theme was proximity of surrounding communities. The mapping tool was reported as providing context for Anytown, BC in relation to its surrounding communities. For example, Participant 10 observed:
“I think for me, it revealed that there are some other [00:02:00] pretty close proximity facilities that would make in my mind that any town be less rural or reduce the rurality of the city area. I guess it also revealed a lot more information around the surrounding areas.” (Participant 10, page 9)

The second common theme that emerged from the interviews was “proximity of health services”. Participants also noted proximity of Anytown, BC to nearby health services. In the following example, Participant 5 makes observations about the visibility of hospitals in the community:

“…but on the mapping tool it’s very clear where you can look, what’s the direction and what’s the distance comparing to the other community especially for the hospitals closer to any town.” (Participant 5, page 13)

The terrain displayed through the mapping tool was also noted by participants, making the region’s geography of interest to participants and the third common theme (i.e. the geography of the area):

“Using the mapping tool, I could see that it was located in the mountains, the mountain ranges; whereas [02:00] on the paper, I had no idea of where this town was.” (Participant 2, page 11)

The three common themes demonstrate that the participants’ perceptions changed based on what they were able to see using the mapping tool.

The findings show that policy makers responded favourably to seeing criteria on a mapping decision support tool. Observations leading to potential new criteria emerged and participants indicated they saw the immediate benefit to using Google Earth in the analysis of their criteria.

4.4 Policy Maker’s Perceived Usefulness of GIS

This section of the paper outlines the study’s usability findings. The purpose of this part of the study was to focus on the participants’ user experience with the Google
Earth mapping software and to understand how useful the tool is in the context of administering rural health policy and programming. Participants’ comments were coded using a predefined usability coding scheme (see Kushniruk and Patel, 2004). In the following section of this research, Nielsen’s usability design themes are first defined and then related back to the study findings, and finally illustrated through participant qualitative interview responses.

**Help and Documentation**

According to Jakob Nielsen, help and documentation should be “available to users when needed” (Kushniruk, 2004, pg 73). Specific examples of help and documentation include a table of contents and frequently asked questions to assist users with usability (Kushniruk, 2004, pg 73). The availability of these resources can affect the user’s experience and can impact upon how useful the user perceives a tool or resource to be.

The research findings show that participants struggled to identify help resources and documentation while using Google Earth. Participant responses indicated that they needed additional documentation about how to use the mapping tool. This gap, as revealed by participant responses, suggests that a user would be forced to make assumptions about the data revealed by the mapping tool. The following quotes demonstrate the tool’s violation of this usability principle by Nielsen:

“Community type A is listed. Nowhere does it tell me what that means though.” (Participant 2, page 6)

“I can find this one by clicking on it here on the map and just see what is the distance. Does it work like that?” (Participant 6, page 5)

“I would like to see it obviously if it's ... in terms of where the information source is from. How up-to-date it is? I think that's important when you're using that type of tool.” (Participant 10, page 12)
In summary, participants’ experience with Google Earth’s user interface could have been improved with greater help and documentation relating to specific user tasks. In some instances, a lack of help and documentation led to participants’ being less confident in making a recommendation about how rural Anytown, BC was in the study scenario.

**Match between System and Real World**

There are two parts of Jakob Nielsen’s ‘match between system and real world’ usability concept. The first part of Nielsen’s concept is the use of the “natural language of the user” (Kushniruk, 2004, pg 73). In other words, rather than using a technical term in a user interface, one could use a term that is familiar to the user. For example, instead of using the term “hyperlink” a system designer could use a word that describes where the hyperlink directs the user to go in the program, such as “Google Search”. The second part of Nielsen’s usability concept is to use “real-world conventions or natural mappings” (Kushniruk, 2004, pg 73). For example, North Americans are accustomed to seeing bodies of water represented visually by the colour blue because in day-to-day life we see water (i.e. lakes, rivers, oceans, etc.) as blue. Therefore, any bodies of water on Google Maps should be also be presented in blue so the user more easily recognizes what he/she is looking at, as the map relates to the real world.

Fifty percent (n = 5) of study participants experienced difficulty with the mapping tool having a match between the system and the real world. The colour scheme of the mapping tool as a representation of real world topography, geology and flora were incongruent. This finding is illustrated by the following participant statement:

“If this Anytown, BC was in the middle of a big grey area, I would assume that it's in the middle of the desert.” (Participant 6, page 9)
This participant and others made assumptions about the geography of Anytown, BC based on the mapping tool’s representation of the landscape in which the community was situated. The participant, quoted above, was zooming out on Google Earth and the system’s lack of uniform satellite photo colors led the user to feel that darker grey areas on the map were desert areas, which was incorrect. Therefore, Google Earth as a decision support mapping tool could be improved to create a better user experience by matching the system to the real world.

**User Control and Freedom**

As a usability concept, user control and freedom equates to the idea that a user “…should feel he/she is in control of the system (and not the reverse)…” (Kushniruk, 2004, pg 72). There are three criteria of user control and freedom: “(1) provide clearly marked exits, (2) support undo and redo transactions, and (3) make it difficult to perform irreversible actions” (Kushniruk, 2004, p. 72). The study findings show that the mapping tool lacked some of the basic user control and freedom mechanisms. For example, Participant 1 tried to view a major medical center and became disoriented on the map:

“I’m just sort of, not frustrated but I’m just sort of finding myself at a roadblock here.” (Participant 1, page 8)

The participant was not able to recover without assistance from the researcher, revealing that the mapping tool did not have a clearly marked exit. A second participant’s experience further reveals Google Earth’s lack of user control:

“Yeah, using the search bar just to see how many kilometers it is.Oops! I forgot to put BC…. I didn’t put the BC in it so it looks like it took me to somewhere in the United States. Going back. It’s actually saying I can’t find Anytown, BC.” (Participant 2, page 6)
The participant was not able to find Anytown, BC again. Without an undo function, the participant was not in control of the experience. The program also performed an irreversible action, making the usability experience of participants challenging. Overall, Google Earth’s user control and freedom could be improved with the added capability to undo and redo while using the mapping software. For the most part participants found the mapping decision support tool more useful than the paper-based; however, the frustration and confusion that occurred in several instances based on a lack of user control over the system was problematic.

Navigation

Navigation usability issues are “coded when the subject comments on basic navigation, or indicates they cannot move through the program/interface etc. to find or go somewhere” (Kushniruk, 2004, p. 66). Overall, 50% (n=5) of study participants experienced navigation issues with the Google Earth software. For example, Participants 3 and 1 posed questions and expressed feelings of confusion with how to navigate the mapping tool:

“Victoria...no Vancouver let's see Vancouver. Where do I go???”
(Participant 3, page 6)

“Okay. What am I doing? I’m still just sort of dragging around and looking. For some reason I’m not seeing Prince George. I don’t know why that’s frustrating me but it must be done too close. I need to zoom out I guess.”
(Participant 1, page 8)

Fifty percent (n=5) of participants experienced navigation issues. However, of the 50% of participants affected, the navigation issues for each affected participant occurred with a low frequency – 80% experienced one usability violation while using Google Earth.
Understanding Procedure

A usability issue coded by the researcher, understanding procedure, occurred when a user was unable to complete a task. In this study, if a participant was not able to successfully complete a task within Google Earth the challenge was recorded. The study revealed three common usability challenges linked to understanding procedure: 1) users experienced difficulty calculating the distance between one community or hospital to the next; 2) users were not able to successfully select a community using the computer mouse; and 3) users were not able to make use of the zoom function to either gain a closer look at a community or pan out to see the surrounding area without losing their orientation on the mapping software.

The next section of the thesis describes several issues that emerged for participants:

Calculating Distance

In this study, participants were asked to use the mapping tool to determine if they could better understand rurality; often the participants sought to better understand calculations of distance using the mapping tool. However, participant 6 revealed usability challenges in understanding the procedure to calculate distance:

“I can find this one by clicking on it here on the map and just see what is the distance. Does it work like that?” (Participant 6, page 5)

Selecting a Community

Given the study expectation that participants’ look at a single community using the mapping tool and using paper-based information, the participant’s changed perceptions of that community resulting from the differences between the paper-based and mapping
decision support tools were important. The participants were interested in selecting the specific community to be looked at using the mapping tool. Participants revealed the second usability challenge linked to understanding the procedures for using the tool – the inability to select a community:

“In terms of proximity to other facilities and so forth, just looking at the surrounding hospitals being Kamloops, and Nicola Valley, that kind of goes to my earlier comment around getting people to GP’s versus GP’s to people. I guess any town ... I see Logan Lake has. Sorry, so you can click on, oops ...” (Participant 10, page 6)

The quote noted above is an example of one participant who wanted to click on a specific community on the map and was unable to complete that task.

*Using the Zoom Function*

With the possible interactivity of the mapping tool, several participants were interested in exploring different viewpoints on the map. The study findings show that users experienced challenges in understanding the procedure to zoom in and out on the map. The following example demonstrates this challenge:

Interviewer: “I don’t know if you expected that or not?”
Participant: “No.” (Participant 9, page 4)

The participant was unable to use the zoom function correctly; instead of zooming out the participant zoomed in too close. The mapping tool did not provide support to understand the procedures related to the mapping tools zoom function.

*Usability Comment*

‘Usability comment’ as a category became an emerging theme within the coding schema. The category, in this study, signified a usability event at which point the participant commented on a feature of the Google Earth mapping tool. Depending on the
participant, the theme either enhanced or hindered their usability experience. Colour, layout and visual emerged as sub-themes and are described below.

Colour

The meaning or interpretation of colour, when displayed on the mapping software, was not always clear to the participant. Sixty percent (n=6) of participants mentioned colour specifically as an issue that could potentially improve their usability experience. For example:

“You know what’s confusing me, there’s a yellow line across it and for some reason my mind is thinking that was the Yukon, BC border based on where it was. That was what was confusing me.” (Participant 1, page 8)

“Yeah. It definitely affects, actually, the way I see it. That's it. If this community, I don't exactly know what this green thing means and what this grey one means but if I just compare it to this green we are here.” (Participant 6, page 9)

Although the Google Earth user interface has a sidebar with mapping layers, and each mapping layer has a visual representation of a symbol and colour which corresponds with the map, it was not seen and/or interpreted correctly by participants who mentioned colour as a usability issue.

Layout and Visual

Overall the participants preferred the layout of the map when compared to the paper decision support. Participants commented that the information was easier to understand and digest on the map when compared to the paper decision support material:

“I think I'm a visual person so, for me, having it laid out like that, just a thousand times better. Being able to see the context but also being familiar with BC, even if it was an area from Ontario, it's still there would be some context there that you just can't communicate through this descriptive listing here.” (Participant 4, page 11)

“Different layers give different visual aspects.” (Participant 6, page 8)
“It was very easy to interpret the information [on the map], because it's all there for you.” (Participant 9, page 9)

In most cases ‘visual’ meant that the data, when displayed on the map, resonated with the participant in a way that paper decision support did not. The following excerpts provide a sample of when the sub-code visual was recorded:

Interviewer: “Did it feel like it was a necessary thing to be doing, to be visualizing it on there?”
Participant: “Yes. It gave me the feeling of it is alive and it is there…. Not just purely fictional.” (Participant 6, page 13)

“Also to, I'm not sure if we deal with the ambulances, but again that shows that they may take longer than 70 kilometers an hour in a highway versus 70 kilometers out in the roads and the mountains. The other I guess item is that certainly a neat way of summarizing everything that's available in a community, so to me to be able to look at it visually certainly brings it to life more than the paper.” (Participant 7, page 3)

“To me I think it makes it more human or I guess patient oriented rather than just both bold numbers. I think visualizing it is certainly a better way of approaching it if your goal is to serve the public better.” (Participant 7, page 8)

Overall, the participants found that Google Earth was usable for the purpose of their analysis. When asked which they preferred, the paper-based tool or the mapping tool, the majority of participants favoured the mapping tool – 70% indicating they liked the mapping tool better (see Figure 11).
The perceived usefulness of the mapping tool among participants was positive.

4.5 GIS Use as Decision Support for Defining Rurality

In this section of the findings the researcher describes participants’ perceptions about GIS decision support as it relates to supporting the definition of rurality. All participants were asked to role-play; in the assumed role as an analyst, each participant provided insights as to whether the mapping tool influenced his/her decisions regarding whether or not Anytown, BC was rural. The research findings, specifically regarding perceptions of rurality as revealed through the mapping tool, will be discussed.

Participant transcripts were coded in terms of Penchansky’s five dimensions of access in order to categorize participants’ perceptions of rural accessibility, and what it means to be rural, in the context of health care. The predefined accessibility codes are summarized from the participants’ think aloud process and semi-structured interview data. Figure 12 outlines the dimensions of access and frequency of use by participants’ in the study.
When participants were asked to determine whether or not Anytown, BC was a rural or isolated community, they most frequently considered the location of health services in terms of geography. Penchansky defines accessibility as the “relationship between the location of the supply and the location of the clients, taking account of client transportation resources and travel time, distance and cost” (Penchansky, 1981, p. 128). Supply, in the case of this study, refers to the health services in and surrounding Anytown, BC in relation to the clients, who are the population of Anytown, BC. Therefore, accessibility was the most frequently mentioned dimension of access, with 70% of responses highlighting this category of access. Excerpts of participant statements relating to accessibility are as follows:

“All I would have to do is look at a map and see its location in relation to major centers and that would be enough on a surface level to say that yeah, it's rural…” (Participant 1, page 5)

“You don’t have a very clear concept how far away, but on the mapping tool it’s very clear where is the can look, what’s the direction and what’s the distance comparing to the other community especially for the hospitals closer to any town. You can see the difference and the distance.” (Participant 5, page 13)

“I like being able to see everything and getting the distance to nearby communities and be able to see that, how far they are.” (Participant 8, page 10)
The second most frequently coded access theme was availability. Twenty-five percent of coded access themes mentioned this dimension of access criteria. Availability, in terms of access, refers to a patient’s access to services and resources in terms of his/her needs (Penchansky, 1981, p. 128). In this study, availability was coded when the participant considered the needs of the population of Anytown, BC in terms of the supply of physicians, facilities, and services within the surrounding area. The following excerpts were coded under the predefined theme of availability:

“For this scenario it looks like if there's zero to three positions within thirty-five kilometers that's a start to being rural or at least isolated.” (Participant 9, page 1)

“If you're outside of 35 kilometers or being transported to a facility that is well outside that and air flown in, I think there's other options in terms of larger circles that you could draw. On top of that, you look at the major medical communities at 326 kilometers away, that would be a very long drive if you’re thinking about it from. It would be a little bit more antiquated form of transport, but if you're moving people to practitioners rather than practitioners to people, I feel like it could limit the nature of the rurality of it.” (Participant 10, page 5)

“Of course, the further the major medical center or hospitals for that matter the more the rural the community is going to be because, again, the access to physicians is going to be harder to get. (Participant 2, Page 7)

Acceptability was the third dimension of access coded in participant responses regarding rural access themes. Penchansky’s definition of acceptability in terms of access is the “Relationship of clients' attitudes about personal and practice characteristics of providers to the actual characteristics of existing providers, as well as to provider attitudes about acceptable personal characteristics of clients” (Penchansky, 1981, p. 129). Examples of the clients’ attitude toward the provider may include their attitude toward the type of facility, neighbourhood where the facility is located, age and gender of the provider, and/or religious affiliation of the facility (Penchansky, 1981, p. 129).
Penchansky also notes that “providers may also have attitudes about the preferred attributes of clients or their financing mechanisms. Providers either may be unwilling to serve certain types of clients (e.g., welfare patients) or, through accommodation, make themselves more or less available” (Penchansky, 1981, p. 129). The study shows that several participants assumed the provider’s view of the client, leading to acceptability judgements on the part of the role-played analyst:

“Because in my experience this [psychiatry] is a big concern. Now there are so few psychiatrists and it seems to be a specialty that is needed, especially in rural areas. I was just thinking of alcohol and other substance abuse [patients].” (Participant 7, page 4)

“If you started mapping drug areas, areas of low income, high income, various things I mean you could start planning your services around the areas that show specific needs or conversely you could use demographic material and see, there are more seniors in a certain area which could tell you we should be putting other resources there.” (Participant 7, page 11)

Accommodation and affordability were two dimensions of access that were not mentioned with enough frequency to be included in the report findings. Only one participant mentioned affordability and only two participants mentioned accommodation in terms of access within the study. The definitions of accommodation and affordability are outlined below as participants lack of response in these two categories will be discussed in the conclusion chapter of this thesis.

Accommodation is “the relationship between the manner in which the supply resources are organized to accept clients (including appointment systems, hours of operation, walk-in facilities, telephone services) and the clients' ability to accommodate to these factors and the clients' perception of their appropriateness” (Penchansky, 1981, p. 128).
Penchasnky’s definition of affordability refers to the costs of the health services provided in relation to the patient’s income and ability to pay for those services (Penchasnky, 1981, p. 128). In Canada, affordability as a definition of access may appear to be less relevant as health care insurance is publicly funded. However, rural Canadian’s seeking health services often incur travel costs and not all patients have extended health benefits that cover certain types of health care costs such as physiotherapy and medication. In this study, participants did not mention affordability with any frequency to be included in the final coding spreadsheet. Both affordability and accommodation are further explored in the discussion and conclusion of this research.

Finally, before one can address the question of how GIS decision support should be defined it was important to determine whether or not participants felt that GIS was an appropriate tool to assist with questions about rural health care. As part of the semi-structured interview, participants were asked: “Should mapping tools be used more for health policy makers decision support?” Table 5 below outlines a summary of participant responses.
Table 5 - Participant Responses Regarding Mapping Tools

<table>
<thead>
<tr>
<th>Participant</th>
<th>Response</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“Yeah. I think definitely I think it seems like it’s a great tool.”</td>
<td>“…allowing some really deep and thoughtful analysis to come out as far as finding new connections and understanding…”</td>
</tr>
<tr>
<td>2</td>
<td>“I would think yes.”</td>
<td>“The mapping tools can give better more accurate information than our paper-based tool right now I believe.”</td>
</tr>
<tr>
<td>3</td>
<td>Participant did not provide a yes or no answer.</td>
<td>“you can probably give then a great overview in 15 to 20 minutes and they can walk out with probably 70% maybe have made up their minds…”</td>
</tr>
<tr>
<td>4</td>
<td>“I think so.”</td>
<td>“…I think it's really useful having that information there for the right person to make that assessment.”</td>
</tr>
<tr>
<td>5</td>
<td>“Yes, definitely.”</td>
<td>“I think we should use more of those tool, the mapping tool to correlate with health care data. Yes, and what kind of resource you need to put in which area.”</td>
</tr>
<tr>
<td>6</td>
<td>“Why not?!”</td>
<td>“They should be used anywhere that they're able. What does putting a very sophisticated tool somewhere and hope for people to go and use it? It's not enough.”</td>
</tr>
<tr>
<td>7</td>
<td>“I think my own experience I like using maps. I like something that's visual and I think most people like that.”</td>
<td>“If you started mapping drug areas, areas of low income, high income, various things I mean you could start planning your services around the areas that show specific needs or conversely you could use demographic material and see, there are more seniors in a certain area which could tell you we should be putting other resources there.”</td>
</tr>
<tr>
<td>8</td>
<td>“I would say yes…”</td>
<td>“…allowing us to question criteria that’s maybe even in place for 20-plus years and developing new criteria for how we think about what is rural”</td>
</tr>
<tr>
<td>9</td>
<td>“I think yes it should be.”</td>
<td>“I think it’s just one tool of many that need to be used…” “I think it’s a good addition. I don’t think it could replace everything that we use”</td>
</tr>
<tr>
<td>10</td>
<td>“Yeah. I think that they should definitely be incorporated more.”</td>
<td>“we need to be able to think outside the box in terms of answering difficult questions. And health care policy, I think, more and more we get difficult questions that require thinking outside the box rather than just on a scale and a piece of paper.”</td>
</tr>
</tbody>
</table>

Overall, 90% of participants (n=9) agreed that GIS should be used more to support health makers’ decision making.

Participant findings about GIS decision support and rurality are listed in table 6 below. Responses varied and were found to be positive overall. The findings chapter will further discuss the future direction of mapping tools with respect to the assessment of health services within rural communities.
### Table 6 - GIS and Defining Rurality

<table>
<thead>
<tr>
<th>Participant</th>
<th>Response</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>“…finding new information or new links that weren’t seen before…”</td>
</tr>
<tr>
<td>2</td>
<td>“…having the most recent information available so that you can look at the map and that you can also verify the figures…”</td>
</tr>
<tr>
<td>3</td>
<td>“you can look at the map and that you can also verify the figures and then…just that extra kind of confidence…”</td>
</tr>
<tr>
<td>4</td>
<td>“For me it’s actually perfect there. You can look at the criteria and you get the feel for what that criteria is meaning. You can see where your town is and how it rates.”</td>
</tr>
<tr>
<td>5</td>
<td>“…from the healthcare point of view then whether specific type of the disease mapping to the GIS and then to see whether this disease outburst in the specific area, whether the location or from the geographic point of view had correlation with that disease.”</td>
</tr>
<tr>
<td>6</td>
<td>“..to add visual and reality view, art view, and aspects to the paper tools.”</td>
</tr>
<tr>
<td>7</td>
<td>“I think it certainly should be used because again it gives one hints of the community and how isolated it is. I mean, that is to me the big factor in rurality, the distance from other communities that have the services [00:06:00] whether it’s shopping, medical or entertainment that rural is isolated.”</td>
</tr>
<tr>
<td>8</td>
<td>“…it allows us to question and develop new criteria that will better align with how we think about what is rural.”</td>
</tr>
<tr>
<td>9</td>
<td>“I think that those assessments still have to be done. I found this useful, but you still have to go through the process to assess the communities before you can put that information on there, right?” [Google Earth does not replace the paper decision support]</td>
</tr>
<tr>
<td>10</td>
<td>“I think that there's a lot of internal components that might be not necessarily a predictor of rurality or a metric that you could really use.” “…there's more kind of fluid decisions to be made in terms of qualifying what is rural and what is not.”</td>
</tr>
</tbody>
</table>

The study found that the mapping software as a decision support is perceived positively by participants, particularly in comparison to paper-based decision support tools as the alternative. Participants reacted positively to their criteria being mapped on Google Earth, perceived usefulness of the mapping tool, and recommendation for GIS tools to be used in decision support for defining rurality.
The research addressed how health policy makers would react to their criteria on Google Earth (GIS light) software. The findings showed that overall health policy makers reacted positively to using Google Earth Software. Three key outcomes were that the mapping tool:

1. could be used to obtain quicker consensus;
2. gave context to the rural issue in the scenario; and,
3. created atmosphere to identify new decision criteria.

Findings revealed policy maker’s perceived usefulness of GIS as it pertains to administrating programs and addressing problems in relation to their usability experience was also positive. Although participants perceived some usability deficiencies with the mapping tool – Help and Documentation, Match between System and Real World, User Control and Freedom, Navigation, and Understanding Procedure – the strength of the usability observations by participants demonstrated that the mapping tool is a valuable aid for policy makers; the map brought the scenario to life for some participants.

Finally, participants commented on how GIS tools should be used in decision support to define rurality. Participants identified three dimensions of access (as defined by Penchansky) with consistent frequency: accessibility, availability and acceptability. The remaining two dimensions of access were noted with such infrequency that they were not analyzed in the findings. The overwhelming majority of participants concluded that GIS should be used more to support health makers’ decision making.
Chapter 5: Discussion and Conclusion

The study sought to address the gap in academic research exploring GIS usability in rural health care related to policy and program decision support. As there are multiple criteria used to define rurality, the study reviewed how policy makers perceive rurality when presented with the information displayed on a map. The study examined how decision support tools used by health care policy makers can influence perceptions of rurality and the analysis that occurs based on those tools.

In this section of the research, the findings are analyzed in terms of the study’s objective and research questions, and the implications of how policy makers reacted to viewing the data on Google Earth and their perceptions of the mapping tool’s usefulness. This chapter will discuss how the findings validate the literature, highlight new insights derived from the findings, and the contributions of the research to health policy making. Before concluding the research, the latter half of the chapter will discuss study limitations and future research directions.

5.1 Policy makers’ Reactions to Rural Policy Criteria on Google Earth

The first finding of interest is how policy makers reacted to the rural policy criteria on the mapping tool. Seventy percent (n=7) of study participants found the mapping tool influenced their perception of rurality when compared to the paper decision support. Participants reported that their understanding of rurality was deepened with the use of the mapping tool when compared to the paper decision support tool. In order to review the findings of health policy makers’ reactions to the rural policy criteria on the mapping tool
the study will first discuss how it influenced the participants’ definitions of rurality, and secondly the emergence of new rural criteria.

### 5.1.1 Mapping Tools Influence on the Definition of Rurality

When participants were asked about their role-play as analysts after using the mapping tool, 40% stated that their recommendation in the role-play changed as a result of using the mapping tool. Of the 40% of participants who were influenced by the mapping tool, 75% said their definition of rural for Anytown, BC had changed. Participants reported they felt the community was less remote after interacting with the mapping tool (see Figure 13 below). The change in the perception of rurality indicates that the paper-based decision support tool did not reveal the full extent of services surrounding the community. The study demonstrated that three components of rurality, present in the paper-based decision support and on the map, changed after being viewed on the map. The mapping tool made three elements more visible to participants: 1) proximity of surrounding communities; 2) proximity of health services; and 3) geography of area.

**Figure 13 - Participant Role-Play Recommendation Change**

The change in perceptions of rurality based on primarily spatial criteria is relevant because it highlights a potential lack of depth currently available to policy makers who
rely solely on paper-based decision support. The findings suggest that with a mapping tool, 40% of policy makers are likely to view the same rural scenario, outlined on paper, in a new light.

The potential implications for the analysis of data based on the mapping tool are significant to policy makers. For example, an ongoing source of political debate is the allocation of limited funds for rural health care needs. The mapping tool can be utilized to assist policy makers in charge of allocating health care resources deepen their understanding of where the gaps exist, spatially, to ensure tax dollars will be better spent. The study’s findings indicate that without using the mapping tool to inform decisions, funds and program support may be allocated to communities which already have more support than initially realized when viewed on the map; for example, the proximity to nearby communities with health services may have been overlooked in the context of the paper decision support. Another example is not having a full understanding of a community’s geography when reviewing the paper decision support. A policy maker may understand, on paper, that the distance to health services is x kilometres. This understanding may be expanded on the map when they are able to see that there is only one road in and out of the community and that the community is located within a mountain range.

Therefore, by using mapping software, policy makers can be better informed about the proximity of surrounding communities, proximity of health services, and geography of the area in order to allocate funds and programs where the greatest impact can be maximized. A recent literature review demonstrated that “The debates around health reform have had a significant health geographic focus” (Allan, 2014, p. 1). A deeper
understanding of rurality will allow policy makers be in a better to position to effectively target recruitment and retention programs to rural areas.

5.1.2 Emergence of New Rural Criteria

The use of the term “access” in health care, as highlighted in the literature review, was shown to have a non-standard definition. The study set out with objective to understand how policy makers perceive rurality on a map. In order to analyze participants’ perceptions, their comments relating to access were coded against Penchansky’s five dimensions of access. Coding revealed that participants predominantly referenced access in terms of availability and accessibility. A key finding is that both definitions are spatially related components of access and were coded by an overwhelming 95% of participant responses. Given this majority response, it is important to ask the question of why this is occurring so frequently and to discuss the implications.

New non-spatially related rural criteria did emerge on a limited basis and not with enough frequency to be coded greater than five times in the coding schema. Few participants noted the mapping tool’s potential to analyze the impact of non-spatial criteria that impacts the residents of the role-play scenario and the health care system. Examples of non-spatial factors noted on a limited basis by three participants are drug alcohol abuse, disease type, psychology, income levels, age, and ethnicity. The frequency of these non-spatial criteria mentioned by three participants was so low it was not statistically relevant to form a trend. However, the implications of this non-spatial criteria being, almost entirely, absent are very relevant. Arguably policy makers who work with rural policy could benefit from the mapping tool’s ability to layer in non-spatial data. The
ability to see non-spatial trends in rural communities that have previously been unseen could potentially transform rural health care policy.

One could argue that the spatial analysis noted by participants reveals how policy makers have not fully realized non-spatial capabilities of GIS. The dominance of spatially-related definitions of rurality by study participants is not entirely a surprise given the policy criteria’s heavy reliance on spatial criteria. The study from O’Connell complements this study’s findings by confirming that policy makers need to ensure they look at all forms of access in rural health care in order to overcome health care issues:

“The combined quantitative and qualitative evidence from our reviews highlights the multifaceted relationship between access barriers and across access dimensions, and how critical it is to complement quantitative indicators with qualitative data to understand the lived realities of communities as well as health care providers and provide insights into how to engage with this reality.” (O’Connell, 2015, p.10)

While this study did not produce a trend in new rural criteria, it did highlight the gap between spatial factors, which highlight distances between populations and health care services, and non-spatial factors, which highlight population demographics and health status. Notably, non-spatial factors are currently missing from rural criteria and, therefore, not considered by analysts in the paper-based or mapping tools.

5.2 Policy Makers’ Perceived Usefulness of GIS

Given study participants’ positive reactions to viewing criteria on a map and the opportunity to support policy makers in better understanding the capabilities of a mapping tool, the next logical finding to examine is the policy maker’s perceived usefulness of GIS. Ninety percent of participants (n=9) agreed that GIS should be used more to support health makers’ decision making. Participant 10 noted, “[in] healthcare policy… we get [more and more] difficult questions that require thinking outside the box
rather than just on … a piece of paper.” Almost all study participants articulated the immediate perceived usefulness of the mapping tool, particularly in comparison to the paper-based decision support tool they were first asked to review. As the research has already indicated, participants looked at the criteria almost exclusively on spatial terms; the additional potential for analysis using the mapping tool by layering in data and analyzing different scenarios may further solidify the already resounding consensus that the mapping tool should be used more as a decision support. The capabilities of the mapping tool software, however, were not fully realized by study participants. The following section highlights some of the key usability issues that the study revealed and analyze how those challenges could create barriers for health care policy makers and/or limit the extent to which the full potential of mapping tools as a decision support could be realized.

5.2.1 Mapping Tool Usability Findings

The study findings highlighted usability challenges for study participants using Google Earth: Help and Documentation; User Control and Freedom; Navigation; Understanding Procedure; and, Visual and Layout. In order for the mapping tool to be fully embraced by policy makers, some basic usability improvements are required. The implementation of these usability improvements will ensure that mapping tool users increase their confidence using the system and, therefore, will be more effective while working. The next section reviews the usability findings within each of Neilson’s usability principles and provides recommendations about how the mapping tool usability could be improved.
Help and Documentation

In the study, the findings revealed a key usability challenge in how a user engages with content that is not generated by the mapping data, but rather by how the mapping tool software is designed to support the end-users. The study found that users required improved support and access to help and documentation relating to where the layer selections were located in the ‘places’ menu as shown in Figure 14 below. The layer selections participants mentioned are not created by Google Earth as part of the default software. Data within the menu exists because the mapping tool developer/programmer creating the decision support content uploads the health care data relating to the community and health services. Consequently, because the layer content is unique and user-generated, a Google Earth user cannot gain insight about the layer content by simply accessing the mapping tool’s ‘help’ menu. Therefore, Google Earth needs to enable programmers who generate content, within the mapping tool, the ability to create a ‘help’ section for unique mapping features and/or data uploaded to the tool to support their end users. The end user needs help and documentation to understand the legend criteria and data contained within the map. Examples of critical information that end users need to easily access include: data definitions, data usage guidelines, data citations, including when the data was last updated and where the data was sourced. Although one could create documentation that is stored outside of Google Earth (i.e. user manual), the policy maker then risks the loss of documentation and/or lack of documentation being utilized. These challenges are less likely to occur if documentation is accessible within the mapping tool itself. Additionally, the likelihood of updates to help and documentation in
tandem with the software and data updates is at risk when the documentation is kept separate from the mapping tool.

**Figure 14 - Example of Google Earth Places Menu**

![Google Earth Places Menu](image)

**User Control and Freedom**

The study findings show that the mapping tool lacked a basic component of user control and freedom. Google Earth’s user control and freedom could be improved with the added capability to undo and redo while using the mapping software, which would allow users to easily recover from becoming disoriented within the mapping tool. The benefit of implementing this usability improvement would also result in the policy maker’s comfort in actively engaging with the data on the map without the fear of accidentally permanently altering the map. Another way to solve this issue would be for the mapping tool to have a timeline of recorded user actions and navigation while using the map. If the user were to encounter an error or become disoriented, he or she would be able to choose how far back in time to go within the tool to where they were once oriented. The implementation of a timeline or undo/redo functionality would resolve to satisfy the three main criteria of user control and freedom which are: “1) provide clearly marked exits, (2) support undo and redo transactions, and (3) make it difficult to perform irreversible actions” (Kushniruk, 2004, p. 72).
Navigation

Overall, 50% (n=5) of study participants experienced navigation issues with the Google Earth software. Out of the five users who experienced issues with navigation, 4 of them experienced only one issue and 1 participant experienced 2 issues. The user would have likely recovered from navigation issues could have been avoided if the mapping tool had the undo/redo functionality emphasized in the last section. There was no common navigation issue relating to a feature of the tool which could be improved. The main usability issue was a hardware issue caused by the computer mouse scroll wheel working in the opposite direction than most users were familiar with.

Understanding Procedure

There were three different areas noted in the findings that caused usability challenges relating to understanding procedure: 1) Calculating Distance; 2) Selecting a Community; and 3) using the zoom function. Each of these is explored below.

Calculating Distance

Going into the study, it was anticipated that calculating distance would be a feature of the mapping tool that participants would want to use in their role-play. This expectation proved accurate. As highlighted in the findings chapter, calculating the distance between communities and/or health services was a challenge for 50% (n=5) of study participants. Difficulty in understanding the procedure of how to calculate a distance could have easily been avoided by: 1) more visible help and documentation within Google Earth, and 2) the ability for the mapping program developer to insert custom help and documentation, a usability improvement mentioned in help and documentation section previously.
Selecting a Community

When two or more waypoints are close together and the mapping tool is zoomed out, the points often overlap. Google Earth has designed a feature to assist with the selection of overlapping points. When the user selects the overlapping points they become separated in order for the user to make a distinct selection. However, when the mouse is moved so the user can make a final selection, the points often collapse before the selection is made. The mapping tool could be improved by allowing more time for the user to make the selection of overlapping points before the points collapse again. For example, participant 10 in Figure 15 below had trouble selecting Lillooet between a health care facility.

Figure 15 - Overlapping Data Points in Google Earth

Using the Zoom Function

The study findings showed that participants would often zoom in too close or too far out. As stated in the above usability findings related to navigation, users were somewhat unfamiliar with the computer mouse used in the study which likely caused most of the issue. All other issues related to the zoom function could have been resolved had the user had the time or been able to find the user preference settings related to navigation within Google Earth. The mapping tool contains navigation preferences within
the toolbar menu to adjust the speed of the mouse wheel, but participants did not have
even sufficient time to explore all the menus in order to find the navigation settings. A/usability recommendation is for Google Earth not to list these preferences deep within the
menus. Had the zoom options been more readily available, especially to new users, the
usability issue would have been unlikely to occur with as much frequency.

**Usability Comment**

As previously stated in the findings chapter, participant comments directly relating to
the mapping tool’s usability were coded for frequency. These comments either enhanced
or hindered participants’ usability experience. Colour, layout, and visual representation
emerged as three sub-themes from the data.

**Colour**

The interpretation of the meaning behind colour was not always clear to the
participant. This issue, like others, specifically relates back to the help and documentation
available within Google Earth. Without the Google Earth developer’s ability to create a
customized ‘Places’ menu with legend criteria descriptions, the user can easily become
confused as to what they are seeing on the map and how it relates back to what the
program developer has coded.

**Visual and Layout**

The layout was found to be a common usability theme, but unlike other usability
themes it referenced a positive usability aspect of the tool which participants found
particularly useful. In most cases visual and layout meant that the data, when displayed
on the map, resonated with the participant in a way that paper decision support did not.
A positive usability experience is a key component in the adoption of mapping tools by policy makers. The study found usability issues and made recommendations with regard to Nielsen’s usability principles: Help and Documentation; User Control and Freedom; Navigation; and, Understanding Procedure. Visual and layout emerged as the main positive usability aspect that users communicated while using the mapping tool.

5.3 **How should GIS be used in decision support to define rurality?**

Now that participants have demonstrated a positive response to using mapping tools, the study will look at how GIS should be used in decision support to define rurality. First, this section of the chapter discusses the importance of defining the term access, as well as the potential for mapping tools to assist with a comprehensive view of the definition. Second, this section of the chapter discusses how participants viewed the mapping tool as valuable but were clear that it was not to be a replacement of paper decision support – rather it was viewed as an enhancement or supplement by participants.

**5.3.1 Defining Access**

There are many variables to consider when using GIS in the context of health care. Graves writes that “factors of health status are often interdependent and interrelated, creating a complex web of causation” (Graves, 2008). If health policy makers do not outline and define what their definition of the term “access” means when trying to measure rurality, they will likely develop a superficial standard and face more challenges in gaining consensus when negotiating with stakeholders. In other words, the same scenario is likely to elicit different recommendations based on the perception of the stakeholder, be it from the patients’ perspective, the health resource planning perspective, the budget perspective, and the physician or client provider perspective. Therefore, the
A literature review conducted by O’Connell in 2015 emphasizes that standard rural criteria across an entire region or province may not address the uniqueness and individual pressures within some rural areas:

“[C]ertain locations may experience greater physical access barriers in comparison to others due to local topography. While national level analyses provide some insights into factors that constrain access to health services, in order to promote equitable access, detailed analyses are required at the district (or similar sub-national) level. After all, strategies for addressing both supply and demand-side access barriers must be implemented at the district level; such strategies are unlikely to be effective if they are not tailored to the barriers specific to that district and which take account of the local context.” (O’Connell, 2015, p.10)

A mapping tool can incorporate non-spatial or qualitative factors to help policy makers take into account district level or local issues with access within a community. The tool itself can serve as a mechanism to layer data relevant to the numerous stakeholder perspectives that inform all aspects of what Graves’ refers to as a ‘complex web’.

As noted in the findings section, participant responses led to the identification of several themes. Most often participants stated that the mapping tool’s impact would allow decision makers to come to a quicker agreement and consensus. This was also found in the Innes review (Innes & Booher 1999) which states that GIS is unique in that it can be used by health policy professionals to bridge the gap between data and information.
5.3.2 Mapping Tool as a Supplement to Paper-Based Decision Support

The literature identified in Bhowmick’s study indicates that maps alone did not meet the needs of the user – they required additional information in the form of tables in order to further understand the map. This study reaffirms Bhowmick’s finding; study participants noted that the mapping tool was an enhancement or supplement to the paper decision support and not a complete replacement of paper decision support. With improved mapping tool usability, it is possible that the need for paper-based decision support tools could reduce over time. However, given the current comfort of study participants with the mapping tool and the usability issues that surfaced during the study, mapping tools are still considered a supplemental tool to the more traditional paper-based materials available.

5.4 Contributions to Health Informatics Practice

5.4.1 Client View vs. Provider View

Higgs’ 2004 study identified that the use of the term access has different definitions and can be used in different ways in the health context. This was certainly evident when coding user responses against Penchansky’s five dimensions of access. Back in 1981 Penchansky wrote that “While access is more often employed to characterize factors which influence entry or use, opinions differ concerning the range of factors included within access and whether access is seen as characterizing the resources or the clients” (Penchansky, 1981, p. 127). Participants’ responses in this study tended to look at the spatial accessibility issues surrounding rurality; participants oscillated back and forth between an end client’s perspective (the patient or population of Anytown, BC) and a
health resource planning perspective (an analyst as outlined in the role-play). The study found that not all rural factors tended to be considered from a policy maker’s perspective when exploring rural accessibility issues. One of the most notable factors missing was rural accessibility from the patient population perspective. The assessment criteria considered the health care provider’s view and not the end client view. To consider the end client, population health profiling in addition to distance and availability of services could be incorporated into rural policy analysis. Health profiling of populations within rural areas will ensure that factors such as affordability, accommodation, and acceptability are part of the analysis to enable a well-rounded patient-centered view of the health care system. The patient’s needs should be the key driver for the health care system and the lesson is to always consider these needs. In future, the considered inclusion of rural population data such as age, gender, and health status would better enable the incorporation of people into the policy. This study did not incorporate the aforementioned data and is outlined in the study limitations section.

5.5 Future Research Directions

The study findings presented interesting future research directions in the field of usability and mapping tools as a form of decision support for rural policy makers. The following section outlines four areas for future research: (1) non-spatial factors used in mapping tools to analyse rural policy; (2) Provincial Comparison of Rural Policy Criteria in Canada; (3) Users Perception of Proficiency with the Mapping Tool; and (4) Client Perspective of Rural Access Criteria.
5.5.1 Review Non-Spatial Factors used in Mapping Tools to Analyse Rural Policy

There is a need to conduct a literature review to further explore the three dimensions of access that were not mentioned by study participants – affordability, acceptability, and accommodation. How frequent do policy makers look beyond distance factors in rural policy issues in Canada? One could conduct a study with interviews to find out if these forms of access are also infrequently researched and studied in Canada. If they are indeed missing from the literature, research could further investigate the potential impact of these forms of access as not commonly being considered in rural evaluations.

5.5.2 Provincial Comparison of Rural Policy Criteria in Canada

There is a need to conduct a Canadian provincial comparison of rural policy criteria relating to rural health care accessibility criteria. A study could seek to interview rural health policy makers in each province. The research could review the rural criteria each province considered in health care and what criteria are potentially missing. The study could then ask the question of whether not each provinces current criteria leverage the analytical capability of mapping systems in their decision making process. Based on the outcomes, the study could provide a recommendation back to health policy makers regarding the strengths and weaknesses of their assessment criteria. The analysis would show the extent to which Penchansky’s five dimensions of access have been considered. The study could result in the creation of a Canada-wide assessment tool that would allow governments, health care providers, rural populations, and physicians to compare and rank their rural health care support to provide: 1) best practices; and 2) greater continuity in approach, including region-specific solutions.
5.5.3 Users Perception of Proficiency with the Mapping Tool

The study was limited in that it did not measure or score participants’ proficiency with the mapping tool features against their perceived skill level noted in the semi-structured interview. Participants generally indicated they perceived their own skill level with the mapping tool as advanced despite experiencing usability issues and using the tool’s basic features. This could mean that the visual representation in itself was quite helpful. Future studies should examine the consequences of a user’s perceived skill level with the mapping tool. This could include measuring participants’ feelings of mastery over the mapping tool during pre-usability testing. Testing usability and expertise of precise mapping functionality could also be included. Similarly, pre- and post-quantitative and qualitative examination could be conducted to understand how mapping tool proficiency and depth of functionality use influences participant conclusions. The objective of such a study could examine whether or not the mapping tool gives the participant a false sense of reinforcing his/her perceptions. In other words, the user may be inadvertently influenced by his/her expectations of what will be identified on the map – looking for only what they want to find, not necessarily being open to seeing new factors.

Another commonality within the participant comments was their high rating of the mapping tool despite the usability issues they encountered. The excerpt below demonstrates the contradiction between the user’s comfort level, which was low, and their rating of the tools usability, which was high:

Researcher: “Did you feel comfortable using Google Earth software? Please elaborate.”
Participant: “No, I don’t think I did. I think when I first … I haven’t used it much before except just on a really surface level personal entertainment basis. I think when I saw all the choices down the left-hand side of it I felt overwhelmed by that. I find for the way I think, I’d be the visual map with the colors and the water and the mountains and the 3D look of it, I find it distracting but overall, I recognize that it’s comfortable. It’s very usable, the Google Earth, it’s designed to be usable. I know that and I think with a little more time and training as some detailed explanations about what these choices down on the menu, on the left hand side mean in relation to the RRP. I would be very comfortable with it after a couple of hours of tinkering with it”.

The above participant quote, like others, assumes the mapping tool would eventually be easy to use and that any usability issue with the tool was due to their inexperience rather than the design of the mapping tool. A further study could research user’s perceptions of the mapping tool over a period of time to see if this perception would hold after the participant was given more experience with the mapping tool. For example, more research could uncover whether policy makers change their mind about the mapping tool once they have had a chance to use it for a prolonged period in the workplace. A long term study could review how policy maker’s perceived usability of the mapping tool evolves with more training and experience.

5.5.4 Client Perspectives of Rural Access Criteria

There is a need to conduct a study with end-user health care clients to learn about their experience with the mapping tool. The study would seek to better understand the end-client’s perspective and to identify whether new rural criteria or considerations emerge with the mapping tool. This work involves identifying additional limitations and gaps in the mapping of decision support tools and/or opportunities for health care policy makers to more fully use the mapping tools capabilities to test their policies with the user groups.
Specifically, new research could reveal differences and similarities between the end-client view of rural criteria and health policy maker’s view; new criteria could emerge.

5.6 Study Limitations

Upon completion of the study and an analysis of the findings, three study limitations emerged. First, participant experience with and/or comfort with using Google Earth created limitations. Second, participant depth of knowledge about the rural health criteria impacted the study. Interestingly, both study limitations impacted participants’ ability to suspend reality and fully immerse themselves in the role-play. In some cases, the distraction caused by these two challenges limited the depth of analysis offered by the participants. The third limitation of the study relates to participants’ own perceptions of rurality based on their urban location.

5.6.1 Participants Prior Experience with Google Earth

The majority of participants had a good understanding of other mapping tools developed by Google; however, not all study participants had prior experience using Google Earth. Participants that had never specifically used Google Earth prior to participating in the study had the added challenge of learning the mapping tool during the study. In these scenarios, it is reasonable to infer that some of the usability issues identified in the study findings would not have occurred if the participant had more time to become familiar with the mapping tool without having to simultaneously focus on the rural criteria.

5.6.2 Participant Depth of Knowledge Regarding Rural Policy Criteria

Although the participants who agreed to participate in the study were screened based on a number of factors, the study findings show that the depth of experience specifically
with regards to rural policy criteria proved to be a challenge for some participants. The program criteria are complex and, at times, confusing to those who may not have a deep understanding of the criteria. Not all participants fully grasped the criteria as presented in the first part of the study, in which they were provided the paper-based decision support tool. The result was the participant’s inability to more deeply comment on the rurality of the community as it related to the criteria.

Participants who were unfamiliar with both Google Earth and rural health criteria lost focus during their role-play as an analyst. More commonly, these participants appeared overwhelmed with understanding the policy criteria, using the mapping tool, and being tasked with developing an opinion for their role-play as an analyst. A future study could obtain more usability results by having the participants focus on a narrower policy and task. For example, the participant could review a single aspect of a rural policy and then perform a specific defined task, which relates to the policy, in Google Earth rather than having them explore the tool.

5.6.3 Participant Perception/Bias of Rurality

All study participants were themselves urban residents and positioned as health care policy analysts. The study findings did not capture potential perceptions premised on the study participants’ own definition of rurality. Nor did the study findings seek to understand the perspective of the rural population receiving care. Therefore, a valuable perspective, that of the rural health care client, was missing from the study. An additional and/or complementary study might seek to gain insights into the health care system users’ perspectives.
5.7 Conclusion

System usability design principles play a key role in the success and adoption of mapping tools among rural health policy makers. The study found that Google Earth’s software design violated Nielsen’s usability design principles in the following categories: Help and Documentation, User Control and Freedom, and Navigation. Despite these usability issues, 70% (n=7) of participants preferred Google Earth over the paper-based decision support. Despite these usability issues, participants found the mapping tool to have three main advantages over the paper-based decision support, the tool allowed them to: 1) gain a more complete picture of the surrounding communities; 2) understand the proximity of health services; and 3) gain greater awareness of the geography of the area. The greater the user experience, the easier it will be for health care policy makers to systematically consider and use mapping tools as part of their suite of decision support tools.

Usability in this study influenced the perceived usefulness of the mapping tool. Overall the participants felt the mapping tools should be used as a form of decision support in rural health policy issues. Mapping was seen as tool to obtain quicker consensus among decision makers, to provide more context to rural issues in the study scenario, and used as a platform which could potentially assist in the identification of new criteria used to define rural health policy. To be clear, the study does not suggest that all health policy makers become cartographers in order to analyze health policy issues. However, mapping tools such as Google Earth do not require extensive user training and was found to have deepened participant’s understanding of rural when visualized on the map.
References


Heath, S., & Szpilfogel, C. (2002). Defining 'rural' and 'rurality' for health and health services research Brandon University, Rural Development Institute.


List of Appendices

Appendix A: Participant Demographic Questionnaire
Appendix B: Interview Guide
Appendix C: Participant Invitation
Appendix D: Participant Consent Form
Appendix E: Sample -Traditional Paper-Based Decision Support
Appendix F: GIS based Decision Support Material
Appendix A: Participant Demographic Questionnaire

Please answer the following eight questions by circling the most appropriate answer or filling in the blank. This information will not be used to identify you, but will inform the overall research being conducted.

1) What is your age range:
   <35
   35 – 50
   >50

2) What is your gender:
   Male
   Female

3) Please circle the job category that most closely resembles your occupation:
   Analyst
   Manager
   Executive
   Medical Consultant
   Student

4) Please identify the types of decision support tools used in your workplace (circle all that apply):
   Databases
   Reports
   Surveys
   Interviews
   Other _________________________________________________
5) How many years of experience do you have using decision support tools (fill in all that apply)?

Databases _____ years
Reports _____ years
Surveys _____ years
Interviews _____ years
Other ________________________________ _____ years

6) How often do you use decision support tools?

Daily
Weekly
Monthly
Annually
Not at all

7) Do you have experience using Geographic Information Systems?

YES  NO

If yes, how many years of experience using GIS and mapping tools?

_____ years

8) How many years experience do you have with Rural Health Care Policy?

_____ years

Thank you for completing the demographic questionnaire.
Appendix B: Semi-Structured Interview Guide

1) Have you used mapping tools? If yes, what barriers, if any, were there in your using this type of decision support?

2) Which did you like better, the paper or mapping tool? Why?

3) Compared to the traditional paper community assessment what, if anything, did the mapping tool reveal?

4) Did the use of the mapping tool influence your definition of rurality? Please elaborate.

5) How do you feel about visualizing rural policy criteria on Google Earth (GIS light) software?

6) What, if any, impact might mapping tools have on the development of new criteria for decision support?

7) How much time per week do you spend learning about new decision support tools?

8) Did you feel comfortable using the Google Earth software? Please elaborate.

9) How easy was it to interpret information when viewed on mapping software?

10) How should GIS tools be used in decision support to define rurality?

11) Do you find GIS to be useful for administrating programs and addressing problems?

12) What did you like the most and conversely the least about using the mapping software?

13) What problems or usability issues did you have using the mapping tool?

14) Did your recommendation in the role-play change as a result of using the mapping tool? Please explain.

15) Should mapping tools be used more for health policy makers decision support? Please elaborate.
Appendix C: Participant Invitation

You are invited to participate in a study entitled “Rurality and Measuring Spatial Accessibility to Health Services Using Geographic Information Systems” conducted by Jason Bond, a graduate student (MSc candidate) at the School of Health Information Science, University of Victoria. Overall research and thesis supervision provided by professor Elizabeth Borycki from the University of Victoria.

Purpose and Objectives
The study will investigate the current research gap exploring the geographic information systems (GIS) used as decision support in rural health care policy.

Participants Selection
You are being asked to participate in this study because you are a health care professional or health sciences student and have experience in rural health issues.

Location
The study will take place at an office located at the University of Victoria at a time that is mutually convenient for the participant and researcher.

Inconvenience
The study is not required to take place during normal business hours, and may be scheduled at a time mutually convenient for the participant and the researcher. Participation in the study will take approximately 60 minutes of the participant’s time.

Risks
There are no known or anticipated risks to the participant for taking part in this research study.

Voluntary Participation
Participation in this usability study is completely voluntary. Should you decide to participate in the study, you may withdraw from participation at any time during the study without consequence.
If you withdraw from the study your data will not be used and all your data (electronic, digital, and paper-based) will be destroyed.

Confidentiality
Confidentiality of the participant and confidentiality of the data will be protected by the researcher.
All information provided by the participant for the purposes of this study will be kept confidential.

If you are interested in participating in the study, or if you have any further questions, you may contact Mr. Jason Bond by email at jjbond@uvic.ca
Appendix D: Participant Consent Form

Participant Consent Form

GIS Usability and Decision Support for Rural Health Policy

You are invited to participate in a study entitled Rurality and Measuring Spatial Accessibility to Health Services Using Geographic Information Systems that is being conducted by Jason Bond.

Jason Bond is a graduate student in the department of Health Information Science at the University of Victoria and you may contact him if you have further questions by email jjbond@uvic.ca

As a graduate student, I am required to conduct research as part of the requirements for a degree in the School of Health Information Science. It is being conducted under the supervision of Elizabeth Borycki. You may contact my supervisor at (250) 472-5432.

Purpose and Objectives
The purpose of this research project is to investigate the benefits of applying Geographic Information Systems in rural health care related to policy and program decision support. There are an overwhelming number of criteria used to define the term rurality in the context of health care. The objective of this study is to understand how health policy makers perceive rurality when presented with the information displayed on a map.

Importance of this Research
Research of this type is important because a further understanding of health professionals usability of mapping tools could potentially lead to: greater savings in a health care system which currently faces increasing cost pressures, greater utilization and understanding of mapping tool benefits in health care, a better understanding - from a policy maker’s perspective - of the issues and pressures rural health care providers face in working in isolated communities to inform policy.

Participants Selection
You are being asked to voluntarily participate in this study because you are a health care professional or health sciences student and have experience in rural health issues.

What is involved
If you consent to voluntarily participate in this research, your participation will include four steps:

1) Participant Consent: Upon arrival to the study the participant will be informed of the research objectives and asked to read and sign the participant consent form before the study can continue.

2) Demographic Questionnaire: You will be asked to complete a short demographic questionnaire. It should take a participant 5 to 10 minutes to complete the questionnaire. The questionnaire will used to gather background information so participants can be aggregated into groups or subgroups, based on their backgrounds and experience, for data analysis and presentation of findings.
3) **Observation**: After completing the questionnaire you will be asked to review and comment on two scenarios that focus on the same rural issue from a policy analyst’s perspective. The first scenario will consist of paper-based decision support in which you will review an issue note about a rural community and be asked for feedback based on a letter and background material relating to the community. During the second scenario you will view a Google Earth profile and a GIS-based report, which focuses on the same rural issue note. The researcher will record your activity on the computer screen using screen capture software. While you are reviewing the scenarios you will be asked to think aloud and describe your thought process surrounding the rural scenarios; the research will audio record your comments.

4) **Post-task Interview**: After having completed the scenarios you will be interviewed for further feedback on your impressions of usability relating to the mapping tool. Your interview will be audio recorded and your answers will be transcribed and coded for identification of common themes across all study participants.

The location of the study will take place in an office assigned by the School of Health Information Science at the University of Victoria.

**Inconvenience**
Participation in this study may cause some inconvenience to you, including time and travel inconvenience. However, the study will be scheduled at a time that is mutually convenient for the participant and researcher. Participation in the study is estimated to take between 60 and 90 minutes of the participant’s time.

**Risks**
There are no known or anticipated risks to you by participating in this research.

**Benefits**
The potential benefits of your participation in this research include the advancement of health mapping decision support usability of which there is a current gap in academic research. Participation in this study may assist with the adoption of mapping software as a decision support for health policy makers as the study has the potential to point out current usability barriers. Also, a greater understanding about health researchers decision support tools could lead to increased efficiencies in the health care system and even potentially reduced costs and improvements in the way health care is delivered.

**Compensation**
As a way to compensate you for any inconvenience related to your participation, you will be given a $25 Starbucks gift card. If you consent to participate in this study, this form of compensation to you must not be coercive. It is unethical to provide undue compensation or inducements to research participants. If you would not participate if the compensation was not offered, then you should decline.

**Voluntary Participation**
Your participation in this research must be completely voluntary. If you do decide to participate, you may withdraw at any time without any consequences or any explanation. If you do withdraw from the study your data will not be used. The $25 Starbucks gift card may be kept.
Anonymity
In terms of protecting your anonymity the researcher will ensure that any and all data collected will be kept separate from the researcher’s name. Each participant will be assigned a participant ID number so that your identity will not be stored with the data collected.

Confidentiality
Your confidentiality and the confidentiality of the data will be protected. Only the researcher (Jason Bond) and the thesis supervisor (Elizabeth Borycki) will have access to participant names and research data. All information provided by the participant will be kept confidential and stored in a secure office either in a locked cabinet or on a hard drive that is username and password protected. Study results will not include participant names or personally identifiable information.

Dissemination of Results
It is anticipated that the results of this study will be shared with others in the following ways: thesis, published articles, and conference presentations. Also, the researcher (Jason Bond) will contact and distribute the thesis results, upon completion, at the participant’s request.

Disposal of Data
Data from this study will be disposed of in an appropriate manner. While the study is being conducted all related data will be stored on an encrypted hard drive and paper responses will be stored in a locked cabinet. Upon completion of the study all participant audio recordings, screen capture recordings, and survey responses will be destroyed. Electronic data will be erased and paper-based responses will be shredded.

Contacts
Individuals that may be contacted regarding this study include the researcher’s supervisor: Elizabeth Borycki (250-472-5432 or emb@uvic.ca).

In addition, you may verify the ethical approval of this study, or raise any concerns you might have, by contacting the Human Research Ethics Office at the University of Victoria (250-472-4545 or ethics@uvic.ca).

Your signature below indicates that you understand the above conditions of participation in this study, that you have had the opportunity to have your questions answered by the researchers, and that you consent to participate in this research project.

Name of Participant __________________________ Signature __________________________ Date __________________________

A copy of this consent will be left with you, and a copy will be taken by the researcher.
Please review the following paper decision support material. Approach the material as if you are a policy analyst who has been asked to make a recommendation about the rurality of a particular community. The question you must address is: Is this a rural or isolated community? The only information you have available to make your decision is what is currently in front of you, which is an assessment of Anytown, BC based on existing medical isolation point criteria. Describe how the material below defines rurality and comment on usability and usefulness of the decision support materials. In doing this please "think aloud" or verbalize your thoughts.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Points Max Pts</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>RRP Medical Isolation Point Rating System</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Number of Designated Specialties within 70 km</strong></td>
<td></td>
</tr>
<tr>
<td>0 Specialties within 70 km</td>
<td>60</td>
</tr>
<tr>
<td>1 Specialty within 70 km</td>
<td>50</td>
</tr>
<tr>
<td>2 Specialties within 70 km</td>
<td>40</td>
</tr>
<tr>
<td>3 Specialties within 70 km</td>
<td>20</td>
</tr>
<tr>
<td>4+ Specialties within 70 km</td>
<td>0</td>
</tr>
<tr>
<td><strong>Number of General Practitioners within 35 km</strong></td>
<td></td>
</tr>
<tr>
<td>over 20 Practitioners</td>
<td>0</td>
</tr>
<tr>
<td>11-20 Practitioners</td>
<td>20</td>
</tr>
<tr>
<td>4 to 10 Practitioners</td>
<td>40</td>
</tr>
<tr>
<td>0 to 3 Practitioners</td>
<td>60</td>
</tr>
<tr>
<td><strong>Community Size (If larger community within 35 km then larger pop is considered)</strong></td>
<td></td>
</tr>
<tr>
<td>30,000 +</td>
<td>0</td>
</tr>
<tr>
<td>10,000 to 30,000</td>
<td>10</td>
</tr>
<tr>
<td>Between 5,000 and 9,999</td>
<td>15</td>
</tr>
<tr>
<td>Up to 5,000</td>
<td>25</td>
</tr>
<tr>
<td><strong>Distance from Major Medical Community</strong></td>
<td></td>
</tr>
<tr>
<td>(Kamloops, Kelowna, Nanaimo, Vancouver, Victoria, Abbotsford, Prince George)</td>
<td></td>
</tr>
<tr>
<td>first 70 km road distance (70km-104km)</td>
<td>4</td>
</tr>
<tr>
<td>for each 35 km over 70 km</td>
<td>2</td>
</tr>
<tr>
<td>to a maximum of</td>
<td>30</td>
</tr>
<tr>
<td><strong>Degree of Latitude</strong></td>
<td></td>
</tr>
<tr>
<td>Communities between 52 to 53 degrees latitude</td>
<td>20</td>
</tr>
<tr>
<td>Communities above 53 degrees latitude</td>
<td>30</td>
</tr>
<tr>
<td><strong>Location Arc</strong></td>
<td></td>
</tr>
<tr>
<td>- communities in Arc A (within 100 km air distance from Vancouver)</td>
<td>0.10</td>
</tr>
<tr>
<td>- communities in Arc B (btwn 100 and 300 km air distance from Vancouver)</td>
<td>0.15</td>
</tr>
<tr>
<td>- communities in Arc C (btwn 300 and 750 km air distance from Vancouver)</td>
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</tr>
<tr>
<td>- communities in Arc D (over 750 km air distance from Vancouver)</td>
<td>0.25</td>
</tr>
<tr>
<td><strong>RSA Specialist Centre</strong></td>
<td></td>
</tr>
<tr>
<td>- 3 or 4 designated specialties in physician supply plan</td>
<td>30</td>
</tr>
<tr>
<td>- 5 to 7 designated specialties in physician supply plan</td>
<td>50</td>
</tr>
<tr>
<td>- 8 designated specialties and more than one specialist in each specialty as set out in the physician supply plan</td>
<td>60</td>
</tr>
</tbody>
</table>
MEDICAL ISOLATION POINT ASSESSMENT

Medical Isolation Factors

1. **Number of Designated Specialties within 70 km**
   All designated specialties within 70 km (by road or ferry) of the community where the specialist(s) meet the FTE income figure as defined below are counted.

2. **Number of General Practitioners within 35 km**
   General Practitioners practicing within 35 km (by road) of the community and who meet the FTE income figure as defined below are counted. General Practitioners practicing in a community within 35 km of the community by ferry are not counted.

3. **Distance from a Major Medical Community**
   Major Medical Communities are designated as Kamloops, Kelowna, Nanaimo, Vancouver, Victoria, Abbotsford and Prince George. Major Medical Community is defined as those communities with at least 3 specialists in each of the Designated Specialties.

   Maximum points are awarded for communities with no road or ferry access.

4. **RSA Specialist Centre**
   Points will be assigned to a community where the regional Physician Supply Plan requires designated specialists to provide services for a community. A community must be included in Appendix A of the RSA in order to be considered an RSA Specialist Centre.

   An RSA community located within 35 km (by road) of an RSA Specialist Centre will receive the same points as the RSA Specialist Centre for this factor.

Living Factors

5. **Community Size**
   Where a community is within 35 km by road of a larger community, the points are based on the population of the larger community. Where a community is within 35 km of a larger community by ferry, the population of the larger community is not counted. When two communities are combined in this Agreement, the populations will be amalgamated.
Community populations are established annually using the most recent National Census-based estimate for the preceding calendar year, which is supplied by BC STATS, Ministry of Finance and Corporate Relations. They are based on regional districts defined by the Ministry of Community, Aboriginal and Women’s Services. In case of changes to regional districts from one year to the next, population assignment is determined by MSP, based on all available information (available on request).

6. **Degree of Latitude**
Points are allocated for those communities in British Columbia located at and above the 52° of latitude.

7. **Location Arc**
Four differential multipliers have been established for the purpose of determining the final point total for determination of retention allowances. Arcs are based on air distance from Vancouver and multiplied by the applicable factor to determine the community’s final point total.

**DESIGNATED SPECIALTIES:**

1. Designated specialties include General Surgery, Orthopedics, Pediatrics, Internal Medicine, Obstetrics/Gynecology, Anesthesia, Psychiatry, and Radiology.

2. Physician FTE count: At the beginning of each calendar year, the number of physicians practicing in each community is verified through written confirmation by the responsible Health Authority. This is done in collaboration with the local and/or regional Medical Advisory Committee.

3. A confirmation form must be submitted for all communities.

4. Physicians are counted as one physician if their total income (including fee-for-service, salary, sessional and subsidy income) exceeds the FTE income figure established by MSP for that year for their specialty.

Income includes fee-for-service, service contract, salaried earnings, and sessional payments. It also includes the RRP fee premium, tray fees, visit and procedural premiums, retroactive payments, GPSC fees and reciprocal payments.
For those physicians who did not practice in the community for the full year, income will be extrapolated to produce an estimated annual income figure. For physicians whose total income (or estimated annual income) is below the FTE income figure, the incomes of all such physicians will be added and divided by the FTE income figure.

The resulting number is rounded down to the nearest whole number, which is counted in the number of physicians in the community. If there is more than one specialist in the same specialty meeting the FTE income figure, only one specialist is counted; if there is more than one specialist in the same specialty who do not meet the FTE income figure, the incomes of those specialists are combined to determine if their combined income equals an FTE. General Practitioners practicing more than 75 percent in a specialty (based upon fee for service billings) will be counted as specialists; all specialists practicing more than 75 percent as a general practitioner (based upon fee for service billings) will be counted as a General Practitioner. The MSP FTE income figure is based on the 40th percentile of earnings for each specialty in the previous calendar year as defined by MSP.

ROAD DISTANCES:

In all cases where reference is made to road distances, these distances are determined using the BC Road Map and Parks Guide:
• road distances are converted to travel time using an assumed average speed of 70 kilometres per hour;
• for communities accessible only by ferry, a multiplier is applied to the ferry distance, based on data from the BC Ferry Corporation and the Ministry of Transportation;
• where communities are combined in this Agreement, the distance from the furthest community is used.
### Rural Retention Program Point Assessment

#### Community: Anytown, BC

**Number of G.P.'s within 35 KM**
- Over 20 Practitioners = 0 points
- 11 to 20 Practitioners = 20 points
- 4 to 10 Practitioners = 40 points
- 0 to 3 Practitioners = 60 points

*Points Assessed: 60*

**Number of Designated Specialties within 70 KM**
- No Specialty = 60 points
- 1 Specialty = 50 points
- 2 Specialties = 40 points
- 3 Specialties = 20 points
- 4+ Specialties = 0 points

*Points Assessed: 60*

**Distance from Major Medical Community**
- Closest Community: Kamloops
- Distance to Closest MMC: 94km
- *Points Assessed: 4*

**Degree of Latitude**
- Communities between 52 to 53 degrees latitude = 20 points
- Communities above 53 degrees latitude = 30 points

*Points Assessed: 0*

**Specialist Centre**
- 3 or 4 designated specialties in the physician supply plan = 30 points
- 5 to 7 designated specialties in the physician supply plan = 50 points
- 8 designated specialties and more than one specialist in each specialty as set out in the physician supply plan = 60 points

*Points Assessed: 0*

**Size of Community**
- Up to 5,000 = 25 points
- 5,001 to 9,999 = 15 points
- 10,000 to 29,999 = 10 points
- 30,000+ = 0 points

*Population: 200 approx.*

*Points Assessed: 25*

**Total Points Assessed:** 149

**Location Arc:**
- Code A = .10 per point (100km from Vancouver by air)
- Code B = .15 per point (100 – 300km from Vancouver by air)
- Code C = .20 per point (300 – 750km from Vancouver by air)
- Code D = .25 per point (over 750km from Vancouver by air)

**Medical Isolation Point Allocation:** 29.8

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**Reference:** Medical Isolation Point Rating System - 2012 Physician Master Agreement, Government of British Columbia

Appendix F: GIS based Decision Support Material

Please review the decision support material below and on Google Earth. Explore the geography of Anytown, BC. Please comment on the usability of the mapping tool and how it may or may not affect your perception of rurality as compared to the paper-based decision support. In doing this please "think aloud" or verbalize your thoughts.

Community Profile: Anytown, BC

<table>
<thead>
<tr>
<th>HEALTH BOUNDARIES</th>
<th>POPULATION SIZE</th>
<th>MEDICAL ISOLATION POINT RATING</th>
</tr>
</thead>
<tbody>
<tr>
<td>HA: IHA</td>
<td>HA: 737,468</td>
<td>06/07 Designation: A</td>
</tr>
<tr>
<td>HSDA: Thompson Cariboo Shuswap</td>
<td>HSDA: 224,230</td>
<td>07/08 Points: 22.35</td>
</tr>
<tr>
<td>LHA: South Cariboo</td>
<td>LHA: 7,483</td>
<td>08/09 Fee Premium: 15.645</td>
</tr>
<tr>
<td></td>
<td>Municipal: 1,756</td>
<td>Flat Fee: $13,678</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>SURROUNDING COMMUNITIES WITHIN 115km</th>
<th>SURROUNDING HOSPITALS</th>
</tr>
</thead>
<tbody>
<tr>
<td>COMMUNITY</td>
<td>DISTANCE (km)</td>
</tr>
<tr>
<td>-----------</td>
<td>---------------</td>
</tr>
<tr>
<td>Ashcroft</td>
<td>0.00</td>
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<tr>
<td>Cache Creek</td>
<td>10.87</td>
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<tr>
<td>Spences Bridge</td>
<td>42.95</td>
</tr>
<tr>
<td>Clinton</td>
<td>50.38</td>
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<tr>
<td>Logan Lake</td>
<td>58.02</td>
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<tr>
<td>Lytton</td>
<td>79.25</td>
</tr>
<tr>
<td>Kamloops</td>
<td>94.42</td>
</tr>
<tr>
<td>Lillooet</td>
<td>98.54</td>
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<td>Merritt</td>
<td>103.26</td>
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</table>

<table>
<thead>
<tr>
<th>MAJOR MEDICAL CENTRE</th>
<th>DISTANCE (km)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kamloops</td>
<td>94.42</td>
</tr>
</tbody>
</table>

Data Sources:
- Physicians Count: Rural Retention Program, Physician Compensation Branch 2012 as at Q1 2013/13
- Hospital Bed Count: OASIS/HAMIS Acute Care Beds Staffed and in Operation as at end of Period 1 - 2011/12
Screenshot: GIS based Decision Support Material