An interactive web-based dashboard representing Medicare-accepting Rural Health Clinics and General Hospitals in Minnesota.

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Abstract

In the state of Minnesota, rural residents face great difficulties in seeking medical care. Minnesota Rural Health Connect (MNRHC) is an internet-hosted webpage designed to enable rural Minnesotans to seek out Medicare-accepting rural health clinics and hospitals through an interactive map. An analysis of the corresponding questionnaire results suggested that the target demographic was successfully reached, with 36.4% and 29.7% of respondents being residents of rural and semi-rural areas, respectively. Of the respondents, 36.8% identified as over the age of 65, and 44.5% of the respondents identified as being between 35 and 65, showing that MNRHC was heavily used among Minnesotans of older age groups. The page was also shown to be well received among users, with user feedback reflecting a satisfaction score of $\mu = 4.18$ ($\sigma^2 = .70$, $n = 209$), on a 1-5 scale. Promising feedback provides evidence of the necessity of a web-based interactive map representing Medicare-accepting rural health clinics and hospitals in Minnesota.

INTRODUCTION

Background

For 1.2 million (22%) of the state's residents, seeking basic medical attention requires traveling great distances, with only one-third of the state's outpatient clinics located in rural regions [1]. Rural Minnesota has a high prevalence of residents using public health insurance programs, such as Medicare, which covers 18.1% of the state's residents [2]. This disparity is primarily caused by rural Minnesotans being older, earning lower incomes, and generally relying on more forms of government assistance than their urban counterparts. With many rural Minnesotans requiring clinics toaccept public health insurance, there is a need for a comprehensive representation of Medicare-accepting rural health clinics in Minnesota.

The internet is quickly becoming the most significant platform for public health information. The soaring prevalence of smartphones, computers, and internet connection in rural Minnesota presents unique opportunities to share healthcare-related information to the masses, and websites are quickly becoming a popular method of distribution [3,4]. These webpages have consistently been shown to be effective distributors of healthcare-access-related information, as they have the ability to instantly distribute and keep up-to-date information [4]. Access to high-speed internet is available in approximately 92% of rural Minnesota, and internet literacy is increasing, making a web-based public health platform a viable option [5].

Many websites contain information on Medicare-accepting clinics, but it can be difficult to find comprehensive and up-to-date information [4,6]. Existing interactive web maps, such as those hosted on insurance companies' and Medicare's sites, do not consistently contain up-to-date information, often failing to retrieve information from state-level provider registries [7]. The lack of accurate information regarding clinics that accept public health insurance creates difficulty for residents to schedule appointments at healthcare centers [8]. With the need for a comprehensive representation of Medicare-accepting rural health clinics in Minnesota came the creation of Minnesota Rural Health Connect (MNRHC), a public-access webpage designed with this need in mind. MNRHC was designed as an easy-to-use, interactive map of all hospitals and Medicare-accepting rural health clinics in Minnesota.

Objectives

Benchmarks of website quality were necessary for the design of the website — creating an incomprehensive and ineffective webpage would only worsen the issue of scarce information on rural health centers. First, the webpage

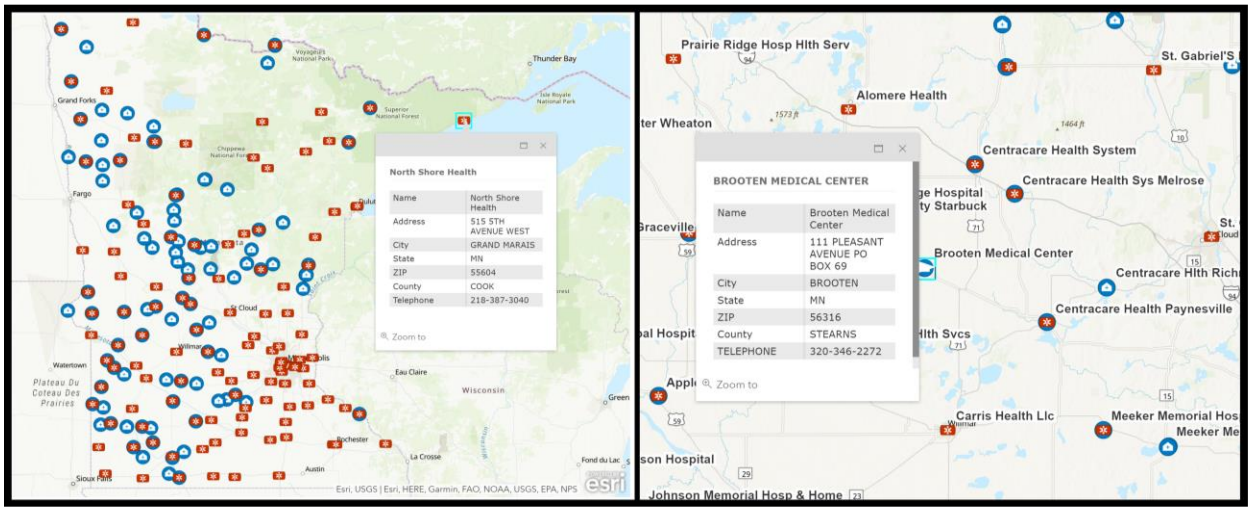
needed to be regularly updated with current information on Medicare-accepting rural health clinics and hospitals in the state. Second, the page needed to be easy to use while having expanded functions to improve effectiveness. Finally, the webpage would be most beneficial if it were to cater to its target demographic of rural Minnesotans.

METHODS

Primary Map

The primary page of the website contains an interactive map of all Medicare-accepting rural health clinics and general hospitals in the state. Viewers are able to zoom in and click on individual clinics and hospitals to view information such as the facility's address, county, ZIP code, and telephone number. These details are presented in a conveniently listed fashion that gives viewers the information they are seeking quickly and effectively.

Figure 1: *Basic Functions of MNRHC Primary Map* [Created by author using www.mnruralhealthconnect.com].



Secondary Map

The Minnesota Rural Health Connect web page also contains a second function, where users can input their ZIP code as well as the distance they would be willing to travel to a clinic. Without storing any data, MNRHC outputs a list of all clinics and hospitals within that distance threshold.

Design

The construction of MNRHC was done with the use of Esri's ArcGIS software and is hosted under the address 'www.mnruralhealthconnect.com.' This software was in combination with the open-access database of state-registered rural health clinics and hospitals [9]. The website updates regularly, along with the changes that are made to the database. These updates occur automatically with an implemented 'web scraper' that retrieves current information daily from the Minnesota Department of Health.

Feedback was requested through a questionnaire located on the front page of MNRHC, which prompted multiple-choice responses. The response distributions were converted to percentages and additionally investigated through averaging and chi-squared analysis when appropriate.

RESULTS

A questionnaire was accessible on MNRHC for five months, during which there were 209 total respondents. This questionnaire was on the front page and was completely voluntary, acting to collect feedback from website users on their experience with the webpage. The questionnaire was designed with basic topics such as the user's general region of residence, reliance on public health insurance, and satisfaction with the page. The prompts were designed solely as multiple-choice responses, allowing for data analysis by response distributions. Most importantly, it was possible to analyze the site's overall effectiveness, with the questionnaire including prompts for the user's overall experience ratings.

The information volunteered through the questionnaire is as follow

Table 1: *Questionnaire Sample Characteristics* [Created by author using respondent feedback (n = 209)].

Characteristic	Percent of Respondents
Region of Minnesota Seeking Care	
Northwest	9.1%
Northeast	2.9%
Central	31.6%
Metro	22.0%
Southwest	13.9%
South Central	12.9%
Southeast	7.7%
Age Group Identified As	
0-18	1.9%
19-34	16.7%
35-64	44.5%
65+	36.8%
Reliance on Medicare	
Not a Factor	51.7%
Considered, but not a large factor	15.3%
Large Factor	33.0%
Overall Satisfaction with MNRHC (1-5 scale)	
1	0.0%
2	1.9%
3	11.0%
4	53.1%
5	33.0%

Classification	Region Living In	Region Seeking Medical Care
Rural/Remote	36.4%	23.0%
Semi-Rural	29.7%	38.3%
Suburban	21.1%	26.8%
Urban	12.9%	12.0%

DISCUSSION

Analysis of the data volunteered by users show clear trends that demonstrate the need for an interactive map representing Medicare-accepting rural health clinics and hospitals. As for the regional data, the website maintained a diverse breadth of users from regions all around the state. Although users from the "Metro" region were quite prevalent, this is to be expected, given the high population in the Metro area [10]. The elevated representation from "Central" Minnesota is similarly expected, as the region

encompasses areas with a relatively high population density, but are still considered rural [11].

The age prompt was intentionally designed to have broad age ranges to preserve privacy among respondents. Of the respondents, 36.8% identified as over the age of 65, while Minnesota's age distribution suggests only 15.8% of the state's residents are in this age category [12]. Similarly, 44.5% of the respondents identified as being between 35 and 65, with only 38.5% of the state's residents identifying as this age [12]. This trend is expected due to the fact that the number of individuals identifying in the age groups of under 18 and 18 to 35 is vastly underrepresented [12].

While the distribution of responses that showed reliance on Medicare was in the minority compared to those who did not rely on it, it, nevertheless, represented the respondents that identified as over the age of 65. Medicare is available primarily for citizens over the age of 65 and people with disabilities, so the age distribution identified in the responses (see Table 1) is consistent with the number of respondents that rely on Medicare [13]. Perhaps the most telling indicator of the website's effectiveness was the user's overall satisfaction score. Respondents were given a scale from one to five, with one being the lowest and five the highest. This was included to rate the functionality of the MNRHC and users' experience with the website. The average score reported by the respondents was $\mu = 4.18$ ($\sigma^2 = .70$, $n = 209$). These ratings confirm MNRHC's effectiveness and suggest that, on average, users are very satisfied with their experience on the page.

Among the clear trends is the observation that MNRHC did, in fact, reach its target demographic of residents in rural areas. The majority of the respondents belonged to rural and remote communities, with a high number of residents representing semi-rural areas. This observation is consistent with MNRHC's goal of reaching residents of low-populated areas of Minnesota. Finally, the data suggest that rural and remote residents are likely to seek care in semi-rural, suburban, or urban areas, as 36.4% of the survey participants identified as living in a rural and remote region, but only 23% reported seeking care in these areas. A chi-square test of independence showed that this difference was significant, X^2 $(3, n = 209) = 18.96$, $p < .05$. This is consistent with the expectations, as rural Minnesotans often travel to more densely-populated regions for care [14–17].

CONCLUSIONS

Addressing the Benchmarks

The results of the study suggest that an interactive map representing Medicare-accepting rural health clinics and hospitals in Minnesota was well-received among users. The results show that MNRHC was successful in meeting its established benchmarks and is a valid proof of concept for its design.

The first benchmark of the MNRHC was that it had to be regularly updated with current information provided by reputable sources. Using the publicly accessible, regularly updated directory provided by the Minnesota Department of Health, the webpage is kept current with the correct names, addresses, and telephone numbers of the various clinics and hospitals [9].

Public Health Significance

MNRHC represents the potential for a web-based interactive map. The webpage represents the joining of reliable, accurate information and an intuitive design with advanced features. While webpages representing clinics and hospitals certainly exist already, such as Google Maps, there is a clear need for platforms that pull together information from reputable, accurate sources [6]. While sites hosted on Medicare's official website and those on private insurance companies look similar, they often fail to retrieve up-to-date information from state-level provider registries [7]. At the same time, sites that do host reliable, current information, such as the Minnesota Department of Health, do not always represent it in an easily-accessible manner [6,9,18]. MNRHC combines the strengths of the two existing approaches and creates a site with accurate information and convenient, easy-to-use features.

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