Modelling effects of hospital services changes on catchment populations in rural and remote areas using GIS

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Abstract

Hospital services are allocated by administrative fiat. GIS is seldom used to provide evidence for optimal location of services. This paper demonstrates an on-line application to enable policy makers to view the geographic areas and populations affected by hospital service closures and relocation using GIS. The graphical user interface (GUI) allows decision makers to select an area of British Columbia, choose a hospital service – or all services - and then model the population served within one, two and four hour travel time catchments around the service. The user can eliminate services to model effects of service closure on population served within a given travel time. This GUI is the first mapping application designed to enable policy makers and hospital administrators allocate services in a rational manner – based on physical accessibility to services.

Background and Relevance

Cost containment involves rationalizing healthcare service delivery through centralization of services to achieve economies of scale. Hospitals are frequently the site of cost containment and rationalization especially in rural areas. Socio-demographic and geographic characteristics make hospital service allocation more difficult in rural and remote regions. This paper presents a methodology to model rational catchments and percentage of the population served around rural hospitals – based on patient travel time – and displayed in real time on-line.

Data and Methods

A road travel time database was used to assign travel times to all road segments in the province of British Columbia. A vector-based algorithm was developed to determine catchments around 70+ rural and remote hospitals. The catchments were then linked with postal code population counts from the 2001 census to determine percentage of population served within one and two hours travel times for specific hospital services. A Java-based GUI was developed to display results in simple maps and tables on-line.

Results

This application provides a means to visualize effects of service closures and provides accurate counts for affected populations of the new catchments – based on travel time. Moreover, it allows modeling of variations in service allocation so that impact can be minimized.

Conclusions

Reduction of rural health services in the form of hospital downsizing or closure has consequently occurred in many Canadian jurisdictions. Smaller rural hospitals, in particular, have been targeted for closure as they are the least efficient to operate. This application provides hospital administrators and policy makers policy makers with precise information about the socio-demographic impact —and geographic distribution— of the effects of service relocation. Demonstration of the GUI indicates the profound effect of service closures on rural and remote populations.