HISTORY OF MEDICINE

Bridging the distance

The evolution of transportation and communication technologies for medicine in rural Canada

Hao Li (Meds 2016), Wendy Cui (Meds 2016)

Faculty Reviewer: Dr Shelley McKellar, PhD (Department of History, Department of Surgery)

OVERVIEW

Amongst the many challenges to the implementation of medicine in rural and remote communities, those pertaining to transportation and communication have persisted throughout the history of Canada, a country with a vast geographical land area dotted with small and remote communities. This article explores the history of medical transportation and communication technologies in rural and remote Canada from the pre-Confederation years, where health care professionals depended largely on primitive means such as sleighs, boats, and foot power, through the early 20th century, which saw an expansion of roads and railways, and to the present day, which features a wide variety of motor transportation and electronic information systems. We examine the benefits and challenges that all of these systems posed, the health care profession's adaptation to them, as well as how the world of medical transportation and communication may further develop.

PRE-CONFEDERATION PERIOD

In the beginning of the 1800s, the main constraining factor for transportation methods was geographical. The earliest settlers ventured into areas accessible by water—canals were constructed and canoes or boats used primarily for movement of bulk commodities of relatively low value. Early, primitive roads made long-distance travel by land difficult and often hazardous, with horseback or walking being the primary means of transportation.¹ Due to these limitations, few centralized clinical institutions, such as hospitals as we now know them, existed. Hospitals were seen as places of last resort for the homeless and the poor. Often run by religious orders, and later municipalities, they represented insalubrious and potentially fatal places. Home visits were preferable until after 1890 to 1914, when public perception of hospitals, transformed by technological and diagnostic innovation, improved, and hospitals became the preferred home of medical treatment.² For those who received their health care at home, it was common for physicians to go to the sick patient's home, often by horse, by buggy, or on foot. These physicians carried their instruments and medicines with them.³

Obstacles to communication largely mirrored those to transportation. Prior to the widespread employment of the telegraph in 1844, communication was served mostly by time-consuming means such as foot power, dog- and horse-drawn sleighs, or ships.⁴ As a result, a rural physician's network of practice would be largely confined to his or her home town. Those who covered more than one area, especially in regions of rural isolation, experienced considerably more stressful schedules. As well, clinics that did exist were largely walk-in as it was nearly impossible to establish an appointment system.⁵ Inefficiency of communication between physicians, combined with a less expansive system of specialized knowledge,

also meant minimal specialization in medicine. Most physicians possessed a broad skillset ranging from diagnosing ailments, to surgery, to setting bones.⁵ One example of this was an early Canadian physician named John Hutchison (1823-1898), who made house calls while maintaining his own office. He was known for his skill in operating on cataracts, and as one of the first practitioners in Ontario to use obstetrical forceps.⁶ Another case of the overwhelmingly prevalent 'wearer of many hats' type of rural general practitioner was Dr. Noel Murphy (1915-2005) of Newfoundland, who acted as physician, surgeon, anaesthetist, radiologist, and laboratory technician in his hospital.⁵

LATE 19TH/EARLY 20TH CENTURY

The first railways allowed for easier access to previously unsettled areas, but it was not until the early 1880s that the road system in the North-West Territories, which included present day Saskatchewan and Alberta, was developed. The development of roads and highways allowed for access to regions of Canada not served by railways. The Alaska Highway, built during World War II, linked British Columbia to Alaska and increased the volume of traffic to the north.⁷ Improvements in access to remote and rural areas also allowed easier and faster transportation by rural physicians. Still, relatively few physicians were settling in rural provinces: in 1914, only 6 out of 7472 practitioners in Canada were located in the territories.⁸ Larger cities like Montreal and Toronto had modern hospitals linked to university medical schools, but the continuing shortage of physicians in rural communities led to many rural physicians remaining general practitioners who continued to make house calls by car, horse and buggy, or sleigh.

Communication methods also advanced steadily during this time. Unfortunately, they would also bring about the initial manifestations of the "rural disadvantage", since urban areas were always the first to see and enjoy these developments. By 1876, thirty years after its invention by Samuel Morse, the electric telegraph linked all major cities in Eastern Canada. However, telegraphs were operated mainly in urban telegraph offices, post offices, schools, and railway stations. The message would arrive in one of those locations and be posted on a bulletin board outside. Rural areas could only receive a message through a messenger delivering it from an urban center.⁹ This implementation likely expedited the practice of public health; however, its impact in the clinical setting is questionable.

Effective communication in rural medicine would not be truly facilitated until the widespread use of telephones. Invented by Alexander Graham Bell in 1874, the telephone in most rural areas remained of a primitive design, called the Magneto Phone, until the 1960s. This early phone required an operator and was not ideal

HISTORY OF MEDICINE

for long-distance communication.¹⁰ This limited a physician's network of practice to a relatively small area. Other "side effects" of telephone use included information insecurity and inequity—most likely not everyone owned a telephone, and only areas that were connected by wiring could communicate by phone. However, the Magneto Phone definitely allowed for faster and more efficient transmission of information from person to person, and contributed to a culture of collaboration amongst rural physicians and between rural and urban physicians, as well as the establishment of an appointment system.

20TH CENTURY TO MODERN DAY

Continuing the evolution of transportation, modern, paved roads began to increase in number by the 1950s, altering the Canadian landscape. Cars became cheaper and more common.⁷ The use of trucks established true physical access to many remote areas and the successful delivery of necessities and previously unattainable food. Sadly, the concurrent development of increasingly sophisticated medical equipment requiring specialized expertise necessitated in many areas the need for centralization of services and a disappearance of these services from rural care centres.¹² This factor, along with the increasing ease of transportation, may have led to the development of a more sophisticated referral system and the continued perpetuation of the traditionally central role of the general practitioner in a rural area as the main provider of care and referral access point.

Meanwhile, communication methods significantly improved in ease and speed, eventually bringing medicine to the modern age. In 1948, Claude Shannon published 2 benchmark papers on information theory discussing the basis for data compression (source encoding) and error detection and correction (channel encoding), ushering in the rise of wireless communications in urban centers by the 1960s and the continuing development and prevalent use of the Internet in communications by the 1990s.¹³ While these technologies have facilitated medical communication greatly, the issue of inequity is similar in all cases of technology, and rural areas have lagged behind their urban counterparts. Some remote regions of Canada still have no access to high-speed or broadband internet.^{13,14,15} Other current issues include suboptimal cell service and a shortage of digital skills and resources, partly due to a lack of technological education opportunities and rural-to-urban migration. Another issue with electronic communication lies in the lack of universality of Canada's electronic medical record (EMR). Only some types of information can be electronically transmitted, and the information that cannot be transmitted electronically must still be sent physically, putting rural and remote regions at a considerable disadvantage.

With regards to modern-day transportation, physical access remains a significant barrier to achieving equity of health care in rural areas; intrinsically inferior physical care services can stem from settlement conditions where transportation of resources is less efficient and more expensive. Strategies have been implemented to ameliorate this obstacle. For example, transport to rural regions inaccessible by land and water can be accomplished by air transport. As a result, emergency care is made faster and more available

to those who do not own a private motor vehicle.¹⁶ Improvements can also be found in other initiatives such as the Easy Ride program, a transportation system for seniors and those with disabilities in Ontario's Huron and Perth counties, aiding some of the most vulnerable rural populations. Mobile units with a traveling nurse practitioner have been piloted, serving very small communities such as those populations numbering less than one hundred.¹⁷

FUTURE DEVELOPMENTS

In conclusion, to sustain the medical health of the rural population, Canada has embraced a rapid evolution in transportation and communication technology over the last 2 centuries. This evolution was stimulated not only by the necessity of efficiently carrying people and equipment from one location to another, but also by the increasing demand for rapid transmission of sizeable amounts of information with minimal loss. The evolution in transportation and communication technology in medicine has allowed rural and remote health care to progress in terms of the efficiency of health care delivery, increased specialization, and improved collaboration between different health care professionals. Improvements in transportation technology within the same periods have also allowed more patient empowerment to remain in rural and remote communities.

Future developments in transportation and communication technology can be used as tools for the provision of better medical care. We hope to see further developments in collaboration between health care professionals as well as improvements in patient access to information (eg utilization of mobile technology to directly provide information to patients). Research in telehealth is currently engaging in the development of a universal EMR system allowing any medical information to be transmitted electronically so that any health care professional can access all relevant information on a patient upon presentation, thus resulting in optimal efficiency, specialization, and collaboration. However, in order to truly take advantage of these wonderful opportunities, it is imperative that rural areas enjoy equal access to them on par with their urban counterpart.

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HISTORY OF MEDICINE

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