

A B S T R A C T

Advocates of telehealth argue that the delivery of health services by means of communications technologies is both feasible and desirable. Nevertheless, the benefits of telehealth, due to the variety of its applications and their uneven development, are not self-evident. The goal of this paper is to reflect on the processes by which telehealth applications do or do not contribute to the delivery of health services. We propose a framework structuring a preliminary analysis of the match between needs and the possibilities offered by telehealth. Four mechanisms of expected benefits are discussed: 1) decreasing patient transfers; 2) decreasing trips by providers and patients; 3) meeting the needs of underserved populations; and 4) building providers' and patients' knowledge and reducing rural isolation. We conclude by stressing that the participation of providers is crucial, both in the research on telehealth and in the steering of its evolution.

A B R É G É

Les promoteurs de la télésanté suggèrent que la prestation de services de santé à distance par le biais de technologies de communication est à la fois faisable et désirable. Toutefois, les avantages de la télésanté, à cause de la variété des applications et de leurs stades de développement inégaux, ne sont pas évidents. Cet article a donc pour objectif de réfléchir sur les processus par lesquels la télésanté contribue ou non à la prestation des services de santé. Nous proposons un cadre qui structure une analyse préliminaire de la concordance entre les besoins et les possibilités offertes par la télésanté. Quatre mécanismes de gains potentiels sont discutés : 1) réduction des transferts de patients; 2) réduction des déplacements des professionnels et des patients; 3) réponse aux besoins des populations sous-desservies; et 4) renforcement des connaissances des professionnels et des patients et réduction de l'isolement en région rurale. Notre conclusion souligne que la participation des professionnels est cruciale à la fois dans la recherche sur la télésanté et dans le façonnement de son évolution.

Telehealth: Passing Fad or Lasting Benefits?

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Telehealth, or the use of information and electronic technologies to provide and support health care when distance separates the participants,^{1,2} is not new. More recent – and yet widespread – is the idea that a system-wide implementation of telehealth should enhance all types of health service, in all regions.³ Nevertheless, detailed analyses identifying the most needed telehealth applications, as well as the clinical and geographical circumstances in which they are likely to prove useful remain uncommon. The goal of this paper is to reflect on the processes by which telehealth applications do or do not contribute to the delivery of health services and indicate aspects that require further investigation. Based on a report⁴ prepared for the *Conseil d'évaluation des technologies de la santé du Québec* (CETS, now AETMIS), we propose a framework structuring a preliminary analysis of the match between needs and the possibilities offered by telehealth.

The rapid development of telehealth applications

According to the US Institute of Medicine, telehealth “has the potential to radically reshape health care in both positive and negative ways and to fundamentally alter the personal, face-to-face rela-

tionship that has been the model for medical care for generations.”¹ Given the many possibilities offered by information technology (video-conference, e-mail, CD-ROM, etc.) and the diversity of health services, telehealth encompasses a wide variety of applications (see Tables I and II). Even though throughout the 1980s, the levels of utilization remained low for most applications,^{1,5,6} several projects were launched with a renewed impetus in Europe, North America, Australia and Asia in the 1990s.

There are two factors that are particularly salient to this burgeoning of telehealth applications. First, the efforts of R&D in telecommunications have resulted in numerous technological improvements and more competitive prices.³ Second, in the context of health care reforms initiated by industrialized countries, telehealth applications have a high “face validity”: logically they should improve clinical communications and access to expertise. For instance, anticipating on research evidence, an Australian policy report² maintained that telehealth would improve health care delivery. In fact, telehealth is generally seen as a way of achieving cost-containment goals, while enhancing access to health services.⁶

Could the expectations regarding telehealth be too great? Should we let a thousand applications of telehealth bloom? There are three arguments to approaching telehealth with a cautious attitude. First, the concrete contribution of telehealth to the population health remains unclear. Wootton⁷ reported a small number of studies (6) showing that there were, in specific instances, advantages to telehealth, such as improved access to health care, faster referral process, reduced unnecessary referrals, improved contact between providers, and improved care because of timely advice. Nonetheless, the

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abovementioned effects are highly sensitive to the geographical location of hospitals, the willingness of providers to use telehealth,⁸ and the extent of its “usability” in diverse clinical services.⁹ Second, as the development of several telehealth applications is still in the early stage, potential users (providers and patients) could play a pivotal role in steering the evolution of telehealth. Indeed, Wyatt underscored that recent “studies seem to have been driven by technology push rather than clinical pull.”¹⁰ To avoid the precipitated diffusion of telehealth by “unbridled curiosity and commercial pressure,” Wootton suggested that its introduction be guided by five principles: “evidence based practice, appropriate risk management, proved cost effectiveness, maintenance of equity in provision of health care and partnership between patients and professionals in future development.”⁷ Third, as discussed in the body of this paper, we suggest adding a sixth principle to the above list: needs assessment. This area of study remains underdeveloped in the field of telehealth.¹¹⁻¹⁴

Are the expected benefits of telehealth plausible?

Before focussing our attention on the plausibility of particular processes⁴ by which telehealth would generate positive impacts, we expose the claims most frequently made in the literature regarding its benefits.

Benefits at the clinical level

Through the transmission of images and numerical data, the implementation of a telehealth network would facilitate obtaining a 2nd opinion on complex and rare cases and securing diagnostic services in remote institutions.^{8,13} In addition, improved and expedited consultations between specialized care units in acute special cases, and promoting the proficiency of physicians and other providers by means of both teleconsultation and video conference-based training were mentioned.¹⁴

Benefits at the Level of the Health Care System

Health Care Districts in Finland listed benefits such as: enhancing citizens’ equality in the access to specialized medical services; improving cooperation between specialized care and primary health care centres; and

TABLE I
Defining Telehealth Applications According to Three Characteristics¹⁷

1. The **domain of application** specifies whether the communications technologies are used for clinical, administrative, research, or public health purposes. The discipline is usually made explicit by coining specific terms such as teleradiology, telepsychiatry, or telenursing.
2. Among the **types of use**, *telediagnostic* refers to electronic communications that contribute to the establishment of a diagnosis. *Teleintervention* (or telesurgery) – although still experimental – refers to surgical procedures that are mediated through electronic means.²² *Telementoring* designates the training of a resident surgeon by a senior (mentor). To clarify legal distinctions, *teleexpertise* (or teleconsultation) refers to one physician helping another from a distance, whereas *teleassistance* refers to the help given by a physician to a patient.²³ *Telemonitoring* involves the repeated or continuous follow-up of a patient’s health status. In certain applications the direct participation of the patient is required, i.e., in mental care²⁴ or in patient education.²⁵
 These types of use may involve two different **modes of information transmission**. First, a communication may be *interactive* and allow participants to discuss freely, share their views, validate what they learn, or reach a consensus. Second, in a store-and-forward communication, data are packaged and transmitted independently from a “spoke site” (a regional hospital or rural health centre), and interpreted by the consulting physician in a “hub site” (tertiary care centre) when convenient. The main advantages are logistical and economical, e.g., images may be sent at night when transmission costs are lower.²⁶
3. The **technological means** include the devices and systems chosen to link two or more sites together and to capture, transmit, display, and archive clinical data, images and verbal exchanges. Either static (i.e., photography of skin lesions) or dynamic images (i.e., fetal ultrasonography) can be transmitted. Those images can be captured directly using medical imaging devices or a digital video camera, or indirectly using a conventional video or photo camera and digitizing with a scanner.

TABLE II
Characteristics and Components of Telehealth Applications

Domains of application	Clinical, administrative, research or public health With static or dynamic image transfer: radiology, pathology, dermatology, cardiology (echocardiographic images), neurology, etc. With data and voice transfer: cardiology, psychiatry, family medicine, endocrinology, gerontology, speech therapy, social work, etc.
Participants	Physicians, patients, nurses, health care professionals, social workers, radiology and laboratory technicians, health administrators, and researchers
Settings	Primary health care centres, regional hospitals, tertiary care hospitals, long-term care centres, patients’ or physicians’ homes, ambulances, remote islands or regions, airplanes, boats, and prisons
Types of utilization	Teleeducation, teleconsultation, teleassistance, telediagnosis, telementoring, telesurgery (experimental), and telemonitoring
Technological means	Standard phone lines, Intranet, Internet, WWW, integrated services digital network (ISDN), T1, Ethernet, local area network (LAN), wide area network (WAN), coaxial cable, cable TV, satellite and microwave
Information technologies	Fax, phone, voice message system, computer, computerized patient record, video, CD-ROM, e-mail, etc.
Connecting medical devices	Electronic stethoscope, electronic microscope, CT scan, ultrasonography, echocardiogram (EKG), blood pressure and glucose monitor, infusion pumps, etc.

reducing the waiting lists in specialized health care.¹⁴ For large countries with scattered rural and urban communities like the USA and Canada, telehealth carries important promises especially with regard to the geographical distribution of physicians and health care providers. For McCarthy, if telehealth cannot replace the local need for providers, it could still be part of a better program aimed at correcting the shortage of providers in remote areas.¹⁵ His argument is based on three assumptions: 1) after a first

face-to-face encounter, providers can follow patients over an electronic contact; 2) a larger reservoir of physicians and primary care providers becomes available; and 3) assisted by physicians, mid-level practitioners may intervene more, and on more complex cases.

Indirect benefits

As hospitals are major employers in rural communities, by “keeping the source of medical care in a rural community, rather than at a distant urban medical centre,

TABLE III
Four Mechanisms of Expected Benefit

Mechanism	Aspects to Investigate	Corresponding Research Activities in TAIL
1. Decreasing patient transfers	What are the transfer patterns across regions? What categories of transfer require admission to a tertiary care centre? Are transfers avoidable due to telehealth?	Burden of illness Community effectiveness Synthesis & implementation
2. Decreasing trips by providers and patients	Why and how far do providers/patients travel? From the patients' point of view, are remote consultations preferable? At what cost?	Burden of illness Community effectiveness
3. Meeting the needs of under-served populations	What are those needs? Could those needs be satisfied by telehealth? Through what applications?	Burden of illness Community effectiveness
4. Building providers' and patients' knowledge & reducing rural isolation	Providing timely support vs. the learning curve? Do the content and logistics correspond to providers'/patients' educational needs? To what extent are the providers from tertiary care centres available?	Community effectiveness Synthesis & implementation

telehealth has the potential to keep jobs in rural areas and contribute to the vitality of communities.¹⁵ Viewed from the other angle, it is also possible to export services and expertise through telehealth. The Australian Committee referred to such uses (export of health education, humanitarian aid) more explicitly than others.²

The abovementioned benefits are appealing, but how can we ascertain whether they correspond to the needs of our health system? The Technology Assessment Iterative Loop (TAIL)¹⁶ can support a preliminary analysis of the match between needs and the possibilities offered by telehealth. TAIL consists of seven research activities:

- 1) identifying the burden of illness;
- 2) assessing the efficacy of interventions in ideal circumstances;
- 3) defining screening and diagnosis strategies;
- 4) assessing the community effectiveness of interventions;
- 5) measuring their efficiency;
- 6) synthesizing research that clarifies the optimal implementation of technology; and
- 7) defining monitoring criteria and reassessing the burden of illness.

In the case of telehealth, research activities of type 1, 4 and 6 are required and should be integrated within a unified framework. More precisely, there are four mechanisms on which further investigation could

focus to help identify in which clinical and geographical circumstances a given telehealth application is valuable (see Table III).

1. Decreasing the Number of Patient Transfers

This would result from remote consultations from providers based in regional institutions with specialists and experts based in tertiary care centres. Indeed, a substantial percentage of transfers are preventable through patients being treated with the local technologies and personnel. The precise number and nature of actual transfers, and the cases in which a given telehealth application would allow the local management of patients should be appraised.

Assessing the extent of such a contribution poses an analytical challenge. Is a teleconsultation more likely to have positive effects over patient transfers if the main treatment option is no treatment accompanied by regular follow-ups? What is the actual proportion of cases that require admission to a tertiary care centre? The effects of telehealth appear to be a function of the domain of application (radiology, psychiatry, speech therapy), and of the types of services that are supported (diagnostic, treatment, education, monitoring).^{8,13} For instance, in Eastern Quebec, an important reduction in patient transfers was observed (82.2% of 45 cases between August 1996 and July 1997) with the use of telediagnostic for pediatric cardiology services in a network of 13 health cen-

tres.¹⁷ As general practitioners avoided taking risks with infants, the impact of telehealth was increasingly important.

2. Decreasing the Number of Trips by Providers and Patients

Specialists and other health professionals travel regularly to rural communities and remote regions and, conversely, patients travel to urban medical centres to see experts. As a consequence, direct and indirect costs could be reduced with the use of telehealth. Therefore, the number and nature of trips, and the cases in which a telehealth encounter would be sufficient for the local management of the patient's clinical condition, should be determined.

This potential contribution is linked to the availability of technology and providers across regions. For which regions is the number of trips high? Which regions struggle in recruiting providers? Would patients prefer travelling to see them face-to-face? Since the use of telehealth also requires time (especially interactive communications), fewer trips might equate with more time spent coordinating its use.

3. Meeting the Needs of Underserved Populations

Remote consultations may provide remote communities with services that are typically available in tertiary care centres. Here, the premise is that electronic access to services is better than no services at all, better than travelling to the closest urban centre or waiting for the specialist to visit. One should examine the needs of the different communities^{18,19} and the telehealth applications that would meet these needs.

This contribution depends on the planning and prioritizing of health care resources. Before raising expectations, one should know the types of resources available in tertiary care centres.²⁰ Otherwise, access to services might not be increased. In addition, the preferences of communities will determine the overall level of utilization and the cost-effectiveness of telehealth.¹³

4. Building Providers' and Patients' Knowledge, and Reducing Rural Isolation

Telehealth could give providers timely access to expertise, offer patients adequately packaged educational material, and

attract physicians and other health professionals to rural communities.^{15,18} However, we must first demonstrate the quality and competitiveness of teleeducation compared to conventional programs, and document how a telehealth system would encourage health providers to establish and maintain their practices in rural institutions.

As telehealth in itself is not a sufficient reason for a provider to practice in a rural community, this final contribution is dependent on processes of knowledge acquisition (for both providers and patients), and on providers' preferences in terms of lifestyle. This contribution also depends on the availability of specialists and experts in tertiary care centres and the establishment of a good professional climate among collaborators. Furthermore, a learning curve seems to characterize the use of telehealth: over time, after detailed discussions, providers gain confidence and learn enough that they stop asking for consultations over certain cases.⁶

Policy issues and the future of telehealth

Bashshur⁶ considers that telehealth has reached "a point of no return" and, alongside other observers,^{3,10,18} predicts that it should play an important role in modern clinical work environments. Others, however, stress that few pilot projects, drawn up to test whether the use of telehealth resulted in better access to health care and increased quality of services, survived beyond the funding period.^{1,5,11} Oscillating between these two extremes, the policymaking process for telehealth could remain at a standstill until a clearer understanding emerges of the clinical and geographical circumstances in which its use proves beneficial.

Integrated research on the four mechanisms identified would help: 1) situate the value of telehealth applications within the broader perspective of the health system; and 2) prioritize the dissemination of the most needed applications. More research will also have to be undertaken on other aspects of telehealth, among which legal issues,⁶⁻²¹ reimbursement, funding and dissemination.

As emphasized earlier,¹⁰ to insure that the results of further research effectively translate into improvements for health services delivery, the participation of providers is important, both in the research on telehealth and

in the steering of its evolution. Providers working in remote areas are in a good position to identify and critically comment on the types of applications that would support their work and respond to their community health needs. The four mechanisms discussed represent a starting point to define the most tangible organizational and health benefits of telehealth and, thereby, shape its future in the Canadian health system.

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