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INTEGRATING TECHNOLOGY AND INFORMATION
FOR BETTER HEALTHCARE
Studies in Health Technology and Informatics

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Global Telehealth 2015: Integrating Technology and Information for Better Healthcare

Edited by
Grant Gillis
COACH: Canada’s Health Informatics Association, Ontario, Canada

Don Newsham
COACH: Canada’s Health Informatics Association, Ontario, Canada

and

Anthony J. Maeder
University of Western Sydney, School of Computing and Mathematics, Sydney, Australia

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Preface

Global Telehealth 2015 (GT2015) was hosted by COACH: Canada’s Health Informatics Association, taking place in Toronto, Canada during May 29–30, 2015. This was the 4th International Conference in the series, which was initiated in 2010 by the Australasian Telehealth Society. The conference series has now matured to the point where it has become an annual event from this year, and a precedent has been set of locating the conference in alternate hemispheres. A total of 25 full length technical papers were accepted for publication in this volume from those originally submitted, as the highest ranked by an international expert reviewer panel of 21 Health Informatics academics and practitioners from 7 countries. We trust this compilation will prove informative and useful in both the Telehealth and wider eHealth domains.

Developments in Telehealth in the recent months and years have demonstrated a growth in adoption, a diversification in service delivery and a broadening of access, all pushing the boundaries of traditional healthcare. The cultural and socio-economic factors are progressively aligning to support successful clinical adoption. Technologies for delivery of Telehealth are increasingly well established and diverse, whether in the form of instantaneous interpersonal communications, or as captured information transmitted for later attention. Workflows and models of care incorporating Telehealth are widely developed and successfully demonstrated in numerous rural, remote and urban healthcare settings around the world.

Additionally, we see some prominent new elements arising in Telehealth today, which offer the potential to further the broadening and integrating of the application of Telehealth. The strongest related trend is the growth of Mobile Health (mHealth), with pervasive access to information and communication services now achievable through personal devices such as tablet computers and smartphones. Closely related is the explosion in the personal and home health monitoring market, enabling the monitoring and tracking of individuals to achieve a “quantified self”, providing value added and enriched datastreams for preventive health and chronic disease management.

Another interesting trend impacting on the future of Telehealth is the emergence of “virtual healthcare” services, using online interactive environments to engage with the subject of care which remotely enable or mimic the desired patient-clinician direct relationship. These can be variously provided by virtual clinics, by anonymous interactions or by agents such as dialogue engines or avatars. In areas where patient personal sensitivity may compromise access to conventional care, such as mental health or youth social issues, provision of these types of services via health portals is increasingly gaining traction.

These new and integrated realms of mobile, personal and virtual are opening up the Telehealth worlds, to serve the patient’s health and care while ensuring the evidence of clinical benefits and business efficiencies are well established. The factors that support such adoption in our countries, the technologies that are at the cutting edge and the use of Telehealth to extend the reach of health care, collectively reinforce the Global Telehealth 2015 theme of “Serving the Underserved: Integrating Technology & Information for Better Healthcare.” Our global healthcare community, through the leadership and knowledge reflected in these papers, will benefit in the equity of access and
uniform provision of healthcare services and influence health policy and strategy decisions worldwide.

Telehealth, in the integrated and broad sense identified above, will continue to contribute directly and comprehensively towards achieving these ideals. In settings where very diverse demographics and population distribution occur, Telehealth has played a leading role in addressing such needs, and the GT2015 host country Canada provides numerous benchmark examples of how such goals can be attained. On behalf of COACH and our Canadian Telehealth Forum we hope that the knowledge shared at GT2015 and this Canadian and international leading thinking will further the discussions and collaboration and lead to breakthroughs in serving the underserved and integrating technology and information for better healthcare.

Don Newsham and Grant Gillis
COACH: Canada’s Health Informatics Association, Canada

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University of Western Sydney, Australia
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Bridging the Distance in the Caribbean: Telemedicine as a means to build capacity for care in paediatric cancer and blood disorders

Ellie ADLER\textsuperscript{a}, Dr. Cheryl ALEXIS\textsuperscript{b}, Prof. Zulaika ALI\textsuperscript{c}, Dr. Upton Allen\textsuperscript{d}, Dr. Ute BARTELS\textsuperscript{e}, Cassandra BICK\textsuperscript{c}, Dr. Jacqueline BIRD-COMPTON\textsuperscript{f}, Dr. Curt BODKYN\textsuperscript{g}, Dr. Rosemary BOYLE\textsuperscript{g}, Stephanie DE YOUNG\textsuperscript{a}, Bonnie FLEMING-CARROLL\textsuperscript{g}, Dr. Sumit GUPTA\textsuperscript{a}, Patricia INGRAM-MARTIN\textsuperscript{h}, Dr. Meredith IRWIN\textsuperscript{e}, Dr. Melanie KIRBY-ALLEN\textsuperscript{e}, Dr. Sharon MCLEAN-SALMON\textsuperscript{h}, Paul MIHELCIC\textsuperscript{e}, Dr. Michelle Ann RICHARDS-DAWSON\textsuperscript{i}, Dr. Michelle REECE-MILLS\textsuperscript{j,k}, Dr. Furqan SHAIKH\textsuperscript{e}, Dr. Corrine SINQUEE-BROWN\textsuperscript{k}, Dr. Minerva Thame\textsuperscript{k}, Dr. Sheila WEITZMAN\textsuperscript{a,e}, Dr. Gilian WHARFE\textsuperscript{j} and Dr. Victor BLANCHETTE\textsuperscript{a,e}

\textsuperscript{a} Centre for Global Child Health, The Hospital for Sick Children, Toronto, Canada
\textsuperscript{b} University of the West Indies, Cavehill, Barbados
\textsuperscript{c} Department of Clinical Medical Sciences, Faculty of Medical Sciences, UWI, St Augustine Campus, Trinidad and Tobago
\textsuperscript{d} Department of Paediatrics, University of Toronto and Division of Infectious Diseases, The Hospital for Sick Children, Toronto, Canada
\textsuperscript{e} Department of Paediatrics, University of Toronto and Division of Haematology/Oncology, The Hospital for Sick Children, Toronto, Canada
\textsuperscript{f} Community Child Health Service, Ministry of Health, St. Lucia
\textsuperscript{g} Milton Cato Memorial Hospital, Kingstown, St. Vincent and the Grenadines
\textsuperscript{h} Collaborative for Professional Practice, The Hospital for Sick Children, and the Lawrence S. Bloomberg Faculty of Nursing, University of Toronto, Toronto, Canada
\textsuperscript{i} Bustamante Hospital for Children, Kingston, Jamaica
\textsuperscript{j} University Hospital of the West Indies, Kingston, Jamaica
\textsuperscript{k} Faculty of Medical Sciences, University of the West Indies, Mona Campus, Jamaica
\textsuperscript{l} University of the West Indies, School of Clinical Medicine & Research, Nassau, The Bahamas and Princess Margaret Hospital, The Bahamas

Abstract. Over the past 50 years, survival for children in high-income countries has increased from 30% to over 80%, compared to 10-30% in low and middle income countries (LMIC). Given this gap in survival, established paediatric cancer treatment centres, such as The Hospital for Sick Children (SickKids) are well positioned to share clinical expertise. Through the SickKids Centre for Global Child Health, the SickKids-Caribbean Initiative (SCI) was launched in March 2013 to improve the outcomes and quality of life for children with cancer and blood disorders in the Caribbean. The six participating Caribbean countries are among those defined by the United Nations as Small Island Developing States, due to their small size, remote location and limited accessibility. Telemedicine presents an opportunity to increase their accessibility to health care services and has been used by SCI to facilitate two series of interprofessional rounds. Case Consultation
Review Rounds are a forum for learning about diagnostic work-up, management challenges and treatment recommendations for these diseases. To date, 54 cases have been reviewed by SickKids staff, of which 35 have been presented in monthly rounds. Patient Care Education Rounds provide nurses and other staff with the knowledge base needed to safely care for children and adolescents receiving treatment. Five of these rounds have taken place to date, with over 200 attendees. Utilized by SCI for both clinical and non-clinical meetings, telemedicine has enhanced opportunities for collaboration within the Caribbean region. By building capacity and nurturing expert knowledge through education, SCI hopes to contribute to closing the gap in childhood survival between high and low-resource settings.

Keywords. Paediatric oncology, Paediatric haematology, Small Island Developing States (SIDS), Telemedicine, Telehealth, twinning

Acknowledgements. Dr. Mohammad Abdelhaleem, Dr. Bharati Datta, Dr. Stephen King, Dr. Jennifer Knight-Madden, Dr. Normand Laperriere, Dr. Michele Lashley, Dr. Isaac Odame, Dr. Stanley Read, Tanya Reid, Dr. Michelle-Ann Richards-Dawson, Dr. Mary Shago, Dr. Manohar Shroff, Brian Smith, and Dr. Stanley Zlotkin for contributions of time and expertise in assisting this work. This work is funded by SickKids Foundation, and through their fundraising efforts, the donors who made the telemedicine network possible include: Scotiabank, David & Christine Anderson, The Bahamas Telecommunications Company Limited, Wayne & Nigela Purboo, Leslois Shaw Foundation, Sandals Foundation.

Introduction

With successful global efforts to reduce infectious causes of death in children, non-communicable diseases such as cancer, are now emerging as an increasingly significant proportion of global childhood mortality. Over the past 50 years, survival for children in high-income countries has increased from 30% to over 80%. In low and middle income countries (LMIC), survival is between 10 – 30%, accounting for over 90% of global paediatric cancer mortality. Unlike many adult cancers, most childhood cancers are not associated with modifiable risk factors, and therefore a focus on building capacity to enhance early detection, treatment and management of patients is appropriate.

Given this gap in survival, established paediatric cancer treatment centres, such as The Hospital for Sick Children (SickKids), in Toronto, Canada are well positioned to share clinical expertise with low-resource settings. Through the SickKids Centre for Global Child Health, the SickKids-Caribbean Initiative (SCI) was launched in March 2013. The goal of SCI is to improve the outcomes and quality of life for children with cancer and blood disorders in six English-speaking Caribbean countries. Defined by the United Nations (UN) as Small Island Developing States (SIDS), Caribbean countries face unique challenges including small population size and limited accessibility that accentuates other challenges faced by developing countries, and must be considered to build sustainable capacity for paediatric cancer care in the region. Telemedicine presents an opportunity to increase accessibility to health care services for SIDS and other underserved populations. Defined by the World Health Organization (WHO) as “the delivery of health care services, where distance is a critical factor, by all health care professionals … in the interest of advancing the health of individuals and their...
communities”, this technology allows SickKids specialists to connect directly and instantly with the participating Caribbean sites, without incurring the cost and time associated with travel.11

1. The SickKids-Caribbean Initiative: Building Capacity for Care in Children with Cancer and Blood Disorders

The SCI has established partnerships between health care specialists at SickKids and their counterparts in the Caribbean, working in partnership with the University of the West Indies (UWI), Ministries of Health and key hospitals and institutions. To reach the goal of improved child health, SCI has implemented a programmatic approach to the enhancement of infrastructure, training, strategies and advocacy. This approach focuses on six key thematic areas that have been operationalized through Working Groups: (1) Diagnostic Services; (2) Clinical Care; (3) Local Oncology Databases; (4) Specialized Nursing Education; (5) Sickle Cell Disease; and (6) Research & Evaluation. Each Working Group is championed by two Co-Leads, one from SickKids and one from one of the Caribbean.

2. Institutions Participating in the SickKids-Caribbean Initiative

2.1 The Hospital for Sick Children (SickKids), Toronto, Canada

SickKids, affiliated with the University of Toronto, is Canada's most research-intensive hospital and the largest centre dedicated to improving children’s health in the country.12 SickKids is a 300-bed paediatric (0-18 yrs) teaching hospital located in Toronto, Canada with a staff that includes professionals from all disciplines of health care and research. In 2012-2013, SickKids clinical activities included 102,037 patient days (average length of stay = 6.6 days), 281,583 clinic visits and 63,638 emergency visits.13 SickKids’ Division of Hematology/Oncology is the largest in Canada and among the largest worldwide. Divided into 5 sections (leukemia/lymphoma, solid tumour, neuro-oncology, non-malignant haematology and stem cell transplantation), in 2013-2014 the Division registered approximately 374 children with newly diagnosed cancer, of which 169 (45%) were lymphoma/leukemia, followed by 124 (33%) solid tumours and 81 central nervous system tumours (22%).14

2.2 Participating Caribbean Institutions

The six countries that are part of SCI include: The Bahamas (Population (POP) 377,374); Barbados (POP 284,644); Jamaica (POP 2.715 million); St. Lucia (POP 182,273); St. Vincent and the Grenadines (POP 109, 373); and Trinidad and Tobago (POP 1.341 million).15 To strengthen the partnership in the areas of research, education and training in the Caribbean, a Memorandum of Understanding was signed with UWI in July of 2012. UWI is a regional public university with main campuses in Jamaica, Trinidad and Tobago and Barbados and over 50 open campuses throughout the Caribbean (including The Bahamas, St. Lucia and St. Vincent and the Grenadines). Formal relationships have been established with individuals within seven hospitals,
focused on those which register the majority of paediatric oncology cases. The hospitals are: Bustamante Hospital for Children, Jamaica; Eric Williams Medical Sciences Complex, Trinidad and Tobago; Milton Cato Memorial Hospital, St. Vincent and the Grenadines; Princess Margaret Hospital, The Bahamas; Queen Elizabeth Hospital, Barbados; University Hospital of the West Indies, Jamaica; and Victoria Hospital, St. Lucia. These clinical institutions have identified “lead physicians” and “lead nurses” who shape and drive SCI activities in the 6 partner countries.

3. Building Telemedicine Facilities to Establish a Network for Consultations and Education

Through SCI, five telemedicine facilities have been opened and one upgraded, as outlined in Table 1. These new facilities are strategically located in, or very near to, the participating hospitals to facilitate engagement of Caribbean hospital staff. This is particularly significant in those countries where pre-existing telemedicine facilities were located far from the clinical sites, making it difficult for physicians, nurses and others working in these settings to travel to existing telemedicine locations during regular working hours. These facilities have allowed SCI to launch two distinct telemedicine-based series, bringing together interprofessional health care providers to engage in real-time discussions. Case Consultation Review Rounds focus on diagnostic management and treatment recommendations while Patient Care Education Rounds address various aspects of paediatric patient care. Leveraging a longstanding relationship with UWI Telehealth Programme in Trinidad and Tobago, SCI has established a standardized telemedicine network to connect participating partner sites in resource limited clinical settings.

3.1 Case Consultation Review Rounds

Case Consultation Review Rounds connect participating sites with SickKids specialists to provide management recommendations for complex cases through collaboratively developed presentations. Providing an educational opportunity for medical students, trainees and professionals, these sessions are a forum for learning about cancer and blood disorders in children including the diagnostic work-up, challenges in management and treatment recommendations. If required, direct pathologist to pathologist consultations provide a review of the histopathological diagnosis and/or provide additional diagnostic services that may not be locally available or accessible, which are then reviewed in the telemedicine rounds. To initiate this activity, a legally binding agreement was signed by a delegate for each participating Caribbean site to indemnify SickKids and contracted physicians for their participation. Select Division of Haematology/Oncology physicians representing key subspecialties were then formally contracted to participate in SCI consultations, thereby initiating a mechanism to backfill the Division for their time. A secure electronic file transfer system was established to send all case related summaries and reports to ensure adherence to ethical and legislative obligations required to protect personal health information.

Since launching the monthly rounds in September 2013, 54 cases have been submitted for consultation (Table 2). To connect all sites, a SickKids contracted bridge operator works with local IT staff. At these one-hour sessions, two cases are usually reviewed,
leaving time for facilitated discussion. This discussion follows the formal case presentation and focuses on the recent management of the specific disease, which provides a valuable teaching element. Additional rounds are scheduled ad hoc based on volume and availability. Of all cases submitted, 35 (65%) were presented at rounds, fifteen (28%) required diagnostic imaging studies and 16 (30%) required additional pathology testing. Figure 1 illustrates the distribution of cases submitted for consultation, indicating the types of diagnoses that referring physicians deem most challenging. Leukemia/lymphoma accounts for the majority of cases reviewed (31.5%), followed by solid tumours (25.9%) and neuro-oncology cases (20.4%). Non-malignant haematology cases accounted for 16.7% of the cases reviewed. The rounds are well attended and received, as indicated by formal evaluation of the rounds. Evaluation data has been collected since May 2014, and asks the attendees to rate the session (i.e. technology, relevance, etc.), the presenter (i.e. knowledgeable, engaging, etc.) and their overall satisfaction with the session (Table 3).

3.2 Patient Care Education Rounds

Another key activity utilizing the telemedicine network is Patient Care Education Rounds. The objective of these sessions is to provide nurses and other professional staff working in SCI participating institutions with the knowledge base needed to safely care for children and adolescents receiving treatment for cancer or blood disorders. The topics presented are chosen based on a needs assessment and in consultation with the Caribbean SCI leaders. Each session is 60 minutes in length, consisting of a 30-minute presentation followed by 20 minutes of questions and discussion. A 10-minute buffer is left for technical issues and extended discussions. Five sessions have taken place to date, and 5 more are scheduled for the remainder of 2015. In total, 204 individuals have attended rounds, with 146 (72%) returning evaluation forms. Similar to those used for the Case Consultation Review Rounds, these evaluation forms ask attendees to rate the session, the presenter and their overall satisfaction with the session. Responses are summarized in Table 4.

4. Sustainable Impact of Telemedicine Activities

Utilizing telemedicine technology for international consultations expedites the review process and provides a forum for clinical education, thereby building sustainable capacity for specialized patient care locally and contributing to improved patient outcomes. Used for both clinical and non-clinical meetings, telemedicine enhances opportunities for inter-Caribbean consultation and collaboration, as learnings from a single case are shared across the region. The importance of dedicated technical support and of consistently collecting evaluations must be underscored. With successes in facilitating these sessions, this technology has been leveraged to connect SickKids to the region for other activities. For example, as part of the establishment of hospital-based paediatric oncology databases, two training sessions were conducted remotely from SickKids in August 2014, and February 2015 with Data Managers from multiple sites. The SCI telemedicine network is being further considered as a vehicle to deliver components of the post-basic nursing training course that is currently under development, to compliment e-learning and allow for weekly debriefing with students.
Importantly, these facilities are only used in part for SCI activities, but are regularly booked to allow for participating in other local needs.

5. Conclusions

Serving as a forum for education, knowledge transfer and management recommendations, telemedicine involves the integration of technology, medicine, social systems and culture. It is a valuable tool to strengthen training and interprofessional collaboration, by increasing the expertise of subspecialists in the Caribbean SIDS. The rounds promote and facilitate bi-directional academic exchange both within the Caribbean region, and between the Caribbean and SickKids. Through candid discussion about real world challenges in the care of children with cancer and blood disorders, participating SickKids clinicians have also learned about how to refine treatment recommendations within a low-resource context, resulting in reverse capacity building. By building capacity and nurturing expert knowledge through education, paediatric patients with cancer and blood disorders will benefit from enhanced diagnostic and therapeutic management. In doing so, SCI hopes to contribute to closing the gap in childhood survival between low and high-resource settings with sustainable benefits for the Caribbean communities in which they live.

![Figure 1](image)

**Figure 1.** Cases submitted by disease type (September 2013 – February 2015)

| Table 1. Telemedicine facilities installed in SCI partner sites through SCI |
|----------------------------------|-----------------|-----------------|------------------|
| **Country**                      | **Name of Facility** | **Location of Facility** | **Date** |
| The Bahamas                      | BTC Telemedicine Room | Princess Margret Hospital | July 2013 |
| Barbados                         | Shaw Family Telemedicine Room | University of the West Indies, Cavehill | Nov. 2013 |
| St. Lucia                        | Sandals Foundation Telemedicine Room | Victoria Hospital | Oct. 2014 |
| St. Vincent and the Grenadines   | Telemedicine Room of the Children of St Vincent and the Grenadines | Milton Cato Memorial Hospital | Oct. 2014 |
| Trinidad and Tobago              | UWI Telehealth Programme (upgrade) | Eric Williams Medical Sciences Complex | Nov. 2014 |
| Jamaica                          | Wayne and Nigela Purboo and Quickplay Media Telemedicine Room | Bustamante Hospital for Children | Feb. 2015 |
Table 2. Summary of cases submitted for consultation (September 2013 – February 2015)

<table>
<thead>
<tr>
<th>Institution</th>
<th>Number of Cases</th>
<th>% of all Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Princess Margaret Hospital, The Bahamas</td>
<td>10</td>
<td>18.5</td>
</tr>
<tr>
<td>Queen Elizabeth Hospital, Barbados</td>
<td>8</td>
<td>14.8</td>
</tr>
<tr>
<td>Victoria Hospital, St. Lucia</td>
<td>2</td>
<td>3.7</td>
</tr>
<tr>
<td>Milton Cato Memorial Hospital, St. Vincent and the</td>
<td>1</td>
<td>1.9</td>
</tr>
<tr>
<td>Grenadines</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Eric Williams Medical Sciences Complex, Trinidad</td>
<td>16</td>
<td>29.6</td>
</tr>
<tr>
<td>and Tobago</td>
<td></td>
<td></td>
</tr>
<tr>
<td>University Hospital of the West Indies, Jamaica</td>
<td>16</td>
<td>29.6</td>
</tr>
<tr>
<td>Bustamante Hospital for Children, Jamaica</td>
<td>1</td>
<td>1.9</td>
</tr>
</tbody>
</table>

**Total Cases**: 54 100

Table 3. Attendee overall satisfaction (1=Poor, 2=Needs Improvement, 3=Adequate, 4=Good, 5=Excellent) at Case Consultation Review Rounds (May 2014 – January 2015)

<table>
<thead>
<tr>
<th>Date</th>
<th>Remote Sites Connected</th>
<th>Evaluations Collected (n)</th>
<th>Overall Satisfaction (/5)</th>
</tr>
</thead>
<tbody>
<tr>
<td>May 21, 2014</td>
<td>6</td>
<td>21</td>
<td>3.90</td>
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<tr>
<td>June 4, 2014</td>
<td>2</td>
<td>12</td>
<td>4.42</td>
</tr>
<tr>
<td>June 18, 2014</td>
<td>6</td>
<td>13</td>
<td>4.23</td>
</tr>
<tr>
<td>July 16, 2014</td>
<td>6</td>
<td>22</td>
<td>4.05</td>
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Table 4. Summary of the Patient Care Educations Rounds (1=Poor, 2=Needs Improvement, 3=Adequate, 4=Good, 5=Excellent)

<table>
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<tr>
<th>Date</th>
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<th>Evaluations Collected (n)</th>
<th>Overall Satisfaction (/5)</th>
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<td>Pain Management in Children with Sickle Cell Disease</td>
<td>36</td>
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<td>Childhood Leukemia: Care of the Family and Child</td>
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<td>Nutrition in Paediatric Cancer</td>
<td>25</td>
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<tr>
<td>Nov. 18, 2014</td>
<td>Potential Interactions between Natural Health Products and Chemotherapy</td>
<td>25</td>
<td>3.88</td>
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<tr>
<td>Jan. 27, 2015</td>
<td>Hydroxyurea in Sickle Cell Disease</td>
<td>39</td>
<td>4.26</td>
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References

The Experiences of Patients Undertaking a ‘Virtual’ Cardiac Rehabilitation Program

Davina BANNER\textsuperscript{a1}, Scott LEAR\textsuperscript{b,c}, Daman KANDOLA\textsuperscript{a}, Joel SINGER\textsuperscript{d,e}, Dan HORVAT\textsuperscript{a,f}, Joanna BATES\textsuperscript{f}, & Andrew IGNASZEWSKI\textsuperscript{c,g}

\textsuperscript{a}School of Nursing, University of Northern British Columbia
\textsuperscript{b}Faculty of Health Sciences, Simon Fraser University
\textsuperscript{c}Division of Cardiology, Providence Health Care
\textsuperscript{d}Division of Cardiology
\textsuperscript{e}Centre for Health Evaluation and Outcome Sciences, Providence Health Care
\textsuperscript{f}School of Population and Public Health, University of British Columbia
\textsuperscript{g}Department of Family Medicine, Faculty of Practice, University of British Columbia

Abstract. Cardiac rehabilitation programs (CRP) are medically supervised, multidisciplinary programs that provide secondary prevention aimed at addressing risk factors and improving lifestyle behaviours for patients following an acute cardiac event. CRPs have been demonstrated to be a cost-effective and evidence-based mechanism to improve patient outcomes, but despite the known benefits of these programs, uptake remains poor. Poor attendance has been linked to many factors, but geographical accessibility is a key concern, since many CRPs are limited to hospitals in urban areas. The widespread availability of the Internet has made it possible to provide virtual health services to populations that may have previously been hard to access. This paper examines the qualitative findings from a 16-month mixed methods randomized controlled trial examining the impact of a virtual CRP (vCRP). The vCRP was revealed to be an accessible, appropriate, convenient and effective way to deliver cardiac rehabilitation services, with patients experiencing both clinical improvements and a high level of satisfaction. To understand the experience of patients undertaking the vCRP, semi-structured interviews were undertaken with a purposive sample of 22 participants. An analysis of the qualitative interviews revealed that the vCRP improved participants’ access to healthcare professionals, supported them to make healthy choices, and enhanced feelings of accountability due to greater surveillance. Barriers to participation, such as computer literacy, and general perceptions of a vCRP were also examined. Further investigation into the use and long-term effectiveness of virtual programs across a broader range of healthcare settings is warranted, particularly in those with multiple chronic diseases and those located in rural and remote communities.

Keywords. Cardiac rehabilitation, virtual, telehealth, qualitative, patient experiences, rural and remote.

\textsuperscript{1} Corresponding author: bannerl@unbc.ca.
Introduction

Cardiovascular disease (CVD) continues to be a major global health concern and the biggest cause of morbidity and mortality among men and women [1]. Rates of CVD are rising, in part due to the ageing population, but also due to the burgeoning effects of chronic disease and obesity [2]. The management of CVD is complex and patients typically require ongoing clinical management, multiple medications and educational programs to support risk factor modification [3,4].

Cardiac rehabilitation programs (CRP) are medically supervised, multidisciplinary structured programs that provide secondary prevention aimed at addressing risk factors and improving lifestyle behaviours [5,6]. CRPs are typically offered following an acute cardiac event, such as a myocardial infarction, and have been demonstrated as a cost-effective and evidence-based mechanism to improve patient outcomes [7-10]. These programs are commonly offered in the community and hospital settings and comprise patient education, supervised exercise, monitoring and support. Despite the known benefits of these programs, the uptake of CRPs remains poor, with only 10-35% of eligible patients attending. Poor attendance has been linked to a number of factors, including female gender, accessibility (including geographical location and transport availability), employment status and perception of health status [11,12]. Geographical accessibility is a key concern, since many CRPs are limited to hospitals in larger metropolitan areas, with rural dwelling patients having more limited access to this resource [13]. The proliferation of low-cost communication technology and the widespread availability of the Internet has made it possible to provide virtual health services to populations that may be hard to access. While there has been a growth in remotely delivered healthcare services, the evidence to support them is sparse and largely limited to feasibility studies [14-17].

To examine the impact of a virtual cardiac rehabilitation program (vCRP), we undertook a 16-month mixed methods randomized controlled trial with blinded outcome assessment consisting of a four-month vCRP with a 12-month sustainability follow-up on exercise capacity and risk factor reduction compared to usual care in patients living in small urban and rural communities without access to standard CRP [18]. In addition to clinical outcomes, we undertook qualitative interviews with a purposive sample of 22 vCRP participants to explore the acceptability and uptake of the program. Incorporating the qualitative component enables a broader examination of some of the contextual, health services and patient factors that can impact upon its development and implementation [19]. This paper will focus upon the qualitative outcomes of this mixed methods study and will provide valuable insights into the development and uptake of the vCRP in rural communities.

1. The Study

The vCRP was designed to mimic a standard hospital-based CRP included on-line intake forms (medical, risk factor and lifestyle forms), scheduled one-on-one chat sessions with the program nurse case manager, exercise specialist and dietician (three times each during the 12 weeks), weekly education sessions, and data capture for the exercise stress test and blood test results. The program was informed by best practice guidelines and was pilot tested. Consecutive adult in-patients with acute coronary syndrome or following a revascularization procedure from two rurally located hospitals
in British Columbia were recruited. To be eligible, prospective participants were required to speak English and have regular Internet access. Patients with any physical limitations to exercise, significant co-morbidities, or previous experience of a CRP were excluded.

78 participants were enrolled in the study and 38 were randomized to the intervention group. Participants in the control group received routine care from their primary care provider. Those in the intervention group received an orientation to the vCRP as well as training on the heart rate and blood pressure monitoring devices. Upon accessing the program, participants were provided with a list of activities to complete for the week. The program lasted four months in duration and a final semi-structured interview was undertaken with a purposive sample of 22 participants to explore satisfaction and to provide feedback on the vCRP. Participants were selected to provide a cross-representation of gender, level of vCRP usage and geography, and sampling was discontinued once no new major themes emerged. Interviews were conducted by a trained research coordinator and transcribed verbatim. Data were analyzed using a qualitative description and coded thematically to garner in-depth descriptive summaries of events or situations [20,21]. Peer checking of the ongoing analysis was undertaken to promote accuracy and rigor [22]. This study was registered at ClinicalTrials.gov (registration number: NCT00683813) and approved by the Simon Fraser University, Providence Health Care and Northern Health Authority Research Ethics Boards. All participants provided informed consent.

2. Summary of Study Findings

An analysis of the study findings revealed that the vCRP was an accessible, convenient and effective way to deliver cardiac rehabilitation services. Data analysis revealed a good overall uptake of the program activities, with participants averaging 27 logins to the website (range 0-140) and 122 individual chat sessions between the vCRP participants and either the nurse, dietician or exercise specialist (mean 3.6 per participant). Those allocated to the intervention group also demonstrated statistically significant improvement in exercise capacity, along with other improvements in total cholesterol, LDL-C, and saturated fat intake. Likewise, an analysis of the interview data identified that the vCRP was an accessible and acceptable form of cardiac rehabilitation. A descriptive analysis of the qualitative data revealed five core themes. These are: accessibility, making healthy choices, surveillance, barriers to participation and perceptions of the vCRP.

2.1. Accessibility

The vCRP was seen as providing easy access to key healthcare professionals, including a cardiac nurse, exercise specialist and dietician. The program helped the participants to have greater awareness of their condition and supported them to work towards their healthcare goals. Many of the participants were satisfied with the virtual format as this could be accessed at a convenient time and negated the need for travel. In particular, the virtual delivery enabled them to recover in their own community. For example, one participant stated that the "... convenience of fitting into your lifestyle is big. Access to numerous experts in one location is also handy. You can ask questions anytime they pop into your head through email."
2.2 Making Healthy Choices

The participants reported greater awareness and motivation to manage their health condition and adopt healthier lifestyle choices as a result of their participation in the vCRP. This included a greater recognition of the need to maintain a healthy diet, to undertake regular exercise with suitable intensity, and to monitor their health condition appropriately. One participant commented: “You just pay more attention, and it’s more upfront and not in the back of your mind ... you are more aware of what’s happening and what you can do about it.”

2.3 Surveillance

During the interviews, many of the participants explained how having ongoing surveillance from healthcare providers, as well as support for self-management activities, helped them to adhere to their recommended program. These participants reported that they felt more accountable for their progress and confident in their recovery. One participant explained: “You know I had stents four years ago, and you start off with the best of intentions, but nobody looks over your shoulder and you peter out. At this time, I felt this is a nifty program ... somebody’s watching it and I better do it. Keeps you honest, keeps you focused.”

2.4 Barriers to Participation

While high levels of engagement in the vCRP were common, some participants reported low-to-moderate levels of involvement. Reasons for this included lack of time, infrequent access to the Internet or computer, lack of motivation, and poor computer literacy. Challenges related to the use of the computer were commonly reported, however, these were largely isolated to the initial set up and were resolved with greater familiarity or direct support from the research team or others.

2.5 Perceptions of the vCRP

Overall, the participants were enthusiastic about their progress during the vCRP, with many reporting that they felt healthier as a result. Importantly, some of the participants highlighted that the program gave them more confidence when interacting with healthcare professionals. One participant highlighted: “it helped with knowing which questions to ask ... it probably helped [family doctor] because I wasn’t asking random questions.”

Conclusion

The vCRP was revealed to be an accessible, appropriate, convenient and effective way to deliver cardiac rehabilitation services, with patients experiencing both clinical improvements and a high level of satisfaction [18]. An analysis of the study findings strongly support the use of virtual programs for patients following a cardiac event and are revealed as a viable alternative to traditional programs for those located in rural and remote areas. More widespread integration of such programs could provide a cost
effective means to help address the growing challenges faced by many global healthcare systems, including the increasing prevalence of chronic diseases and obesity, growing health disparities and more limited access to healthcare services in rural and remote communities.

Further mixed methods research is warranted to explore long-term outcomes of the vCRP. This should include studies to explore the more widespread integration of the program in settings across Canada, including Aboriginal communities, and globally. Insights from caregivers and healthcare providers would also be a useful addition. Finally, expanding this model to other patient groups, including those with multiple complex chronic diseases, would provide important insights and opportunities.

References


ECHO Ontario Chronic Pain & Opioid Stewardship: Providing access and building capacity for primary care providers in underserviced, rural, and remote communities

Ruth E DUBIN\textsuperscript{a,1}, John FLANNERY\textsuperscript{b, c}, Paul TAENZER\textsuperscript{d, e}, Andrew SMITH\textsuperscript{f}, Karen SMITH\textsuperscript{g}, Ralph FABICO\textsuperscript{h}, Jane ZHAO\textsuperscript{i}, Lindsay CAMERON\textsuperscript{j}, Dana CHMELNITSKY\textsuperscript{k}, Rob WILLIAMS\textsuperscript{l}, Leslie CARLIN\textsuperscript{m}, Hannah SIDRAK\textsuperscript{n}, Sanjeev ARORA\textsuperscript{p}, Andrea D FURLAN\textsuperscript{q, m, n}

\textsuperscript{a} Adjunct Assistant Professor, Department of Family Medicine, Queen's University, Kingston, Canada
\textsuperscript{b} Medical Director, Musculoskeletal (MSK) Program, Toronto Rehabilitation Institute, University Health Network, Toronto, Canada
\textsuperscript{c} Outpatient Services – ECHO, Musculoskeletal (MSK) Program, Toronto Rehabilitation Institute, University Health Network, Toronto, Canada
\textsuperscript{d} Adjunct Assistant Professor, Department of Physical Medicine and Rehabilitation, Faculty of Health Sciences, Queen's University, Kingston, Canada
\textsuperscript{e} Adjunct assistant professor, Departments of Medicine, Oncology, and Psychiatry, Faculty of Medicine, University of Calgary, Alberta, Canada
\textsuperscript{f} Staff Physician, Neurologist, Pain and Addiction Medicine, Centre for Addiction and Mental Health (CAMH), Toronto, Canada
\textsuperscript{g} Associate Dean, Continuing Professional Development, Faculty of Health Sciences, Queen’s University, Kingston, Canada
\textsuperscript{h} Continuing Professional Development, Faculty of Health Sciences, Queen’s University, Kingston, Canada
\textsuperscript{i} Telehealth Program Manager, Centre for Global eHealth Innovation, University Health Network, Toronto, Canada
\textsuperscript{j} Chief Medical Officer, Ontario Telemedicine Network, Canada
\textsuperscript{k} Assistant Professor, Department of Physical Therapy, University of Toronto, Toronto, Canada
\textsuperscript{l} Director of Project ECHO, Department of Internal Medicine, University of New Mexico School of Medicine, United States of America
\textsuperscript{m} Clinician Scientist, Toronto Rehabilitation Institute, University Health Network, Toronto, Canada
\textsuperscript{n} Associate Professor, Division of Physiatry, Department of Medicine, Faculty of Medicine, University of Toronto, Toronto, Canada

\textsuperscript{1} Corresponding Author: Dr. Ruth E. Dubin, 202-800 Princess St, Kingston, ON, K7L 5E4, Canada; Email: rdubin@kingston.net
Abstract. Chronic pain is a prevalent and serious problem in the province of Ontario. Frontline primary care providers (PCPs) manage the majority of chronic pain patients, yet receive minimal training in chronic pain. ECHO (Extension for Community Healthcare Outcomes) Ontario Chronic Pain & Opioid Stewardship aims to address the problem of chronic pain management in Ontario. This paper describes the development, operation, and evaluation of the ECHO Ontario Chronic Pain project. We discuss how ECHO increases PCP access and capacity to manage chronic pain, the development of a community of practice, as well as the limitations of our approach. The ECHO model is a promising approach for healthcare system improvement. ECHO’s strength lies in its simplicity, adaptability, and use of existing telemedicine infrastructure to increase both access and capacity of PCPs in underserviced, rural, and remote communities.

Keywords. Chronic pain, Ontario, telemedicine, ECHO (Extension for Community Healthcare Outcomes), primary care

Introduction

Chronic pain is a prevalent and serious problem. One in five Canadians suffers from moderate to severe chronic non-cancer pain daily or most days of the week [1]. Pain is one of the most common reasons patients seek medical care in Canada and accounts for more healthcare utilization than any other condition [2, 3]. Despite universal healthcare coverage in Canada, non-pharmacological treatments (physiotherapy and counselling) for chronic pain are not covered by most provincial healthcare plan – yet drugs are.

Healthcare practitioners in Canada receive minimal training in chronic pain [4, 5]. A 2007 Canada-wide survey revealed that medical students receive an average of 16 hours of training in pain management while veterinarians receive 87 hours [6]. Further, family physicians, who see the majority of pain patients receive less than four hours of chronic pain training in their two-year residencies [7]. And finally, there are no licensure requirements for pain management knowledge for Canadian physicians [5].

Frontline primary care providers (PCPs) manage the great majority of chronic pain patients. Wait times for appointments with a pain specialist can stretch into years [8]. This has led to over-prescribing of potent narcotic analgesics with a subsequent epidemic of opioid misuse, abuse, and unintentional overdoses in Ontario [9]. In 2010, the National Opioid Use Guideline Group (NOUGG) published the Canadian Guidelines for the Safe and Effective Use of Opioids for Chronic Non-Cancer Pain [10]. This national Guideline provides a tool to counter the misuse, abuse, and diversion of prescription opioid medications and to address the knowledge gaps of those prescribing opiates. Uptake of the guideline, however, has been limited [11].

With these gaps and challenges in mind, Dr. Ruth Dubin, Dr. Andrea Furlan, and their colleagues replicated the ECHO (Extension for Community Healthcare Outcomes) model, first developed at the University of New Mexico. This paper describes the development, operation, and evaluation of the first cycle of ECHO Ontario Chronic Pain & Opioid Stewardship project.

1. Development of ECHO Ontario

ECHO Ontario Chronic Pain & Opioid Stewardship is a demonstration project funded by the Ontario Ministry of Health and Long-Term Care (MOHLTC) addressing the problem of chronic pain management in Ontario. The goal of ECHO Ontario is to increase PCP competence and confidence in managing chronic pain. Using existing
telemedicine infrastructure provided by Ontario Telemedicine Network (OTN), ECHO Ontario transcends geographic barriers by connecting PCPs from all across Ontario via multipoint video and teleconference technology. ECHO Ontario addresses the identified knowledge gaps by providing short didactic presentations and case-based learning, as well as no-cost continuing medical education (CME) credits.

The ECHO model was first developed at the University of New Mexico to connect the academic health centre in Albuquerque with rural clinicians willing to treat patients with Hepatitis C Virus (HCV) in their home communities. Using a hub and spoke model, clinical experts at the academic hub connect with multiple PCP “spoke” sites. Learning occurs multi-directionally within the hub and spoke community.

The four core tenets of the ECHO model are to 1) use telehealth technology to **leverage scarce healthcare resources**; 2) share best practices and **reduce variation** in care; 3) harness **practice-based learning** and develop specialty training expertise among PCPs, and 4) monitor and **evaluate outcomes** of the ECHO model and, when indicated, adopt changes to improve the desired outcomes [12, 13].

Since 2003, there have been 39 successful ECHO clinic replications focused on a variety of medical issues (chronic pain, mental health and addictions, endocrinology and diabetes, rheumatology, etc). Many different organizations have replicated the ECHO model including the U.S. Departments of Defense and Veteran’s Affairs, Harvard University, the University of Washington, the Irish Republic, Northern Ireland, Uruguay, and the National Institute of Mental Health and Neurosciences in Bangalore, India [14, 15].

2. **Operation of ECHO Ontario**

ECHO Ontario runs weekly two-hour sessions. Each session connects the central “hub” of chronic pain experts at two academic health centres co-located in Toronto and Kingston with primary care “spokes” distributed throughout the province of Ontario (Figure 1).

![Figure 1. Map of ECHO Ontario community spoke sites](image-url)
The interprofessional representation of the ECHO Ontario hub consists of physiatry, pain medicine, neurology, addiction medicine, family medicine pain expert, psychology, nursing, social work, physical therapy, occupational therapy, pharmacy, chiropractic, clinical librarian, and telemedicine technicians.

ECHO spoke PCPs are recruited from urban as well as underserviced, rural, and remote locations across Ontario. The distribution of spoke participant professions is 45% physicians, 23% registered nurses and nurse practitioners, and 32% other healthcare providers, including physician assistants, social workers, pharmacists, physiotherapists, occupational therapists, and mental health workers. The majority (48%) of spoke participants are within their first 1-9 years of practice and below the age of 39 (44%).

2.1 Structure of an ECHO session:

1) Didactics: After announcements and roll-call of participants, a member of the hub gives a brief lecture on a chronic pain topic. The topics for these didactics are based on needs assessment of the spokes and program outcomes which is contingent upon new developments or local issues. Examples of topics covered to date include: the 5 pillars of chronic pain management, functional goal setting, the qualitative sensory exam, switching/tapering and stopping opioids, urine drug screening, pain psychology, and non-pharmacological treatment for chronic pain.

2) Case presentations: Each week, one or more PCPs present a de-identified patient case. These cases are highly complex, with chronic pain, mental health, addictions, and often multiple additional medical diagnoses. Most are disadvantaged psychosocially, economically, ethnically, and geographically. Revisiting patient cases is also encouraged to allow further reflection and follow up. The case presentation is coordinated by a facilitator. The facilitation skills include excellent listening skills, supportive non-judgmental summary of cases, and genuine curiosity as to how the spoke PCPs would approach this management of the case prior to closing comments and recommendations from the hub experts.

Case presenters receive a summary of all recommendations following each clinic session. If an occasional patient requires urgent access to specialist care, the ECHO hub members are able to arrange expedited referral to an appropriate service. This ensures that specialists see the patients they can best help in a timely fashion.

Each ECHO Ontario session is recorded and archived, compliant with Ontario provincial privacy legislation and available for viewing after each session to individuals who are registered as spoke [16].

3. ECHO Ontario Evaluation Methods

Monitoring and evaluating outcomes is fundamental to the ECHO model. ECHO Ontario uses a mixed methods research approach to collect data.

3.1 Quantitative data

We are collecting prospective data in the form of questionnaires regarding clinician knowledge about chronic pain, self-efficacy, attitudes and behaviours, demographics,
and practice characteristics. Clinicians are assessed at a minimum of two time points: before they join ECHO, at the end of each cycle, and after they decide to stop attending ECHO sessions.

We are also investigating the impact of ECHO Ontario on the individual patient cases presented during ECHO sessions with a grant received from the Canadian Institutes for Health Research (CIHR). Each case presentation includes reports of pain levels, function, mood, quality of life, and prescribed medications. In collaboration with the Ministry of Health, patient healthcare utilization is tracked and economic analyses will be conducted.

3.2 Qualitative data

We are conducting focus groups and semi-structured interviews with spoke PCPs. We do a semi-structured interview every 10 sessions with five randomly selected spoke participants. Questions pertain to educational and clinical components. To date, one focus group has been conducted where ECHO spoke participants were asked about clinical impact and participation in ECHO. Themes that emerged from focus group discussion include developing a sense of being a part of an ECHO community of practice, identification of knowledge gaps in chronic pain management, and comments on the ways in which ECHO impacts clinical practice.

Regarding the identification of a knowledge gap, one family physician in rural Ontario said, “I think I’m at the point where I realize now how little I actually know about chronic pain. So I would say my confidence in managing it is actually less than it probably was before I started this program and I haven’t kind of gotten to the point where I feel that I’ve got that expertise. So I’m hoping if I stick with this I will get there but it’s been four months, five months. […] I’ve certainly gained knowledge but I’ve also realized that there are a lot of gaps that I didn’t recognize before.”

Another family physician in rural Ontario said, “I would say that my chronic pain patients, I don’t have a huge number. They are my most challenging patients and I’ve got their faces in my brain. And my top three probably take more brain and mental energy than the next 500 most challenging people. And so, I often felt quite helpless before ECHO. They had seen all the specialists and the specialists had sent them all back to me with not a lot of help. So with ECHO I feel like I’m getting the tools to better deal with them. And I feel that if I have a challenging case, I can present to this panel of experts, like I get good answers. Or if I have a question about chronic pain, I can get it answered by an expert really easily. So it’s like I’ve got back-up for my hardest, most challenging people.”

By using both qualitative and quantitative methods, we hope to gain an understanding of the mechanisms by which ECHO Ontario produces benefits for PCPs, patients, and the healthcare system. To date, we have completed one full cycle of ECHO Ontario curriculum, containing 31 sessions. An average of 17 OTN sites joined via telemedicine each week, with an average of 35 spoke participants.

A total of 31 new patient cases plus 7 follow-ups (18 female, 13 male) have been presented and discussed in cycle 1. The average age of patients presented was 52 years (sd = 16 years, range = 20 – 86 years). The top five most common pain diagnoses, in order of frequency are: low back pain, fibromyalgia, myofascial pain, neuropathic pain, and migraine headaches. The top five most common non-pain diagnoses, in order of frequency are: depression, insomnia, fatigue, hypertension, and diabetes. Reasons that PCPs present cases at ECHO include: seeking advice on opioid dosing and rotation,
clarification of pain diagnoses, poor pain control, looking for general advice, and wanting guidance on non-pharmacologic strategies and/or adjuvant analgesics.

4. Discussion

4.1 Strengths

The ECHO model has many strengths which address the specific challenges of chronic pain management in Ontario. ECHO Ontario increases access for PCPs to specialist knowledge. Ontario is Canada’s most populous province, with 13.6 million residents, spread over an area greater than 1,000,000 km². Telemedicine technology is crucial. ECHO Ontario was able to use existing OTN infrastructure to overcome Ontario’s massive geographical barriers without needing significant additional funding from our publically funded healthcare system.

ECHO Ontario also gives motivated PCPs the opportunity to attain new knowledge [17]. Regular weekly sessions allow PCPs to schedule time to attend and present cases based on their patients’ needs. Between sessions, the ECHO hub experts are available via email or telephone in case urgent issues arise.

The ECHO Ontario curriculum and education framework addresses the chronic pain knowledge gap of Ontario primary care providers. Our participants are motivated adult learners who bring their own experience and needs to each session. ECHO Ontario builds spoke self-efficacy and confidence thereby increasing clinician capacity in urban, underserviced, rural, and remote communities. ECHO Ontario also provides no-cost Continuing Professional Development (CPD) credits which may be especially relevant to providers who otherwise have to travel long distances for their required CPD.

Patient cases are discussed in a way that enhances spoke self-learning. The spoke PCPs are the first to ask for clarifying information from their presenting colleague, and to make suggestions for investigations and treatment. Only after the spoke participants have spoken, do the hub experts offer their thoughts, views, or insights. Long-running ECHO sessions at the University of New Mexico demonstrate that spoke participants are consistently providing best-practice advice and functioning like specialists, ie. at the highest level of their scope of practice [18].

The problem of chronic pain is complex and requires a multimodal approach [19]. The interprofessional composition of the ECHO Ontario hub reflects this management approach without the expense of creating multiple stand-alone pain rehabilitation programs. Standard telemedicine bridges distance to allow one specialist to assist one patient. ECHO increases capacity by force multiplying specialist expertise to multiple PCP’s in one session.

The creation of a community of practice is a major benefit of the ECHO model. The weekly ECHO sessions build strong relationships between geographically dispersed and often isolated PCPs. This network also includes clinical experts in academic centers. ECHO clinics at the University of New Mexico have shown how the mutual support and camaraderie increases provider satisfaction, and reduces isolation and burnout among PCPs regardless of their locations [20].

ECHO acts as an effective triage system [21]. Patient cases that require access to tertiary clinics are identified and fast-tracked to appropriate care. Given that wait times for pain specialty clinics across Canada often stretch into years [8], facilitating faster
access to specialty pain care may reverse the usual downward spiral of disabling chronic pain.

The majority of patients can and should be managed by their PCP in their own communities. In a non-inferiority controlled trial, Project ECHO New Mexico showed that hepatitis C patients achieved the same, if not better, cure rates when managed by their PCP’s, when compared to the academic health center [12]. Many patients who suffer from chronic pain are unable to travel the long distances to pain clinics or cannot afford the cost of travel. ECHO provides the right care, to the right patient, at the right time.

ECHO Ontario’s pragmatic approach to supporting PCPs in providing community-based best-practice care is well-aligned with the health system-wide priority of enhancing capacity in primary care. As a result, the project has benefited from strong support from its primary institutional stakeholders: the University Health Network, Queen’s University, and the MOHLTC.

4.2 Limitations

There are limitations to the evaluation of the ECHO Ontario model. Spoke participants are a self-selected group; participation in Ontario is voluntary. We expect that ECHO Ontario spoke participants are early adopters who have a public-health mindset; hence, our spoke population may not be a representative sample of the average PCP in Ontario. Also, considering the total numbers of PCP’s in Ontario, and our early stage of development, we are attracting only a tiny minority. Our conclusions regarding the benefits of this model may not be generalizable at this time to the broader provincial practitioner and patient populations.

5. Conclusion

The ECHO model is a promising approach for healthcare system improvement that is attracting attention from many jurisdictions. ECHO’s strength lies in its simplicity, adaptability, and use of existing telemedicine infrastructure to increase both access and capacity of PCPs in underserviced, rural, and remote communities.

Acknowledgements

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References


Scaling Up the Use of Remote Patient Monitoring in Canada

Bobby GHEORGHIU and Fraser RATCHFORD

Abstract. Evidence supporting the use of remote patient monitoring (RPM) as a cost-effective means of keeping patients from being re-admitted to hospitals or making repeated emergency department visits is growing, especially for the treatment of chronic obstructive pulmonary disease (COPD) and congestive heart failure (CHF). A recent study funded by Canada Health Infoway, titled Connecting Patients with Providers: A Pan-Canadian Study on Remote Patient Monitoring, aimed to assess the current state of RPM solutions; to examine the evidence for patient and health system benefits achieved both in Canada and internationally; and to determine the critical success factors needed to support further investment and scaling-up of RPM solutions across the Canadian health care system. Break-even analysis of four different implementations reviewed in this study demonstrated that RPM programs can be viable and sustainable for large and small jurisdictions; however, more evidence is needed with regards to a number of potential applications for RPM beyond the management of COPD and CHF.

Keywords. Home monitoring, telehealth, telehomecare, cost effectiveness.

Introduction

As Canada’s population continues to age and grow, we face increased challenges surrounding the management of chronic disease. Secondary prevention that helps to keep those with chronic conditions well and to avoid unnecessary hospital admissions and emergency department visits, benefits both the health system and patients and their families. While the topic has been near the forefront of policy discussions for some time, there are no easy solutions to these complex challenges.

Remote patient monitoring (RPM) is increasingly becoming an important part of the solution for certain serious chronic conditions. It has been touted as a game-changing model of health care delivery for many years, and recent evidence suggests that its use in Canada has the potential to deliver high quality, cost-effective care while improving patient-reported outcomes.

RPM is the delivery of health care to patients outside of conventional care settings (e.g., a patient’s home), made possible by connecting the patient and a health care provider through technology. It involves the electronic transmission of patient data (e.g., symptoms, vital signs, outcomes) from a remote home location to the provider, as
well as the supporting services and processes required to conduct data review, interpretation, coaching and potential alteration to the patient’s course of care.

For instance, the Care Coordination/Home Telehealth (CCHT) program of the Veterans Health Administration in the U.S. currently manages more than 70,000 veteran patients using home telehealth technologies. The program has demonstrated successful outcomes. Through the end of fiscal year 2010, veterans reported patient satisfaction levels greater than 85 percent for home telehealth services offered through CCHT. In addition, the program was associated with a greater than 40 percent reduction in bed days of care, as compared with pre-enrollment figures, for the CCHT population receiving home telehealth [1]. Because the Department of Veterans Affairs operates a large integrated delivery system financed primarily by public money, lessons from the VHA’s experience may be more applicable to other integrated delivery networks or government-sponsored systems [2].

This study explores the viability of operating remote patient monitoring programs in a Canadian context and discusses key ways in which they can be integrated into mainstream care delivery processes.

1. Methods

An independent, pan-Canadian study, funded by Canada Health Infoway, employed a mixed-methods approach including:

1. Analysis of detailed RPM program information, including utilization data, funding applications, pilot results, satisfaction surveys and evaluation findings,
2. A literature review consisting of meta-analyses, systematic reviews of peer reviewed RPM trials, and meta-reviews (reviews of reviews),
3. Interviews with over 20 key informants including policymakers, clinicians, researchers and vendors with extensive RPM and Telehealth experience,
4. A synthesis and review of available Canadian evidence from RPM program and pilot evaluations, and
5. A break-even or point-of-sustainability analysis (number of active patients needed in an RPM program in order to make its operation sustainable from a health system viewpoint) based on operational data from Canadian RPM programs, including detailed cost and benefit information from selected programs, to inform case studies and emerging solutions.

Final output included a review identifying critical success factors and requirements/recommendations to enable broad-scale deployment and fuller realization of benefits.

2. Results:

Canadian telehealth programs reported use of RPM by more than 2,500 Canadians in 2012 [3]. In Canada and internationally, the number and range of evaluations of RPM programs is growing quickly, with most published studies demonstrating reductions in emergency department visits and hospital readmissions, particularly for chronic obstructive pulmonary disease (COPD) and congestive heart failure (CHF) [4,5]. For
example, the analysis found that Canadians using RPM were less likely to be admitted
to hospital or to visit the ER, with benefits valued at $21 million [6]. In addition,
surveys of both patients and clinicians suggest consistently high levels of satisfaction,
as well as improved ability of patients to self-manage [6].

A literature search and detailed review of four Canadian case studies uncovered a
number of significant benefits related to the use of RPM. A recent 21-month
evaluation of 60 patients with COPD in the province of Quebec revealed a 50%
reduction in hospital length of stay and 37% decrease in number of visits to hospital
emergency departments [4]. A separate RPM program developed by the University of
Ottawa Heart Institute (UOHI) has cut hospital readmission by 54% for CHF patients
[7].

A break-even analysis was conducted on four programs of different size and
targeting different patient populations. As expected there was large variability in terms
of the number of enrolled patients needed in order for programs to be ‘sustainable’
(about 60 to over 300). Ultimately, the break-even point is dependent on the nature of
services, patient population, and specific metrics and assumptions used to calculate
costs and benefits, which varied with each program and was not always consistently
reported in studies. This aligns with other findings in the literature, where the economic
savings from telemonitoring solutions compared to usual care for CHF patients across
10 studies ranged from 1.6-68.3% and showed significant differences according to
what variables were used [8]. Nevertheless, this calculation offers a directionally valid
assessment of the benefits gained through RPM implementation.

The study also found substantial room for growth and maturation of RPM use
across Canada. Each of the four programs for which detailed case studies were
conducted is serving 16-52% more patients than their program-specific ‘break-even’
point.

3. Discussion

Despite results supporting a number of benefits related to the use of RPM, this
evidence is still fairly limited, especially as it relates to large-scale deployment and in a
Canadian context. 2,500 enrolled patients represent a very small fraction of the
Canadian population affected by chronic disease. Furthermore, RPM use is growing in
areas as diverse as asthma, mental health, post-surgical care, rehabilitation and
hypertension as new applications continue to be discovered and technology continues
to evolve. For these applications, factors such as clinical and administrative processes
and workflows, start-up and operational costs, and especially health outcomes need
further study since the lack of evidence is a significant barrier to larger-scale, health
system-wide investments. Nonetheless, the case analysis suggests that long-term
sustainability and potential for growth is a realistic goal for programs large and small.

What can jurisdictions and/or health systems do to increase the chance of success
for these programs? The case studies reviewed along with Canadian and international
literature suggest a number of key success factors for moving past the pilot stages and
growing RPM into a mainstream care delivery mechanism:

a) engagement of and collaboration with clinicians and patients in the
development of RPM programs in order to ensure buy-in and a clear value
proposition for key stakeholders;
b) integration into established clinician pathways and processes in order to facilitate patient referrals;
c) selection and recruitment of suitable patients (some patients are too ill to participate, while others may not require active monitoring); and
d) ongoing measurement of impacts and outcomes attributed to RPM in order to grow the evidence base and strengthen business cases for increased investment.

All of these elements are needed to ensure strong value for RPM investments and to facilitate the scaling up of these programs over time.

Conclusion

While there have been some mixed outcomes reported in international studies, Canadian evidence suggests that for a targeted segment of the population, RPM presents a cost-effective, innovative solution that transforms the health care delivery model by bringing care into the home and significantly improves patient-reported outcomes such as satisfaction and quality of life. While start-up costs for most programs may be high, this analysis provides evidence to suggest that long-term sustainability is a realistic goal for a variety of RPM programs.

Overall, the study found that continued growth and sustainability of RPM programs in Canada will be dependent on consistent engagement and collaboration with providers, recruiting and retaining the patients who are most likely to benefit from the intervention, and providing integrated and coordinated care while consistently measuring and demonstrating benefits.

References

Building a Patient-Centered Hospital Web Site: Best Practices in China

Edgar HUANG a,1

a School of Informatics and Computing, Indiana University

Abstract. In this case study, based on six criteria, four Chinese hospitals were chosen from a national sample to showcase, through content analysis and in-depth interviews, the best practices of serving patients online. The extensive findings have addressed the following three questions: what these hospitals have in common in their Web development, what problems and challenges they are facing, and how they have excelled in serving their patients online. The study concludes that, like larger hospitals, smaller hospitals can also excel in creating an outstanding Web site to serve their patients so long as they truly care about their patients, have a clear vision and strong expertise in IT development. The study also concludes that Chinese private hospitals can learn from these state-owned hospitals in establishing a good reputation through professional and responsible interaction with patients. The four hospitals studied may shed light on the Web development in many other Chinese hospitals that are going through the same healthcare new media adoption. The findings from this study can also help Chinese hospitals form their visions in serving patients online.

Keywords. Hospitals, Web sites, Interactive tools, Videos, China

Introduction

At the end of 2007, China became the largest online market in the world. [1] McKinsey Global Institute [2] predicts that the Internet will contribute 7% to 22% of GDP growth in China and that “The Internet can save some ¥110 billion to ¥610 billion in annual healthcare expenditures, which is 2 to 13 percent of the growth in health-care costs projected from 2013 to 2025” (p. 12). The report has sent a clear message to Chinese hospitals: get on the digital bandwagon. This study has attempted to find out how digital technology can help Chinese hospitals better serve their patients online. Four Chinese hospitals have been chosen to showcase the best patient-centered hospital Web sites in China today.

China started to build its healthcare network in 2003 [3]. Ten years later, only 42% of Chinese hospitals had a Web site [4]. Many hospitals in China still take their Web sites as “a window to conduct propaganda to the world” (p. 959) [5]. As a result, numerous Chinese hospitals’ Web sites convey only what a hospital wants its visitors to see and has hardly taken into consideration what the visitors truly need when they visit a hospital Web site; such a Web site often have not provided a platform for visitors to efficiently interact with the hospital [6,7]. This hospital-centered mentality has not played a positive role in attracting visitors [8]. Many Chinese scholars and
hospital professionals have called on hospitals to make their Web sites truly patient-centered [8-11].

But what is a patient-centered hospital Web site like? Several scholars both in and outside of China have proposed design models. Bai and Yang [3] maintain that a good hospital Web site should incorporate a hospital information system (HIS), which enables medical treatment documentation, financial processing and analysis, administrative management, etc.; doctors and patients can share and search the information from the system through an interactive interface; and functions such as telemedicine, online payment, online appointment-making, and online inquiry can become routine. Xue [9] suggests that hospitals reduce the amount of propaganda content and make a site more engaging—to do so, every aspect of design should regard patients’ needs as the top priority in a Web site design and make the Web site part of the hospital’s service system. Huang [12] argues that interactivity and multimedia are the two most important features for the Web and concludes that both interactive tools and e-health videos should be extensively implemented to engage patients.

1. Literature review

Studies on Chinese hospital Web sites have been seen from time to time; however, most of such studies have suffered from the following problems. Some were not studies at all; the authors simply jumped to conclusions [13]. Some were studies, but the conclusions were not based on findings. For instance, Liu, Bao, Liu, and Wang [14] investigated the quality of leading general hospitals’ Web sites in China. The authors concluded, “[Chinese] hospital Web sites showed a good performance in content…” (p. 1559). However, the study neither investigated any user nor defined what constituted good content. Some did not explain how their data were derived. For instance, Liu and Huang [7] stated that their study investigated 4,165 hospitals in China and in other countries, but the authors never explained how they had sampled these hospitals and which countries had been sampled. Some sampled a few hospitals in a local area [10,15], and some even stayed on the “our hospital”-level [5,8,16] and came up with findings and conclusions that could not be applied to most parts of China. In short, making casual claims without evidential support is popular among these Chinese scholars. As of today, extremely few studies have methodically investigated how Chinese hospitals have developed their Web sites to meet patients’ needs.

Based on a systematic probability sample drawn from a comprehensive list of Chinese hospitals, Huang, Wang and Liu [17] found in total 14 interactive tools used on Chinese hospital Web sites in 2013, but the average number of interactive tools used per Web site was only 3. The authors also found that only 5.1% of Chinese hospitals’ Web sites had a dedicated menu listing interactive tools on their home pages to make their site action-driven, and even fewer hospitals allowed patients to execute private functions, such as checking lab results, in a personalized and registration-requiring patient portal (1.3%). The authors concluded that Chinese hospitals needed to more systematically implement interactive tools on their Web sites to provide quality healthcare. In a sister study, Huang, Liu and Wang [4] found that only 21.8% of Chinese hospital Web sites contained video(s), and 44.3% of the Web sites that carried videos carried only one video. The study concluded that Chinese hospitals needed to learn how to turn videos into an integral part of their marketing strategy so as to create...
both conceptually and technologically user-centric Web sites to serve themselves and, more importantly, to serve their patients.

Based on the earlier studies, this study attempted to answer the following three questions:

RQ1: What do these hospitals have in common in their Web development?
RQ2: What problems and challenges are these hospitals facing in their Web development?
RQ3: How have these hospitals excelled in serving their patients online?

2. Methodology

This study has used a case study approach. Content analysis and in-depth interviews were used to triangulate findings from different perspectives and to find themes through comparisons. This study comprises four cases. Using “small sample” to discount a case study misses the point [18]. Although case studies generally do not require a random sample, uncovering best-practice hospitals mandates a thorough investigation of the hospitals in China. In addition, some selection criteria should be set prospectively. Therefore, 2,385 (12.5%) out of a total of 19,084 Chinese hospitals were sampled and examined. For any of these hospitals to be included in this case study, the hospital Web site had to contain:

1. At least 70% of the links that directly pertain to patients in above-the-fold space on the home page (News links were ignored. Links about hospital leaders, Communist Party activities, or hospital teaching, for instance, were not related to patient service.),
2. At least 10 interactive tools,
3. At least 20 e-health videos for patients,
4. A personalized patient portal,
5. A menu that contained interactive tools, and
6. A menu or a section that contained patient-related videos.

With such stringent criteria, only 9 out of 2,385 hospitals were left, and none of them was a private hospital. Eventually, the following four hospitals willingly participated in this study:

1. China-Japan Friendship Hospital (China-Japan).
2. Dongzhimen Hospital (Dongzhimen).
3. Pinggu District Hospital (Pinggu).
4. Sun Yat-sen Memorial Hospital (Sun Yat-sen).

Each of the four hospitals has a unique context. Sun Yat-sen is the largest of the four in terms of the number of beds and is ranked 44th overall among Chinese hospitals [19]. China-Japan is also a large hospital and ranked 81st nationally, but unlike the other three hospitals that are affiliated to universities, China-Japan is affiliated to the central government [19]. Dongzhimen is highly reputable nationwide as a Chinese medicine hospital and is ranked No. 3 in the neurology category in 2014 in China [20], but its size is much smaller. Pinggu is a rural hospital and mainly serves the patients from the Pinggu District in Beijing.
A content analysis on the above hospitals’ Web sites was conducted by two coders in the summer of 2014. The intercoder reliability, using Scott’s Pi, reached an average of .867 for all variables. Because human subjects would be involved in interviews, the protocol of data collecting received university institutional review board (IRB) approval first. The study information sheet and interview questions were all written in Chinese and were sent to the interviewees before an interview began. The initial interviews with the person or people in each of the chosen hospitals were conducted by the author in person in China from August to October 2014. The interview data and the content analysis data were compared. Follow-up interviews via email were conducted for interviewees to clarify and supplement their earlier answers.

3. Findings

Table 1 provides a synopsis of the four hospitals.

<table>
<thead>
<tr>
<th></th>
<th>China-Japan Friendship Hospital</th>
<th>Dongzhimen Hospital</th>
<th>Pinggu District Hospital</th>
<th>Sun Yat-sen Memorial Hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Web site</td>
<td>zryhyy.com.cn</td>
<td>dzmyy.com.cn</td>
<td>pgyy.com</td>
<td>syshospital.com</td>
</tr>
<tr>
<td>Location</td>
<td>Beijing</td>
<td>Beijing</td>
<td>Beijing</td>
<td>Guangzhou</td>
</tr>
<tr>
<td>Affiliation</td>
<td>National Health and Family Planning Commission</td>
<td>Beijing University of Chinese Medicine</td>
<td>Capital Medical University</td>
<td>Sun Yat-sen University</td>
</tr>
<tr>
<td>Hospital Reputation</td>
<td>III-A¹</td>
<td>III-A</td>
<td>III</td>
<td>III-A</td>
</tr>
<tr>
<td>Number of beds</td>
<td>1500</td>
<td>574</td>
<td>960</td>
<td>1800</td>
</tr>
<tr>
<td>Average daily Web site visits</td>
<td>45,000</td>
<td>33,000</td>
<td>2,100</td>
<td>30,000</td>
</tr>
<tr>
<td>Annual budget for Web development (RMB)</td>
<td>75,000</td>
<td>30,000</td>
<td>5,000</td>
<td>83,000</td>
</tr>
<tr>
<td>Who built the site</td>
<td>External</td>
<td>External</td>
<td>External</td>
<td>External</td>
</tr>
<tr>
<td>Number of employees responsible for development &amp; operation</td>
<td>2</td>
<td>35</td>
<td>2</td>
<td>&gt;100</td>
</tr>
<tr>
<td>Personalized patient portal</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>A menu for interactive tools</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>A menu or section for videos</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>Above-the-fold links for patients</td>
<td>79%</td>
<td>75%</td>
<td>93%</td>
<td>100%</td>
</tr>
<tr>
<td>Number of videos for patients</td>
<td>270</td>
<td>85</td>
<td>24</td>
<td>66</td>
</tr>
<tr>
<td>Median of video views²</td>
<td>1413</td>
<td>1533</td>
<td>579</td>
<td>271</td>
</tr>
<tr>
<td>Number of interactive tools</td>
<td>12</td>
<td>12</td>
<td>13</td>
<td>13</td>
</tr>
</tbody>
</table>

### Interactive Tools

| Site Search | ✓ | ✓ | ✓ | ✓ |
| Online Appointment | ✓ | ✓ | ✓ | ✓ |
| Finding A Doctor | ✓ | ✓ | ✓ | ✓ |
| Doctors’ Service Schedules | ✓ | ✓ | ✓ | ✓ |
| Online Inquiry | ✓ | ✓ | ✓ | ✓ |
| Cost Search | ✓ | ✓ | ✓ | ✓ |
| Social Media | ✓ | ✓ | ✓ | ✓ |
| Interactive Maps | ✓ | ✓ | ✓ | ✓ |
| Online Surveys | ✓ | ✓ | ✓ | ✓ |
| Hospital’s Mailboxes | ✓ | ✓ | ✓ | ✓ |
| Patient Self-Test Tools | ✓ | ✓ | ✓ | ✓ |
Finding Medical Staff’s Qualifications
Checking Lab Results
Mobile App
Virtual Hospital Tours
Checking Lab Exam Progress

1. In China, III-A hospitals are the best hospitals in its ranking system.
2. Since the central tendency of the number of times the videos were viewed was highly skewed for each hospital (from 0.66 to 8.8), median was used instead of mean to describe central tendency in this case.

Table 1 has self-evidently presented much about how these four Chinese hospitals have used their Web sites to serve their patients. Here are more of the commonalities and differences among the four hospitals, as revealed in Table 1, further content analysis, and in-depth interviews.

First, all four hospitals have a predominantly patient-centered design on their home page. For instance, the China-Japan home page features its online services in six different ways from top to bottom of the home page, as a menu item, as two section bars, and as three side sections. Except for the hospital news stories, almost all links above the fold of the home page are for patients. The bottom space presents online services for doctors and for internal communication. The Dongzhimen home page and Pinggu home page are very similar to the China-Japan counterpart in terms of page structure. Guoyong Yu, Director of the Department of Social Work at Dongzhimen said: “Our hospital leaders and I agree that most patients are not interested in seeing our hospital leader’ photo or even news. Patients want to find out on our Web site how their own medical problems can be solved.”

Weidong Liu, Director of External Relations at Pinggu concurs: “When our patients get on our Web site, they are probably already in anxiety, and we want them to feel at ease through our clear and simple design. Unlike private hospitals’ Web sites, which focus on marketing, our Web site focuses on serving our patients.”

The Sun Yat-sen home page is unique. Four big buttons—Doctors’ Service Schedule, Finding A Doctor, Online Appointment, and Online Inquiry—are clearly seen in the middle of the page. Clicking on any of these buttons will guide a visitor to its Hospital Service sub-site. In order to best serve its patients, the hospital has designed eight sub-sites to target different kinds of visitors so that patients will not get exposed to the content irrelevant to them. The Hospital Service sub-site home page carries a highly user-friendly Hospital Visiting Guidance section to guide the patients to find what they want based on the logical flow of a typical hospital visit. Almost all Chinese hospital Web sites carry and usually promote the information about their Communist Party activities. Sun Yat-sen’s Hospital Service sub-site does not, and such information is tucked away deep in another sub-site. When asked why the party information is so de-emphasized, Weixiong Chen, Deputy Director of the Communist Party Committee Office, a dermatologist, and an autodidactic IT developer at Sun Yat-sen, said: “Serving our patients is the focus of the hospital. Making our Web site patient-centered is our hospital party committee’s top priority.”

Second, each of the four hospitals has at least one shining point in their Web development.

- Since China-Japan has so many healthcare videos, the site has provided different ways, including “videos recommended by the experts,” “most watched videos,” “videos by theme,” and “healthcare lectures,” for its videos
to be easily found. Its Doctors’ Service Schedule shows clearly who from what department serves at what hours, how much appointment fee is for each doctor, and who has no service at what hours.

- The design of the Dongzhimen site can be described with one word: organic. Once a patient has landed on a doctor’s profile page, the patient can see detailed information about the doctor, including phone number and email—extremely rare among Chinese hospitals. Three buttons on the right of the profile: “Online Inquiry,” “Online Appointment,” and “Online Follow Up” pertain only to this particular doctor. All departmental pages contain not only basic departmental information but also patient education articles pertaining to the focus of that department and a list of answers to the questions raised posted by patients. If a visitor cannot find a satisfying answer, a button “I Want To Ask” is by the list. Only 8.5% of Chinese hospital Web sites carry videos showing patient stories [4]. Dongzhimen is one of them. Yu from Dongzhimen has recommended her doctors to two highly famous Chinese medicine TV programs, in which doctors tell stories about their experiences with patients. Sometimes, patients also appear to supplement a doctor’s talk. Dongzhimen then puts such patient stories, which promote both the doctors and the hospital on its Web site to attract online traffic.

- Though not as reputable nationally as the other three hospitals, Pinggu is one of the very first hospitals in the nation that have developed a mobile app and has promoted it on its home page. It even allows its patients to check lab results, a tool that China-Japan and Dongzhimen do not yet have.

- On the Sun Yat-sen site, in each doctor’s profile page, there are rich interactive tools to interact with a particular doctor. For instance, a patient can see the doctor’s service schedule, make an appointment with the doctor, scan the doctor’s WeChat information, see the doctor’s information on Weibo.com and Yihu.com, ask the doctor a question, fill out a satisfaction survey for the doctor, and scan barcode to open his or her information on a smart phone so that a patient can interact with the doctor in WeChat or do the above functions on the go. The information under doctors’ service schedules is updated automatically by the hospital’s HIS.

Third, all four hospitals have taken advantage of external resources when building their Web sites. For instance, for every hospital to develop an Online Appointment system is a daunting task. Some municipal governments and private companies have developed common systems for local or regional hospitals to use. The three hospitals from Beijing use the Beijing Uniform Online Appointment Platform while Sun Yat-sen uses 1m1m.com and yihu.com. In addition, Sun Yat-sen and China-Japan allow patients to make an appointment via WeChat. All three Beijing hospitals got their information in Cost Searches regarding Chinese medicine prices, Western medicine prices, and medical service prices from a page owned by Beijing Municipal Commission of Development and Reform. All four hospitals have claimed Online Inquiry as their most-often-used interactive tool, and all of them have taken advantage of Good Doctors (haodf.com), an independent site on which doctors from different hospitals answer patients’ questions and compete for patients.

Fourth, all four hospitals have noticed the importance of serving their patients on the go. Sun Yat-sen and Pinggu have already built and are using their mobile apps. Sun Yat-sen has even seamlessly integrated its mobile app into the WeChat platform. As a
result, when a visitor opens WeChat, he or she can connect to the hospital’s mobile site, and everything on the site can be easily shared within WeChat. Dr. Chen from Sun Yat- sen, has promoted the mobile site in different ways. For instance, in the name of holiday greeting, Chen sent doctor’s profile pages to the respective doctors so that, in the future, a doctor can easily share his or her information with his or patients. China-Japan and Dongzhimen were close to being done with their mobile app development at the time of interview. Tieshan Zhang, Director of the Department of Information at China-Japan, said: “Instead of spending more time on developing our Web site, we will spend much more effort on developing our mobile app.” Dongzhimen was taking advantage of Weiguanwang (meaning mini official Web site) (www.wgwchina.com)—a way for enterprises to promote themselves in WeChat—to build its Web site for mobile devices.

Fifth, Three of the four hospitals wish to enhance their search functions, especially the Finding A Doctor function, so as to attract desired patients. Pinggu, as a smaller hospital, does have the financial pressure to attract as many patients from its district as possible. Therefore, Liu from Pinggu hopes to improve its unguided site search and add more interactivity to its doctor’s profile pages. The other three hospitals have too many patients to handle, but they all wish to find the patients who truly need their doctors’ expertise. Zhang from China-Japan said, “A patient with a common cold does not have to see an expert who is specialized in difficult respiratory diseases. Our online interactive tools, if well designed, can help us find the kinds of patients we desire.” The Sun Yat-sen site is the only site that allows a patient to find a doctor by disease type on top of name and department, but it is completing and improving its database to include more precise terms for disease types so that patients can more easily use its search tool. Chen from Sun Yat-sen said, “We need to use a language that patients can understand to tell the differences among some departments that can be confusing to patients.” Dongzhimen already has a very mature search function coupled with its detailed information about each doctor and department.

Finally, all four hospitals are experiencing some problems and challenges in their Web development:

- None of the four hospitals has done a return on investment (ROI) assessment for their Web development.
- None of these hospital Web sites went through rigorous user testing. As a result, diversified problems are observed.
- None of the four hospitals has implemented the Online Payment function though they are each developing one.
- Though all four hospitals have various mailboxes for visitors to file online complaints or make suggestions, these mailboxes have been hardly used.
- All four hospitals are trying to come up with an appropriate proportion of online appointments since many patients do not visit hospital Web sites and prefer to walk in.
- Although the Online Inquiry tool is the most-often used interactive tool on all four hospitals, these hospitals are still trying to find ways to encourage their doctors to answer the questions.
- Pinggu and Sun Yat-sen have yet to make videos an integral part of online marketing and patient education, and both wish to do much more to promote their Web sites to their patients since they have not got the expected amount of exposure.
• Sun Yat-sen has used no Patient Self-testing Tools while the other three hospitals used only three or five tools. In contrast, Peking Union Medical College Hospital, the top hospital in China, has developed 133 of such tools— the most in China.

4. Discussion and Conclusions

As of 2014, these four Chinese hospitals have made outstanding progress in their Web development in comparison to thousands of their peers. Chosen from more than 2,000 Chinese hospitals, they are the best in China in serving their patients online. Since September 2013, the cell phone has become the No. 1 device to access the Internet in China [21]. Therefore, these four hospitals are on the right track to serve more and more patients on the go. It is understandable that larger hospitals tend to have more resources, manpower, and expertise to develop their online presence. However, Pinggu, a smaller local hospital, is not inferior to hundreds of much larger hospitals in China in its Web development. This small hospital even has a mobile app and the Checking Lab Results feature. Considering the fact that, in 2013, only 3.6% of Chinese hospitals’ Web sites had this feature and no hospital Web site had a mobile app, Pinggu and, actually, all the other three hospitals are on the bleeding edge of hospital Web site development in China. Dongzhimen is also a small hospital, even smaller than Pinggu. Nevertheless, it has one of the most well-rounded, most visited, and organic hospital Web sites among the four hospitals, and it demonstrates clear caring for its online visitors. Most important, all these four hospitals have designed their Web sites by taking patients’ needs as their top priority. Yu from Dongzhimen said: “Our peers like our Web site and wish to redesign theirs based on our template. But the most important concept they need to learn is to make a site patient-centered. If they don’t understand this concept, their redesign won’t go very far.” These findings suggest that taking advantage of new media to serve patients online is hospital-size-free. Pinggu’s and Dongzhimen’s exceptional performances have demonstrated that smaller hospitals can also excel in coming up with an outstanding Web site to serve their patients online so long as they truly care about their patients.

Another lesson from these findings is that developing a highly competent hospital Web site to well serve patients requires a clear vision on top of expertise. Although all these four hospitals commissioned an external company to (re)design a site for them, they have strong in-house expertise, especially at China-Japan and Sun Yat-sen. Dr. Chen from Sun Yat-sen, for instance, is a medical doctor and an IT guru. His insight into hospital Web site development as an insider is unique and rare among his peers in the nation and has brought up one of the best hospital Web sites in China. However, although he has a team to support him, he often handles most of the development and updating and even answers questions from Online Inquiry by himself. As a result, he often feels burned out, and his misunderstanding of multimedia may have hurt his site. For instance, because he devalued the importance of e-health videos, he misplaced them and made them very difficult to find; Sun Yat-sen’s extremely low number of video views is the lowest among the four hospitals—not something such a large and nationally reputable hospital deserves; his patient education materials are hardly supported by multimedia. Such mistakes have also resulted from the fact that the Web site did not go through rigorous user testing—a problem that permeates the four hospitals. All the interviewees from these four hospitals said that they were
understaffed, and their low or extremely low budgets support their claims. Pinggu has the fewest videos and wishes to produce more videos in-house. It can certainly borrow experience from China-Japan. These four hospitals have 12 to 13 interactive e-health tools, but 21 e-health tools were found on U.S. hospitals [22]. Many tools, such as ER Waiting Times, Online Flower/Gift Shop, Online Nursery, Online Patient Caring, and Online Payment, have been hardly found in China. Health self-test tools have been very under-used. Numerous Chinese hospital Web sites have prioritized Communist Party activities on their home pages. These four hospitals have, however, consciously chosen to prioritize patients’ needs because of their similar visions.

The fact that no private hospitals in China were chosen in this study cannot be ignored. They were not chosen because they did not meet the criteria. Although Chinese private hospitals were significantly more aggressive in adopting interactive e-health tools [17] and in using e-health videos [4] than their state-owned counterparts, their overall performances were lacking in comparison to these four state-owned hospitals. One very big difference probably lies in the use of the Online Inquiry tool. None of these four hospitals’ Online Inquiry tools is real-time while almost all the counterparts on Chinese private hospitals are. All questions for these four hospitals are answered by their doctors. Since doctors in any hospital have to work with patients, non-medical staff members usually have to answer questions from visitors on private hospitals’ Web sites in real time. Such answers oftentimes are shallow and even irresponsible [11,23]. What is worse is that the Online Inquiry tool on numerous Chinese private hospitals’ Web sites are designed in such a way that “it stays no matter where a user navigates on a page; it blocks the content behind it; when a user clicks to close it, it comes back after a few seconds; it shakes to call attention” (p. 81) [17]. In short, such an Online Inquiry window is very annoying and intrusive. Chinese private hospitals are financially self-sustaining. It is understandable why they need to aggressively market themselves online, but they have much to learn from these four state-owned Chinese hospitals in terms of establishing a good reputation by interacting with patients’ responsibly and professionally and developing their Web sites with their patients’ interests as the top priority.

In his diffusion of innovation theory, Rogers [24] characterized adoption participants into five categories from innovators, early adopters, early majority, late majority and laggards. He wrote, “In deciding whether or not to adopt an innovation, we all depend mainly on the communicated experience of others much like ourselves who have already adopted” (p. 293). In other words, the early adopters of an innovation can profoundly affect the innovation decisions of late adopters. The four hospitals in this study are all early adopters of healthcare new media. Their outstanding performances today can shed light on the Web development in many other Chinese hospitals that are going through the same healthcare new media adoption. The findings and conclusions from this study can also help Chinese hospitals form their new visions in serving patients online.

Acknowledgements

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References


Perspectives of Champlain BASE Specialist Physicians: Their Motivation, Experiences and Recommendations for Providing eConsultations to Primary Care Providers

Erin KEELY, Paul DROSINIS, Amir AFKHAM and Clare LIDDY

Department of Medicine, University of Ottawa, Ottawa, Canada
Division of Endocrinology/Metabolism, The Ottawa Hospital, Ottawa, Canada
C.T. Lamont Primary Health Care Research Centre, Bruyère Research Institute, Ottawa, Canada
The Champlain Local Health Integration Network, Ottawa, Canada
Department of Family Medicine, University of Ottawa, Ottawa, Canada

Abstract. Electronic consultation can improve access to specialist care. However, specialists have been identified as less likely to adopt electronic solutions in clinical settings. We conducted an online survey to explore the perspectives of specialists who use the Champlain BASE eConsult service in Eastern Ontario, Canada. Specialists were asked their opinions on experience with the service, their current consult/referral practices, recommendations for change and expansion of the service, and compensation models. We tabulated descriptive statistics from the multiple choice and Likert scale responses and performed a content analysis with an emergent code strategy for open-text responses. Specialists (n=34, 77% response rate) agreed that the Champlain BASE eConsult service is a feasible way to improve access to specialist care (94%), improves communication between specialists and primary care providers (PCPs) (94%), has educational value for PCPs (91%), and is user friendly (82%). A majority of specialists (88%) felt the service should be expanded provincially and 67% felt it should allow specialist-to-specialist consultation. 88% of specialists agreed that the current compensation process is best. This study provides an in-depth look at the perspective of the specialist physicians who use the Champlain BASE eConsult service. Specialists stated specific recommendations for change that will allow us to ensure the service remains sustainable.

Keywords. electronic consultation, eConsult, specialist care, access to care, wait times

Introduction

Reform of the referral-consultation process is needed as access to specialty care remains a major barrier to effective health care in Canada. In the Canadian universal
health insurance programs, access to a specialist requires a referral from a primary care provider (PCP) or other physician. With the traditional referral-consultation process, the patient must meet with the specialist before recommendations are provided to the PCP.

Canada has the second longest wait times for seeing a specialist compared to ten other countries [1]. Forty-one percent of patients waited over two months to see a specialist and 73% of PCPs identified long waits to see a specialist as a frequent barrier to patient care [2,3]. Excessive wait times, inequitable access depending on geographic location, and poor communication between providers leads to patient anxiety, delays in diagnosis, duplication of services, dissatisfaction among providers, and ultimately poor patient care [2,3].

Innovative specialist care services that are population-based, centrally organized, and integrated with emerging technologies such as eConsult can greatly improve access to specialist care [4-13]. However, physician engagement remains a key barrier to implementation of new ideas and technology [8]. Specialist physicians have been identified as being less likely to adopt electronic solutions in clinical settings, and there is very little information on what motivates specialists to become involved in electronic services such as eConsult [11,14].

In order to reduce wait times for access to specialist advice, we developed a novel eConsult service, Champlain BASE (Building Access to Specialists through eConsultation). We have recruited and retained over 50 different specialty services that have provided over 4600 eConsults to date. Physician engagement and commitment was essential for the success of this project. The goal of this study was to explore the perspectives of specialist physicians who currently provide eConsults, understand what motivated them to become involved in and continue to provide this service, and use these perspectives to help inform the planning of eConsult services in other regions.

1. Methods

The study was based in the Champlain Local Health Integration Network, which is one of 14 regional health districts in Ontario, Canada. It has a population of 1.2 million people [15].

We administered a 25-item, web-based questionnaire to specialist physicians registered to use the Champlain BASE eConsult service on or before May 20, 2014 if they had responded to at least one eConsult. Specialists who had not yet completed the survey received two reminder emails.

1.1. The eConsult Service

The Champlain BASE eConsult service is an asynchronous web-based application that allows PCPs (family doctors or nurse practitioners) to submit a patient-specific question to a specialty. PCPs fill out a four-field electronic form and have the option to attach any other pertinent electronic files (e.g., laboratory results, digital images). The case is assigned to an individual specialist who is asked to respond within a week. Specialists have the option to request more information, provide a recommendation, or suggest a face-to-face referral (not necessarily to their own clinic). The communication between the PCP and the specialist is iterative, with each provider receiving a
notification email to alert them about new information of pending action. The full
details of the eConsult service development have been reported elsewhere [5,9,13].

In Ontario's universal health insurance system, access to a specialist generally
requires a referral from a PCP or other physician. Most specialists are paid based on fee
for service with some physicians or practices compensated in other ways depending on
their practice model (e.g. capitated, salaried). The fee structure varies depending on the
specialty type. A novel compensation model was implemented for the Champlain
BASE eConsult service that is separate from the provincial billing program: all
specialists are remunerated on a quarterly basis using a standard hourly rate ($200 per
hour) that is pro-rated to the self-reported time it takes the specialist to complete the
eConsult. PCPs are not remunerated.

1.2. Survey Design

The 25 item survey was developed based on a review of available literature and
designed to answer questions raised by policy makers, specialists, funders, and the
eConsult project team. Specialists were asked their opinions in four key areas:
experience with the service, current consult/referral practices, compensation models,
and recommendations for change and expansion of the service. Questions were
answered via a mix of rank ordering, multiple choice, Likert scale, and open text.

1.3. Analysis

Descriptive statistics were generated by exporting the data collected in FluidSurveys.
For questions that were answered using the 6 point Likert scale, we recoded the
answers into a binary variable by collapsing Likert values 1-4 (chose not to answer to
neither agree nor disagree) and values 5-6 (agree or strongly agree). One specialist did
not complete the entire survey so we analyzed their answers where appropriate.

As different specialists joined the eConsult service at different times, we examined
response bias between responding and non-responding specialists by comparing both
demographic characteristics and familiarity with the service (length of time registered
and number of eConsults answered). Statistical testing was done via the Wilcoxon
Rank Sum Test and Fisher’s Exact test where appropriate. All statistical tests were

In 13 questions there was an opportunity for the specialists to expand on their
multiple choice answer or to leave an open text comment. We performed a content
analysis with an emergent code strategy based on these written responses. Two
reviewers coded the responses separately and met regularly to develop and define the
codes. The entire team met on multiple occasions to obtain consensus on the codes and
resolve any disagreements.

2. Results

Forty-five specialists were eligible to participate, of whom one was a principal
investigator and thus excluded. Thirty-four specialists answered the survey (response
rate 77.3%) representing 23 different specialty services including internal medicine
subspecialties, surgical services, pediatrics, obstetrics, radiology, and psychiatry. The
majority worked in a university-based practice, slightly more participants were male,
and most were between the ages of 30-49 (see Table 1). The current estimated wait time for a non-urgent appointment was reported as greater than 6 months for 45% of respondents, 3-6 months for 21%, 1-3 months for 24%, and less than one month for only 6%.

Responding and non-responding specialists showed no significant differences based on gender (p=0.73) or number of years registered to use the service (p=0.62). However, specialists who responded to the survey had answered more eConsult cases compared to non-responding specialists (p=0.046).

### Table 1. Characteristics of specialist physicians who participated in the study.

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Distribution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender [% (No.)]</td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>47.1 (16)</td>
</tr>
<tr>
<td>Age [% (No.)]</td>
<td></td>
</tr>
<tr>
<td>30-49</td>
<td>58.8 (20)</td>
</tr>
<tr>
<td>50+</td>
<td>41.2 (14)</td>
</tr>
<tr>
<td>Number of eConsults answered per specialist [median (IQR)]</td>
<td>43.5 (16-143)</td>
</tr>
<tr>
<td>Time registered in service [years (IQR)]</td>
<td>2.43 (0.6-3.4)</td>
</tr>
<tr>
<td>Type of Practice [% (No.)]</td>
<td></td>
</tr>
<tr>
<td>University-based practice</td>
<td>82.4 (28)</td>
</tr>
<tr>
<td>Community Hospital based</td>
<td>11.8 (4)</td>
</tr>
<tr>
<td>Community-office based group practice with other specialists</td>
<td>8.8 (3)</td>
</tr>
<tr>
<td>Community office based mixed practice with specialist and primary care</td>
<td>8.8 (3)</td>
</tr>
<tr>
<td>provider member</td>
<td></td>
</tr>
<tr>
<td>Community office based solo practice</td>
<td>5.9 (2)</td>
</tr>
<tr>
<td>Other</td>
<td>2.9 (1)</td>
</tr>
<tr>
<td>Specialties Represented [%]</td>
<td></td>
</tr>
<tr>
<td>Pediatrics (9)</td>
<td>Orthopedic Surgery (3)</td>
</tr>
<tr>
<td>Neurology (6)</td>
<td>Gynecology (3)</td>
</tr>
<tr>
<td>Endocrinology (6)</td>
<td>Gastroenterology (3)</td>
</tr>
<tr>
<td>Cardiology (6)</td>
<td>Hematology (3)</td>
</tr>
<tr>
<td>Dermatology (6)</td>
<td>Neuroradiology (3)</td>
</tr>
<tr>
<td>Infectious Diseases (6)</td>
<td>Radiology (3)</td>
</tr>
<tr>
<td>Internal Medicine (3)</td>
<td>Pain Medicine (3)</td>
</tr>
<tr>
<td>Pediatric Cardiology (3)</td>
<td>Rheumatology (3)</td>
</tr>
<tr>
<td>Other</td>
<td>Chose not to answer (12)</td>
</tr>
</tbody>
</table>

#### 2.1. Using the Champlain BASE eConsult Service

The majority of specialists stated that their motivation to sign up for the service was that it allowed them to provide innovative patient care (79%) and improved their communication with PCPs (70%). When asked for their top 3 reasons for continuing to be involved in the eConsult service, 56% listed improved access for primary care, 21% ongoing positive feedback from PCPs, and 15% the potential to integrate into referral/triage process (see Figure 1). Eighty-two percent felt the service is user friendly and 79% felt eConsult is easily integrated into clinical workload. Over 90% of all specialists agreed or strongly agreed that the eConsult service improved access to specialist care, resulted in improved communication between providers, and was a good mechanism for providing education to PCP.
Figure 1. Top three motivations for specialists’ continuing involvement in the eConsult service. (n=34)

2.2. Compensation Models

Eighty-eight percent of specialists agreed that the current compensation process is best, 67% felt that the current compensation rate was fair, and 85% agreed the current frequency of payments is reasonable.

While many specialists (67%) were satisfied with the rate of compensation they received for eConsult, some felt payment should be higher. Though most specialists felt that eConsults were easier to answer than traditional consultations, they expressed differing opinions on whether this justified a lower rate of compensation. Some felt the pay should be increased in order to ensure competitiveness of the service, while others argued that they should receive a premium given the rapidity and timeliness of their responses. Similarly, other specialists noted that while the current compensation is fair, the fee is still significantly less than it would have been had they seen the same patient face-to-face: “I appreciate that eConsults is not as onerous a process as an in person consultation and we are not the [most responsible physician] but there does seem to be a substantive discrepancy. That being said I agree that the manner in which payments are tracked and dispersed is good.”

In contrast, specialists who were satisfied with the amount of pay they received cited the non-monetary value of the service: “we are never going to make as much money as face-to-face time. But this is way easier, more useful and kind of fun.” Other comments on compensation included suggestions for modifying how the timing is tracked, creating specific billing codes for eConsult, and remunerating PCPs.

2.3. Next Steps

There was strong support for expanding the service to other regions and allowing for specialist to specialist eConsults (67%). The main reasons given for supporting expansion was the eConsult service’s value in reducing unnecessary face-to-face consultations, ease of use, and ability to provide education and reassurance to PCPs.

Suggestions for changing the current service included improving the technical aspects of the site, increasing discussions around privacy and legal issues, adding folders to save responses to common questions, and allowing for increased feedback from PCPs.
3. Discussion

The Champlain BASE eConsult service is the first multispecialty service of its kind in Canada and is improving access to specialist advice and enabling access to care within days instead of months. Our study is one of the first to examine specialists’ perspectives on an asynchronous eConsult service across a diverse range of specialty services. We found that specialists who use our service are satisfied with it, motivated to participate, and highly supportive of expansion. Specialists supported the current compensation model and method of tracking payments. Some asked for increased compensation to ensure competitiveness while others appreciated the nonmonetary value of the service. Suggestions for change included modifying the overall feel of the application and exploring ways of saving responses to common questions.

The traditional referral process is rife with poor communication between primary and specialty care, which has led to dissatisfaction [16]. In our study, specialists expressed interest in finding new solutions to ensure good communication between PCPs and specialists, a crucial step in improving access for patients and building collegiality between providers [17]. These findings are similar to other studies [12,18].

Previous studies have reported PCPs’ perspectives on single-specialty eConsults. Whited et al. reported that 55% of providers found an educational benefit when performing eConsults (compared to 35% for usual care) [19] and van der Heijden et al. stated in 85% of cases general practitioners noted a positive educational effect [20]. Our study, which reports on multiple specialties, reflects these findings.

Sustaining new services of health care delivery such as eConsult requires new models of funding. Dependency on face-to-face visits as a required element of reimbursement is less critical now, with increases in telemedicine/virtual visits and store-and-forward type eConsult services. Our findings reflect the need to compensate specialists for their time and suggest uniformity between the specialist groups is acceptable as is a time-based payment model. In order for new technology initiatives to succeed, the user must not perceive that the new system is more onerous or takes more time than the traditional model. Our specialists reported that the system is easy to use and the majority found it was easily integrated into their regular workflow.

Our study has several strengths. We have assessed the perspectives of specialist physicians on a number of different dimensions in order to provide recommendations to provincial partners in concert with the multiple, ongoing, and completed research studies on our service. Our examination of the open text comments has yielded rich information that we can use to ensure the service can be sustainable. Our specialists represent a fully engaged population that have answered many eConsults.

Though our sample of specialists are engaged and have great experiences with the service, they are a select group from the underlying population of specialist physicians in our region, and may have responded more positively to the eConsult service than would non-respondents, those who had yet to complete an eConsult, or those were not interested in registering with the service. Selection bias may therefore affect our results, which could limit our study’s generalizability.

Future research is needed to examine those specialists who did not readily adopt the eConsult service in order to understand barriers to participation in this type of technology. Additionally, several specialists requested the ability to save answers to common responses, suggesting that PCPs are consistently asking the same or similar questions. Future research should therefore examine the types of questions being asked in order to provide greater targeted education to PCPs.
Conclusion

Specialists are satisfied with the Champlain BASE eConsult service and recognize the value of providing improved access to patients and providers. They are highly supportive of expanding eConsult across Ontario and stated specific recommendations for change that will allow us to ensure the service remains sustainable.

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References


Improving Mental Health Care for Young Adults in Badakshan Province of Afghanistan Using eHealth

Shariq KHOJA a, Maria Arif KHAN a, Nida HUSYIN a, Richard SCOTT b, Abdul Wahab YOUSAFZAI c, Hammad DURRANI d, Fatima MOHBATALI e, Dodo KHAN a

a Tech4Life Enterprises, Canada and Pakistan
b University of Calgary, Canada
c Shifa International Hospital, Islamabad
d French Medical Institute for Children, Islamabad
 e Aga Khan Health Services, Afghanistan

Abstract. Decades of war, social problems and poverty, have led large number of Afghan youth aged between 18-25 years suffering from mental health problems. Other important contributing factors include extreme poverty, insecurity, and violence and gender disparities, contributing to worsening mental and emotional health conditions in the country. The reported project is designed to strengthen the health system for improving mental health services in the province of Badakshan by improving awareness in the community and empowering frontline health workers. The project uses technological innovations, in combination with traditional approaches, to reduce stigma, enhance capacity of health providers and improve access to the specialist. The project also focuses on skills development of health providers, and empowering them to provide quality mental health services through access to interactive protocols, Management Information system and telemedicine.

Keywords. Mental Health, eHealth, Telehealth, Youth, Afghanistan, Telemedicine

Introduction

About 50% people over 15 years of age in Afghanistan face some kind of mental health problem. The prevalence is reported to be higher in young adults (18-25 years), adversely affecting families and reducing productivity in this key age group [1]. The most common issues in young adults are: depression, anxiety, post-traumatic stress disorders (PTSDs), and drug abuse. The Government of Afghanistan’s ‘Mental Health Strategy 2009-2014’, focuses on community based interventions and improving treatment, but does not have the capacity to implement desired solutions. A mental health care system hardly exists outside the capital city of Kabul [2]. The purpose of this study is to design and test an intervention for strengthening a mental health system that improves awareness in the community, informs health practitionerers, and makes treatment accessible to young adults in the remote province of Badakshan.

1 Corresponding author: khojashariq@gmail.com.
1. Methods

The project follows a community-based interventional design, currently implemented in four districts of Badakshan province, while 3 districts in the same province have been taken as control. Achievement of three distinct approaches combine to achieve the stated goal.

1. **Embraced**: Reduce stigma and emphasize mental health disorders are treatable. This is being achieved through enhancing mental health awareness in the community using interventions, such as town-hall meetings and community discussions. Short message service (SMS) messages are being sent to registered participants in the 18-25 years age group.

2. **Informed**: Raise skills and knowledge of healthcare providers, and information available to them for diagnosing and treating mental health problems. This is being achieved by improving skills and knowledge development through face-to-face and virtual education for community health workers (CHWs), and clinicians at community health centres (CHCs) and district hospitals, and applying blended learning approaches with adult learning principles.

3. **Accessible**: Better diagnosis and treatment at the community and health facility level. This is being achieved by introducing eHealth facilitated service delivery (screening and telemedicine) for rural and remote communities. Service delivery has been enhanced by introducing telemedicine consultations.

This paper presents the initial results from the implementation and adoption of the solutions in the case districts. The impact of the technology, comparing with the control population, will be done after the mid-term evaluation planned in mid-2015.

1.1. Technology

The eHealth program has two main parts: 1. SMS technology for young adults in the community; and 2. a mobile application for health providers. Both these technologies are described below.

1. **SMS Technology for young adults**: SMS messages are sent every week to all the registered users in the community. The messages are sent from the pool of simple messages in local language, targeting four key health problems, i.e., depression, psychosis, PTSD and drug-addiction. The purpose of these messages is to create awareness among the young adults about these mental health problems.

2. **Smartphone application for health providers**: The main objective of the mobile application is to empower the health workers based in the communities and the primary health facilities, for collecting information from and providing services to young adults suffering from four common mental health issues, i.e., depression, psychosis, substance abuse and PTSD. The mental health mobile application follows mental health Gap Action Program (mhGAP) guidelines and protocols from the World Health Organization (WHO), and approved by Ministry of Public Health, Afghanistan. This application is GPS-based, developed on android platform to facilitate the health workers in creating awareness and improving their knowledge about mental health issues. The application has also integrated two other applications i.e. an eLearning platform (Moodle) and a Telehealth...
application (MDConsults). This application is developed in two languages English and Dari (local language) for better understanding and acceptability amongst the community.

1.1.1. Key Features of the Mobile Application:
The mental health mobile application is comprised of five key features.

1. **Patient Information:** Allows collection of individual patients’ information for registration and HMIS of the mental health related issues amongst the community.

2. **Guidelines and Protocols:** Allows interactive access to specific guidelines for each mental health issue that would aid the health care provider to have a better diagnosis by reviewing the signs and symptoms.

3. **mLearning for Community:** Enables access to interactive learning material for the community through health provider for improving awareness in the community.

4. **mLearning for Health Care Providers:** Enables capacity building among Health providers to have a first-hand knowledge about the mental health problems.

5. **Mobile Telemedicine:** Mobile version of MDConsults is used to conduct teleconsultation between the patient and the physician in either live or store-and-forward mode, depending on the available connectivity.

![Figure 1. Menu of mental health mobile application.](image1)

![Figure 2. Template of screening questions](image2)

![Figure 3. Screenshot of MOODLE](image3)

![Figure 4. Menu of mobile telemedicine](image4)
2. Results

To date over 10,000 text messages have been sent to 1200 registered adolescents. The telemedicine application has been implemented and is in use at 4 district level facilities and one hub facility in case sites. A highly versatile mental health mobile application empowers the health workers based in communities and primary health facilities which follow WHO recommended mhGAP guidelines and protocols for screening and referrals. The application has also integrated two other features, i.e. eLearning (Moodle) for learning and a telehealth application (MDConsults) for remote Teleconsultation. Besides that, 51 sessions for the community and 33 blended learning sessions for health providers have been attended by 8,006 community members and 596 health providers.

![Graphs showing distribution of health providers attending face-to-face sessions by gender and age-group](image1)

**Figure 5.** Graphs showing distribution of health providers attending face-to-face sessions by gender and age-group

![Graphs showing distribution of community members receiving text messages by gender and type of messages](image2)

**Figure 6.** Graphs showing distribution of community members receiving text messages by gender and type of messages
### Table 1. Blended earning

<table>
<thead>
<tr>
<th>Activity</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Community Health Workers</strong></td>
<td></td>
</tr>
<tr>
<td>Number of sessions</td>
<td>19</td>
</tr>
<tr>
<td>Number of participants</td>
<td>347</td>
</tr>
<tr>
<td>Number of registered CHWs</td>
<td>93</td>
</tr>
<tr>
<td>Number of access to online modules uploaded</td>
<td>61</td>
</tr>
<tr>
<td><strong>Facility-based health providers</strong></td>
<td></td>
</tr>
<tr>
<td>Number of meetings</td>
<td>14</td>
</tr>
<tr>
<td>Number of participants</td>
<td>249</td>
</tr>
<tr>
<td>Number of registered HPs</td>
<td>27</td>
</tr>
<tr>
<td>Number of access to online modules uploaded</td>
<td>16</td>
</tr>
</tbody>
</table>

2.1. **Mental Health Mobile Application**

The mental health mobile application is currently in use by 95 CHWs and 25 facility-based health workers, serving a target population of over 100,000 in all four case districts. Using the guidelines and protocols, CHWs have performed 1954 screenings to-date in targeted population and identified 160 mental health cases. All these identified cases are served with face-to-face consultations. To date 137 cases have been treated successfully while others are under treatment.

2.2. **Telemedicine Desktop Application in Use at Health Facilities**

Telemedicine desktop application is used to perform in-patient live teleconsultations by establishing the web connection between the health provider who is facilitating the patient; and the mental health specialist at remote end. This desktop application is installed in each health facility of case districts.

### Conclusion

All approaches adopt a mix of traditional and culturally sensitive technology solutions. The program will be further evaluated to demonstrate ‘value’ of the solution, allowing an evidence-based business model to be developed.

### References


Improving Access to Pediatric Cardiology in Cape Verde via a Collaborative International Telemedicine Service

Luís Velez LAPÃO\textsuperscript{a,1} and Artur CORREIA\textsuperscript{b}

\textsuperscript{a} WHO Collaborating Center for Health Workforce Policy and Planning. Instituto de Higiene e Medicina Tropical – Universidade Nova de Lisboa, Portugal
\textsuperscript{b} Ministry of Health, Cape Verde

Abstract. This paper addresses the role of international telemedicine services in supporting the evacuation procedures from Cape Verde to Portugal, enabling better quality and cost reductions in the management of the global health system. The Cape Verde, as other African countries, health system lacks many medical specialists, like pediatric cardiologists, neurosurgery, etc. In this study, tele-cardiology shows good results as diagnostic support to the evacuation decision. Telemedicine services show benefits while monitoring patients in post-evacuation, helping to address the lack of responsive care in some specialties whose actual use will help save resources both in provision and in management of the evacuation procedures. Additionally, with tele-cardiology collaborative service many evacuations can be avoided whereas many cases will be treated and followed locally in Cape Verde with remote technical support from Portugal. This international telemedicine service enabled more efficient evacuations, by reducing expenses in travel and housing, and therefore contributed to the health system's improvement. This study provides some evidence of how important telemedicine really is to cope with both the geography and the shortage of physicians.

Keywords. Extending access, Telecardiology, Evacuations and follow-up services.

Introduction

The Cape Verde’s National Healthcare Service (NHS) provides a basic set of health services, from promotion to treatment and recovery, and regulates and supervises the activities and quality of provision. Given the structure of human resources, the NHS \cite{1} does not have specialists in all areas of medicine, with shortages in some key specialties and lacking also technological responses for diagnosis and treatment of some diseases. This presents an opportunity to study the problem and solutions of medical evacuations.

Miot et al. \cite{2} defines telemedicine as the provision of health services at a distance and as a way to meet the needs of the population, especially that found in remote geographical areas or with poor accessibility to healthcare \cite{3}. The use of telemedicine in providing healthcare in remote areas is an economic, social and human development asset to their communities \cite{4}. According to the WHO \cite{5}, telemedicine could provide health services in situations where distance is a critical factor. Telemedicine has been

\textsuperscript{1} Corresponding author: luis.lapao@ihmt.unl.pt.
providing health services with very effective results, when compared to the benefits under conventional practice [6] and with the support of information systems [7].

Paediatric cardiology (PC) pathology is very constant and broadly spread among the child populations: In statistical terms, in every 1000 born children 8 have cardiopathies of some sort [8]. A significant number of parents live outside Cape Verde's main islands; their children will be born in regional hospitals, not having direct access to PC specialists. A supplementary factor that enhances the potential of telemedicine is that a quick and correct diagnosis of complex cardiopathies is possible and that healing and adjusted follow-up is possible as well. International telemedicine services with Cape Verde started in 1999, when a modus operandi between the Hospital Agostinho Neto (HAN) located in Praia and the University Hospitals of Coimbra (UHC) was signed. The main objective was to support and follow the gynaecology and obstetrics course conducted at HAN, with specialist support from the UHC. However, it was pediatric cardiology that took the lead due to pressure from health professionals and parents.

1. Telemedicine Services Opportunity

Today telemedicine is no longer a technical issue but a business one: a sustainable service needs to be properly developed [9]. Still, there are areas of concern like the threat of malpractice due to misdiagnosis, which raises questions over the acceptability of image quality, and the reluctance of physicians to become involved in telemedicine [10].

The resistance to change is significant since telemedicine introduces new, and uncertain, aspects into the services, even more if one thinks on international services that have to cope with regulations and legislative framework of the countries participating [11]. To overcome this, benefits and the real impact on populations’ health should be shown. There are also human and economic factors [11]. The human factors are linked with the equipment use, difficulties in adopting telemedicine (i.e., technical support, coordination between sites, etc.) and service customization (i.e., target population, interaction with other organizations, etc.). The economic factors are professional image (i.e., impact on social recognition, use of innovation, etc.), written benefits (i.e., fair relationship between effort and return, understanding costs, less medical error, etc.), service billing (i.e., clear rules for service payment) and healthcare organization (i.e., impact on the interaction of system actors).

Considering physicians, although they show interest they are often afraid of increasing their workload, the patients’ hostile response, lack of reimbursement and lack of leadership from the management [12-14]. Patients are usually quite satisfied, mostly due to good communication and to commuting avoidance [15-17]. Teledermatology (first referenced in Medline in 1992) seems to be a much more recent telemedicine application than teleradiology (first reported in 1950). Projects generally served sparsely populated areas, resulting in insufficient patient contacts to provide statistically valid data [18]. Factors that influenced the timing of trials of telemedicine were technology-driven as opposed to needs-based. Most projects have taken place, mainly focusing on technical feasibility, during periods when commercial providers were injecting funding [19].
2. Cape Verde Reform Challenge

The NHS is organized according to levels of care. Health-centers are the entrance in the system and the gateway to hospital care, which are considered the central structure of care. However, the stock of specialists cannot respond to all health problems of the population, which gives to medical evacuations additional importance, as an ultimate level of the NHS. Telemedicine services could play an important and critical role linking levels of care.

Medical evacuations are a major challenge, financially and socially, for evacuated patients and families. The largest destination for patients from Cape Verde is Portugal, based on a protocol signed between the two countries. In 2010, 341 patients were evacuated: neoplasm (about 24% of cases) and circulatory system diseases (including cardiology and pediatric cardiology), with about 17%, are the main situations.

3. Methodology

Mixed methods were used in this study: qualitative and quantitative analysis, descriptive, using a focus group, semi-structured interview and case study for studying the financial impact of external processes evacuations. Data and reports from the Ministry of Health were also used.

The focus group research technique was applied joining cardiologists from HAN, who participated in sections of telemedicine, and public health physicians responsible for the evacuation process and decision-making [20]. Formal invitations were sent nominal and customized with a week's notice, including copies of the authorization of the ethics committee for the research, for the five doctors in the cardiology of HAN; of the five invited doctors, the study involved three since one doctor was on vacation outside the country of nationality and the other claimed not to have knowledge of Portuguese to participate in the study. The focus group was moderated by one of the researchers, who then explained and informed participants of all details including the objectives of the research, and invited them to sign the terms of consent. The focus group followed a pre-established guide including topics for discussion.

Given that medical evacuation is mostly a clinical issue, an open-ended questionnaire was added to allow respondents to freely express their views and perceptions on different aspects of the subject; and a case study was written to enable better understanding of the costs and benefits involved [21].

4. Technology and Services Description

In 2000, a project in Brava Island (Cape Verde) with the support from the U.S. Embassy, designed an ISDN line platform (with 128KBps of bandwidth) and using NetMeeting for communication with the transmission image of X-Rays in JPEG. Despite the quality of the JPEG, the image was not the best, but physicians managed to communicate and often to establish a diagnosis. In 2007 it was organized, supported by the European Community, as a technical action aiming at uniting two central hospitals and a hospital in Spain, to both train physicians and to enable second opinion consultations on Neuroradiology CT-Scan reports. For this purpose a universal platform was used integrating DICOM protocols suitable for the diagnosis of quality pictures
with echo-graphs integration and high-resolution cameras. From this the ISDN
communication protocol with eight 1024Kps of capacity was used.

In 2009, with support from the UHC, and sponsored by both Cape Verde and
Portuguese Telecom (PT), it was organized as an action aiming at developing PC services.
It also included a component of training and post-evacuations follow-up [22]. In 2010,
Chinese cooperation had initiated a connectivity project (with a fiber-optic network) to
support telemedicine services within Cape Verde. In 2012, a cooperation project started,
financed by Slovenia (and entirely in Portuguese), linking all health infrastructures of
Cape Verde with the two central hospitals.

Telemedicine service is based on Medigraf equipment, enabling the distance
visualization of an eco-cardiogram. All the images and sounds can be recorded in the
system database (~1 Mbps per session). The data can be recorded at both places. The
system simply requires a 512 Kbps link, or alternatively a VPN integrated in the RIS
(Portuguese Healthcare Network). The network now joins the Portugal, Cape Verde,
Angola and São-Tomé-e-Príncipe.

Since 2009, the telemedicine service has already validated the evacuation of 31
patients with a PC diagnosis. These patients represent the sample considered in this case
study. The patient ages varied between 1 month and 11 years old. The entire evacuation
process, of whatever kind, depends on a physician's proposal, and it requires approval by
the Board of Public Health (BPH).

A survey was done to validate patient acceptance. Most parents accepted well the
use of technology, understanding the impact on costs reduction and added convenience
(since 49% had no heart disease diagnosed). When necessary the patient will later go for
a face-to-face evaluation (evacuation) in the HUC. In some cases children were treated
with diuretics and the tele-consultation was subsequently repeated.

A Tele-consultation viability test was performed in the first year with 78 cases.
Most diagnostics were confirmed in a face-to-face consultation, 10% had a surgical
indication and only 0.013% of diagnostics (one) were not confirmed.

5. Case Study Results

External evacuations using telemedicine follows a similar workflow process, the
difference is that the case had been previously studied and decided by both Cape Verde
and Portuguese physicians. These includes patient results from tests performed locally, a
tele-cardiology diagnosis and in some cases, a proposed therapy. In these cases the
decision to evacuate the patient is facilitated. The BPH have regular meetings to analyze
the processes and to authorize evacuations. The process flow chart is virtually the same,
with the advantage of allowing the sick leave process to be studied, with the possibility
to immediately start receiving treatment. Another advantage is to treat locally many
patients relying on the follow up done remotely.

The focus group first addressed beneficial and cost issues. There is a general
opinion that communication costs are still high: on average € 5,000/month for two
sessions per week, lasting between 1-to-2 hours, with an average of 3-4 patients. The
communication quality is good, however from time to time with some technical
interruptions. As strong points are the strength, the quality and unconditional support
from PC team at UHC. It was recognized that telemedicine services have avoided
numerous evacuations, reducing the financial and social consequences. Several
participants also revealed that the evacuation processes with telemedicine were faster
than without telemedicine. Both experts from the hospital and the BPH pointed out the difficulties in arranging consultations in Portugal after the evacuation decision was taken, in which patients have to cope with waiting lists for surgery.

There is the perception, by several participants, that almost 100% of the evacuation diagnoses are confirmed in Portugal, establishing the technical quality of the process. Telemedicine also helps on issuing a second opinion especially when there are uncertainties; it helps the decisions for cases that evacuation is the unique solution available and also contributes to enrich the experiences and technical approach of HAN physicians. One participant mentioned that, with cases of evacuation of patients to Coimbra with telemedicine, the treatment and return to Cape Verde were faster.

The interview results were not very different from the focus group. The participants demonstrated collaboration and total openness to talk about all issues. There was some difficulty in getting different opinions. The whole evacuation process is done by the BPH map that should be approved by the Minister of Health. It goes through the following steps after approval:

• Contact with the Consular Section of the Embassy of Cape Verde in Portugal;
• Request for travel tickets directly to social services of the Ministry of Health;
• Application for visa at the Consular Services of the Embassy of Portugal;

If the evacuation is of utmost urgency it goes directly through an emergency service. For the non-urgent evacuation cases, interviewees were unanimous in considering that most processes were swift in Cape Verde, but they would find difficulties in communicating with the Portuguese health structures. The participants concluded that the formal institutionalization of telemedicine in the process of evacuation would be beneficial in allowing an effective control of patients evacuated.

6. Business Services Benefits

The evacuation process is a fundamental feature of healthcare in Cape Verde. Whenever the constraints of the country relating to the lack of technical resources, human, material, means of diagnosis and treatment endanger the lives and safety of the patient. Of the 31 patients studied, 45% had a family member accompanying and a nurse. There is a fee for specific transportation of medical evacuations: the cost of transportation can vary between 1500 and 2500 € per evacuation [23]. Other costs (like allowances for health professionals and patients and their companions, etc.) could reach € 300 month, not mentioning medicine costs [23]. The cost of the treatments performed, according to the evacuation protocol, is to be taken by the Portuguese NHS.

Telemedicine services, by reducing several evacuations, avoid all these costs, not to mention the family and social issues of living abroad; and if we take into account that the NHS already has the equipment for teleconsultation, the cost of operation is perfectly manageable and benefits justified. The cost reduction is even more noticeable when it comes to follow up where the patient does not need to move, receiving their treatment in their home environment saving the financial and social costs caused by family separation.
Conclusion

Despite some limitations, the evacuation procedure is an important asset and cost-effective service that can be used in diagnosis, treatment and follow-up, bringing benefits and improvements to the NHS both in terms of access to quality services and in terms of costs. Nevertheless with the increasing cost of the provision of healthcare, the deficit of professionals, allied financial difficulties to finance the technology to perform heart surgery in Cape Verde telemedicine has brought a reduction in the time for accessing services and decreasing cases of evacuation, as well as minimizing the costs to follow up with consequences at the level of costs associated with the process.

This study also highlights that telemedicine can be important for Cape Verde in other areas (ophthalmology, dermatology, etc.), given the need to offer specialized care that the country does not have, neither the technical level of the central hospitals and reference even less locally where demand is growing as a result of changing epidemiological profile, as well as the issue of geographical dispersion, there is an urgent need to seek solutions to resolve these issues. Telemedicine is the only solution already experimented with tangible results both nationally and internationally.

Several reports have recommended the need for effective coordination of medical evacuations from Cape Verde [23], not merely on the bureaucracy but also focusing on a more interventionist, pro-active monitoring and controlling processes.

Telemedicine needs to be addressed as organizational and business service. The MOMENTUM approach is now been used to further address this issue. There are clear clinical advantages, such as inter-changes between hospitals, better use of equipment and distance teaching and learning. There are also advantages for the patients, such as quick clinical diagnostics, better waiting list control, costs reduction and access to pediatric cardiology consultation from remote places. This study proves how important telemedicine really is to cope with both the geography and the shortage of physicians.

Acknowledgment

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References

Improving Access to Cardiac Rehabilitation Using the Internet: A Randomized Trial

Scott A. LEARa,b 1, Joel SINGER c,d, Davina BANNER-LUKARIS e, Dan HORVAT f, Julie E. PARK g, Joanna BATES h, and Andrew IGNASZEWSKI b

a Faculty of Health Sciences, Simon Fraser University
b Division of Cardiology, Providence Health Care
c Centre for Health Evaluation and Outcome Sciences, Providence Health Care
d School of Population and Public Health, University of British Columbia
e School of Nursing, University of Northern British Columbia
f Department of Family Medicine, Faculty of Medicine, University of British Columbia
g Department of Medicine, Faculty of Medicine, University of British Columbia

ABSTRACT. Cardiac rehabilitation (CR) is essential for secondary prevention, yet only 10%-30% of eligible patients attend as geographical proximity is a major barrier. We evaluated a ‘virtual’ CR program (vCRP) delivered by the Internet to patients in small urban and rural areas. In our study, in-patients (n=78) with acute coronary syndrome or post-revascularization were randomized to usual care (UC) or vCRP. The vCRP was a four-month program that included heart rate monitoring; physiologic data capture; education sessions; ask-an-expert sessions; and chat sessions with a nurse, exercise specialist and dietitian. Participants were assessed at baseline and four months, and followed for another 12 months. The primary outcome was change in maximal time on the treadmill stress test (MTT) between groups adjusted for age, sex, diabetes status and Internet use for health information. The vCRP resulted in a greater increase in MTT by 45.7 seconds (95% CI: 1.0, 90.5) compared to usual care (p=0.045). Cholesterol levels and dietary quality improved in the vCRP compared to the UC group. Participants perceived the vCRP to be an accessible, convenient and effective way to received healthcare. Eleven (30%) and 6 (18%) participants in the UC and vCRP groups, respectively, had cardiovascular-related events (p=0.275). In conclusion, the vCRP was safe and effective and resulted in sustainable risk reduction without the requirement of face-to-face visits and directly monitored exercise.

Key Words. telemedicine, exercise, risk factors, cardiac rehabilitation

Introduction

Patients with cardiovascular diseases (CVD) are at greater risk of subsequent events, co-morbidities and premature mortality, therefore effective and ongoing management is needed to reduce this risk. Cardiac rehabilitation programs (CRP) are effective at improving lifestyle behaviours and reducing risk factors in CVD patients, as well as reducing CVD events and premature mortality, while being cost-effective [1-4].

1 Corresponding author: SLear@providencehealth.bc.ca
However, as little as 10% to 30% of eligible patients attend these programs [5-9] as the majority of CRP are limited to hospitals in large urban areas with geographical accessibility as one of the main barriers to attendance [10-11].

The proliferation of low-cost communications technology, such as the Internet, has opened up an array of opportunities for patient communication while bridging geographic distance. The Internet holds great promise in improving access to health care services as it is ubiquitous, requires little infrastructure and cost, and is readily scalable to large populations. Despite the enthusiasm for technology supported health care services, the evidence to support such use in cardiac rehabilitation is limited to feasibility and pilot studies [12-15]. We conducted a 16-month randomized controlled trial with blinded outcome assessment consisting of a four-month vCRP with a 12-month sustainability follow-up on exercise capacity and risk factor reduction compared to usual care in patients living in small urban and rural communities without access to standard CRP.

1. Methods

Cardiac in-patients (admitted for either acute coronary syndrome or revascularization procedure) from two hospitals in British Columbia were screened for study eligibility. To be eligible, participants must have resided in either Northern British Columbia, or the Coast Garibaldi region, as these areas are geographically isolated from the metropolitan areas, comprised of significant rural areas and scattered communities and have no outpatient CRP. Patients must have been at low or moderate risk [16], had regular Internet access (home, work or other environment), no physical limitations to regular physical activity and were fluent in English. Patients with previous experience with cardiac rehabilitation, depression, uncontrolled diabetes and other significant comorbidities that may interfere with effective cardiovascular management, pregnant women and those who the attending physician thought were unsuitable for participation were excluded. This study was registered at ClinicalTrials.gov (registration number: NCT00683813) and approved by the Simon Fraser University, Providence Health Care and Northern Health Authority Research Ethics Boards. All participants provided informed consent.

1.1 Outcome Measures

The primary outcome of exercise capacity was determined through a symptom-limited maximal treadmill exercise test using the Bruce protocol [17] and reported as maximal time in seconds as a proxy indicator. The study was powered to detect a clinically relevant difference (delta) of 60 seconds between the groups considering both the 4-month and 16-month time points. Total cholesterol, HDL-C, triglycerides and blood glucose were assessed from fasting blood samples collected in the morning. Blood pressure was assessed using the BpTRU (model BPM-200, VSM MedTech Ltd.) oscillometric office BP monitor [18] and taken as the average of five measures in the left arm following 10 minutes of seated rest. Smoking status was determined by self-report. Body mass index was calculated from weight in kilograms divided by height in metres squared. Weight was assessed with participants in light street clothing, footwear removed and pockets emptied. Waist circumference was recorded in centimetres as the average of two measures taken at the point of maximal narrowing against the skin.
following a normal expiration. Physical activity was determined by the 4-week modified Minnesota LTPA questionnaire and reported as the average weekly kilocalories (kcal/wk) expended [19]. From this questionnaire we further determined leisure time physical activity by removing the categories regarding lawn and garden, and home repair activities as well as any household or work related activities. Diet was reported as percent daily kilocalories fat, protein and carbohydrates using a three-day food record [20] analyzed by a registered dietitian using the ESHA Food Processor SQL Software (Salem, OR). Hospital admissions and emergency room visits were identified by patient self report and confirmed through collection of medical records. These medical records were adjudicated by the study cardiologist (AI) blinded to the participant group assignment and categorized into emergency room visit events only and major cardiovascular events (revascularization, unstable angina requiring hospitalization, stroke and death of any kind).

1.2 Study Procedures

Following baseline assessment, participants were randomized (1:1) to either usual care or the ‘virtual’ cardiac rehabilitation program (vCRP). The randomization research coordinator informed the participants of their group assignment.

Participants randomized to usual care (care from their primary care physician) were given simple guidelines for safe exercising and healthy eating habits, and a list of Internet-based resources. Apart from the study follow-up assessments, there was no contact between the study personnel and the usual care participants for the duration of the study, nor was there any attempt to control for the level of patient care.

Participants randomized to the intervention were registered to the vCRP website with a unique username and password, and received an off-the-shelf heart rate monitor (Polar s610i) and a home blood pressure monitor (Lifesource UA779) for the intervention. Participants underwent a 30 minute in-person training session following their randomization on the use of the vCRP, heart rate monitor and blood pressure monitor. The vCRP included on-line intake forms (medical, risk factor and lifestyle forms), scheduled one-on-one chat sessions with the program nurse case manager, exercise specialist and dietitian (three times each during the 12 weeks), weekly education sessions in the form of interactive slide presentations, data capture for the exercise stress test and blood test results, progress notes (for health professionals), and monthly ask-an-expert group chat sessions.

Upon logging in participants were directed to the webpage that corresponded to their week in the vCRP. This page displayed the tasks that needed to be completed for each week. The one-on-one chat sessions were used to discuss progress, any change in symptoms, provide exercise prescription, dietary recommendations, and risk factor management. The heart rate monitor allowed for exercise heart rate data to be stored and downloaded to the patient’s home computer and then uploaded to the vCRP webserver. Participants were asked to wear their heart rate monitors when exercising and upload their exercise data at least twice per week onto the vCRP. In addition, they were to enter their weight, pre- and post-exercise blood pressure, and random glucose (if diabetic) twice per week for 2 weeks, once per week for 2 weeks and once per month thereafter, unless instructed otherwise by the nurse case manager.

Participants from both groups returned for a follow-up assessment after four months. After this time, participants in the vCRP group were graduated from the program and returned to usual care. vCRP participants underwent a semi-structured,
open-ended interview at the end of the intervention to assess patient satisfaction and attitudes. After another 12 months, all participants returned for a subsequent final assessment.

1.3 Statistical Analyses

Distributions of continuous variables are reported as median and interquartile ranges (25th and 75th percentiles) while counts and percentages are reported for the categorical variables. In order to account for the correlations between multiple measures within an individual, linear mixed effects models were used to compare the group differences over time. Follow-up assessments (i.e. measures at 4 months and 16 months from baseline) were taken as the outcome while adjusting for the baseline value to capture the true intervention effect using intent-to-treat analysis. Age, sex, type 2 diabetes and Internet use for health information, were chosen for the multivariate models. These covariates were chosen due to their relationship with the primary outcome. Comparisons of dichotomous outcomes between groups were made using the Fisher’s exact test. P-values less than 0.05 were considered statistically significant. All statistical analyses were performed using SAS 9.3 (SAS Institute, Cary, NC).

2. Results

A total of 78 participants were recruited and randomized to usual care (n=40) or the vCRP (n=38). Participants were well balanced with respect to the demographic variables except for family history of CVD and current diagnosis of type 2 diabetes (Table 1).

| Table 1. Baseline demographics and medical history of the two study groups. |
|-----------------|------------------|------------------|------------------|------------------|
|                 | Usual Care (n=40) | Intervention (n=38) |
| Age             | 58.4 (52.8, 64.7) | 61.7 (51.3, 65.2) |
| Male            | 32 (80%)          | 34 (90%)          |
| Education       |                  |                  |
| Less Than High School | 9 (23%)        | 8 (21%)          |
| High School     | 8 (20%)          | 10 (26%)         |
| Some Post-Secondary | 9 (23%)        | 9 (24%)          |
| Post-Secondary Degree/Diploma | 10 (25%)  | 9 (24%)          |
| Post-Graduate Degree | 4 (10%)       | 2 (5%)           |
| Average Annual Household Income |            |                  |
| <$20,000        | 2 (5%)           | 3 (8%)           |
| $20,000 to $30,000 | 2 (5%)         | 1 (3%)           |
| $30,000 to $40,000 | 2 (5%)         | 4 (11%)          |
| $40,000 to $50,000 | 1 (3%)         | 0 (0%)           |
| $50,000 to $60,000 | 5 (14%)        | 4 (11%)          |
| >$60,000        | 25 (68%)         | 25 (68%)         |
| Marital Status  |                  |                  |
| Single          | 1 (3%)           | 2 (5%)           |
| Common Law      | 1 (3%)           | 3 (8%)           |
| Married         | 35 (88%)         | 29 (76%)         |
| Divorced        | 1 (3%)           | 3 (8%)           |
| Widowed         | 2 (5%)           | 1 (3%)           |
| Family History  | 14 (35%)         | 20 (53%)         |
Internet access and use at baseline were similar between the two groups apart from a higher rate of accessing the Internet for health information in the vCRP group (data not shown). The baseline values of the primary outcome of maximal time on the treadmill and the secondary outcomes were clinically similar between the groups (Table 2).

### Table 2. Baseline risk factors of the two study groups.

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Usual Care</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total time on exercise stress test (seconds)</td>
<td>543 (430, 581)</td>
<td>545 (446, 578)</td>
</tr>
<tr>
<td>Total cholesterol (mmol/L)</td>
<td>3.47 (2.96, 4.39)</td>
<td>3.60 (2.95, 4.47)</td>
</tr>
<tr>
<td>LDL-C (mmol/L)</td>
<td>1.81 (1.51, 2.21)</td>
<td>1.84 (1.33, 2.31)</td>
</tr>
<tr>
<td>HDL-C (mmol/L)</td>
<td>1.02 (0.82, 1.30)</td>
<td>1.00 (0.86, 1.26)</td>
</tr>
<tr>
<td>Triglycerides (mmol/L)</td>
<td>1.26 (0.96, 1.61)</td>
<td>1.50 (0.96, 2.35)</td>
</tr>
<tr>
<td>Total cholesterol/HDL-C</td>
<td>3.22 (2.70, 4.36)</td>
<td>3.38 (2.78, 4.11)</td>
</tr>
<tr>
<td>Blood glucose (mmol/L)</td>
<td>5.5 (5.0, 6.1)</td>
<td>5.8 (5.2, 6.5)</td>
</tr>
<tr>
<td>Systolic blood pressure (mmHg)</td>
<td>115 (109, 130)</td>
<td>122 (109, 133)</td>
</tr>
<tr>
<td>Diastolic blood pressure (mmHg)</td>
<td>76 (69, 83)</td>
<td>76 (69, 85)</td>
</tr>
<tr>
<td>Smoking status</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Never</td>
<td>10 (25%)</td>
<td>12 (32%)</td>
</tr>
<tr>
<td>Former</td>
<td>28 (70%)</td>
<td>23 (61%)</td>
</tr>
<tr>
<td>Current</td>
<td>2 (5%)</td>
<td>3 (8%)</td>
</tr>
<tr>
<td>Body mass index (kg/m²)</td>
<td>29.7 (27.3, 33.6)</td>
<td>29.9 (26.2, 33.1)</td>
</tr>
<tr>
<td>Waist circumference (cm)</td>
<td>103.7 (96.4, 111.1)</td>
<td>102.9 (95.5, 114.2)</td>
</tr>
<tr>
<td>Leisure time physical activity (kcal/week)</td>
<td>1130 (583, 2169)</td>
<td>1300 (724, 2761)</td>
</tr>
<tr>
<td>Dietary intake</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbohydrate (% kcal/day)</td>
<td>43.4 (40.5, 48.3)</td>
<td>49.2 (45.4, 52.5)</td>
</tr>
<tr>
<td>Protein (% kcal/day)</td>
<td>17.8 (16.0, 20.9)</td>
<td>17.8 (15.1, 21.4)</td>
</tr>
<tr>
<td>Fat (% kcal/day)</td>
<td>35.0 (31.4, 42.1)</td>
<td>30.2 (26.3, 34.5)</td>
</tr>
<tr>
<td>Saturated fat (% kcal/day)</td>
<td>10.9 (8.0, 12.0)</td>
<td>8.3 (6.2, 11.0)</td>
</tr>
</tbody>
</table>

The median number of website logins per person was 27 (range: 0 to 140), while the median values for exercise sessions and blood pressure measures uploaded was 22 (range: 0 to 138) and 3 (range: 0 to 9), respectively. There were 122 one-to-one private chat sessions between the vCRP participants and either the nurse, dietitian or exercise specialist, which averages to 3.6 per participant. The average participant utilized 2.4, 2.6 and 2.7 hours of nursing, dietitian and exercise specialist time, respectively.

After adjustment for the maximal time on the treadmill at baseline, age, sex, type 2 diabetes and Internet use for health information, participants in the vCRP had a greater increase in maximal time on the treadmill by 45.7 (95% CI: 1.04, 90.48) seconds compared to the usual care group over the 16 months (p=0.045) (Figure 1). Total cholesterol and LDL-C were 7% (p=0.026) and 12% (p=0.022) lower, respectively, in
the vCRP group. These differences were no longer significant when adjusted for potential confounders. Participants in the vCRP group had 1.6% kcal/day higher dietary protein and 1.4% kcal/day lower dietary saturated fat compared to the usual care participants, \( p=0.04 \) and \( p=0.018 \), respectively, and these differences remained significant after adjusting for confounders, \( p=0.03 \) and \( p=0.018 \), respectively.

![Figure 1](image_url)

**Figure 1.** Maximal time on the treadmill exercise stress test over the 16-month study for the vCRP group (dashed line, square markers) and the usual care group (solid line, diamond markers). Data and 95% confidence intervals were determined from the linear mixed effect model (\( p=0.045 \) for difference between groups).

There was a non-significantly greater number of patients with at least one emergency room visit or major event in the usual care group compared to the vCRP (11 [30%] vs. 6 [18%], respectively, \( p=0.275 \)). Taking into account all events (including multiple events for the same participant), there were 22 events in the usual care group compared to 8 in the vCRP group.

From the interviews, participants perceived the vCRP to be an accessible, convenient and effective way to deliver healthcare services. A key benefit was seen to be the easy access to vCRP health professionals. Participants reported greater awareness and motivation to manage their health condition and adopt healthier lifestyles through participation in the vCRP. As a result, many of the participants expressed feeling confident and reassured, and more attuned to self-management activities. The majority of participants reported that they felt their health had improved.
3. Discussion

The four-month vCRP was safe and superior to usual care in reducing CVD risk by improving exercise capacity, cholesterol and dietary factors. These findings were reinforced by patients reporting that the vCRP improved their access to health care, provided greater awareness of their condition and supported self-management. The vCRP was delivered with a minimal use of health human resources, which was calculated as less than eight hours of staff time per patient, compared to a standard of 40 to 60 hours of onsite time for a standard 12 to 16-week CRP.

Previous studies have found that an increase in exercise capacity of 1 metabolic equivalent (3.5 mL/kg *min) was associated with a 12% to 50% reduction in mortality. Given this association, our observation of an improvement of 46 seconds (approximately 0.77 metabolic equivalents or 2.7 mL/kg *min) on the exercise stress test greater than that of the usual care group is clinically relevant and translates to a 9% to 38% reduction in mortality. Of importance is that the benefits of the vCRP were sustained for a 12-month period after removal of the four-month intervention. This is a key finding as recidivism in cardiac rehabilitation is commonplace following completion of a program, and indeed, the drop-out rates in these programs are as high as 35%.

To our knowledge, only one randomized study previously investigated the use of the Internet for cardiac rehabilitation remotely, which comprised of online chats between patients and nurses/dietitians, online educational resources and financial incentives for participation. After six months, there was no difference in exercise capacity and the only parameter to improve compared to the control group was weight reduction. These results may reflect the limited nature of their program; there was no formal multi-factorial intervention, nor did the intervention provide a structured, monitored exercise program. Our vCRP consisted of similar components but also included exercise data monitoring and exchange of other physiological markers making it more reflective of comprehensive CRP.

While a number of communication technology mediums exist (telephone, video-conferencing, telemonitoring), we chose to use a web-based program delivered through the Internet as it is 1) commonly available in people’s homes, 2) requires less capital expense than more costly options such as telemonitoring devices, 3) is more convenient than video-conferencing programs that require patients to travel to a central location and 4) the technology is readily scalable to large patient populations without further incurring additional technology costs. While home Internet access has been found to be lower in older age groups it has been steadily increasing in this group. Indeed the lower prevalence in older adults is likely a cohort effect rather than an age effect per se, such that as adults in their 50s and 60s get older, their use of the Internet will likely continue, making this modality a viable medium to reach a large patient population.

Conclusions

In our study, we found that a cardiac rehabilitation program delivered exclusively through the Internet to patients in small urban and rural locations was safe and effective at providing sustainable improvements in exercise capacity and reductions in CVD risk. Not only does our vCRP have the potential to improve patient access to proven care, it did so requiring minimal health human resources; less than an average of eight
hours of staff time were needed per patient making this model of care cost efficient and readily sustainable. These results indicate that a low-cost technology such as the Internet can be used safely and effectively in remotely delivering cardiac rehabilitation to patients without the requirement of face-to-face visits and directly monitored exercise.

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Disclosures

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References


What are the Costs of Improving Access to Specialists through eConsultation? The Champlain BASE Experience

Clare LIDDY a,b,1, Catherine DERI ARMSTRONG c, Paul DROSINIS d, Ferdinand MITO-YOBO a, Amir AFKHAM a, and Erin KEELY e,f

a C.T. Lamont Primary Health Care Research Centre, Bruyère Research Institute, Ottawa, Canada
b Department of Family Medicine, University of Ottawa, Ottawa, Canada
c Department of Economics, University of Ottawa, Ottawa, Canada
d The Champlain Local Health Integration Network, Ottawa, Canada
e Department of Medicine, University of Ottawa, Ottawa, Canada
f Division of Endocrinology/Metabolism, The Ottawa Hospital, Ottawa, Canada

Abstract. Excessive wait times and poor access to care are among the most significant problems facing health care service delivery in Canada and beyond. We implemented the Champlain BASE eConsult service in the region of Ottawa, Canada to increase access to specialist care. We have collected ongoing utilization data and provider surveys over a three year period, providing a unique opportunity to explore the economic aspects of this multispecialty eConsult service. This is an economic evaluation from the perspective of the payer: the Ministry of Health and Long-Term Care of Ontario. All eConsults submitted during April 1, 2011 to March 31, 2014 were included. We attributed cost savings only to those cases where an eConsult led to the avoidance of a face-to-face specialist visit. A total of 2606 eConsults directed to 27 different specialty groups were included. In 40.3% (n=1051) of cases processed, a face-to-face specialist visit was originally planned but avoided as a result of eConsult, while 29% led to a referral. The estimated cost per eConsult for Years 1, 2, and 3 were $131.05, $10.34, and $6.45 respectively. Results from a sensitivity analysis project that the eConsult service will break even once we reach 7818 eConsults. This is one of the first studies to examine costs across a multispecialty eConsult service. We saw a marked decrease in the cost per eConsult over each annual period. Future research is needed to identify and examine similar outcomes that may lead to cost savings.

Keywords. Referral, eConsult, electronic consultation, cost savings, economic analysis, wait times

Introduction

Poor access to specialist care is a common problem faced by many countries [1,2]. Excessive wait times and inequitable access lead to patient anxiety, delays in diagnosis, and potentially the further deterioration of the patient’s condition [2].

1 Corresponding author: cliddy@bruyere.org.
There is an opportunity to improve access to specialist care through the use of innovative e-health platforms such as electronic consultation (eConsult). eConsult is a form of asynchronous communication whereby primary care providers (PCP) and specialists can communicate through the use of a secure web based platform, thus enabling PCPs to receive advice from specialists in a timely manner.

Several countries have implemented eConsult systems to improve access to dermatology, neurology, nephrology, and pulmonology, and have shown positive impact with regard to quality of images, improved access to care, and provider and patient satisfaction [3-7]. However, few studies have reported on the financial and economic aspects of eConsult systems, and those that have report on a multiple outcome measures and economic perspectives [8-12]. A systematic review done on synchronous telemedicine (video) systems concluded these systems are not cost effective from the health system perspective between primary care and hospital specialists, noting high staffing and technology costs [13]. There is a need to further explore the costs and potential economic benefits of eConsult systems.

In our region of 1.2 million people, we have implemented an eConsult service, which has reduced the wait-times for accessing specialist advice from months to days [14]. Over 40% of our cases resulted in avoidance of an unnecessary face-to-face referral, meaning hundreds of patients are no longer waiting to see a specialist [15]. We have collected ongoing utilization data and provider surveys over a three year period, providing a unique opportunity to explore the economic aspects of this service. Our results will not only inform ongoing discussions about scale up but are also generalizable to other regions as they consider implementing their own eConsult services to address wait time issues.

1. Methods

1.1. Study Design

This is an economic evaluation using cost analysis from the perspective of the payer: the Ministry of Health and Long-Term Care of Ontario. Patient cost savings have been reported elsewhere [15]. The study took place in the Champlain region of Eastern Ontario, Canada. The region is culturally and linguistically diverse with a population of 1.2 million people and includes Ottawa and its surrounding rural communities [16]. There is one main urban referral centre and the region has disease burdens and health outcomes similar to the rest of the province. In Canada, the healthcare system is publicly funded and freely available to the population. Administration of healthcare services occurs at the provincial level.

1.2. The eConsult Service

The Champlain BASE eConsult service is a web-based application designed to allow PCPs (family doctor or nurse practitioner) and specialists to communicate electronically. PCPs log on to the system, fill out a simple electronic form detailing their question, attach any pertinent electronic files deemed helpful for the specialist, and then send the eConsult to a specialty service. At the conclusion of each eConsult, PCPs complete a brief five question close-out survey about the case. Specialists receive
quarterly remuneration at a rate of $200 per hour prorated to their self-reported time it
takes to complete the eConsult.

The service was built on a secure platform that was already in use as the “regional
collaboration space” in our health area. The main component of this platform is
Microsoft SharePoint, a versatile, commercially available off-the-shelf product that is
widely deployed in the industry, with many useful resources and references freely
available on the worldwide web. As such, implementation costs for the eConsult
service were primarily for development of the forms and workflows, leveraging much
of the existing shared infrastructure. There were two iterations of the design: a) the first
one in 2010 for the proof-of-concept phase, and b) the second one in 2011 for the
current phase.

1.3. Data Collection

We used data routinely collected by the system (number of eConsults directed to each
specialty type, self-reported time for specialists to complete the eConsult) and impact
data (avoidance of a face-to-face referral or a new referral initiated) for three
consecutive one-year periods: April 1, 2011 to March 31, 2012 (Year 1); April 1, 2012
to March 31, 2013 (Year 2); and April 1, 2013 to March 31, 2014 (Year 3).

We used the management records of the project to identify resources required to
provide eConsult services for patients, and used detailed expenditure information to
identify costs associated with the delivery of eConsult.

1.4. Cost Analysis

We calculated both direct and variable costs associated with the service. Our direct
costs were only start-up costs, which included developing the electronic forms,
workflows, and web page design. Our variable costs were ascertained based on
interviews with key stakeholders and involved the tasks required to support a fully
operational eConsult service.

Variable costs consisted of delivery costs and consultation-specific costs. The
delivery costs included user setup/registration, support, and administration costs.
Support costs consisted of daily interactions with PCPs and included password resets,
as well as addressing specific issues/queries for individual providers or cases,
particularly related to the multitude of operating systems and browser types used by
providers to access the service from their devices. Administrative costs included
reporting, billing, analysis, specialist scheduling, and following up with PCPs and
specialists on outstanding cases. The consultation-specific costs were calculated based
on: (a) payments made to specialists and (b) assignment costs for staff to direct each
eConsult to the appropriate specialist.

Investments in equipment and related software were not carried forward into
subsequent years, as we considered them sunk (i.e., one-time) costs. They are included
only in the evaluation of the period in which they occurred (i.e. Year 1). In addition,
costs incurred by patients, PCPs, and patients’ accompanying persons, as well as other
societal costs, were not included in this analysis.

We tabulated all the costs associated with running a fully operational eConsult
service. We reviewed the eConsult delivery process in detail from the conception of the
project to its completed implementation. Every activity that occurred as a direct result
of eConsult and would not have happened otherwise was recorded as an additional
activity. Conversely, specialist payments that would have been made if every activity relating to the traditional referral-consultation had occurred but were avoided as a result of eConsult were considered an avoided activity.

For costs directly related to patient referrals, we used responses from a short survey that PCPs completed at the conclusion of each eConsult to tally the number of avoided referrals (i.e. instances where eConsult was able to resolve a situation without leading to a face-to-face referral that was originally contemplated) and added referrals (i.e. situations in which eConsult led to a referral that would not have otherwise been made) and multiplied each item by the cost of the relevant specialist consultation using the Ontario Fee Schedule. We calculated the total savings attributable to eConsult by taking the difference between the total costs avoided and the total additional costs as shown in Eq. (1).

\[
\text{[Costs Avoided]} - \text{[Added Referral Costs + Operational Costs]} = \text{[Costs Saved]} \quad (1)
\]

The routine use of an eConsult service can lead to cost savings in numerous different ways, including quicker response times (which can decrease patient anxiety and lead to earlier diagnoses which may prevent further degradation of a patient’s condition), improved communication between providers (which can reduce costly, unnecessary medical tests), and avoidance of face-to-face specialist visits. For the purpose of this analysis, we attributed cost savings only to the proportion of cases where the outcome was the avoidance of a face-to-face referral. Our estimate is conservative in that it does not attribute cost savings to any other outcomes nor those cases where PCPs: (a) confirmed their original decision not to refer, or (b) still needed to refer but were able to use specialist advice to more effectively manage their patients’ care in the meantime.

1.5. Sensitivity Analysis

A break-even analysis was performed in order to predict how many eConsults would be required in order for the system to generate cost savings based on our assumptions. For this analysis, we excluded the specialties clinical pharmacy, diabetes education, and radiology, as they do not represent medical specialties that a PCP would normally refer to in a traditional clinic setting. Costs were tabulated to find the total avoided costs, costs attributed to the specialists who responded to the eConsults, the total added costs, and the associated delivery costs. The average avoided and total costs per eConsult were then plotted against a varying number of total eConsults.

2. Results

A total of 235 PCPs completed 2606 cases referred to 27 different specialty groups over the entire study period. The specialty groups providing the highest number of eConsults were dermatology (17.7%), endocrinology (9.9%), neurology (9.1%), hematology (8.6%), obstetrics/gynecology (7.4%), and cardiology (7.3%). In 40.3% (n=1051) of cases processed, a face-to-face specialist visit was originally planned but
avoided as a result of eConsult (in fact, only 29% of all eConsult cases led to a referral). In 3.6% (n=93) of cases, a referral was initiated where one was not originally planned.

In Year 1, PCPs initiated 190 eConsults related to 14 different specialty services. During this period, 42% (n=79) of referrals were avoided and 2.6% (n=5) were added. In Year 2, PCPs initiated 787 eConsults related to 20 different specialty services. Here, 41.1% (n=324) of referrals were avoided and 2.8% (n=22) were added. In Year 3, 1629 eConsults were directed to 27 different specialty services. During this time, 40% of referrals (n=648) were avoided and 4.1% (n=66) were added.

The start-up costs for eConsult were $10,000.00, representing 28.4% of the costs during the first year (estimated to be $35,264.81). Once added referrals ($634.65 in additional costs) and avoided referrals ($10,364.50 in savings) were factored in, eConsult had a net cost of $24,900.31 in its first year. In its second year, eConsult saved $43,976.85 in avoided referrals while incurring $52,123.38 in costs, of which 63% were payments to specialists. In its final year, eConsult saved $85,182.25 in avoided referrals while incurring $95,687.66 in costs, of which 72.4% were payments to specialists. After taking into account the added and avoided referral cost, the estimated cost per eConsult for Year 1, Year 2, and Year 3 was $131.05, $10.34, and $6.45 respectively. The average cost across all three years was $16.71 per eConsult.

Assuming the traditional cost of a face-to-face visit is $150 and specialists take an average of 13 minutes to answer each eConsult, we predict our service will break even once we reach 7818 eConsults (see Figure 1).

![Figure 1](image_url)

Figure 1. Break-even plot for total costs per case against those where the PCP reported a face-to-face visit was avoided. We project eConsult will break even at 7818 eConsults.

3. Interpretation

eConsult represents an innovative, inexpensive way of improving access to specialist care. Our findings suggest that an eConsult system will generate cost savings within four years of implementation based only on potential cost savings from a public payer...
perspective attributed to avoided specialist visits. If factoring in additional economic aspects from a patient perspective such as more rapid access to care, reduced likelihood of more deterioration, avoided travel costs, time off work for a visit, parking, and food, the potential overall costs savings for eConsult is tremendous and will be realized earlier. Although the start-up can be capital intensive, this will vary in health regions depending on presence of existing infrastructure which meets security and privacy requirements. The program cost significantly more in its first year. However, by its second and third year, we saw a marked decrease in the cost per case as the bulk of the costs shifted from operational costs to specialist remuneration. In contrast to telemedicine synchronous systems, many eConsult services including ours do not require additional equipment, either centrally or in the provider’s office [17]. This enables adoption costs including training to be low. This is reflected in our low operational costs.

Few studies have performed economic analyses of asynchronous eConsult systems and those that have are mostly dermatology store and forward eConsult systems [18]. Whited et al. found that teledermatology did not result in cost savings when compared to usual care but that it had the potential to result in cost savings if the proportion of avoided visits were higher or if societal costs were included [12]. Similarly, Eminovic et al. found that teledermatology can reduce costs if patients had to travel further to see the specialist or if more than 37% of eConsults result in avoidance of a face-to-face referral [8]. Moreno-Ramirez found a negative correlation between the unit cost of an eConsult and the volume of eConsults processed [10]. However, this “break-even point” can vary considerably depending on the specialty.

There are many ways that an eConsult service can lead to cost savings for the patient and for the payer. We chose to use a conservative estimate and only attribute cost savings to avoided face-to-face specialist visits. Other potential areas for cost savings that are not captured in our analysis include avoiding duplication of laboratory tests, preventing further degradation of patient condition and/or choice of less effective treatment options, more effective future specialist visits if needed, and associated savings to patients each time a visit was avoided.

Future research should examine the different outcomes that may lead to greater cost savings as more eConsult services are developed and implemented. Expediting access to specialist advice may lead to decreased emergency department visits and medication use as well as avoiding costly unnecessary tests. This should be examined. In addition, the risks associated with delayed care should be quantified from both the patient and payer perspective. Patient avoided costs in terms of lost wages, productivity, and transportation should also be examined within a multispecialty eConsult service.

Another important consideration in the assessment of cost savings is whether the care provided by eConsult is comparable in quality to what would be provided by traditional consultation. In our pilot study, several physicians provided positive feedback on the eConsult system, noting its simplicity and effectiveness and reporting high satisfaction ratings on end of consult surveys [14,19]. Participants also perceived some benefits from the system, including quicker responses from specialists and the educational value of submitting eConsults; this may likely reduce future referrals or eConsults for a similar condition [14,20].

Our study has some limitations. Its findings can only be generalized to health systems with technical infrastructure sufficient to harbor a secure transmission of health information. Without this infrastructure, start-up costs would be considerably
greater. Second, our methodology included direct financial costs; an evaluation using economic costs would make our results more generalizable to other settings.

Conclusion

This is one of the first studies to examine costs across a multispecialty eConsult service. We showed a marked decrease in the cost per eConsult over each annual period with a projected break-even point at 7,818 cases. Future research is needed to identify and examine similar outcomes that may lead to cost savings, as well as patient and provider perspectives on eConsult and evaluate the program’s effect on quality of care outcomes.

References

The Current State of Electronic Consultation and Electronic Referral Systems in Canada: an Environmental Scan

Clare LIDDY a,b,1, Matthew HOGEL a,b Valerie BLAZKHO a,b and Erin KEELY c,d

a C.T. Lamont Primary Health Care Research Centre, Bruyère Research Institute, Ottawa, Canada
b Department of Family Medicine, University of Ottawa, Ottawa, Canada
c Department of Medicine, University of Ottawa, Ottawa, Canada
d Division of Endocrinology/Metabolism, The Ottawa Hospital, Ottawa, Canada

Abstract. Access to specialist care is a point of concern for patients, primary care providers, and specialists in Canada. Innovative e-health platforms such as electronic consultation (eConsultation) and referral (eReferral) can improve access to specialist care. These systems allow physicians to communicate asynchronously and could reduce the number of unnecessary referrals that clog wait lists, provide a record of the patient’s journey through the referral system, and lead to more efficient visits. Little is known about the current state of eConsultation and eReferral in Canada. The purpose of this work was to identify current systems and gain insight into the design and implementation process of existing systems. An environmental scan approach was used, consisting of a systematic and grey literature review, and targeted semi-structured key informant interviews. Only three eConsultation/eReferral systems are currently in operation in Canada. Four themes emerged from the interviews: eReferral is an end goal for those provinces without an active eReferral system, re-organization of the referral process is a necessity prior to automation, engaging the end-user is essential, and technological incompatibilities are major impediments to progress. Despite the acknowledged need to improve the referral system and increase government spending on health information technology, eConsultation and eReferral systems remain scarce as Canada lags behind the rest of the developed world.

Keywords. Specialist care, electronic consultation, e-health, electronic referral, primary care, eConsult, wait times

Introduction

Accessing specialist care is a major challenge for Canadians. Patients report excessive wait times [1,2], uncoordinated care, and duplicate testing [3]. Both primary care providers (PCPs) and specialists report dissatisfaction with the referral process [4]. These issues can result in significant breakdowns in continuity of care, inappropriate treatment, and potential harm to the patient [5].

There is an opportunity to improve access to specialist care through the use of innovative e-health platforms such as electronic consultation (eConsult) and electronic

1 Corresponding author: cliddy@bruere.org.
referral (eReferral). Electronic consultation links the PCP and the specialist electronically, enabling specialists to offer advice directly, often without the need for a face-to-face visit [6-8]. Electronic referral refers to automation of the referral process, including scheduling, and may or may not have eConsultation capabilities. Many electronic systems are being implemented around the world [9,10], most of which are specific to one specialty or expansions of shared electronic health records (EHR). For example, eReferral has been implemented as an extension of shared EHRs within the San Francisco General Hospital network [11]. This web-based system integrates directly into the hospital’s EHR to populate referral forms, allowing specialists to review the referral request and determine appropriateness and urgency for scheduling, communicate directly with the referring PCP, and—if possible—answer the referral question without a face-to-face visit. The system has been shown to reduce no-shows, increase referrals per day, and contribute to significant cost savings [12-14].

In Canada, while there has been increasing adoption of electronic medical records (EMR) within primary care [15,16], the use of technology within the specialist community is limited, with only 21.5% of GPs and 10.1% of specialists using EMRs exclusively in 2010. The consultation and referral process still relies on faxing requests and telephone scheduling [17]. A recent report by the Canadian Medical Association suggests that “there has up until now been very little coordination on this front between various stakeholders which more often than not can lead to duplication of efforts” [18].

As part of a broader program aimed at building access to specialist care in Ontario [7], the purpose of this study was to identify other eConsultation and eReferral systems in Canada. It was initiated as a systematic review of the literature; however, the lack of published Canadian data led to the employment of an environmental scan methodology which included an online search for grey literature and key informant interviews [19-21]. This first national overview of asynchronous eConsultation and eReferral systems provides an in-depth perspective of the development and adoption challenges for eConsultation and eReferral systems within Canada.

1. Methods

1.1. Systematic Literature Review

We searched Medline and EMBASE on January 29th, 2013 using combinations and variants of keyword terms to identify eConsultation and eReferral systems in Canada. Selection criteria required the system to be asynchronous and to connect primary care and specialty physicians through electronic means. The focus on asynchronous communication systems between physicians excluded real-time telemedicine systems. A grey literature search was performed on February 4th, 2013 using the Google search engine. Websites belonging to Provincial Ministries of Health, health quality organizations, and national professional organizations were searched using their embedded search engines with the previously described search terms, or parts thereof. The search was repeated by a second reviewer to ensure thoroughness of results and reproducibility of the search strategy.
1.2. Key Informant Interviews

A list of potential interview candidates was generated from the results of the literature review and online scan. The participants were stratified based on location and system type (maximum variation sampling) [22]. These candidates were invited to participate in semi-structured telephone interviews conducted between April 16th and 23rd, 2013. Verbal consent was provided by the interviewees at the time of the interview. The interview guide was developed by adapting the RE-AIM framework [23] and the questions were structured to obtain a better understanding of the system in question as well as the process of designing, implementing, and maintaining it. Interviews were recorded and transcribed. Copies of the interview transcripts were sent to each interviewee for approval to increase the trustworthiness of the results. Thematic synthesis analysis was performed [24]. Three members of the research team (MH, VB, CL) independently reviewed and coded the interviews. Codes were discussed and developed into descriptive themes and subsequently into analytical themes. Descriptive saturation was deemed to be achieved by the reviewers when no new descriptive codes, categories, or themes were emerging from the data [25]. At this time it was determined that no additional interviews were required. Ethics approval was obtained for this study from the Ottawa Hospital Research Ethics Board and Bruyère Research Institute.

2. Results

Three asynchronous electronic systems to facilitate consultations/referrals in Canada were identified in the environmental scan: the Bridging General and Specialist Care (BGSC) eReferral system in Manitoba, the Ambulatory Referral Management (ARM) system in Toronto, and the Champlain BASE (Building Access to Specialist through eConsultation) system in Eastern Ontario (Table 1).

The Manitoba eReferral system (BGSC) streamlines the consultation and referral process by ensuring properly directed referrals and creating an auditable electronic trial. Through 2010, 22% of the 1000 referrals submitted through BGSC were recognized as inappropriate on submission, with 60% of those being properly re-directed and 40% returned to the practitioner for resubmission [26]. Family physicians and specialists rated the referral process more favorably when referrals were made electronically [26]. BGSC is now in the process of re-launching within Manitoba eHealth.

The eReferral system (ARM) was initially deployed locally by The Hospital for Sick Children in Toronto. In 2012 it was integrated into the Electronic Child Health Network (eCHN), a provincially-accessible pediatric patient information portal. ARM has improved the quality of referral information submitted and decreased the number of incomplete/ rejected referrals, improved efficiency and workflow at both ends of the referral submission process, and provided a mechanism for capturing wait time information [27].

The Champlain BASE system allows a PCP to submit a patient-specific clinical question to a specialist. The PCP can attach relevant electronic files (e.g. lab results, images, information generated from EMRs). If a direct answer cannot be provided, the specialist can request more information or suggest a face-to-face referral [28]. In 43% of cases, a face-to-face specialist visit was originally planned but avoided as a result of the system [28]. User satisfaction is high with satisfaction ratings of 4.63/5.
Table 1. Asynchronous electronic systems to facilitate consultations/referrals in Canada

<table>
<thead>
<tr>
<th>Name</th>
<th>Year</th>
<th>System Type</th>
<th>Number of PCPs</th>
<th>Number of Specialists</th>
<th>Number of Referrals/Consults Processed</th>
</tr>
</thead>
<tbody>
<tr>
<td>BGSC</td>
<td>2008</td>
<td>Web-based</td>
<td>177</td>
<td>55 specialists</td>
<td>1906 referral requests</td>
</tr>
<tr>
<td>BGSC (re-launch)</td>
<td>2014</td>
<td>Web-based</td>
<td>20</td>
<td>39 specialists</td>
<td>140 referrals</td>
</tr>
<tr>
<td>ARM</td>
<td>2006</td>
<td>Fax-based</td>
<td>5000</td>
<td>54 specialty clinics</td>
<td>67000 referrals</td>
</tr>
<tr>
<td>BASE</td>
<td>2010</td>
<td>Web-based</td>
<td>200+</td>
<td>26 specialty services</td>
<td>843 eConsults</td>
</tr>
</tbody>
</table>

In the other provinces there is much activity focused on improving referral with the intent to implement full eReferral systems (Table 2). For example, the Alberta (AB) Closed Loop Referral system (launched in 2014) will facilitate the electronic submission of referrals to multiple specialty services and maintain an electronic log of patients’ progress through, and status within, the referral process. Pooled referrals with central intake processes and electronic specialist physician databases are also being widely implemented.

The goal of central intake systems employed in British Columbia (BC), Saskatchewan (SK), and Newfoundland (NL) is to diffuse the patient demand for specialty service across the entire load of specialist providers, as opposed to allowing wait lists to grow with certain specialist providers but not others. In most systems, PCPs (in consultation with patients) may forgo the next available specialist if they prefer a specific physician.

The goal of specialist directories such as the system in place in Nova Scotia (NS) is to provide a guide that will help physicians connect their patients to the most appropriate specialist and reduce misdirected referrals [29]. This may reduce the time patients spend seeking specialist care and reduce some of the burden on specialists’ wait lists.

Table 2. Referral improvement initiatives

<table>
<thead>
<tr>
<th>Prov</th>
<th>System Name</th>
<th>System Type</th>
<th>Specialty Services</th>
<th>Number of users</th>
<th>Impact/Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>BC</td>
<td>OASIS: Osteoarthritis Service Integration System</td>
<td>Fax-based Central Intake/Triage</td>
<td>Orthopedic Surgery</td>
<td>1200 PCPs have access; Over 26000 &quot;client encounters&quot; (2011)</td>
<td>Improved access to services and access to first available specialist, improved use of system resources</td>
</tr>
<tr>
<td>AB</td>
<td>AHS Closed Loop Referral*</td>
<td>Fax-based Central Intake/Triage</td>
<td>Multiple</td>
<td>TBD</td>
<td>TBD</td>
</tr>
<tr>
<td>SK</td>
<td>Pooled Referral Project</td>
<td>Fax-based Central Intake/Triage</td>
<td>Surgery (7)</td>
<td>70 surgeons participating</td>
<td>19 - 20,000 referrals/year go through central intake</td>
</tr>
<tr>
<td>NB</td>
<td>Provincial Surgical Access Registry</td>
<td>Real Time Information Management</td>
<td>Surgery (12)</td>
<td>15 surgical centers, 240 surgeons have access</td>
<td>34% decrease in median wait time for all surgery, 92% surgeries completed in 6 months</td>
</tr>
<tr>
<td>NS</td>
<td>Surgeon Directory</td>
<td>Specialist Directory</td>
<td>Surgery (11)</td>
<td>1200 FPs in NS have access to the public website</td>
<td>TBD</td>
</tr>
<tr>
<td>NL</td>
<td>Orthopedic Central Intake Project</td>
<td>Fax-based Central Intake/Triage</td>
<td>Orthopedic Surgery</td>
<td>22 specialists</td>
<td>Reduction in median wait time for high-priority (72%) and routine-priority referrals (45%), 80% compliance rate</td>
</tr>
</tbody>
</table>
2.1. Key Informant Interviews

Semi-structured interviews were performed with seven individuals involved in the design and/or maintenance of the systems described above. Four themes emerged: eReferral as an end goal, the importance of re-organizing the referral process before automation, engaging the end user, and technological incompatibilities as impediments to progress. Most were focused on eReferral without consideration of eConsultation as a feature. eReferral was identified as an end goal of consultation and referral redesign. Engaging the end user throughout the design and implementation process was cited as a key enabler. Many technological barriers were discussed, such as incompatibility between electronic health systems.

Informants from Saskatchewan, Nova Scotia, and Newfoundland who worked with establishing pooled referral systems and physician directories stated explicitly that the evolution of their system into an eReferral platform was a desired objective. Each interviewee recognized the efficiency of an eReferral process, and the importance of an auditable electronic trail that would enable PCPs to remain informed of patients’ status. Development of an eReferral system is underway in Saskatchewan and in the planning stages in Nova Scotia. Newfoundland is farther from making an eReferral system a reality, but its importance as an objective was stressed during the interview.

Many informants stated that the referral process in their province needed to be reorganized before an eReferral system could be implemented. Recognizing and improving upon the workflow challenges was considered a crucial step prior to automation: “we’re designing our processes first, and then we’ll bring in an electronic system to automate that process later.” An often-repeated observation was that automation of a system that was already dysfunctional would not lead to any improvements and would likely complicate the referral process even more. It was this observation that drove the development of the pooled referral systems as a stepping-stone in the progression to eReferral.

A critical element to understanding the referral workflow process, designing system improvements, and implementing a new system was to engage the physicians involved in those processes. Five of our informants assembled focus groups or committees composed of family physicians and specialists to discuss areas for improvement and to design a better system. All five emphasized the importance of that process. The two key informants that didn’t engage physicians from the beginning described this as a missed opportunity and something that they would do differently. Informants also spoke to the importance of having physician champions on their team. As they understand and relate to the physician role, physician champions offer an advantage in the recruitment of potential users and are thus able to increase user uptake.

Extracting data from EMR and EHR systems emerged as a major impediment to the design and development of both eReferral and pooled referral systems. The ability for a physician to submit their referral request directly from an EMR system was
viewed as an important design element from the user’s perspective. In reality, designing a system able to draw information from multiple different EMR systems was a significant challenge: “the lack of IT integration and synchronicity is the real barrier to making [eReferral] always work the best it can.”

3. Interpretation

Despite the demand for improvements in the referral process and the investments in health technology, eConsultation and eReferral systems remain scarce in Canada [30,31]. eConsultation and eReferral systems have been implemented and tested in the United States [10,32-34], Ireland [35], England [8], the Netherlands [36], and Finland [37,38], among many other countries. According to the 2012 Commonwealth Fund Survey, Canada was last among the 11 countries analyzed in the percentage of doctors able to exchange patient summaries and test results electronically with other doctors [39]. These results suggest a need to examine the challenges in implementing health information technology in Canada, and develop a new implementation strategy.

The key informant interviews identified a number of important factors consistent with other reports investigating the challenges experienced in implementing and integrating e-health initiatives in other healthcare settings [40-42]. Socio-technical interaction, or the ability of technology to integrate into standard workflow, is an essential component to the success of an e-health initiative [40]. Exploring this interaction when implementing a new initiative can uncover process inefficiencies. The importance of understanding and improving the referral process was one of the themes uncovered in this study, and a major reason why many of the systems identified had yet to evolve into full eReferral platforms.

The importance of engaging the end users and identifying physician champions was also spoken to extensively in our interviews, and is an important consideration identified in other studies [40-43]. The re-emergence of these common implementation challenges stresses the need for better knowledge sharing. The CMA, in an attempt to improve coordination of referrals/consultations and minimize the duplication of efforts, has stated that improved knowledge sharing is a goal within their organization [27].

Many informants in our study described EMR interoperability as a significant impediment, a finding which has been reported elsewhere [44]. The push from the federal and provincial governments to adopt EMRs within primary healthcare practices, combined with the minimal regulation and direction guiding EMR selection, has resulted in the adoption of a variety of different EMR systems that are unable to communicate with one another or provide common information to other systems. The Canadian Institute for Health Information has recently released a draft proposal for EMR content standards [45], and Canada Health Infoway has committed to providing assistance for upgrading EMR systems to improve their interoperability [31]. These are important steps, as ensuring that EMR systems can provide standard, easy-to-read information is a critical element of successful eReferral systems.

This study was subject to several limitations. There is an overall lack of reporting on eConsultation/eReferral systems in Canada. It is possible that a system meeting our inclusion criteria exists and has either not been reported on or did not turn up in our scan. The key informant interviews, with the exception of two interviews that involved two interviewees, relied on the input from one individual per system. All key informants were involved in the design/implementation of their system and thus may
have been inclined to overstate the impact of the system/understate the challenges and barriers encountered, although where available, we relied on published results.

Conclusion

Despite the current lack of eConsultation and eReferral systems in operation in Canada, several provinces are in various stages of implementing their own eReferral systems. The lessons learned from these projects should be disseminated in order to decrease the duplication of efforts and mistakes. Improving interoperability of EMR systems is becoming a bigger priority. As drawing data from EMRs into eReferral systems becomes easier, designing eReferral systems will become more practical and physician buy-in will likely increase. Improvement is needed in the specialty referral process, and eConsultation and eReferral systems offer the potential to meet these needs.

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Achieving Greater Consistency in Telehealth Project Evaluations to Improve Organisational Learning

Anthony MAEDER a,1, Kathleen GRAY b, Ann BORDA b, Nathan POULTNEY a & Jim BASILAKIS a

a School of Computing, Engineering & Mathematics, University of Western Sydney, Campbelltown, Australia
b Health and Biomedical Informatics Centre, The University of Melbourne, Parkville, Australia

Abstract. Telehealth pilot projects and trial implementations are numerous but are often not fully evaluated, preventing construction of a sound evidence base and so limiting their adoption. We describe the need for a generic Telehealth project evaluation framework, within which evaluation is undertaken based on existing health systems performance indicators, using appropriately chosen measures. We provide two case studies explaining how this approach could be applied, in Australian and Canadian settings. It is argued that this framework type of approach to evaluation offers better potential for incorporating the learnings from resultant evaluations into business decisions by “learning organisations”, through alignment with organisational performance considerations.

Keywords. Telehealth, project evaluation, benefits realisation, health systems performance, learning organisation

Introduction

Few areas of eHealth have seen the large volume and variety of pilot projects and trial implementations that have occurred worldwide in Telehealth, over a comparatively long time period. These projects often embrace several innovative contributions concerning many different implementation aspects, such as technology choice and deployment, or redesign of business processes and clinical workflows. However, relatively few such projects have been publicly reported as rigorously and comprehensively evaluated, to provide understanding of the success and failure factors as well as a reliable evidence base for clinical effectiveness. Indeed, many projects have suffered from application of multiple inconsistent evaluation methodologies and piecemeal evaluations applied selectively to specific project aspects [1], thereby devaluing the underpinning research foundations as well as the learnings and impact of

1 Corresponding author: Prof Anthony Maeder, School of Computing, Engineering & Mathematics, Telehealth Research & Innovation Laboratory, University of Western Sydney, Locked Bag 1797 Penrith NSW 2751, Australia; Email: a.maeder@uws.edu.au
the project as a whole [2]. This detrimental effect in turn limits the widespread adoption and diversification of Telehealth services, as the contribution to evidence may be perceived as unsound or incomplete.

This situation has led to a widespread perception that there is a lack of readily useable and combinable evidence of clinical and economic efficacy for Telehealth solutions, and so reviews of existing evidence can be inconclusive [3]. Furthermore, available evidence may have been obtained in small and specialised settings, and consequently does not necessarily map well to situations where scalability and sustainability of Telehealth systems are important elements [4]. There is a corresponding lack of universality in impact and effectiveness measures used in evaluations, and these are seldom well aligned with the overall drivers of health policy, such as health systems performance indicators. Similarly, there is poor development of general measures for clinician and patient related elements of specific interventions, and to represent the interests of stakeholder groups such as health consumers [5]. This paper argues the need for Telehealth evaluation approaches to incorporate appropriately chosen measures based on explicit health systems performance expectations, which can be related back to relevant aspects of health services and systems policy, and will therefore be accepted as more widely applicable by decision makers.

Various factors contribute to the lack of evaluation consistency and coverage in Telehealth projects. Typically, evaluation receives lower priority and tends to be deferred in the project management cycle, due to constraints such as cost, expertise and time [6]. Project teams may be unable to collect the amount and type of data needed for executing the preferred evaluation method, or the timescale over which the data must be collected may exceed the project duration. There has been a lack of well-established codified methods for conducting evaluation of project aspects and outcomes directly related to Telehealth. Attempts have been made to address this situation by developing a variety of flexible evaluation frameworks specifically aimed at Telehealth. Unfortunately, adoption of these for application to actual projects has been low due in part to their limited exposure, as well as the difficulty of merging and triangulating results obtained when different frameworks have been applied to different projects [7]. We believe a comprehensive framework is desirable, which would allow flexible incorporation of elements of other frameworks as desired, but would be built on a foundation independent of their various diverse evaluation methods. Additionally, if such a framework is well aligned with health system drivers, such as performance indicators, it can be more readily accepted in health policy and strategy decisions, than a choice of narrower evidence components would typically support.

Inconsistency of evaluation methods and measures, and consequent inability to correlate the findings from different evaluations has made it difficult for health organisations to share or adopt related learnings across the health sector. Potential benefits range from increased capacity to improved outcomes, while challenges range from lack of resources to measurement issues. Decisions for provision of resource allocation to new Telehealth services which cannot be informed by or build on lessons learned from previous projects, may be a key obstacle to mainstreaming Telehealth as a mode of healthcare delivery. Many healthcare agencies have adopted a “learning organisation” in order to align business objectives with performance expectations [8]. Applying the related idea of the “learning healthcare system” [9], we suggest that Telehealth projects must rise to the challenges of managing knowledge about Telehealth as a mode of health care service delivery, and of incorporating feedback
loops to enable system-wide improvements. This aspiration could be addressed by identifying a range of common elements across various Telehealth (or in the broader perspective, eHealth) project evaluation methodologies, and various health performance and productivity indicators used for health policy and planning. It also requires the development of approaches and platforms for making resulting evaluation findings more accessible and interpretable, which is another major area for investigation beyond the scope of this work.

We provide a brief summary of the state of the art in Telehealth evaluation frameworks in the next section. Then we discuss the type of performance indicators that might be incorporated in Telehealth evaluation framework designs to inform the development of appropriate evaluation measures. In the remainder of the paper, we provide two case studies of how these frameworks measures can be applied, in Australian and Canadian settings. We argue that this applied framework approach offers better potential for incorporating the resultant evaluations in business development and delivery, in a “learning organisation” mode of corporate governance.

1. Telehealth Project Evaluation Frameworks

Numerous suggestions have been made for project evaluation frameworks to be used for ICT projects in the health sector: these have been reviewed in [10]. These may draw their inspiration and structure from established generic ICT-oriented approaches (such as TAM / UTAUT which are typically applied to implementation of new systems) or from custom health ICT-oriented approaches (such as CHEATS which incorporates strong human factors elements). While many of the elements of these generic approaches are also applicable to Telehealth projects, there is currently no universal standard approach to evaluate specifically Telehealth projects (or indeed services). Attempts to codify Quality of Service criteria for Telehealth (such as the “Telescope” project in EU, and the recent ISO TS 13131:2014) may influence the future development of such standards.

The fundamental purpose of Telehealth project evaluation is the examination of the effectiveness, appropriateness and cost of a Telehealth intervention or service delivered by the project. This is achieved by answering four key questions [13]:

1. Does the intervention/service work?
2. For whom? And how well?
3. At what cost? And bringing benefits?
4. How does it compare with the alternatives?

These questions lead to a constructive positivist approach which extracts details in support of answering the questions, and has strongly influenced the construction of bottom-up (or individual factor-based) evaluation frameworks.

Early work by Hebert [11] suggested that Telehealth project evaluation frameworks should incorporate elements from at least three perspectives: structure, process and outcomes. This high level model provides a good natural fit with over project management and evaluation philosophies but does not usefully identify elements that are peculiar to Telehealth. By contrast, a far broader view was taken by
van Dyk [12] in proposing a systems-maturity-based model incorporating three orthogonal aspects of analysis in a 3-dimensional evaluation “cube”:

- **Maturity categories:** technical and non-technical IT infrastructure, work culture and practices.
- **Maturity levels:** internal and external benchmarking, change management, and organisational learning.
- **Telemedicine process:** each step in the telemedicine process needs to be successfully executed.

Common principles for identifying evaluation aspects were derived from consideration of the various frameworks described above [10]. These can be categorised as:

- **Technology aspects:** infrastructure components to delivery of a Telehealth service.
- **Administration and business aspects:** processes underpinning a Telehealth service critical to operating of the service, as well as health economics and policy elements.
- **Clinical aspects:** Telehealth services need to show benefits or desired outcomes.
- **Human factors aspects:** the way people work and response to the use of Telehealth.
- **Stakeholder aspects:** clinicians and patients are primary stakeholders, and administrative staff and support staff are also in scope.

Using this categorisation approach, we have recently proposed an integrating framework [13] which addresses these principles and allows choice of appropriate (but unprescribed) measures for its four different component classes which are as follows:

1. **Patient (control/use)**
2. **Clinician (Quality of care/benefits)**
3. **Organisation (viability/sustainability)**
4. **Technology (capability/capacity)**

A sound method for selecting measures within these components is to base them on a well-defined external reference set of factors which are recognised as essential considerations for high level organisation and operation of health services. In the next section we discuss the motivation for choosing such factors from the existing domain of health system performance indicators.

### 2. Performance Indicators and Evaluation Measures

For a nation’s health care system to “learn” as much as possible from its operations rapidly and expediently, so as to optimise its investment in health systems development (including areas such as eHealth and Telehealth), requires the existence of a national health systems assessment plan [14]. Implementing this plan leads to evaluation of projects or programs in relation to performance indicators that have been collaboratively developed and are commonly recognised by health care consumers, providers and policy-makers. Monitoring and reporting the performance of the publicly funded health care system, based on performance indicators derived from international
frameworks produced by OECD, WHO and similar agencies, is undertaken by several national governments [15]. Typically, a nation’s selected indicators are thematically grouped and linked to essential metrics for example for: accessibility, appropriateness of care, competence / capability, comprehensiveness, continuity of care, effectiveness, efficiency, efficient resource allocation, equity, expenditure / cost, healthy lives / health status, innovation / capacity to improve integration, patient experience, productivity / technical efficiency, responsiveness / trust, safety.

In order to align Telehealth services evaluation with evaluation of the health services they support – what we might call “meaningful evaluation” - evaluation planning must connect with the priorities of national agencies that undertake health system performance monitoring and the types of performance indicators that are most apt for translation into criteria for evaluating Telehealth projects and programs. The examples that follow illustrate the conceptual foundations in health services planning that may be missing from many grassroots Telehealth evaluation plans. These examples also show how “meaningful evaluation” would look different in two comparable countries, Australia and Canada, based on their health services priorities (their publicly funded health systems are co-operated by other levels of government too, but for reasons of space we consider overarching their national agendas only).

In Australia, the National Health Performance Authority (NHPA) has formulated performance indicators for hospitals and hospital networks, as well as for networks of primary and community care providers [16]. Performance indicators follow principles of policy fitness, scientific soundness and administrative efficiency. They reflect overarching priorities of equity, effectiveness and efficiency. They distinguish between performance outputs and outcomes. Their detail draws substantially on the standards and guidelines developed by the Australian Commission on Safety and Quality in Health Care (http://www.safetyandquality.gov.au/). An online “Indicator Catalogue” is associated loosely with the work of the NHPA (http://www.aihw.gov.au/all-indicators/). Reference to this performance oriented fabric runs through the mainstream activities in health policymaking nationally, and has influenced hallmark initiatives such as the establishment of safety and quality monitoring agencies, to assist with performance improvements in those domains, or the migration of Health services funding models towards incorporation of performance elements in their formulation.

In Canada, the Canadian Institute for Health Information recently reframed performance measurement for the whole health system, adding social determinants of health and health system outputs to the previous input and outcome dimensions of performance [17]. An online “Indicator Library” organizes 100 nationally applied performance indicators according to this Health System Performance Measurement Framework (http://indicatorlibrary.cihi.ca/display/HSPFM/). This work complements the Canada Health Infoway Benefits Evaluation (BE) Framework [18] for health information systems, deployed in Canada through its jurisdictional partners.

The BE Framework has three broad dimensions of HIS quality, use and net benefits. The quality dimension covers the technology aspects of the system, information and service. The use dimension covers system usage and user satisfaction. The net benefits dimension covers care quality, patient access and provider productivity. The updated BE Framework Report [19] contains instructions and resources to support application of the framework. It incorporates updated indicators for each original program area as well as new indicators, such as those within Telehealth implementations, and including guidance for planning benefits evaluation related to ICT for health solutions.
Similar to other eHealth innovations which aim to improve health system performance, Telehealth is not explicitly included in either country’s performance indicators. Thus it is not surprising that Telehealth evaluation plans still exhibit what has been broadly described as “indicator chaos”. Notwithstanding existing evaluation frameworks that have been developed for scholarly or industry purposes, we argue that to make Telehealth evaluation meaningful within the health system where it operates, the challenge remains to define indicators and metrics aligned with those of the system as a whole, test the feasibility of data collection, then test the power of this approach to generate transferable lessons from cumulated findings from separate sites over time.

3. Case Study I: Australia

Many past Telehealth projects and pilots in Australia have been based on the aspiration of Health service delivery optimisation, within local envelopes of funding and control. These factors tend to deflect any evaluation undertaken towards establishing those objectives, rather than assessing the influence on the broader system. This has partially resulted from disconnection between local performance objectives, often based on clinical effectiveness of a Health services unit, and higher level organisational performance objectives, keyed in to regional and national priorities and which often ignore unit level considerations.

A current initiative in the State of Victoria, Australia has engaged health informatics researchers with four health service provider organisations in designing a general purpose Telehealth evaluation framework that would be able to reference appropriate Australian national health system performance indicators. Table 1 illustrates orthogonal mapping of elements from the candidate performance frameworks, arranged from the most specialised to the most general level of interest in evaluation. The next stage in refinement of this scheme is to define the essential metrics and minimum data sets that stakeholder groups could be expected to provide, that would be required to determine the specific effects of Telehealth adoption on Health services outputs and outcomes.

Initial application of this approach has been incorporated in the evaluation processes for pre- and post- evaluation of the use of Telehealth to augment home visits by community care teams. The focus project entitled “The Royal District Nursing Service Integrated Home Telehealth Project” included nurse-supported care plan management and follow-up monitoring under guidance from a primary care clinician. Applying our approach resulted in development and initial testing of re-usable survey questions for four stakeholder groups, i.e. those groups identified as data sources in Table 1. Table 2 maps these against preliminary findings from the Patient/Client group as an illustration. The full application of the survey process and analysis of its final results are being undertaken as part of an Australian government funded Telehealth Pilots Programme (http://health.gov.au/ehealth-nbntelehealth) based on utilisation of the National Broadband Network, an initiative to increase ubiquitous connectivity to fast internet services across urban, regional, rural and remote parts of Australia.
Table 1. Telehealth project evaluation referencing national performance indicators.

<table>
<thead>
<tr>
<th>National Performance Frameworks</th>
<th>Relevant indicators and measures</th>
<th>Data sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia College of Rural &amp; Remote Medicine. (2012). ACRRM Telehealth advisory committee standards framework. [AT HAC%20Framework%20Standards%20Framework_0.pdf](<a href="http://www.ehealth.acrrm.org.au/system/files/private/AT">http://www.ehealth.acrrm.org.au/system/files/private/AT</a> HAC%20Telehealth%20Standards%20Framework_0.pdf)</td>
<td><strong>Adequate performance of IT equipment and infrastructure:</strong> The Telehealth equipment works reliably and well over the locally available network and bandwidth. The equipment is compatible with the equipment used at the other Telehealth sites and in the home. All the healthcare organisations participating in the teleconsultation, meet the standards required for security of storage and transmission of health information. Peripheral devices are used in a fit for purpose manner jointly determined by the patient and clinician. The Telehealth equipment is installed according to producer’s guidelines, where possible in collaboration with other organisations/clinicians using the Telehealth system. The equipment and connectivity are tested jointly by the participating healthcare organisation to ensure that they do what the producer claims they will. <strong>IT risk management:</strong> Risk analysis is performed to determine the likelihood and magnitude of foreseeable problems. There are procedures for detecting, diagnosing, and fixing equipment problems, Technical support services are available during the time that equipment is operating. There is back-up to cope with equipment or connectivity failure, which is proportionate to the consequences of failure.</td>
<td>IT managers’ service agreements and logs</td>
</tr>
<tr>
<td>Australian Commission on Safety and Quality in Health Care. (2012). Practice-level indicators of safety and quality for primary health care specification. <a href="http://www.safetyandquality.gov.au/wp-content/uploads/2012/02/consultation-paper-practice-level-indicators.pdf">consultation-paper-practice-level-indicators.pdf</a></td>
<td><strong>Appropriateness:</strong> health summary; timely initial needs identification; client assessment; complete care plan and timely review; recalls and reminders; adherence to clinical guidelines; medication review <strong>Effectiveness:</strong> client improvement / stabilization; attainment of goals of care <strong>Coordination:</strong> referral process and content; allocation of care coordinator; timely communication with care team <strong>Safety:</strong> adverse drug reactions and medication allergies; documented/near misses or adverse events investigated and followed up; infection control.</td>
<td>Service providers’ patient / client records</td>
</tr>
<tr>
<td>Australia’s Health Performance. (2010). Chapter 9 National Health Performance Framework and Indicators. <a href="http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=6442452959">WorkArea/DownloadAsset.aspx?id=6442452959</a></td>
<td><strong>Accessibility:</strong> People can obtain healthcare at the right place, at the right time irrespective of incomes, physical location and cultural backgrounds. <strong>Continuity of care:</strong> Ability to receive uninterrupted coordinated care or service across programs, practitioners, organisations and levels over time. <strong>Responsiveness:</strong> Healthcare service is patient oriented. The client is treated with dignity, confidentiality and encouraged to participate in choices related to their care.</td>
<td>Service users’ direct experiences</td>
</tr>
<tr>
<td>Australian Council on Healthcare Standards. EQUIP National Table. <a href="http://www.achs.org.au/media/38984/table_equipnational_standards.pdf">table_equipnational_standards.pdf</a></td>
<td><strong>Service delivery:</strong> (6 elements) <strong>Provision of care:</strong> (4 elements) <strong>Workforce planning and management:</strong> (4 elements) <strong>Information management:</strong> (4 elements) <strong>Corporate systems and safety:</strong> (9 elements)</td>
<td>Board of Management reports</td>
</tr>
</tbody>
</table>
Table 2. Example of mapping indicators to measures for the Patient/Client group.

<table>
<thead>
<tr>
<th>Patient / Client indicator</th>
<th>Measure</th>
<th>Preliminary findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Accessibility</td>
<td>How often have you seen / consulted your healthcare provider? Where have you seen / consulted your healthcare provider (for example, clinic, hospital, home)? How much have you paid out of pocket (this includes consultation fees, transportation, accommodation fees)? How many times have you had to wait to see / consult your healthcare provider due to service side issues (for instance, healthcare providers is running late or is not available)? How many times have you had to wait to see / consult your healthcare provider due to personal issues (for instance, you don’t have transportation or you are too unwell to travel)?</td>
<td>Patients/ clients were in their own home for more of the consultations they had with their healthcare provider, after the introduction of Telehealth. They reported no changes in any other factor.</td>
</tr>
<tr>
<td>Continuity of care</td>
<td>On how many occasions when you saw / consulted her/him was your healthcare provider up to date with your information (for example, blood pressure, medication, lab test results)? On how many occasions were you able to see/consult with more than one healthcare provider at the same time?</td>
<td>Patients/ clients found their healthcare provider was equally up to date with their health information, before and after the introduction of Telehealth. They were not ever able to see more than one healthcare provider simultaneously, either before or after the introduction of Telehealth.</td>
</tr>
<tr>
<td>Responsiveness of care</td>
<td>On how many occasions did you feel that you were treated with dignity and respect during the consultation? On how many occasions did you feel assured of your privacy and confidentiality during the consultation? On how many occasions did you feel that you were able to make decisions and choices about your care during the consultation? On how many occasions did your descent, or speaking background, or religious beliefs or other cultural identity have an adverse effect on the way a healthcare provider responded to you?</td>
<td>Patients/ clients were positive about all factors, both before and after the introduction of Telehealth.</td>
</tr>
</tbody>
</table>

4. Case Study II: Canada

Canada Health Infoway developed the BE Framework (described above) for evaluation of eHealth projects, which defined a range of Benefits Evaluation Indicators (see Figure 1). Areas of common benefits characteristics were identified: Systems, Information, Services and Usage, and associated sets of appropriate indicators were specified for use in evaluation exercises. The Benefits Evaluation Framework has been fairly pervasive as a primary tool to assess the effectiveness of Telehealth services across the health jurisdictions in Canada.
In 2011, Infoway commissioned an independent pan-Canadian study to describe Telehealth use in Canada and the benefits achieved to date [20]. The benefits were assessed utilizing the above Benefits Evaluation Framework. Amongst the study findings, in 2010, 5,710 Telehealth sites were being used in at least 1,175 communities across the country and nearly one-third (94,000) of a total 260,000 sessions are estimated to have been from rural and remote communities. The report also indicates that Telehealth in the home has future potential, offering improved quality of care for patients with chronic diseases and cost reductions in avoiding utilization of emergency and hospital services.

The province of British Columbia (BC) has undertaken a number of such Telehealth evaluation studies within its jurisdiction. One example is the Ministry of Health report [21] prepared to provide initial insights into the early benefits of Teleoncology use in BC – a program which was established in 2008. The evaluation demonstrated both qualitative and quantitative benefits. The qualitative benefits included the delivery of improved access for providers and patients and their families. The quantitative benefits included reduced negative societal impacts such as the cost of greenhouse gas emissions associated with travel to and from consultation sites.

In the same year, the Ministry of Health in collaboration with the Inter Tribal Health Authority and Vancouver Island Health Authority prepared an evaluation of a Teleophthalmology project [22] designed to enable screening eye examinations of First Nations patients at risk of diabetic retinopathy who live in remote Vancouver Island communities. Key to the community delivery of the retinal screening clinics was the positive impact of the relationships with community health care providers over the course of the project. The Teleophthalmology Project itself presented an opportunity for First Nations health organizations to collaborate and build on the delivery of diabetic care and self-management of the disease.

A recent executive summary to an evaluation report prepared by Gartner on British Columbia eHealth benefits [23], including Telehealth services, suggests that the
province continues to gain from its investments in Telehealth. The study methodology leverages the model and findings of three pan-Canadian benefits evaluation studies for Diagnostic Imaging, Drug Information Systems, and Telehealth previously commissioned by Infoway. Access, quality of care, and productivity are among the measures reported in the study for Telehealth. For example, there is a reported 881 Telehealth ‘endpoints’ across BC, with the number of Telehomecare patients doubling since 2009. In terms of Quality of Care, using Telehealth facilities, patients receive care closer to home, and receive specialist care faster as in the evidence of wait times for tele-wound care home consults falling from as long as 6-8 weeks down to 2-3 days. Productivity is evidenced, for example, by the number of physicians able to see patients in remote, rural locations without traveling.

Conclusion

We have advocated the adoption of a generic Telehealth project evaluation framework, within which evaluation is undertaken based on existing health systems performance indicators, using appropriately chosen measures. The two chosen case studies demonstrate the utility of the approach, making use of substantially different indicators to suit different stakeholder groups. They also individually show that an evaluation framework can make values and principles explicit and this increases the likelihood they will be integrated into practice and promotes a reflective approach, potentially resulting in greater understanding of, and ongoing revisions to, values and practice. We contend that this approach offers better potential for incorporating the learnings from the resultant evaluations into business decisions, by health agencies that aspire to be “learning organisations”. Considering evaluation-related benefits and challenges further increase the likelihood of an evaluation framework successfully guiding an evaluation. Repeated application of this methodology will lead to development of standardised expectations at national level and international levels, which in turn would enable sharing of the learnings (e.g. through a coordinated repository of project derived evidence). It could also lead to convergence of knowledge, skills and values so that current and next generation Telehealth practitioners would be trained in alignment with framework perception.

References

Governance and Management of National Telehealth Programs in Asia

Alvin MARCELO a,1 Jai GANESH b, Jai MOHAN c, DB KADAM d, BS RATTA e, Gumindu KULATUNGA f, Sheila JOHN g, Andry CHANDRA h, Oscar PRIMADI i, Athika Abdul Sattar MOHAMED j, Muhammad Abdul Hannan KHAN k, Abul Alam AZAD l, Portia MARCELO a

a University of the Philippines Manila, b Sri Sathya Sai Central Trust, Prasanthi Nilayam, Andhra Pradesh, India, c International Medical University, Malaysia, d Telemedicine Maharashtra India, e Telemedicine Society of India, f Suwasariya, Ministry of Health, Sri Lanka, g Medical Research Foundation, Sankara Nethralaya, Chennai, India, h Directorate Ancillary and Health Facility, Ministry of Health Indonesia, i Center of Data & Information, Ministry of Health Indonesia, j Ministry of Health Maldives, k GIZ Bangladesh, l Ministry of Health, Bangladesh

Abstract. Telehealth and telemedicine are increasingly becoming accepted practices in Asia, but challenges remain in deploying these services to the farthest areas of many developing countries. With the increasing popularity of universal health coverage, there is a resurgence in promoting telehealth services. While telehealth that reaches the remotest part of a nation is the ideal endpoint, such goals are burdened by various constraints ranging from governance to funding to infrastructure and operational efficiency. Objectives: enumerate the public funded national telehealth programs in Asia and determine the state of their governance and management. Method: Review of literature, review of official program websites and request for information from key informants. Conclusions: While there are national telehealth programs already in operation in Asia, most experience challenges with governance and subsequently, with management and sustainability of operations. It is important to learn from successful programs that have built and maintained their services over time. An IT governance framework may assist countries to achieve success in offering telehealth and telemedicine to their citizens.

Keywords. Telehealth, telemedicine, IT governance, management, framework

Introduction

Telehealth and telemedicine have been practiced in Asia for quite some time [1,2] but only recently has there been accessible documentation to evaluate public funded national programs. The Telemedicine Development Center of Asia [3] has extensively documented experience providing regional support to countries’ need for remote medical education. Innovative private-sector-led programs also abound [4] but largely

1 Corresponding author: alvin.marcelo@gmail.com.
operate through internal funding. Telehealth programs working nationally with public funds are often unpublished.

The Asia eHealth Information Network (www.aehin.org) is a group of four hundred plus eHealth advocates composed of representatives from ministries of health, ministries of information technology, academe, and non-government sectors with an interest in promoting eHealth in the region and within their respective countries. Since its inception in 2012, the AeHIN has embarked on strengthening the capacity of countries for designing and implementing national-scale health information systems. Recently, it co-organized a conference on measuring and achieving universal health coverage with information and communications technology [5]. In this conference (and in a previous one [6]), telehealth and telemedicine were cited as key technology-dependent activities that can contribute greatly to realizing the benefits of universal health care (UHC). IT governance was also listed as an important enabler for successful national eHealth systems.

Telehealth and telemedicine are complex processes that are dependent on even more complex underlying information technologies. Without an organizing framework like IT governance, implementers of these programs (health and IT professionals) succumb to this complexity and often encounter failure. Adding to the challenge is the lack of experience of many implementers with the sophistication required by systems that need to be deployed nationally.

Many citations can be obtained about telehealth and telemedicine practice in Asia but only a few programs are actually operating (or were designed to operate) at national scale with support and funding from government. This paper aims to collate public funded, national telehealth programs and assess their governance and management systems using an industry-accepted IT governance framework.

COBIT5 is an IT governance framework developed by the Information Systems Audit and Control Association (www.isaca.org). It is considered a best practice framework created and maintained by a global group of experts with experience in governing and managing complex IT environments. The framework is available for free at www.isca.org/cobit.

ISO/IEC 38500 Information technology – Governance of IT for the organization is an international standard on corporate governance of IT released by the International Organization for Standardization Organization (ISO) and the International Electrotechnical Commission (IEC). It is a framework for the effective governance of IT at the highest levels of the organization. The standard is downloadable at www.iso.org for a fee. As the two frameworks are comparable, COBIT5, which is freely downloadable, will be used for this study.

A key principle of COBIT 5 is to separate governance from management. This separation serves to clarify the lines of accountability (governance) and responsibility (management) for key processes in the whole enterprise information technology program. Governance requires "evaluating stakeholder needs; setting direction through prioritization and decision making; and monitoring performance, compliance and progress against plans" [7]. Management on the other hand, takes the “results, guidance and output from these governance activities, and plans, builds, runs and monitors activities (PBRM) to ensure alignment with the direction set by the governance body”. This alignment of governance and management is aimed at achieving the enterprise objectives. The hypothesis is that when strategy is aligned with operations, then stakeholder needs will be met.
1. Objectives

The objectives of this article are: to enumerate the various national telehealth programs in Asia, assess their underlying governance and management structures, and identify factors that may contribute to their success or failure from the governance and management perspectives.

2. Methodology

A search of Pubmed for “national telehealth programs” AND “Asia” was conducted followed by specific searches per country (replacing “Asia” with “country name”). Requests for information were also released in the AeHIN general mailing list. A Google search was also performed for the same query strings. Regional telehealth activities such as those conducted by the Telemedicine Development Center of Asia (TEMDEC), which are beyond national scope, were excluded. Programs that have reached national-scale but not yet formally endorsed by the ministry of health were also excluded from the study.

3. Results

The search yielded a total of nine national/state-wide telehealth programs from seven countries (Table).

3.1. National Telehealth Programs

Seven countries have national telehealth programs collected from the review of literature and from the request for information.

A review of the state of governance and management of these national telehealth programs was done from the following sources: published articles, official websites, and personal communications with key informants. Where possible, information was obtained from the focal point of the management body of the national telehealth program.

| Table 1. State of governance and management of publicly funded national telehealth programs in Asia |
|------------------------------------------|--------------|-----------------|---------------------------------|
| **Country (program)** | **Governance** | **Management** | **Reference** |
| India (ISRO Teledicine Program) | Development and Education Communication Unit (DECU) | Devolved to inter-institutional level coordinators | isro.gov.in/applications/tele-medicine |
| India (Sankara) | Sankara | Department of | www.sankaranethralaya.org |
Either the Ministry of Health (MOH) alone or a multi-sector group led by MOH governs the national telehealth programs listed. Of the nine programs, formal units within the MOH structure manage six, academic institutions manage two, and a non-government organization operates one.

4. Discussion

Varghese and Scott [8] had conducted a survey on telehealth policies in 2004 and discovered wide variance in policy maturity and readiness of countries in the region. Ten years after, these policies have evolved into concrete implementations as summarized in this paper. This paper’s high-level analysis, which focused on governance and management, revealed several interesting facets about national telehealth programs in Asia.

Governance has been cited in the literature as an important factor in successful telehealth programs [9,10].

COBIT5 emphasizes, as a matter of principle, the importance of separating governance from the management of enterprise IT [11]. They claim that with this separation, there is an easier check and balance between the two domains resulting in better performance for both.

In this study, while most telehealth programs claim that they have governance and management structures, a few admit that their governance bodies have not been as active as desired. These admissions are further corroborated by the lack of accessible
websites to obtain references about the activities of the governance body or even how to access telehealth services.

These websites are sensitive indicators of the state of governance and management, as they serve as mechanisms for disseminating information about the programs as well as portals to the actual telehealth services. These are important knowledge products especially if the target audience is the general public.

Realizing that most members of the highest decision-making body of a national telehealth program may not have the comprehensive knowledge about IT, COBIT5 emphasizes five processes that they should own to empower the rest of the complex processes underneath them to move in accordance with their desired strategy and directions.

The five key processes for the governance bodies of national telehealth programs are: “ensure governance framework setting and maintenance, ensure benefits delivery, ensure risk optimization, ensure resource optimization, ensure stakeholder transparency.” [12]

4.1. Ensure Governance Framework Setting and Maintenance

From all the sites studied, there were no explicit statements about any overarching IT governance framework being adopted by the national telehealth program. Although this lack of information does not mean that there is no underlying framework, its absence on program websites suggests that it is not being communicated explicitly to the stakeholders. In such cases, there is practically no governance framework being maintained.

In the Philippines, while the National eHealth Steering Committee had adopted COBIT5 as their governance framework [13], the National Telehealth Service Program has not yet formally aligned with it.

Ensuring governance framework setting is a leadership function that triggers the rest of the framework into action.

4.2. Ensure Benefits Delivery

Where available, the programs expressed similar benefits: access to quality health information, good governance, equity, and improved health outcomes [14]. Many of the countries have formally expressed aspirations for UHC and cited telehealth as an important tool to achieve that. Key performance indicators (KPIs) however are not evident in most programs and are difficult to elicit from their official websites. With IT governance, these KPIs are ideally formalized at the outset and are publicly announced.

4.3. Ensure Risk Optimization

Risks were not explicitly mentioned in the program websites although some have mentioned privacy, confidentiality, and sustainability in scientific publications describing the program. Risk registers are often proprietary and it is usual for most enterprises not to divulge them due to the sensitive nature of their contents. However, high-level statements on key risks (privacy and confidentiality) are indications of the programs’ awareness of these risks and of their efforts to take a proactive stance to prevent these risks from converting into problems.
4.4. Ensure Resource Optimization

All of the programs reviewed are funded by the national government through public funding. Financial statements were not readily accessible from the programs but a few had cited the difficulty of sustaining their efforts without a guarantee of constant regular resources from national government. In general, most programs are challenged by the lack of funds to sustain their programs which may suggest poor resource optimization.

4.5. Ensure Stakeholder Transparency

In the review of official documents, websites, and key informant interviews, stakeholder transparency is still implicit and is not formally expressed. While some programs have clear published organizational structures, most do not explicitly inform the public about their prevailing governance mechanisms, minutes of meetings, or formal agreements.

Governance is ideally established by the highest decision-making body in the country which takes accountability for evaluating the needs of stakeholders, for setting directions, and for monitoring progress. Aside from defining the expected benefits from the national telehealth program, they also determine acceptable risks and provide the necessary resources to operate it. Since most benefits will redound to the health sector, the ministry of health is the natural leader of the national telehealth program. But because risks and resources are often shared with other agencies (e.g., ministry of ICT, national health insurance agency, clinical professional associations, health providers, sub-national governments, academe, etc.), a multi-sector structure is the ideal form for governance. Unless this structure is created and its members perform their governance tasks, the national telehealth program will be confronted with obstacles often beyond management’s ability to surmount, resulting in failure.

Management on the other hand requires a thorough understanding of the benefits, risks, and resources set forth by the governance structure. Aside from ensuring smooth operations, they also constantly communicate with the decision-makers on the state of the program and provide feedback that all components needed to deliver the benefits are operating as expected. The lack of websites for some programs indicates that their core governance process of stakeholder transparency has not yet been activated.

Conclusions

National telehealth programs are one of the most complex enterprise information systems around the world due to the number of stakeholders and components involved in its design and operation. Such complex systems can benefit tremendously from the systematic organization offered by IT governance frameworks. Although the maturity and sophistication of each program studied varied widely, they all shared in the vision of better access to health information towards an empowered and healthier citizenry. A clear vision is a good starting point for the application of IT governance for national telehealth programs. But in order to concretize this vision into actual benefits to relevant stakeholders, alignment of governance and management is required.

The lack of clarity on the state of governance for the national telehealth programs suggests that most of the threats they face such as sustainability and stakeholder
adoption are rooted on this problem. Unless addressed explicitly through the application of IT governance frameworks, these programs will continue to be susceptible to the challenges posed by their complex environments.

References


Telehomecare Reduces ER Use and Hospitalizations at William Osler Health System

Sandra MIERDEL\textsuperscript{a,1} and Kirk OWEN\textsuperscript{b}

\textsuperscript{a} Telehomecare, Ontario Telemedicine Network, Toronto
\textsuperscript{b} Decision Support, William Osler Health Services, Brampton

Abstract. Background: The Ontario Telemedicine Network’s Telehomecare initiative brings together specially trained clinicians and technology to coach patients with COPD and/or heart failure to monitor vital signs and manage their health at home.

Objectives: To evaluate pre- and post-enrollment and post discharge data captured by Telehomecare host William Osler Health System (WOHS).

Outcomes: Results demonstrate a 46% reduction in emergency department use and a 53% reduction in hospitalizations post-enrollment compared to pre-enrollment. Average length of stay (LOS) dropped by 25% of a day compared to pre-enrollment. In addition, six months after Telehomecare discharge, inpatient admissions and emergency department visits continued to decline, by 65% and 57% respectively, compared to pre-enrollment. While average LOS increased between pre-enrollment and post-discharge, the reduction in acute inpatient episodes created a net reduction in accumulated inpatient days of 563.16 days (63% reduction).

Conclusions: The WOHS Telehomecare results strongly support the positive influence of the program on health system utilization and the development of effective long-term self-management skills. Next steps could include reviewing, more closely, the reasons for hospital utilization and undertaking a cost-benefit analysis to support further expansion of the program to address other chronic illness and care needs.

Keywords. Telehomecare, self-management, health system utilization, technology, chronic disease, telehealth

Introduction

It is estimated that the major categories of chronic disease, diabetes, heart disease, chronic respiratory illness, cancer, were responsible for more than 65% of healthcare expenditures in Ontario in 2010/11 [1]. These patients require ongoing care and monitoring and are, therefore, not well served by the existing episodic model of care. An innovative new Telehomecare initiative brings together specially trained clinicians and technology to help patients with chronic disease monitor vital signs and learn to
manage their health at home through self-management coaching. The program, which is overseen by the Ontario Telemedicine Network and funded provincially and federally, is targeted to patients with Chronic Obstructive Pulmonary Disease (COPD) and/or Congestive Heart Failure (CHF).

Following a successful pilot, the initiative began provincial implementation in 2012. To date, more than 4,500 patients have enrolled in Telehomecare through seven Ontario Local Health Integration Networks (LHINs) that deliver it through hospitals or Community Care Access Centres. William Osler Health System (WOHS) is the host organization for Telehomecare for the Central West LHIN.

Oxygen saturation, weight, blood pressure and heart rate are measured weekdays and transmitted by tablet to a designated clinician who can monitor patterns, thereby helping to prevent exacerbations and hospital re-admissions or avoidable ER visits. Coaching addresses topics like generating an action plan, healthy lifestyle, being active and exercising, managing breathing and saving energy, preventing symptoms and taking medications, learning about self-management and practising for the weekend. Monitoring results are shared with the patient’s most responsible provider to complement the existing circle of care. To enroll in Telehomecare, patients can self-refer or be referred by a care provider.

The initiative is based on Best Practice Guidelines including those of the Canadian Thoracic Society and the Canadian Cardiovascular Society. Through constant evaluation, Telehomecare is designed to respond to changing needs and emerging technology, ensuring cost-effective sustainability. Telehomecare helps patients manage their own health and enjoy the best possible quality of life while, at the same time, helping to ensure the appropriate use of healthcare resources.

1. Study Aims

To evaluate program impact, WOHS tracked health system utilization data for patients participating in Telehomecare pre- and post-enrollment as well as post-discharge.

Results of changes in emergency department (ED), acute inpatient (IP) admissions and average lengths of stay (LOS) were analyzed.

2. Study Methods

WOHS, in partnership with Headwaters Health Care Centre (HHCC), a community hospital and only other acute care organization within the Central West LHIN, initiated a review of hospital utilization by patients enrolled in Telehomecare to assess program impact. Considering the structure of the program (a six-month intervention), the review was constructed to focus on three six-month periods of time: immediately prior to enrollment in the program, during the enrolled period and immediately following discharge from the program.

All patients enrolled and registered with a virtual visit in Telehomecare, from initiation (April 2012) to September 2014, were retrieved from WOHS’ electronic medical
record system (Meditech). Visits were grouped to unique patients by health card number. The chronologically first visit date reported for each patient was determined to be the patient-specific enrollment date. Enrolled patient discharge date or September 30, 2014 was used alongside the enrollment date to determine the duration of participation for each patient with a visit within the study period.

Patients enrolled for at least five months were included in the pre- and post-enrollment review. For inclusion in the post-discharge review, patients must have been discharged from Telehomecare for at least five months by September 30, 2014, and not have expired in hospital or at any Central West LHIN acute care facility within that five-month period.

Patient-specific acute inpatient episodes and ED visits were retrieved for all selected cases. WOHS & HHCC utilized both an encrypted email server, hosted by Osler, and encrypted files to enable a review of acute inpatient and emergency department activity at both facilities for all selected cases. The retrieval period spanned to include activity with acute discharge dates and ED registration dates up to six months prior to the earliest recorded enrollment date, and acute inpatient admission dates and ED registration dates up to September 30, 2014. LOS details were calculated for acute inpatient cases using the period between admission and discharge date. No diagnostic criteria were established to determine inclusion of the acute inpatient or ED activity in the review, therefore all acute inpatient and ED interactions a patient had with either WOHS or HHCC were included in the review.

Counts of acute inpatient and ED episodes within monthly periods pre- and post-enrollment and discharge were derived. The activity was grouped to a patient by their reason for enrollment (‘Reason for Visit’ as collected in medical record) in Telehomecare (i.e. CHF, COPD or both diagnoses). Six-month activity rates were calculated as the sum of all activity (acute inpatient or ED) within the six-month period, divided by the number of patients included in the review. Average LOS was calculated for all acute inpatient episodes within the three periods of interest.

3. Results

Reported results reflect activity from initiation to September 30, 2014.

3.1. Pre- and Post-Enrollment Group (12-Month Review)

The average age of the 466 identified pre- and post-enrollment Telehomecare participants was 73.2 years (47% 75–79 years, 29% 80–89 years, 4% >90), with a 50–50 split between male and female participants. The six-month ED activity rate was 42% lower compared to the pre-enrollment rate. The six-month inpatient activity rate post-enrollment was 53% lower than the pre-enrollment rate. Average LOS was a quarter day shorter when compared to the pre-enrollment period.
Table 1. Patients enrolled in Telehomecare showed dramatic reductions in both the number of hospitalizations and ED visits after enrollment, as well as in the average length of stay in hospital, when compared to the period before enrollment.

<table>
<thead>
<tr>
<th>Patients enrolled at least 5 months...</th>
<th>Activity/Patients/6-month period (n=466)</th>
<th>Inpatient Episodes</th>
<th>ED Visits</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Avg Length of Stay (days)</td>
<td>Pre-Enrollment</td>
</tr>
<tr>
<td></td>
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<td>0.93</td>
</tr>
</tbody>
</table>

3.2. Pre- and Post-Enrollment/Post-Discharge (18-Month Review)

A total of 125 patients were included in this review period. In the post-discharge group, average age was 72.9 years (45% 75–79 years, 26% 80–89 years), 55% male and 45% female. Six-month ED activity rates declined across the three periods, from 1.68 visits per patient pre-enrollment to 0.72 visits per patient post-discharge (57% reduction). Six-month inpatient activity rates also declined across the three periods, from 1.01 discharges per patient pre-enrollment to 0.37 discharges per patient post-discharge (64% reduction).

The highest average LOS occurred during the enrollment period, 7.80 days, dropping after discharge to 7.15 days, but remaining slightly higher (1%) than the pre-enrollment period (7.08 days). The average LOS for the COPD cohort showed more significant improvement post-discharge than did the CHF cohort when compared to the pre-enrollment period (8.73% reduction vs. 15.25% increase). While the average LOS for the total cohort increased between the pre-enrollment and post-discharge periods, the reduction in acute inpatient episodes created a net reduction in accumulated inpatient days of approximately 570 days (63% reduction).
Figure 2. 18-Month Review (Pre/Post Enrollment and Post-Discharge).

Table 2. The 18-month Review results demonstrate that the reduction evident from the pre/post enrollment analysis was both maintained and improved. This post-discharge review shows decreasing hospitalizations and ED visits across the period alongside a net reduction in inpatient days.

4. Conclusions

Results for William Osler Health System demonstrate a significant reduction in emergency department use and reduced hospitalizations both post-enrollment and post-discharge when compared to pre-enrollment data. In addition, six months after discharge from Telehomecare, inpatient admissions and emergency department visits continued to decline. These results are consistent with evidence from recent studies using rigorous research methods that associate home-based telehealth interventions (e.g. telemonitoring, telephone support, videoconferencing) with beneficial results that include reductions in use of healthcare services, which include hospital admissions/readmissions, length of hospital stay and emergency department visits [2,3].

The increase in average LOS at six months post-discharge for enrolled patients with CHF may suggest that when patients did utilize the acute care system, their need and/or medical complexity was greater than in the pre-enrollment period. The result may indicate a more appropriate use of acute care resources, and that patients required
hospital admission to stabilize their condition. The Telehomecare results from William Osler Health System are strong evidence for the benefit of the program in positively influencing health system utilization through a model of care that empowers patients to develop effective and long-term self-management skills well past program discharge.

As a program designed to coach and strengthen patient disease self-management, Telehomecare appears to be meeting aims related to the reduction of dependence on the acute care system. CHF and COPD patients in the Central West LHIN, and provincially as greater deployment of the program rolls out, are benefiting from an innovative combination of specially trained clinicians and technology, right in their own homes. Patients are gaining greater awareness of their condition, as well as the important measures of their well-being, and are supported to gain confidence in their ability to self-manage.

Currently, Telehomecare programs are available in seven LHINs in Ontario, with the goal to have all LHINs across the province offer the program to eligible patients. Work is underway to apply the same methodology to evaluate program impact on health system utilization across all current and future Telehomecare programs. Consistent data collection and analysis allow for the evaluation of program impact/outcomes across the province.

While the program evaluation outlined herein offers a foundational performance measure, there exists great opportunity for further review. Another key indicator of Telehomecare success would be perceived benefit on the part of the patient, which might offer insight into whether the changes in patient health system utilization (acute inpatient and ED episodes) are aligned with a better grasp of tools, measures and community resources available to self-manage their disease.

Building from the existing evaluation, there is also opportunity to review, more closely, the reasons for hospital utilization, with respect to diagnosis and condition complexity. While improved patient experience, access to care and better well-being are the primary objectives of the program, a cost-benefit analysis could potentially strengthen support for further expansion of Telehomecare to a wider range of patients with other chronic illness and care needs.

A recent systematic review conducted by Bashur et al, with participation by Dr. Edward M. Brown, Chief Executive Officer, Ontario Telemedicine Network, looked at the impact of telemonitoring on key chronic diseases such as heart failure, stroke and COPD [2]. The study found that the capacity for early intervention and rapid response associated with telemedicine and the resulting empowered, educated and engaged patients, can have significant effects on outputs, one of which is cost of service. The study found that costs are frequently reduced by avoiding unnecessary services. Moreover, the study suggests that the costly complications of chronic illness may be reduced, yielding improved health outcomes among better informed patients, who are more likely to engage in positive health behaviours and adhere more closely to prescribed medical regimens and self-care guidelines.

When considering the large burden chronic disease places on the healthcare system, healthcare transformation can be supported by a shift to a chronic care model, with a greater emphasis on creative, innovative solutions that potentially reconfigure the traditional service delivery model to offer sustainable options for delivering high-quality care at the right cost [4,5]. The aim is to support those with chronic diseases to maintain their independence and remain in their own community and in their own homes, receiving the right care, at the right time, in the right way and by the right providers.
An integrated model of care that connects patients to their healthcare teams in real time can shift the health system from expensive hospital-based acute and ED care to a more proactive community-based model in which care options are delivered in patients’ own homes.

Expansion of Telehomecare across Ontario can offer the community supports to manage and prevent exacerbation of chronic disease, promoting improved access to care for enrolled patients, while also offering cascading benefits for the entire health system.

References

Telehealth Application in Occupational Health

Janet G. MORRISON 1
British Columbia Institute of Technology, School of Health Science

Abstract. While occupational health is a significant driver of population health, productivity, and well-being in Canadian society, most workers do not currently have adequate access to qualified occupational health services. A case study is used to demonstrate the utility of a telehealth approach to service delivery.

Keywords. Occupational health, telehealth, Canada, underserved populations

Introduction

While most adults spend a significant portion of their waking hours in paid employment, occupational health services are currently only available to those working for the largest, most concentrated, and well-funded employers. Employees of small to medium sized firms, who make up the bulk of the Canadian work force, or those in workplaces spread across wide geographic areas, remain an underserved population.

Telehealth programs have often been implemented in an attempt to apply a technological solution to the problems of regional disparities in care, limited resources, and large geographic/demographic/healthcare provider distances. Telehealth is defined as “the use of electronic information and telecommunications technologies to support long-distance clinical health care, patient and professional health-related education, public health and health administration” [1]. Some examples of telehealth applications include the use of health information networks, electronic health record systems, health portals, telemedicine, and personal wearable and portable communication systems [2].

This paper takes the position that telehealth methods could be a way to provide occupational health services to currently underserved worker populations. An example of a telehealth application in healthcare is provided as an illustration of the utility of a telehealth approach to occupational health services.

1. Context – Why Is This Important?

Occupational health and wellbeing has a significant impact on population health. Workplace injuries and illnesses caused by poorly designed equipment, work processes, or work environments lead to temporary or permanent disability, decreased productivity, and may result in loss of employment and a poor quality of life for both

1 Corresponding author: janet.morrison@bcit.ca.
individuals and their families. On an individual level, poorly designed work or work practices are a factor in the development of workplace stress and its effects: cardiovascular disease and psychological illnesses such as depression, anxiety, and anger/violence issues. Moreover, the risk of occupational disease has recently been highlighted by the death of over 349 health care workers in the recent ebola outbreak [3]. Health care and other workers are routinely exposed to more common infectious diseases (for example hepatitis, HIV, influenza, mumps, measles, whooping cough, etc.) that also carry the risk of illness, chronic disease, and death.

Without access to high quality and readily accessible occupational health services, the majority of the working population lack information about how they can understand, prevent or mitigate risks, or where they can seek advice regarding injuries or illnesses arising from their occupational exposures.

2. Case Study

The case study describes the implementation of a telehealth system in the occupational health nursing service of a large suburban health authority in British Columbia – the Workplace Health Call Centre (WHCC). This health authority employs approximately 29,000 workers over a wide geographic area comprising 12 acute care sites and 7600 residential care beds. The occupational health nursing service employs 11 full time equivalent occupational health nurses (OHNs). The OHN service focuses on communicable disease exposure, prevention, and control.

Prior to 2009, the OHNs were situated in the acute care sites of the health authority. In 2008 a quick succession of infectious disease outbreaks (mumps, measles and chickenpox) in the community resulting in employee exposures, overwhelmed the service capabilities of the OHN staff. It quickly became apparent that the OHN service simply did not have any surge capacity to deal with rapidly developing outbreaks. Furthermore, employees’ occupational health histories, and in particular, records of their immunizations, either did not exist (only about 10-20% of employees had immunity records on file) or were not readily available. The lack of immunity records added to an already difficult staffing situation since non-immune staff could not be scheduled to work in areas where they might be exposed to an infectious disease.

It was decided to re-organize the department to create a centralized workplace health call centre with corresponding field services teams. A key component of the call centre approach would be the adoption of the WHITE (Workplace Health Indicator Tracking and Evaluation) database as an electronic health record. WHITE had originally been developed by the Occupational Health and Safety Agency for Healthcare (OHSAH), a joint venture of health care employers, researchers and unions in British Columbia, in order to develop a comprehensive, province wide database of health care incident, injury and illness data. Work had begun on WHITE in 2002 and it was first released in 2004. Over time it evolved into a web based system containing 5 modules covering functions such as incident and injury reporting and documentation; electronic submission of Workers’ Compensation Claim documents and claims cost tracking; recording and tracking of long and short term disability; and documentation of worker training and education. It also had the capability to be used as an employee health record to document and record employee health histories, immunizations, communicable disease exposures, and allergies. The OHNs began using this in 2009.
Under the new system new employees call the WHCC and can complete their immunization history with an OHN in less than 10 minutes – formerly this required a face-to-face visit and took about 30 minutes. An employee who experiences contact with blood or body fluids can call the WHCC and speak directly with an OHN. Using WHITE the OHN documents the incident, provides individual counseling to the employee and if necessary, emails laboratory requisitions, refers to medical treatment, or if applicable, advises on the availability of immunization clinics offered by the field services team. A follow up protocol is implemented that tracks laboratory results, matches incident source and victim results, and if necessary, flags the file for future follow up. The WHCC also receives notification of blood and body fluid exposures of health care workers reported to Emergency Departments and all follow up laboratory results are centralized to the call centre for a more consistent approach to documentation and management.

The final piece of the service was to centralize the documentation and follow up of all occupational communicable disease exposures within the call centre. Examples of these diseases include meningococcal disease, mumps, measles, pertussis, and tuberculosis. In the event of an exposure, the OHNs are notified by the health authority Infection Control Practitioners. The OHNs use protocols based on the guidelines of the British Columbia Centre for Disease Control to determine if employees meet the definition of exposure and if they require protection through furloughing, immunization, or prophylaxis.

OHN field services teams serve as the interface between the WHCC and the employee. The field services teams have regularly scheduled clinics throughout the health authority; however in the event that mass immunizations are required, for example in the fall when mass immunization for influenza is required, team size can be increased and additional clinics scheduled. Likewise in the event of disease outbreaks, a ‘flying squad’ can be assigned to conduct immunizations at a specific facility.

Aside from better service availability and increased efficiency, it quickly became apparent that the call centre approach had other immediate benefits. In addition to a fourfold improvement in compliance with new employee health histories, data on communicable disease contacts such as tuberculosis, needlestick injuries, and blood and body fluid exposures could now be systematically collected for trend analysis. Importantly, the system’s surge capacity was demonstrated during an outbreak of pertussis (whooping cough) in the summer of 2012 and again in 2013 during a measles outbreak.

The WHCC approach was so successful in this health authority that it has subsequently been expanded to serve the entire province, a total of 110,000 health care employees.

3. Discussion

The case study described above is an example of a successful implementation of an occupational health telehealth system designed to deliver specific services to a health care worker population. However, it could be argued that telehealth applications in occupational health could provide broader and much needed services to a wider population.

The Canadian workforce reflects many of the health problems common to developing countries:
• An ageing workforce – the number of workers aged 65 or greater is increasing [4] which means that workers may have one or more chronic illnesses such as diabetes, cancer, obesity, or some form of physical or cognitive impairment.
• There is an increased risk of exposure to infectious diseases, emerging diseases, and new risks in the workplace, for example nano-technology and new chemicals.
• Mental health issues and co-morbidities such as alcohol and drug abuse, and smoking.

In the United Kingdom, a recent task force report from the Council for Work & Health [5] called for a more proactive and expanded approach to occupational health services. This approach would see a wider application of occupational health services to include the provision of health coaching to workers to prevent the development of chronic illnesses, and to provide support for workers with chronic health conditions to help them manage their conditions while they stay at work. The report also called for services to be extended to those who are currently unable to work due to chronic illness or disability with a view to assisting them to return to paid employment. These, and other health promoting efforts, are certainly amenable to telehealth applications.

3.1. Positioning Occupational Telehealth

The task force [5] also questioned the positioning of occupational health promotion services with employers and suggested that these services might be better aligned with public or community health providers. Currently, the majority of occupational health services available to working Canadians are provided by workplace regulators, compensation boards, and employers. The main thrust of these efforts focus on the vested interests of those providers: regulatory compliance, and returning workers to work following injury. While unions play a significant role in occupational health and safety advocacy only about one third of Canadian employees are currently represented by unions [6]. Consequently, in all but the largest organizations, there is little or no emphasis placed on health promotion for workers or their families, and workers seeking balanced and unbiased advice regarding their occupational health have few sources to turn to. To overcome this inequity it would make sense that occupational telehealth would make its greatest impact situated within a public or community health service.

3.2. Limitations

Workplaces are complex socio-technical environments shaped by organizational, regulatory and social rules, conventions, and norms. In many ways telehealth is a disruptive technology [7]. Normalization, the process by which an innovation becomes the normal way of working, requires the ongoing investment of meaning, commitment, effort, and appraisal by those involved [8, 9]. As can be seen in the case study, the success of the WHCC required buy-in and co-operation at many levels of the organization. Developing and implementing a successful telehealth initiative requires a thoughtful approach. Further, the expansion of occupational telehealth in Canada is currently limited by a lack of qualified health professionals: statistics published by their
professional associations show that there are only 716 certified occupational health nurses [10] and 54 certified occupational health physicians [11]. An expansion of occupational telehealth services would require increased health manpower, and the implementation of occupational health services standards and accreditation. [See for example 12].

Conclusion

Occupational health is a significant driver of population health and directly influences the productivity and well-being of Canadian society. Occupational telehealth has the potential to deliver high quality services to working Canadians, the majority of whom currently do not have the ability to access to this kind of service. The case study illustrates the utility of a telehealth system, combined with face-to-face field service teams, to deliver high quality occupational health services to a large, widely dispersed employee population. While this example was specific to health care, it could be adapted to provide a wide variety of proactive health promotion services.

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Exploring the Views of Emergency Department Staff on the Use of Videoconferencing for Mental Health Emergencies in Southwestern Ontario

Kyle R. PANGKA a, Ranjith CHANDRASENA a, b, Nishardi WIJERATNE c, and Miriam MANN a, d

a Schulich School of Medicine, London, Ontario, Canada
b Chatham-Kent Hospital Alliance, Chatham, Ontario, Canada
c Queen’s University School of Medicine, Kingston, Ontario, Canada
d Huron Perth Healthcare Alliance, Stratford, Ontario, Canada

Abstract. Patients presenting to a rural emergency department (ED) with mental health symptoms have difficulty accessing services of mental health professionals [1,2]. Videoconferencing (VC) has been found to improve patient access to health services that require specialist care in rural EDs [3,4,5]. Although previous studies highlight the benefit of using VC for patients presenting with mental health emergencies, no study has investigated the current views and use of VC for mental health emergencies in EDs in Southwestern Ontario [3,5,6]. To explore the views of ED staff regarding the use of VC in mental health emergencies, structured telephone interviews were conducted with representatives from EDs in the Erie St. Clair and Southwest Local Health Integration Networks (LHIN). Participants noted that using VC for mental health emergencies may improve patient experience and benefit crisis response teams. VC was perceived by some participants as a means to expedite the direct assessment of a patient presenting with a mental health emergency by a mental health specialist. However several participants stated that using VC for mental health emergencies strains ED resources. Lack of use and difficulty accessing a psychiatrist were identified as potential barriers to implementing the use of VC for mental health emergencies.

Keywords. Telehealth, Videoconferencing, Mental Health, Rural, Emergency Department, Psychiatry, Telepsychiatry, Emergency Medicine

Introduction

Telepsychiatry in the form of videoconferencing (VC) has been found to improve patient access to psychiatric services in rural or remote regions [3,4,5]. VC is occasionally used in emergency departments (EDs) to connect patients presenting with a mental health emergency to off-site mental health specialists, such as mental health nurses, crisis workers, or psychiatrists. Yellowlees et al have described cases involving the use of VC in the emergency management of depression with suicidal ideation, acute psychosis, post-traumatic stress disorder, and child abuse [7]. Programs incorporating VC in mental health emergencies have been implemented in Australia and Norway to improve patient access to mental health specialists in rural areas. This study aimed to explore the views of ED staff regarding the use of VC for mental health emergencies in Southwestern Ontario.
areas [5,8,9,10,11,12]. The Mental Health Emergency Care Rural Access Program (MHEC-RAP) in New South Wales utilizes mental health nurses to assess and triage patients by phone or through VC [10]. The program also involves 24/7 support from psychiatrists at either the central site, or on-call [10]. The MHEC-RAP services a population of approximately 300,000 and from 2008 to 2011 the program averaged 208 emergency telephone triages and 65 VC assessments per month [10].

The University Hospital of North Norway (UNN) introduced a program in which VC studios were installed in remote regional psychiatric centers and in the homes of psychiatrists participating in a 24/7 on-call service to enable psychiatrists to take part in patient consultations by VC [11,12]. A study of the program by Trondsen et al found VC had a positive effect on patient and healthcare worker experience: Patients valued direct communication with psychiatrists through VC and the use of VC increased the confidence of the healthcare workers involved in making decisions about patient care [12].

In this study we explore the perspectives and experiences of ED staff in Southwestern Ontario on the use or potential use of VC in mental health emergencies. This study aims to uncover ideas related to the use of VC in mental health emergencies from an ED standpoint.

1. Methodology

Interview questions were designed to explore the potential or current use of VC to connect patients with an off-site mental health worker in the setting of a mental health emergency in the ED. All 35 EDs across the Erie St. Clair and Southwest LHINs were invited to participate. It was requested that information about the study be forwarded to ED chiefs, ED program managers, and ED managers of psychiatric care. Purposeful sampling was used to recruit participants. Ultimately 17 participants, representing 18 EDs, were recruited (See Table 1 and Figure 1).

Structured telephone interviews, approximately 15 minutes in length, were conducted with participants. The interviews were audio recorded and transcribed verbatim. The transcripts were analyzed using coding and categorization to identify underlying themes. The transcripts and analysis were independently reviewed by Dr. Wijeratne who verified the analytic process and provided feedback.

<table>
<thead>
<tr>
<th>Position</th>
<th>Participants</th>
</tr>
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<tbody>
<tr>
<td>ED Program Manager</td>
<td>9</td>
</tr>
<tr>
<td>EM Physician</td>
<td>2</td>
</tr>
<tr>
<td>ED Director of Patient Care</td>
<td>2</td>
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<tr>
<td>EM Nurse</td>
<td>2</td>
</tr>
<tr>
<td>Psychiatric Assessment Nurse</td>
<td>1</td>
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<tr>
<td>Crisis Team Coordinator</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>17</strong></td>
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</table>
2. Results

2.1. VC Use Was Seen as Beneficial to Patients and Crisis Teams

The majority of ideas relating to the effect of using VC in mental health emergencies on patient experience were positive:

*Once we explain the process, that it isn’t videotaped, that no one else is listening to this, that this is strictly confidential, they become….they’re happy with it and they don’t need to travel an hour and a half. They get the care they need.* - ED Nurse 1

The majority of participants from EDs that use VC for mental health emergencies believed that the use of VC expedites treatment:

*It’s faster and it’s more convenient because of our geographic area. A lot of these patients can’t get transportation. [Later in interview] If it’s appropriate they can have their follow up with videoconferencing.* – ED Director of Patient Care 1
It’s immediate access, especially in the winter time. It allows for direct contact with a mental health professional, because otherwise they would be transported. – ED Program Manager 4

A few (4) participants speculated that using videoconferencing for mental health emergencies can better connect patients with mental health resources:

I believe we are getting help for these people so that they don’t advance to that. So they don’t advance to needing a form 1--they are getting support and connected with a psychiatrist sooner than if we send a consult. – ED Nurse 1

Our clients have all responded pretty positively for an emergency. We do see some of our clients for videoconferencing not really in an emergency situation—I know you’re not asking about that, but they’re very positive about it. – Crisis Team Coordinator

Four participants noted the option of using VC is beneficial to crisis response workers:

The roads are closed sometimes for a couple days so in the event that something happens, this gives us an option of being able to see somebody through videoconference, as opposed to putting somebody in danger on the road. – Crisis Team Coordinator

2.2. VC Use was Perceived to Place Additional Strain on ED Resources

A number of participants (6) thought using VC for mental health emergencies has a negative impact on ED resources:

It’s adding something onto the nursing plate, because they’d be the ones organizing the computer, getting things going…and already we’re in a bit of a situation where it can be sink or swim. – ED Physician 2

I would see some of the barriers as resources for us, with only two nurses. So it may not be their first thing to think of and a telephone call might be what they feel is more appropriate. – ED Program Manager 6

The need for patient supervision and set up time were deterrents to using VC in the setting of a mental health emergency.

2.3. There are Barriers to Implementing the Use of VC for Mental Health Emergencies

Three participants noted that VC was rarely used for mental health emergencies at their ED workplace. Lack of staff support, resistance to change, and trouble remembering were mentioned as reasons for this:

I think our biggest barrier is our physicians aren’t big supporters of it. [...] I don’t think they often think about it. Certainly our ER staff is aware that it’s available to them, but I think there’s a perception that it’s going to take longer and there’s the perception that ‘what if it makes the patient worse?’ – ED Program Manager 8
I think from a physician and nursing perspective it’s tough remembering you have access to that service. I don’t know if that’s a downfall or one of the challenges? – ED Program Manager 3

Three participants described lack of access to a psychiatrist as a barrier to implementing the use of VC in mental health emergencies:

We really don’t have any barriers. Our only thing would be having a psychiatrist to be available on the other end. – ED Program Manager 6

My personal feeling with it is that it was always a problem of getting somebody with access at the other facility to do the videoconferencing. – ED Nurse 2

3. Discussion

Several participants commented that patients responded positively to use of VC in mental health emergencies to connect them with an off-site mental health specialist. Trondsen et al found that patients valued direct communication with a psychiatrist over VC and associated the use of VC with their case being taken seriously [12].

The majority of participants who stated their ED site uses VC in mental health emergencies felt the use of VC to connect with an off-site mental health specialist expedited patient treatment. Although off-site mental health specialists may provide support over the phone to ED staff in rural or remote communities, VC offers a means of immediate and direct interaction between the mental health specialist and patient. VC may expedite the assessment of a patient by a mental health specialist in situations where an in person meeting is either not possible, or associated with considerable delays. Geographic isolation of the remote site, unsafe weather conditions, or lack of bed availability at the second site, may make VC the most efficient way for a patient to be assessed by a mental health specialist. A few participants pointed out that crisis response workers also benefit from this application of VC as it may decrease the need for them to travel to distant sites.

A few participants speculated that using VC in mental health emergencies may better connect patients to mental health resources. It was noted by participants that patients could be followed-up after their initial presentation by a mental health worker in their home community using VC. This idea is noteworthy from an ED standpoint, as connecting patients with accessible and appropriate follow up prevents revisits to the ED [13].

It should be noted that several participants felt the use of VC in the setting of a mental health emergency places additional strain on ED resources. Participants believed that tasks such as equipment set up and patient supervision during the VC session added to ED nursing duties. One participant explained that having a nurse assigned to set up the VC equipment and participate in a VC session may be detrimental in a rural or remote ED with limited nursing staff.

Lack of routine use of VC and difficulty accessing a psychiatrist through VC were identified as potential barriers to implementing the use of VC in mental health emergencies. A lack of routine use of VC may lead to ED staff to feel uncomfortable with setting up the VC equipment or a decreased awareness of the option of using VC.
It is reasonable to believe that if there are repeat instances where the VC equipment is set-up in vain, or where waiting to connect with an off-site mental health worker delays patient care, ED staff may be discouraged from using VC for mental health emergencies.

4. Study Limitations

The absolute number of participants (17) in this study is arguably low. Furthermore, the positions held by the participants and the stated usage of VC in their ED workplace were not equal in number, which may have disproportionately affected how prominent certain views were in our data.

Purposeful sampling was used to select participants that had a role in the ED and were perceived by researchers as potentially knowledgeable regarding their ED workplace. However, it is possible that in some cases participants may not have provided a true or representative picture of experiences at their ED site.

We felt structured interviews to be appropriate for gathering data as they allowed responses to be compared between participants. It was easier to recognize overall ideas when respondents had the same questions as a starting point.

With these limitations, it is important to note that this is a purely qualitative exploratory study and that our results should not be interpreted with a quantitative approach. Though not generalizable, the findings of our study give a sense of the perceived advantages, disadvantages, and barriers to the use of VC for mental health emergencies from an ED standpoint.

Conclusion

VC is perceived by some ED staff as a means to expedite the direct assessment of a patient by a mental health specialist. Several ED staff participating in this study saw VC as a method to better connect patients with mental health resources.

A number of participants believed the use of VC for mental health emergencies placed additional strain on ED nursing staff. Lack of use and difficulty accessing a psychiatrist were identified as potential barriers to the implementation of VC use for mental health emergencies.

Our study explored the perspectives of ED staff on the potential use or current use of VC in mental health emergencies in Southwestern Ontario. Our conclusions add to the understanding and lively discussion regarding this application of VC and emphasizes the need for quantitative data to further our knowledge of advantages and drawbacks of using VC for patients presenting with a mental health emergency to the ED.

References


Hype, Harmony and Human Factors: Applying User-Centered Design to Achieve Sustainable Telehealth Program Adoption and Growth

P.G. ROSSOS ab1, O. ST-CYR c, B. PURDY a, C. TOENJES a, C. MASINO a and D. CHMELNITSKYa

aUHN Telehealth Program, Centre for Global eHealth Innovation, University Health Network, Toronto
bFaculty of Medicine, University of Toronto
cDepartment of Mechanical and Industrial Engineering, University of Toronto

Abstract. Despite decades of international experience with the use of information and communication technologies in healthcare delivery, widespread telehealth adoption remains limited and progress slow. Escalating health system challenges related to access, cost and quality currently coincide with rapid advancement of affordable and reliable internet based communication technologies creating unprecedented opportunities and incentives for telehealth. In this paper, we will describe how Human Factors Engineering (HFE) and user-centric elements have been incorporated into the establishment of telehealth within a large academic medical center to increase acceptance and sustainability. Through examples and lessons learned we wish to increase awareness of HFE and its importance in the successful implementation, innovation and growth of telehealth programs.

Keywords. Telehealth, telemedicine, human factors, user-centered design, adoption, innovation

Introduction

Despite decades of international experience with the use of information and communication technologies in healthcare delivery, widespread adoption remains limited and progress slow. Escalating health system challenges related to access, cost and quality currently coincide with rapid advancement of affordable and reliable internet based communication technologies creating unprecedented opportunities and incentives for telehealth. In this paper, we will describe how Human Factors Engineering (HFE) and user-centric elements have been incorporated into the establishment of telehealth within a large academic medical center to increase acceptance and sustainability. Through examples and lessons learned we wish to increase awareness of HFE and its importance in the successful implementation of telehealth programs.

1 Corresponding author: Peter.Rossos@utoronto.ca.
Background

The present global status of telemedicine capability and adoption is well summarized in two recent Gartner publications [1,2]. Although ability to deliver healthcare services when the clinician and patient are in separate locations offers significant benefits, barriers remain including clinician resistance to change and finding effective ways of sustainably accommodating telemedicine workflows. Human Factors Engineering (HFE) is defined as “the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data, and other methods to design in order to optimize human well-being and overall system performance” [3]. While applications of HFE in system design can be traced back to the mid-1900s, applications of HFE principles to the domain of healthcare and telehealth specifically are relatively new [4,5].

The University Health Network (UHN) is an internationally recognized academic and research organization affiliated with the University of Toronto, consisting of four hospitals. The Toronto Rehabilitation Institute joined the partnership in 2011, complementing the Toronto General Hospital, Princess Margaret Cancer Centre and the Toronto Western Hospital. The UHN Telehealth Program was initiated in 2002 to reduce travel limitations and ensure equitable access to specialized services for patients in rural and remote areas. Located within the Centre for Global eHealth Innovation, the Program’s primary focus is on clinical care while also supporting educational events and research initiatives locally, nationally, and internationally. For over a decade, the Program has grown steadily with relatively fixed resources through key user-centric elements influenced by human factors methods and integrated into the design of telehealth implementation and processes. In general, incremental scalable initiatives are directed at the intersections between people, process and technology as depicted in the classic Venn diagram for change.

1. People

1.1. Finding the Right Patients

The first step involved matching patients and providers to optimize the return on resource investment. Clinical care areas with regional and national referral networks
were selected and postal codes were extracted from the hospital registration system to identify distant patients. The Program team analyzed and modeled referral populations, wait times, avoidable travel costs and greenhouse gas emissions [6]. This information was packaged along with basic knowledge regarding telehealth and presented through academic, business and clinical meetings. Clinical coordinators identified high volume interprofessional clinics and individual physicians for work shadowing and personal interviews. UHN Telehealth activity was conscientiously aligned with organizational strategic goals including patient centered care and global contribution.

1.2. Supporting the Right People

The Program Team endeavors to optimize telehealth practice workflows and spare clinicians from technology and process related issues. Patient and clinician surveys are administered to identify and remedy concerns. In the Program’s 2013 survey, 29% of clinician users would use telemedicine more if they didn’t have to leave their office. Privacy, data security and interjurisdictional licensing are managed by the Program; when required the team advocates on behalf of patients and clinicians to draft or modify policies and procedures [7]. Senior management is continuously updated on Program financial and outcome data. The Program responsibly manages volumes and resource requirements while supporting and enabling hospital best practices and accreditation requirements.

1.3. Rewarding the Right People

Although all UHN physicians belong to academic practice plans, fee-for-service revenue capture is generally required. The Program advises all MDs on telehealth remuneration through Ontario Ministry of Health Benefits for Physician Services. Nurse Practitioners and Allied Health Professionals are offered support and services to improve quality of care delivery. Recognition, collaboration and support for academic activities is encouraged and provided wherever possible to all clinicians and members of the care team. Early scholarly presentations and publications in areas including pre-admission clinics [8], home parenteral nutrition[9], bone marrow[10] and lung transplantation created excitement and credibility within the organization. Currently most UHN priority care areas include telehealth in their strategic plans.

2. Process

2.1. Workflows

In order to promote user uptake and adoption clinical and administrative workflow disruptions must be minimized. Telehealth “should be viewed as an extension of the way providers care for patients in a more technologically dynamic environment rather than as an entity distinct from standard clinical workflows” [11]. The introduction of telehealth into a clinic creates opportunity to implement telehealth models that enhance workflow and increase capacity in the hospital. At UHN all telehealth visits are registered and documented in the electronic patient record in the same manner as face-to-face clinic encounters. Baseline processes are collaboratively reviewed by UHN
Telehealth and clinic teams prior to introducing telehealth in order to ensure seamless care coordination for both local and remote patients [12].

An example of this approach was demonstrated with the introduction of telehealth practice into the complex care pathway for provincial and regional bariatric services. The bariatric care pathway is comprehensively multi-staged from initial pre-operative patient education to long-term post-surgical outcome monitoring up to five years post-surgery. Many of the patients live far from Toronto as referrals are centralized regionally then sent to the designated bariatric centres for the province. Early on, team members from the Bariatric clinic and the UHN Telehealth Program worked together to map out the typical care pathway in order to identify where telehealth would be most beneficial. Select individual assessments for both pre and post-operative pathways were deemed appropriate for telehealth for the following care areas: endocrinology/nutrition, social work, psychosocial, surgical and psychiatric assessments. This successful Telehealth integration supports the needs of Bariatric clinic for maintaining a continuity of care—crucial for successful post-operative patient outcomes. The Program successfully completed over 300 interprofessional clinical telehealth consultations in the initial 18 months and has served as a model for complex care delivery that can be extended to other surgical procedures and medical conditions [13].

2.2. Training & Support

Training process must be imbedded into telehealth programs; initial and ongoing telemedicine users must be well trained and supported both technically and professionally [14]. The UHN telehealth team has developed protocols and checklists for initial training as well as ongoing practice. The UHN Program website is updated on a regular basis with information and tips for current and new users. In higher volume areas a train the trainer model is utilized. All designated areas have clearly displayed instructions related to hardware and technical support contact information. The support team carries smartphones and is immediately available to troubleshoot [15].

2.3. Other Process Considerations

Scheduling requires dedicated expertise to ensure patients, providers and relevant records are coordinated. Clinical administrative staff are trained and supported to seamlessly manage telehealth visits through the UHN enterprise scheduling system and the Ontario Telemedicine Network (OTN). Privacy best practices were introduced through a brief slideshow developed to launch on initiation of the telehealth visit confirming that the clinician was in a private closed room and reminding them to confirm patient identity at the outset. Process improvement is addressed continually between clinicians and the team; creative user-centric solutions are encouraged.

3. Technology

A core enabler of telemedicine implementations is the technology. Issues such as robustness, scalability and quality must be taken into account [6]. The Program pioneered mobile workstations in clinics to align with scheduling and workflows. The devices were initially assembled in-house and the ability to distribute the OTN across
the UHN network required significant negotiation. In 2002 the telemedicine delivery model was based upon a fixed studio equipped with hardware and a dedicated secure network connection – it was clear that this model had to be expanded to better serve UHN patients and clinical care areas. Technical innovation and adoption to enable efficiency and optimize cost is at the core of the Program. In 2009, the two technical support personnel conceived and implemented smartphone initiated and supported events in order to effectively handle simultaneous activities across campus sites. This was presented nationally and received Award for Technology Innovation at the Canadian Society of Telehealth, 2009. Other innovations and early adoption initiatives have included desktop and personal videoconferencing, digital stethoscopes, hand held cameras, cardiac monitoring, electrophysiology and deep brain stimulation devices. Through partnerships across the UHN there is collaborative expertise in home telemonitoring, telepathology, telesurgery, telerehabilitation and convergence with the electronic health record. The emphasis is on appropriate use, testing and evaluation. Nothing is taken for granted as demonstrated in studies performed to determine the optimal eye gaze angle to facilitate human non-verbal communication in patient care [16].

4. Results

The Program received an extremely favorable on-site review by Accreditation Canada in November 2014. Sixty-seven criteria were evaluated and all but one low priority item was met despite relatively fixed resources and steady program growth as demonstrated in Figure 2. Patient and provider surveys conducted in 2013 were also very positive where 95% of patients felt as comfortable receiving care through telehealth as they would have in person. The major themes identified were convenience, time-savings, cost-savings, travel distance avoidance, appointment efficiency and maintaining the continuity of care. Similarly, all clinicians users surveyed in the same period agreed that they would recommend videoconferencing to their colleagues for patient consultation.
Patient care is distributed among clinical care groupings as seen in Figure 3.

In 2015 UHN Telehealth will work with the clinical groups towards a five year strategic plan. Further expansion into community, home, rehabilitation and complex care areas will be highlighted along with convergence into a new hospital clinical information system and ConnectingGTA – a regional EHR that will soon be launched. Throughout this journey we will continue to collaborate, learn from others and apply...
HFE and user-centric principles towards people, process and technology in the interests of delivering the best care possible.

References

eHealth for Remote Regions: Findings from Central Asia Health Systems Strengthening Project

Afroz SAJWANI¹, Kiran QURESHI, Tehniet SHAIKH, and Saleem SAYANI
Aga Khan Development Network eHealth Resource Centre

Abstract. Isolated communities in remote regions of Afghanistan, Kyrgyz Republic, Pakistan and Tajikistan lack access to high-quality, low-cost health care services, forcing them to travel to distant parts of the country, bearing an unnecessary financial burden. The eHealth Programme under Central Asia Health Systems Strengthening (CAHSS) Project, a joint initiative between the Aga Khan Foundation, Canada and the Government of Canada, was initiated in 2013 with the aim to utilize Information and Communication Technologies to link health care institutions and providers with rural communities to provide comprehensive and coordinated care, helping minimize the barriers of distance and time. Under the CAHSS Project, access to low-cost, quality health care is provided through a regional hub and spoke teleconsultation network of government and non-government health facilities. In addition, capacity building initiatives are offered to health professionals. By 2017, the network is expected to connect seven Tier 1 tertiary care facilities with 14 Tier 2 secondary care facilities for teleconsultation and eLearning. From April 2013 to September 2014, 6140 teleconsultations have been provided across the project sites. Additionally, 52 new eLearning sessions have been developed and 2020 staff members have benefitted from eLearning sessions. Ethics and patient rights are respected during project implementation.

Keywords. Afghanistan; CAHSS Project; eHealth; eLearning; health care; ICT; Pakistan; Tajikistan; teleconsultations.

Introduction

The Central Asia Health Systems Strengthening (CAHSS) Project, a five-year project (2013-2017), is a joint initiative between the Aga Khan Foundation, Canada (AKF, C) and the Government of Canada, through the Department of Foreign Affairs, Trade and Development. One of the components of CAHSS, i.e. eHealth, employs Information and Communication Technologies (ICT) to improve the health status of communities in Afghanistan, Kyrgyz Republic (activities yet to commence), Pakistan and Tajikistan in South-Central Asia. In order to achieve this goal, the CAHSS eHealth Programme provides specialist health care services through a regional hub and spoke teleconsultation network of government and non-government health facilities so as to make quality health care more accessible and affordable for our target communities and conducts capacity building activities for health care professionals, enabling them to deliver quality health care services.

¹ Corresponding author: afroz.sajwani@akdn.org.
1. Background and Rationale

Isolated and marginalized communities living in rural, mountainous regions of Afghanistan, Kyrgyz Republic, Pakistan and Tajikistan do not have access to health care institutions and qualified health care providers. They have to pay large sums of money for travel, food and lodging to go from remote locations, where it is not possible to obtain high quality diagnostic and treatment services, to higher level health facilities to seek specialist health services. The Aga Khan Development Network (AKDN) understands the significant role that ICT can play in linking health seekers to health care institutions and providers, and providing comprehensive and coordinated care to communities situated in remote areas. The eHealth Programme therefore aims to leverage the power of ICT to link underserved communities in South-Central Asia with health care institutions and health care providers to provide access to low-cost, equitable health services, and help minimize the barriers of distance and time.

2. Objectives

The eHealth Programme under CAHSS establishes and expands eHealth operations in the South-Central Asia region. The Programme improves access to low-cost, quality specialist health services for these communities and builds the professional capacity of health care providers. The ultimate goal of the CAHSS project is to improve the health status of men, women and children in target areas of South-Central Asia. The objectives of the eHealth Programme under the CAHSS Project are to:

- increase access to specialty health care services for target communities by providing low-cost and high-quality diagnosis and treatment services through teleconsultations, and
- build professional and educational capacity of health professionals through eLearning to deliver quality health care services.

3. Design and Target Population

Activities under the eHealth Programme are conducted through a two-tier hub and spoke model developed in a systematic, coordinated, evidence-based and cost-effective manner. Figure 1 depicts the proposed eHealth connections by 2017, in the targeted areas of the focus countries.

Tier one consists of seven health facilities in Afghanistan, Pakistan and Tajikistan. In Afghanistan, the health facilities are:

- French Medical Institute for Children (FMIC);
- Bamyan Provincial Hospital (BPH); and
- Faizabad Provincial Hospital (FPH).

In Pakistan, Tier one facilities are:

- Aga Khan University Hospital, Karachi (AKUH, K); and
- Gilgit Medical Centre (GMC).
In Tajikistan, Tier one facilities comprise of:

- National Medical Center (NMC); and
- Khorog Oblast General Hospital (KOGH).

Tier two consists of 14 district level health facilities in Afghanistan, Kyrgyz Republic, Pakistan and Tajikistan. Each of the Tier two facilities will have the space and equipment needed to connect with Tier one and other Tier two facilities and to support teleconsultation and eLearning operations. By 2017, the eHealth network is expected to connect and operationalize all these facilities in Tier one and Tier two for teleconsultation and eLearning activities.

The AKDN eHealth System in South-Central Asia currently supports the operations of health care facilities that are owned by the Aga Khan Health Services (AKHS), and health care facilities that result from public-private partnerships (PPP) including those owned by the government but managed by AKHS, or owned and managed by the government. Government-owned and managed facilities are selected for inclusion in the AKDN eHealth system based on a set of quality criteria and standards of operation.

![Figure 1. Proposed eHealth Connections by 2017](image-url)
4. Interventions

The health facilities supported under the eHealth Programme will be connected over a period of five years, from 2013 to 2017. The eHealth system 1) utilizes teleconsultations to provide specialist health services to communities within defined catchment areas; 2) provides eLearning services to enhance professional, clinical and managerial capacities of health care providers working within AKHS owned and managed facilities or in government facilities in the South-Central Asia region. These services are provided in the following way:

1. **Teleconsultation Services:**
   The eHealth Programme delivers diagnostic and treatment services for various health care specialties through live and store-and-forward teleconsultations. The availability of teleconsultation services increases access to quality health care services and reduces travel, time and other costs borne by patients and their families.

2. **eLearning Services:**
   a. Continuous medical, nursing and professional education sessions are offered to doctors, nurses and allied health professionals in Afghanistan and Tajikistan through eLearning. These sessions are designed to improve knowledge and skills of health professionals and ensure continuous professional development, enabling them to effectively deliver clinical care and manage health operations. eLearning sessions offered within and from Pakistan are part of eHealth Programme’s 2015 plans.
   b. **eHealth certificate course** is a year-long online course designed to create eHealth champions. This course will build eHealth capacities of professionals working in the health field and enable them to manage, administer and provide implementation oversight for eHealth programmes in low- and-middle income countries. The implementation of the eHealth certificate course is part of eHealth Programme’s 2015 plans.

The teleconsultations and eLearning sessions utilize the hub and spoke model, as discussed earlier, whereby experts from the hub site provide consultations to patients and training sessions to health care providers at the spoke site, via ICT.

5. **Data Collection**

As part of the CAHSS Project, eHealth data is collected, analyzed and reported on a quarterly basis. Following are the output and outcome indicators of the eHealth Programme through which activities are monitored and performance is evaluated:

- number of eHealth connections upgraded and established in project supported health facilities;
- number of project supported health facilities offering full range (both live and store-and-forward) of eHealth services;
• number of project supported health facilities with guidelines in place to assure quality of eHealth services;
• number of M/F clients who attend project health facilities for live and store-and-forward consultations;
• number of new eLearning sessions developed; and
• number of participants in eLearning courses (M/F) by course.

eHealth coordinators at the implementation sites provide feedback on activities and day-to-day challenges to project managers on a monthly basis. These coordinators also provide data on the above mentioned project indicators on a quarterly basis. On an annual basis, the project management team visits all the implementation sites to conduct monitoring and to provide refresher training to eHealth coordinators and on-site implementers, such as doctors, nurses, community health workers, etc.

6. Results and Outcomes

As of December 2014, eleven spoke sites have been connected to four sub-hub sites, which are further connected to three hub sites, as illustrated in Table 1.

<table>
<thead>
<tr>
<th>Hub Sites</th>
<th>Sub-Hub Sites</th>
<th>Spoke Sites</th>
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<td><strong>Tajikistan</strong></td>
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<td>NMC</td>
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<td>Darvaz District Hospital</td>
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All project supported health facilities connected so far have guidelines in place to assure quality of eHealth services. These sites provide live and/or store-and-forward teleconsultations in various fields such as cardiology, dentistry, dermatology, ear-nose-and-throat, internal medicine, neurology, obstetrics/gynecology, orthopedics, pain management, pathology, pediatrics, psychiatry, surgery, and radiology.

From April 2013 to September 2014, a total of 6140 teleconsultations have been provided across the project sites in Pakistan, Afghanistan and Tajikistan. Of these,
3592 were live teleconsultations (1786 male patients and 1806 female patients) and 2548 were store-and-forward teleconsultations (1340 male patients and 1208 female patients).

In the same time period, 52 new eLearning sessions have been developed to provide continuing education and professional development training to health care providers at project sites. From April 2013 to September 2014, various existing and new eLearning sessions were delivered from NMC and FMIC to sub-hub and spoke sites, catering to a total of 2020 beneficiaries (969 male patients and 1051 female participants).

These teleconsultation and eLearning activities have contributed towards improving the health status of our target communities by making quality health care services more accessible and affordable for them and building the professional capacity of health care providers.

7. Challenges

The eHealth Programme has faced and mitigated several challenges encountered during the implementation of eHealth activities. These challenges include:

a) **Connectivity**: There was unstable connectivity in some sites. **Solution**: Fiber optic lines were used where possible. Where there were no options, satellite (iDirect Connectivity) was used. Back-up connectivity, wired and wireless (3G, iDirect and Yahclick), was also used.

b) **Lack of skilled eHealth workers**: eHealth coordinators lacked necessary expertise required to effectively implement eHealth activities. **Solution**: Technical training was delivered periodically, building their professional development and providing them the confidence to carry out eHealth activities. Additionally, an online certificate course in eHealth is being offered to build the eHealth capacities of health care providers.

c) **Sustainability**: The need to create a sustainable financial model to continue offering eHealth services once donor funding ends. **Solution**: Agencies have started charging subsidized fees to beneficiaries (e.g., in Pakistan). In the long run, eHealth services must be rebranded as premium services instead of subsidized services.

d) **Language and gender barriers**: During consultations, patients and doctors located in different sites had trouble communicating due to differences in the native languages, and gender imbalances between trainer and trainees would lead to hesitancy in learning. **Solution**: Regional eHealth coordinators, native to the country of operation, were hired to act as a liaison and effectively coordinate and implement eHealth activities with the local population. For training, both male and female trainers were assigned to encourage active learning.

e) **Socio-political challenges**: Strife between various religious parties and political strikes halted eHealth operations. **Solution**: Extra time is included in project timelines to account for such unforeseeable circumstances. eHealth coordinators and other workers have been trained, making it possible to work with them remotely.
8. Ethics and Confidentiality

Before patients are inducted into the CAHSS Project for teleconsultation services, consent is taken from them. Through the consent, they are informed about the nature and process of the teleconsultation and they voluntarily decide whether or not to participate. They are ensured that their rights are protected and that information regarding their medical history and condition is kept confidential. Data received from the participants is kept confidential and only used for their treatment. The online case management system that is used to gather patient information is user-authenticated and password protected.

Conclusion

The eHealth Programme under the CAHSS Project contributes towards improving access to quality health services using low-cost approaches in the target countries. eHealth activities implemented through the project will ultimately contribute towards improving the health status of the target communities. Building the capacity of health care providers to deliver quality health services and charging patients a subsidized teleconsultation fees is our key approach to achieving sustainability.

The project will expand the scope of eHealth in the region and attract local and international organizations to engage and invest in similar eHealth activities to improve health outcomes. Entering into PPPs will further ensure effectiveness and sustainability of eHealth services. The eHealth Programme would expand over the years to cover an increasing number of sites in each country. Expansion would lead to changes in the existing hub-and-spoke model. Spoke sites would be converted into sub-hub sites as additional spoke sites are added to the system and connected to them. Sub-hub sites would then have a two-pronged operation model: 1) act as a spoke site and consult the main hub sites for services 2) act as a hub site and offer consultation services to the newly added spoke sites; hence the term “sub-hub.” AKDN’s eventual expansion of eHealth operations will provide greater access to quality health care within the region, creating an integrated eHealth network which will benefit communities as well as provide great learning for the region.
Community Health Nursing through a Global Lens

Norma SARKAR 1, Amber DALLWIG, and Patricia ABBOTT
University of Michigan, Ann Arbor, Michigan, USA

Abstract. Community Health Nursing (N456) is a required senior clinical course in the undergraduate nursing curriculum at the University of Michigan in which students learn to assess and address the health of populations and communities. In 2012, we began our efforts to internationalize the curriculum using a globally engaged nursing education framework. Our goal is for all students to have an intercultural learning experience understanding that all students are unable to travel internationally. Therefore, this intercultural learning was implemented through a range of experiences including actual immersion, virtual activities (videoconferencing) and interventions with local vulnerable populations. Grants were obtained to provide immersion experiences in Quito, Ecuador and New Delhi, India. Several technologies were initiated with partner nursing schools in Leogane, Haiti and New Delhi, India. Weekly videoconferencing utilizing BlueJeans software and exchange of knowledge through the Knowledge Gateway facilitated intercultural exchange of knowledge and culture. Local clinical groups work with a variety of vulnerable populations. A private blog was developed for all sections to share community assessment data from local and international communities. Qualitative evaluation data was collected for local and international students to begin to assess cultural competence and student learning. Analysis of data documented increased awareness of culture and identified the many positive benefits of interaction with a global partner.

Keywords. Community Health Nursing, Intercultural learning experience, Videoconferencing, Global health perspective

Introduction

Technology has brought new global teaching opportunities and facilitated a global health focus in nursing education without the time and expense of travel. Nursing and Global Health are strongly related as nurses will encounter a wide variety of culture and beliefs wherever they practice. As said by Kulbok et al, “immigration, travel and technology have allowed all parts of the globe to touch each other” [1]. As part of our quest to enhance cultural exposure for our students, the Community Health Nursing course at the University of Michigan (UM) School of Nursing has supplemented physical immersion experiences with a variety of technologies including videoconferencing with global partners, an electronic community of practice (E-CoP), and a course blog.

1 Corresponding author: nsarkar@med.umich.edu.
1. Background

Community Health Nursing (N456) is a required senior clinical course in the undergraduate nursing curriculum at UM in which students learn to assess and address the health of populations and communities. The course includes didactic and applied clinical experiences, with clinical groups of eight students. In 2012, we began our efforts to internationalize the curriculum using the globally engaged nursing education framework developed by Mary Riner of Indiana University [2]. Course objectives related to a global focus include: understand the role of nurses and public health professionals, demonstrate skills that apply the nursing process to populations, and understand health promotion and delivery of health care in the community. The Global Health Learning Goals include: Cultural Competence, Population Health from a global perspective (vulnerable populations and health disparities), Community Assessment and Analysis utilizing Social Determinants of Health and Value of Community Partnerships.

Our goal is for all students to have an intercultural learning experience, however, the reality of time, cost, and safety concerns prevent us from sending the entire student class abroad. Therefore, we have used a mixed methods approach to enable all of our nursing students to participate in a global exchange by using one of 3 different strategies: 1.) participating in a global immersion experience in Quito, Ecuador or New Delhi, India; 2.) participating in live videoconferencing classes with global outreach sites; and 3.) via community placements within Southeast Michigan with culturally diverse or vulnerable populations. The immersion experiences in country involve 15-20 students and include clinical hours with a global partner and occur after the didactic portion of the Community Health Nursing course is completed. Immersion participants are encouraged to blog about their experiences and are required to submit online reflective journals from abroad. These communications are shared across class sections to enhance learning and appreciation of context.

The videoconferencing “shared classrooms” are accomplished via the use of BlueJeans application over the Internet. BlueJeans works especially well in low bandwidth countries, allows recording of sessions and technical analysis of the quality of the transmission. We are currently utilizing the BlueJeans approach with two international partners: Faculty of Nursing Science of the Episcopal University of Haiti (FSIL) in Leogane, Haiti; and Salokaya College of Nursing in New Delhi, India. During the semester, weekly videoconferences with our global partners focus on the conduct of a Community Assessment in a local community. Additionally, students on both ends use the Social Determinants of Health framework to compare and contrast the strengths and stressors of each community and their causative factors. The Social Determinants of Health framework emphasizes the cultural and socio-economic factors that impact the health of populations, and provide a richer appreciation of the context of health in a given area. Each synchronous videoconferencing session is approximately ninety minutes in length and written materials are shared by each partner prior to the session to facilitate discussion by students.

Both UM and global partners use additional technology including a portal called the “Knowledge Gateway” and a private class blog to support interactivity and exchange for the N456 course. The Knowledge Gateway is an E-CoP administered by the World Health Organization and it currently supports over 300,000 health and development specialists across the globe in various electronic communities. Within the Knowledge Gateway, our group at UM has created a private community for faculty and
student knowledge exchange. This virtual community allows us to exchange ideas, share and archive course related information, and distribute information for preparation for our videoconferencing sessions. Librarians from the Taubman Health Science Library link from this virtual community to specially designed and digitally delivered health research guides. Open source materials are made available for use by our international partners, which is an important mechanism for knowledge distribution to low resource areas. All students who are participating in the course are included in email distribution groups, course blogs, and encouraged to utilize the Knowledge Gateway E-CoP to facilitate digital exchange of knowledge, experiences, and perspectives.

The private blog developed for the N456 Community Health Nursing course facilitates the exchange of ideas across all clinical sections of the course and our international partners. Community assessment data derived from local and international communities are presented, compared, and contrasted in this digital global exchange. Each clinical section in the UM course and our international colleagues are asked to report and respond in a series of eight interactive questions posted on the blog throughout a given semester. The purpose of the dialog is to encourage student dialog across disparate students and groups as they debate and discuss community assessment projects based on the Social Determinants of Health framework.

Our third Global Health strategy for N456 students is community placements within Southeast Michigan with culturally diverse or vulnerable populations. Intervention with specific cultures or vulnerable populations facilitates understanding of health beliefs and customs and exploration of social and environmental justice issues. Sharing about these populations and social issues is facilitated through the course blog discussed earlier.

2. Evaluation of Efforts

All courses at the UM are evaluated. For the purposes of this paper, we will focus upon the results of the evaluation of the videoconferencing shared classroom, blogs and E-CoP and their impact on students and faculty. UM students and their global partners (FSIL and Salokaya) have completed evaluation questionnaires upon conclusion of the videoconferencing, blogs and E-CoP experiences. To date, we have completed two semesters of videoconferencing with FSIL in Haiti and one semester of videoconferencing with Salokaya College of Nursing in New Delhi. The fall, 2012 experience included 8 UM students and 14 FSIL students in Haiti. The course conducted in the fall of 2013 included 8 UM students and 17 FSIL students in Haiti. In the winter of 2013, 7 UM students and 16 Salokaya students in India participated. All students at UM and distant sites participated in the evaluation process. We used a deductive approach of identifying themes from qualitative data as suggested by Bradley, Curry and Devers [3].

In regards to the UM student responses over the first two terms of interaction with FSIL in Haiti, culture emerged as the primary theme mentioned by U of M nursing students over both terms. This theme emerged in response to questions posed across the four categories of: “most important thing learned from peers”, “learned about country for impact on practice”, “value of videoconferencing” and “learned about self”. Terms used included expressions such as; “became culturally aware”, “better understood cultural beliefs”, “greater respect for their culture”, and “a culturally eye-
opening experience”. UM students working with Haiti also expressed interest in the marked differences in the roles of Haitian nurses, and identified the language barriers (French/English) to be quite challenging for knowledge sharing and exchange.

In comparison, the data from the Haiti students over both terms showed culture as a major theme along with differences in overall Haitian health and healthcare in response to the question of the “most important thing learned from peers”. The benefits of interaction with a global partner were most often described in response to the “value of videoconferencing”, and the difficulties of language were identified as the most challenging part of videoconferencing. The FSIL students identified the many differences in disease burden and health care delivery in Haiti as a major theme in the evaluation of course benefits. FSIL students placed most value on the interaction with UM students and the knowledge they gained from those interactions. The FSIL students identified the understanding of English (in regards to idiom and US vernacular) as their biggest challenge.

A similar tool was utilized for evaluation of the Salokaya experience but an additional question about the “value of partnership” was included. The data derived from the evaluation survey amongst nursing students at Salokaya School of Nursing in New Delhi also revealed culture as a theme, but only in response to the question of “what was most valuable about the partnership”. Their primary theme was knowledge in response to the “most important thing learned from peers” as a result of their exchange. Interestingly, the data from Salokaya illustrates the emergence of a new theme of “confidence” in the following three categories: “most important thing learned from peers”, “value of videoconferencing” and “learned about self”.

In regards to the impact on faculty that was gathered in end of term focus groups, enhanced knowledge regarding a formalized Community Assessment process was cited as a faculty outcome. Additionally, the blog facilitated quality discussions among clinical sections utilizing the Social Determinants of Health framework. Finally, the emphasis on experiences with vulnerable populations, and an expressed interest in global health projects using technology were all cited by faculty as areas of personal learning and interest.

3. Discussion

While further research is needed using larger sample sizes, the major theme that emerged from the UM student groups was centered upon the benefits of cultural exchange and the learning that resulted from it. This finding supports the UM School of Nursing’s goal to increase cultural sensitivity and appreciation in our students. Additionally, our findings lend credence to the assertions of Riner [2] who suggests that a successful global engagement experience must have attaining cultural competence as a core expectation. Thus, our goal will be to more specifically measure the changes in cultural competence that occur based on initiatives such as these in the future. We continue to enhance the interactions and knowledge exchange by following best practices for working with students where English is a second language. Despite the challenges, the FSIL students consistently cited the positive value of interaction with their global UM partner. The expression of increases in confidence by students in New Delhi was an indicator of value that UM brought to the experience, while UM students also gained important skills and knowledge by the India interchange. We believe that adhering to the principles of respect, patience, and sensitivity will continue
to decrease the barriers for knowledge exchange and enhance the levels of cultural competence for all participants.

Finally, our faculty exposure, while challenging in some regards, resulted in increased confidence in the application of technology to the educational process and the heightening of awareness in regards to learning opportunities for students and self. The technology enabled faculty to gain perspective and access to experiences and situations that, in the past, were only possible through physical travel. We believe that the exposure will result in increasing willingness to utilize similar technologies with our UM nursing students.

In summary, the course focus on the health of populations provides an excellent opportunity to provide students with a global health perspective, and to afford faculty the opportunities to teach powerful lessons that cannot be achieved by reading a book. Integration of technology into the course design enabled us to expose our students and faculty to the interconnections and commonalities of the global battle to reach “Health For All”. This experience has opened new doors for the UMSN to “reach and teach” – not only our students, but ourselves as citizens of the globe.

References


Improved Immediate and Continued-Care Outcomes for Stroke through Community-Wide Data

Steven H. SHAHA\textsuperscript{a,b} and Diane GILBERT-BRADLEY\textsuperscript{b}

\textsuperscript{a}Center for Policy & Public Administration
\textsuperscript{b}Allscripts

Abstract. Strokes account for 1 of every 18 deaths in North America, and remain a major burden cost-wise and clinically for societies globally. Quicker and more clinically astute care for stroke leads to improved outcomes for the patient, families and the healthcare system at large. The intervention shared illustrates how a locally-programmable EMR with inherent community-wide communications capabilities leads to proven better outcomes for all. The impacts range from initial hospital encounter through acute-care treatment, and then more broadly into post-discharge care community-wide. Implications for all healthcare communities are established.

Keywords. outcomes research, stroke, community health records, continued care, proven impacts

Introduction

Mortality data indicate that stroke accounts for approximately 1 of every 18 deaths in North America \cite{1}. On average, someone suffers a stroke every 40 seconds, and strokes remain the #1 cause of permanent disability in the United States. Stroke is complex not only because of the initial, immediate impacts on patients and care provider organizations, but also because of the longer term burdens for both. Patients need quick and precise treatment for best initial response \cite{2,3}.

Despite the magnitude of the Stroke for healthcare, few organizations have been capable of optimizing stroke care “across the continuum” \cite{4,5}. Information and documentation gathered at one place within the patient’s flow is seldom available at the next place in sequence. Caregivers do best possible care at each encounter, but in the absence of information flow conduit is elusive. The expenses associated with implementing electronic medical records (EMRs) in acute care settings, and electronic patient records (EPRs) in ambulatory settings, have not solved the problem, but have furthered the island nature of data rather than integrated electronic health records (EHRs).

The operational answer to improved stroke care, immediate and longer term, is telehealth \cite{2,6}. Integrated telehealth data through community-connected EHRs is the

\textsuperscript{1} Corresponding author: steve.shaha@allscripts.com.
viable, fully achievable goal. EHR-driven telehealth has been materialized in several healthcare settings, as illustrated in the case study shared hereafter.

Two additional assets are needed, however, before the integrated EHR maximizes its favorable impact and generalizability, as described herein [7,8,9,10]. First, disparate ambulatory EPRs and acute EMRs must be enabled to share data fluidly to create an integrated “single source of truth” for clinical tracking and decision-making, and fiscal management and cost-reduction. Second, those involved in the use of the data must be outcomes-driven and results-motivated, with an intrinsic or extrinsic focus on improving clinical, cost and efficiency outcomes. That latter asset is best achieved through the establishment and refinement of clinical decision support (CDS) capabilities with minute-to-minute patient-clinician decision optimizations as the substantiation.

1. Methods and Solution

Neurologists at a 474-bed urban facility determined to optimize Stroke care across the continuum collaboratively reflecting inpatient (IP), including IP rehabilitation (IP-Rehab), emergency department (ED), skilled nursing facility (SNF) and post-discharge primary care practice perspectives [4,5,6]. They first designed advanced CDS-driven order sets for managing new-onset stroke patients from the outset, reflecting 13 patient care and documentation elements from evidence-based medicine as promoted by the appropriate national college of neurologists.

Post-acute care leveraged the integrated capabilities achieved through the IT professionals. Complete data from the acute-care experience were passed to the post-acute SNF and to PCP settings. SNFs also merited from the building of order sets and care maps for stroke patients, mapped and adjusted through the EHR to needs matching those of the specific patient being transferred, as was the case for post-acute IP-Rehab. Home-based care also was programmed for distribution to the patient through instructions and the integrated portal, as well as to the primary care physician (PCP) through data transfer.

The organization had enjoyed integrated computer-based prescriber order entry (CPOE) for 3 years prior to the selection of stroke as a focal resolution. CPOE was inherent to all clinical locations. This assured that estimates of savings-related outcomes would reflect the change in use, more than a specific CPOE implementation. Finally, alert systems were incorporated for each setting, and across all, reflecting the minimization of alert fatigue, and the maximization of clinical relevance and information richness for decision-making.

2. Findings and Results

2.1. Impact in Acute Care Setting

Analyses contrasted six months pre-implementation baseline (n=242) versus six months post-implementation (n=264, severity neutral). To guide the intervention, the pre-implementation data were examined to identify specific areas of challenge in either treatment or the documentation thereof: suboptimal performance was verified in 12 of 13 areas (see Figure 1).
Therefore order sets and alerts designed were focused on remediation of known shortcomings.

Analysis of the 6-month post-implementation contrasting data showed significant improvements in 11 of the 13 areas, representing a 40.5% net improvement collectively, which was an 80%+ improvement from pre-to-post (see Figure 1).

Additional pre-versus-post contrasts revealed further improvements in key metrics, including:

- 9.4% more discharged to home versus skilled-nursing-facilities or inpatient rehabilitation (p<.001, see Figure 2).
- 35.7% fewer 31-day readmissions (p<.001).
- 7.5% shorter length-of-stay (LOS, p<.01).
- 11.4% lower direct cost-per-case (p<.001).
- 12.7% lower indirect cost-per-case (p<.001).
- Cumulative reduction in cost “to the bottom line” estimated at between $230,000 and $565,000 (US $).

A big and important concern on the part of the entire team was that discharge not be accelerated only for the purposes of reducing costs, or so as to appear to have improved care and clinical impacts yet actually simply be hurried. For these purposes, the data were intensely analyzed further to ensure outcomes were improved for patients beyond the immediate or shorter term care for stroke patients.

Figure 1. Pre-versus post performance
2.2. Impact in Skilled Nursing Post-Acute Care Setting

Data from the network post-acute care SNFs were further analyzed to quantify impacts pre- versus post-implementation. Previous analyses had already shown significant increases in discharges to SNF from acute care (see Figure 2), but it was crucial to verify that outcomes were superior for SNF patients cared for with the new CDS during their acute care, and with data transferred through the interoperable solution.

Figure 2. Pre- versus post-acute care discharge patterns

The Care Coordination Network enabled the SNF to receive all data associated with the patient health record electronically, and thus know all past care and clinical specifics, and continue care from those foundations.

SNF data showed that the patients managed through CDS during their hospitalization had significantly lower 31-day readmission rates for stroke-related issues and significantly shorter LOS in the SNFs (both p<.001, see Figures 3-4).

Figure 3. Pre versus Post-acute care readmissions from skilled nursing facilities.
This SNF leadership interviewed claimed that the improved care and data transfers combined resulted in significant efficiencies that amounted to capacity for 130 additional admissions annually, approximately an 8% increase.

2.3. Impact in Other Post-Acute Care

Data were analyzed to quantify impacts pre- versus post-implementation for all patients discharged to home. Previous analyses had shown significantly greater discharges to home from acute care (see Figure 2). Now the aim was to determine impacts on patients and community resources to further ensure that improved care and rapid acute-care discharge was indeed better, and not simply hasty for cost-effective reasons. Also to verify that information passing to PCPs and patients was associated with improved outcomes.

Data showed that the patients discharged to home after being managed through CDS during their hospitalization had significantly lower 31-day readmission rates – nearly one-third as many – for stroke-related issues (p<.001, see Figure 5).

This success also reflects the communication enabled through the patient portal, which established interchange between the patient and the care giving organizations, as well as reminders and prompts to do appropriate care-related activities.
Despite that portal-based connectivity, however, it is likely that the average age of stroke patients reflected in this study, or any care environment, may preclude active and productive use of Internet-based capabilities for some years to come. Therefore the impacts seen are likely associated with improved care throughout the location-related environments as previously reviewed. Outcomes quantified:

- Fewer ED visits ($p<0.001$).
- Fewer clinic visits ($p<0.01$).
- Fewer PCP patient-initiated interventions ($p<0.01$).

**Discussion and Conclusions**

Data collectively indicate that stroke outcomes were significantly improved through better CDS-enhanced care during acute-care, and improved data capabilities for acute and subsequent post-acute care and patient guidance. All was achieved by enabling the EHR-driven telehealth capabilities needed. None of these advantages could have been achieved without the progressive implementation of interoperable, integrated data capabilities. Results and impacts should only further improve from these baselines once stroke aged patients become even more Internet-savvy and capable and habituated to using the basis for the patient portal communication.

While it is difficult to estimate the precise financial impact of such changes, there is no question that these consistent and cross-continuum improvements in length of stay alone amounted to substantial and meaningful reductions in cost-per-case. However, personalizing the data makes even more pertinent the conclusion that such improvements make a difference for patients and personal capabilities, including lower dependency on healthcare settings and professionals.

Few studies exist that examine so fully and openly the impacts of interoperability on provider organization resources and on patients. Data indicate uniformly that the investment and achievement are worthy of the effort and verified in actual impacts. Outcomes cannot be improved without practitioners and patients, and the organizations upon which they both depend, being capable of basing best care decisions on information that collectively provides insight across care settings and across time.

**References**


Optimal Care Mother-Baby and Outcomes through Community-wide Data Sharing, Interoperability and Connectivity

Steven H. SHAHA \textsuperscript{a,b,1} and Diane GILBERT-BRADLEY \textsuperscript{b}

\textsuperscript{a}Professor, Center for Policy & Public Administration
\textsuperscript{b}Allscripts

Abstract. The power of interoperable systems with data/information integration, central to achieving the goals of Telehealth, is illustrated through mutually beneficial sharing between Labor & Delivery (L&D) and Obstetrics (OBs) Clinics. Data shared between L&D and OB brought improved practice patterns and outcomes, and increased satisfaction at both. Staffing and skillsets were significantly improved by knowing complications arriving and anticipated volumes. OBs increased clinic efficiencies and improved patient-direct care time with improved clinical and cost outcomes.

Keywords. Integration, Interoperability, Electronic Medical Records (EMRs), Electronic Health Records (EHRs), Coordinated Care, Interprofessional Communication

Introduction

The majority of communities cannot currently benefit from healthcare-related information passed electronically between disparate settings \cite{1,2}. Patients appear for care or health maintenance in a variety of locations and venues, and there enjoy encounters with different clinicians seeking to optimize outcomes, including clinical, cost-related and efficiency \cite{3,4}. Yet each setting generally acts as an island, each making best decisions as an isolated occurrence.

Healthcare continues to seek the benefits of coordinated action in favor of all involved, from patients to clinicians to providing organizations, and even payors \cite{2,5}. One major advantage which would enable or even propel such capabilities is information sharing across settings. Integrated information would enable integrated decisions and care and optimize outcomes, from clinical to cost controls to efficiency \cite{6,7}. Yet such remains a real, often legitimate challenge.

Electronic Medical and Health Records (EMRs and EHRs) alone cannot enable truly integrated care or coordination \cite{8,9}. Even those who have achieved such integration have most often been forced to meet rigid vendor-determined requirements. Such externally-dictated requirements often include “rip and replace” demands which force the removal of often-useful and legitimate solutions in order to meet “all from

\textsuperscript{1} Corresponding author: steve.shaha@allscripts.com.
one vendor” requirements. Such rigid “rip and replace” obligations often cause cost and adaptation-related challenges that users can find difficult or even unmerited.

Ideally, the optimization of care and related efficiencies and cost constraints can be achieved by maximizing interoperability among various systems in the different settings [6,10-12]. Establishing connectivity and interactivity among former islands would result in a coordinated network of care for the benefit of all involved, from patients to practitioners and the provider organizations, improving clinical to cost to efficiency performance measures [6,13-16]. Further, enabling integration of solutions and applications without forcing “rip and replace” approaches would save the adjustment and cost required at individual locations and users, and thus show respect and concern from the integrating entity for the individuals involved [2,6,10,12]. Achieving interoperable systems that can exchange crucial data across settings, even when founded upon solutions from non-identical vendor sources, is the key capability to best patient-focused care and outcomes [2,6,15]. Data are needed to prove both the efficacy of interoperable, integrated systems, and to prove their value and worth to clinicians, patients and healthcare systems. No conclusion should be drawn on opinions alone or on marketing promises, but all should seek data substantiating the achievability and efficacy of interoperable, integrated systems.

1. Aim

These directions reflect the important goals and imperatives for Telehealth, and the reality that integrated information capabilities throughout healthcare geographies provide the best foundations for achieving and improving mutual goals [24-26]. Demonstrated successes in Telehealth have reflected the increased need for integrated information sharing capabilities across platforms and geographies, regardless of solution vendor sources [27]. Thus the focus and aim of this research is to illustrate the power and beneficial impact of integrated, interoperable environments ideally structured to achieve the objectives and impacts of successful Telehealth and healthcare more broadly.

One community-centric hospital and its community-wide partners was determined to integrate data from interoperation systems throughout their community in order to achieve the most cost-effective and clinical efficacious outcomes across settings and throughout the community. What follows is an illustration of the powerful achievement and its beneficial results.

2. Case Study

A common challenge thought healthcare is the dramatic ups and downs in Labor & Delivery (L&D) [17-21]. Women appear in L&D or Emergency with delivery-related occurrences continuously, yet the details for best care and complications are missing and must be created, or recreatet. The staffing repercussions are predictably onerous. Similarly, post-delivery experiences at OB (Obstetrics) clinics are complicated by the need to recreate delivery-related histories for both mothers and infants, and accuracy remains a challenge.
2.1. Background – OB and L&D

The important impact of systems that are truly interoperable, and established on integrated data frameworks, is well described and quantified by reviewing its impact on the care in prenatal, L&D and post-partum care settings. Mothers and prenatal infants are generally cared for and evaluated by obstetricians and OB clinics and practices, generally aligned with healthcare systems. While all expectant mothers are not properly compliant with best prenatal practices, those that are – most – provide data through the OB documentation regarding the mother and the fetus that are invaluable for best outcomes. Conscientious maternal/fetal infant care professionals care for and assess expectant mothers, their unborn fetuses, and ultimately both the mother and her new infant thereafter. Strong patient-clinician relationships are established and maintained for best outcomes.

Conversely and concurrently, the L&D areas within healthcare delivery systems generally receive expectant mothers (mothers) and their soon-to-be-born fetuses with little or no warning or preparation. Mothers arrive at the hospital in various stages of labor or related “complaints” with little or no warning, and hence no preparation focused or adjusted based upon their specific needs. L&Ds generally staff for what the organization perceives as normal days or nights, prepared for both the uncomplicated usual deliveries, and those that require high resource and skills due to complications and challenges to mother or baby.

Despite their shared mission, the OBs and L&Ds seldom exchange data for tight patient-specific or patient-collective coordination of care. Two difficulties result from the absence of coordination between OBs and L&Ds. First, L&Ds are chronically adjusting to whatever arrives, which is often far too little for the staffing and preparedness in place, or far too much for best care and attention. L&Ds generally vary between overburdened and understaffed, versus under-utilized and overstaffing. If they knew “what was coming” as provided by the OBs then L&Ds could be far more optimally prepared and resourced.

The second difficulty is the post-delivery situation at the OB setting. Once a delivery has occurred, and both the mother and the infant have been discharged from the hospital’s post-partum process, the OBs encounter both patients (more if multiple births) with no data-based record of the L&D experiences, results or challenges/complications. Through assessment, interview and interaction, the OB professionals compile a best-possible record of the birth process and results, assess and quantify challenges, and begin care for the mother and baby.

As can be seen, everyone would benefit if prenatal data for mother and baby/fetus from the OBs were available to the L&D, and if post-partum and L&D data for the mother and baby were available back to the OBs. However, such is not readily achievable in most healthcare settings and communities due to EMRs and data systems from different vendors and sources.

Interestingly, the OBs are often the same OBs or partners thereof who practice within the L&D and post-partum areas. Yet the data from their own OB sources, or those of their partners, are missing during the L&D experiences. Conversely, the data post-L&D and post-partum is missing for them when they are back in their own OB clinics or practices.
2.2. Interoperability and Data Exchange – Methods

A community-focused health system became keenly aware of the OB-L&D communication challenges. The source of the awareness was very reality-based: when the L&D encountered some difficult workload and skill-deficit circumstances due to information inadequacies, the OBs themselves realized quickly and readily that the maternal and fetal data already gathered and computerized at the OB clinics – their own or other allied OBs – would provide much needed enhancement for the L&D to predict their needs and staff most appropriately. Simultaneously, all OBs foresaw the benefits of post-delivery data for mother and infant being accessible post-hospitalization within their OB practices.

IT professionals, OBs and L&D functionaries combined and collaborated to:
- Describe best data for L&D from OB for guiding anticipated predictions of patient volume and risk-based needs regarding maternal or fetal complications.
- Describe best data for OBs post-partum for knowing risks or complications encountered, and best care options and outcomes in continuation.

The IT professionals achieved data sharing between the OBs and the L&D. This required the evaluation of system-level capabilities, and the leveraging of the openness and interoperability potentials either learned or established. The specific data elements focused upon included:
- From OB to L&D:
  - Estimated date of delivery, thus providing staffing-need estimates for L&D long before.
  - All risk-reflective assessments and predicted challenges – for mother and for fetus/infant – thus providing L&D with proactive estimates of needs for personnel, skill sets and more clinically complex needs and requirements.
- From L&D to OB:
  - Mother-related details regarding the delivery and post-partum experiences, including medications, any risk assessments or proscribed needs.
  - Baby-related details regarding the delivery, nursery and post-partum experiences, including medications, any risk assessments or proscribed needs.

A system-wide integration engine was leveraged as well, and enabled the routine, fluid and near-real-time interchange of data between OBs and L&Ds as needed. No expensive nor disruptive “rip and replace” was needed, and yet the interoperability and data-interchange was accomplished.

2.3. Results and Findings

Results have brought very positive and statistically significant benefits for both settings (all shown p<0.01 or better). Data for pre-implementation reflect 480 OB prenatal cases for which data/records were passed to the L&D, and 1,080 post-partum
cases/records were passed back to the OBs and OB clinics, the latter reflecting the same 480 mothers, plus a number of infants including 46 multiple births and two (2) demises. Data for post-implementation reflect capture of precisely equal numbers, captured sequentially until frequencies were identical, reflecting random selection as well.

Significant reductions in complication rates in L&D have been documented which L&D and OB clinicians attribute to improved knowledge of risk-reflective information available at the time of delivery. L&D did not report reductions in staffing or related costs, which were not foreseen as an impact. However, L&D did report more flexibility and flexing in staffing, most notably for registered nurses (RNs), as numbers were shifted to better match with foreseen arrival rates for mothers as predicted based upon OB data.

Significant reductions in post-hospitalization OB-related metrics were also quantified and verified, including:

- Reduced post-partum emergency department (i.e. ED) visits.
- Reduced emergent or unanticipated calls or visits to the OB or OB clinic.
- Reduced costs for medications correlated with management of unforeseen complexities during the birth process (i.e. L&D) or in post-hospitalization care (i.e. OB).

Three additional benefits were experienced, one very much unanticipated. The mean OB clinic waiting times for mothers (and accompanying infant and potentially other children) were computed before and after the integration, interoperability achievement. As shown in Figure 1, the amount of time waiting from arrival until seeing the OB physician fell 40.6%, from an average of 126 minutes to 74.8 minutes post integration (see Figure 1).

![Figure 1. Reduction in pre-physician waiting time component of patient total office visit time.](image)

Simultaneously, the total patient visit time in the OB clinic from arrival to discharge also improved 31.7% from an average of 141.7 minutes to 96.8 (see Figure 2).
These data showed that having the data beforehand associated with patient needs and care improved efficiencies sufficiently to enable a reduction of visit time from nearly 2 ½ hours to about 1 ½ hour.

Unexpectedly and happily, a third time-related improvement was quantified. The average time with the OB physician before the implementations discussed was 15.7 minutes, reflecting the need of OB physicians to document and dictate all that had been learned and required recording. That OB-direct time was unexpectedly raised to 22 minutes in the post-implementation reality, an improvement of 40.1% in OB-direct time with patients (see Figure 3).

The OBs and staff were surprised when these findings were shared with them, not having either expected or perceived such. However, the surprise was favorable, with the clear anticipation that the improvements in patient-related outcomes and behaviors seen were affected by the greater personal time available with the OBs and their clinical staff.

Interviews were held to establish qualitative information regarding the impact of the interoperability and integration on OBs and L&D staff. Sample remarks shared clearly illustrate the impact from the clinician’s perspective include:
• “Standardization of the OB content has greatly increased the efficiency in how we view patient data. We don’t have to spend extra time asking the same questions for each visit. This is especially important when our patients arrive to Labor & Delivery and things are happening quickly.” Obstetrician in L&D

• “The critical information in terms of prenatal labs and fetal height/fetal heart tones flows from note to note. This has improved care coordination.” L&D Staff

• “We don’t have to spend extra time asking the same questions for each visit.” Obstetrician

• “Mom’s history is available to review connected with the infant’s chart as opposed to having to close one chart/patient and open up another.” OB Nurse

• “When an infant goes to his/her clinic visit, the maternal history can be easily accessed by the physician.” Obstetrician

3. Discussion and Conclusions

EMRs and EHRs alone cannot enable truly integrated care or coordination, but when integrated they can excel. Interoperability is a legitimate and achievable goal, as shown in this case study. Solution openness enables organizations to propel their aligned entities from island-like hopes to coordinated outcomes. Clinicians and IT professionals make ideal teams when backed by facilitating and mutually empowering systems.

Organizational leadership and IT professionals determined to achieve integration of care across the variety of settings through integration-focused computerization. They led in the operationalization of interoperability, establishing communication capabilities not only across settings, but across the varying open solutions throughout. They made possible the coordination of care and resources for both inpatient (IP) and ambulatory outpatient (OP) settings. The illustrative example of L&D and OB provides evidence as a compelling test case for studying the benefits achieved through integration.

L&D now receives prenatal information electronically and in near-real-time from OB practices and clinics regarding mothers and their fetuses, including risks or complications foreseen, as well as anticipated dates for confinement or delivery. The data routinely sent include continued updates whenever information is enhanced at the OB settings, thus ensuring that L&D knows all factors possible at any time that might be helpful for care or resource management. In reverse, all data reflecting mother or baby are passed to the non-hospital OB settings for continued care and optimization of practices, decisions and outcomes. All data behave as a single integrated information source and system, and are constantly available to both OB and L&D entities for care optimization and maximized resource management. Satisfaction of clinicians is an integral part of well-run healthcare systems, despite often anti-clinician comments made throughout poorly managed care systems [22,23].

The newer phases of development in integration have by need and vision incorporated patient-based and patient-sourced messaging and communication capabilities through integrated patient portal capabilities. The impacts and outcomes associated with such are to be shared in the future.
Integration and interoperability should not necessarily or dictatorially require a “rip and replace” strategy in order to work [2,4,6,13]. Systems should be “open” by design and interoperability is a goal. In this study, results have brought very positive and statistically significant benefits for both settings, including significant improvements in complication rates and favorable repercussions, improved efficiencies, and increased satisfaction for OBs, RNs, and patients [6,11,15].

References


Evaluating a Telehealth Follow-up Program for Cardiology Patients Using Administrative Data

Samuel Alan STEWART a,1, Leslie WORTH b and Carolyn BURTON b

a University of Saskatchewan, Saskatoon, Saskatchewan, Canada
b Saskatoon Health Region, Saskatoon, Saskatchewan, Canada

Abstract. This project evaluated the effect of a telehealth follow-up intervention on readmission rates for patients discharged from the Saskatoon Health Region cardiology units with ACS or HF. 1-year readmission rates for ACS patients were 27.4% (95% CI: [26%, 29%]) before telehealth implementation and 25.2% (95% CI: [24%, 27%]) after, producing an insignificant hazard ratio of 1.07 (95% CI: [0.97, 1.18], P=0.1899). For HF 50.3% (95% CI: [44%, 56%]) of pre-implementation and 47.9% (95% CI: [43%, 53%]) of post-implementation patients had a 1-year readmission, producing a HR of 1.04 (95% CI: [0.83, 1.26], P=0.6882). This analysis found no significant effect of telehealth on readmission rates for ACS or HF patients.

Keywords. Telehealth; Heart Failure; Administrative Data; Health Systems

Introduction

Hospital readmission places a significant burden on the healthcare system [1], particularly in Acute Coronary Syndrome (ACS) and Heart Failure (HF) patients, where readmission rates have been reported as high as 50% [2]. Preventing readmission is a complex problem, but if done correctly can keep patients out of hospital and save the healthcare system valuable money and resources over time.

Telehealth interventions can be a cost-effective way to follow-up with patients after discharge, decreasing readmission rates without burdening healthcare workers. Telehealth has a myriad of definitions in the healthcare literature: for this project we are referring to telehealth interventions as phone-based patient contact systems. Telehealth interventions have been implemented in previous environments, with moderate success [3], but there has been little published in its evaluation in ACS and HF in reducing readmissions using administrative data.

In 2012 the Saskatoon Health Region (SHR) implemented an automated follow-up system for patients discharged from the Cardiology Unit with ACS or HF. This system (called TelAsk locally, after the company performing the follow-up) has been in place for 3 years, but its effect on readmission has never been objectively evaluated. This project will measure the effect of TelAsk on reducing readmission rates for ACS and HF patients leaving the hospital in the SHR.

1 Corresponding author: sam.stewart@usask.ca.
1. Background

TelASK is an interactive voice response system used to call ACS and HF patients at specific time intervals over a 6-12 month time period. The automated calls consist of predetermined questions related to symptoms, medications, depression screening, and lifestyle management. The system uses a program specific algorithm and based on responses will trigger a call back from a cardiac nurse clinician if necessary.

The literature seems to suggest that telehealth can be effective in reducing readmissions. A systematic review of systematic reviews [3] suggests that telehealth can reduce hospitalizations, but many of these studies were performed using self-reported rather than administrative records.

2. Methods

All patients discharged from a SHR hospital between January 1st, 2010 and December 30th, 2013 with a discharge code of ACS or HF were extracted from SHR admissions records. Patient information extracted included age (at first discharge), gender, discharge diagnosis, readmission date and readmission diagnosis (where applicable). For TelAsk patients, there was also detailed data on contact, and for ACS patients only this included discharge date and dates of all individual calls (if any).

There were three distinct groups in the study population: non-cardiology patients, cardiology patients before TelAsk implementation, and cardiology patients after TelAsk. The non-cardiology and the pre-TelAsk patients act as control groups for the TelAsk intervention. We used an intent-to-treat analysis in the bulk of the analysis, with a follow-up investigation on the effect of contact within the TelAsk program. Time to readmission was studied using Kaplan-Meier Curves and Cox-Proportional Hazards models. All analyses were performed using R 2.15.2 [4].

3. Results

Table 1. Demographic information for study participants

<table>
<thead>
<tr>
<th></th>
<th>Non-Cardiology</th>
<th>Cardiology: Pre-TelAsk</th>
<th>Cardiology: TelAsk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (SD)</td>
<td>75.5(13.7)</td>
<td>75.3(14.5)</td>
<td>76.2(13.4)</td>
</tr>
<tr>
<td>Male (%)</td>
<td>285(51)</td>
<td>276(51)</td>
<td>299(51)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>275(49)</td>
<td>248(47)</td>
<td>294(49)</td>
</tr>
<tr>
<td>Readmit %</td>
<td>0.412</td>
<td>0.443</td>
<td>0.419</td>
</tr>
<tr>
<td><strong>HF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age (SD)</td>
<td>79.7(12.5)</td>
<td>78.1(13.6)</td>
<td>79.7(12.4)</td>
</tr>
<tr>
<td>Male (%)</td>
<td>112(41)</td>
<td>158(50)</td>
<td>175(49)</td>
</tr>
<tr>
<td>Female (%)</td>
<td>161(59)</td>
<td>129(50)</td>
<td>182(51)</td>
</tr>
<tr>
<td>Readmit %</td>
<td>0.447</td>
<td>0.503</td>
<td>0.417</td>
</tr>
</tbody>
</table>

Table 1 presents a brief summary of the patients, including age, gender and readmission rates. Table 2 presents the readmission rates for ACS and HF patients across all three groups by year and at set time intervals. Figure 1 presents the Kaplan-Meier curves for the ACS and HF readmissions and Table 3 presents the hazard ratios for all of the survival analyses. The results demonstrate that the TelAsk intervention
has had little effect on readmission rates within the Cardiology unit, and that non-Cardiology patients have a higher re-admission rate than Cardiology patients for ACS diagnoses, but not for HF.

**Table 2. Readmission Numbers and Rates for ACS and HF.**

Results are presented as “number (proportion, 95% CI)”

<table>
<thead>
<tr>
<th></th>
<th>Non-Cardiology</th>
<th>Pre-TelAsk</th>
<th>TelAsk</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>231 (0.412, [0.37, 0.45])</td>
<td>399 (0.282, [0.26, 0.31])</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>232 (0.443, [0.4, 0.49])</td>
<td>339 (0.266, [0.24, 0.29])</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>247 (0.419, [0.38, 0.46])</td>
<td>338 (0.261, [0.24, 0.29])</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>185 (0.359, [0.32, 0.4])</td>
<td>321 (0.252, [0.23, 0.28])</td>
<td></td>
</tr>
<tr>
<td>30 Day</td>
<td>226 (0.103, [0.09, 0.12])</td>
<td>162 (0.06, [0.05, 0.07])</td>
<td>164 (0.064, [0.05, 0.07])</td>
</tr>
<tr>
<td>60 Day</td>
<td>125 (0.16 [0.14, 0.18])</td>
<td>101 (0.098, [0.09, 0.11])</td>
<td>108 (0.106, [0.09, 0.12])</td>
</tr>
<tr>
<td>90 Day</td>
<td>87 (0.2 [0.18, 0.22])</td>
<td>71 (0.124, [0.11, 0.14])</td>
<td>64 (0.131, [0.12, 0.14])</td>
</tr>
<tr>
<td>180 Day</td>
<td>189 (0.286, [0.27, 0.31])</td>
<td>179 (0.191, [0.18, 0.21])</td>
<td>142 (0.186, [0.17, 0.2])</td>
</tr>
<tr>
<td>365 Day</td>
<td>267 (0.408, [0.39, 0.43])</td>
<td>223 (0.274, [0.26, 0.29])</td>
<td>181 (0.257, [0.24, 0.27])</td>
</tr>
<tr>
<td><strong>HF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2010</td>
<td>122 (0.447, [0.39, 0.51])</td>
<td>78 (0.481, [0.4, 0.56])</td>
<td></td>
</tr>
<tr>
<td>2011</td>
<td>158 (0.503, [0.45, 0.56])</td>
<td>79 (0.527, [0.45, 0.61])</td>
<td></td>
</tr>
<tr>
<td>2012</td>
<td>149 (0.417, [0.37, 0.47])</td>
<td>89 (0.497, [0.42, 0.57])</td>
<td></td>
</tr>
<tr>
<td>2013</td>
<td>135 (0.421, [0.37, 0.47])</td>
<td>93 (0.463, [0.39, 0.53])</td>
<td></td>
</tr>
<tr>
<td>30 Day</td>
<td>146 (0.115, [0.1, 0.13])</td>
<td>33 (0.106, [0.07, 0.14])</td>
<td>41 (0.108, [0.08, 0.14])</td>
</tr>
<tr>
<td>60 Day</td>
<td>77 (0.176, [0.16, 0.2])</td>
<td>21 (0.173, [0.13, 0.21])</td>
<td>24 (0.171, [0.13, 0.21])</td>
</tr>
<tr>
<td>90 Day</td>
<td>55 (0.22 [0.2, 0.24])</td>
<td>19 (0.234, [0.19, 0.28])</td>
<td>21 (0.226, [0.18, 0.27])</td>
</tr>
<tr>
<td>180 Day</td>
<td>126 (0.319, [0.29, 0.34])</td>
<td>38 (0.356, [0.3, 0.41])</td>
<td>53 (0.366, [0.32, 0.41])</td>
</tr>
<tr>
<td>365 Day</td>
<td>159 (0.445, [0.42, 0.47])</td>
<td>46 (0.503, [0.44, 0.56])</td>
<td>43 (0.479, [0.43, 0.53])</td>
</tr>
</tbody>
</table>

**Figure 1.** Survival curves for ACS (left) and HF (right)
Table 3. Cox Proportional Hazards Models for Risk of Readmission for ACS and HF. Models were calculated for both 90 day and 365 day readmission, and controlled for age and gender

<table>
<thead>
<tr>
<th></th>
<th>HR</th>
<th>95% CI</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>ACS</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Year</td>
<td>Non-Cardio vs. TelAsk</td>
<td>1.68</td>
<td>[1.58, 1.78]</td>
</tr>
<tr>
<td></td>
<td>Pre-TelAsk vs. TelAsk</td>
<td>1.07</td>
<td>[0.97, 1.18]</td>
</tr>
<tr>
<td>90 Day</td>
<td>Non-Cardio vs. TelAsk</td>
<td>1.57</td>
<td>[1.43, 1.72]</td>
</tr>
<tr>
<td></td>
<td>Pre-TelAsk vs. TelAsk</td>
<td>0.95</td>
<td>[0.8, 1.1]</td>
</tr>
<tr>
<td><strong>HF</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 Year</td>
<td>Non-Cardio vs. TelAsk</td>
<td>0.89</td>
<td>[0.71, 1.06]</td>
</tr>
<tr>
<td></td>
<td>Pre-TelAsk vs. TelAsk</td>
<td>1.04</td>
<td>[0.83, 1.26]</td>
</tr>
<tr>
<td>90 Day</td>
<td>Non-Cardio vs. TelAsk</td>
<td>0.97</td>
<td>[0.73, 1.22]</td>
</tr>
<tr>
<td></td>
<td>Pre-TelAsk vs. TelAsk</td>
<td>1.06</td>
<td>[0.75, 1.37]</td>
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</tbody>
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Within the TelAsk population (all patients since January 1, 2012), not all patients were contacted, for a variety of reasons (ineligibility, declined service, failed contact). This sub-analysis investigated the intent-to-treat assumption by studying the readmission rates between the contact and no-contact groups within the TelAsk cohort. Figure 2 presents the Kaplan-Meier curves for both HF and ACS, and Table 4 presents the Hazard Ratios for both 90 and 365 day readmission. Again, the results suggest that TelAsk has had very little effect on readmission rates for those that received it.

Figure 2. Survival curves for ACS (left) and HF (right) within the TelAsk cohort

Table 4. Cox Proportional Hazards Models for Risk of Readmission for ACS and HF in TelAsk cohort. Models were calculated for both 90 day and 365 day readmission, and controlled for age and gender

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<th>HR</th>
<th>95% CI</th>
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<td><strong>ACS</strong></td>
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<td>1 Year</td>
<td>Contact vs. No Contact</td>
<td>1.15</td>
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<tr>
<td>90 Day</td>
<td>No Contact vs. Contact</td>
<td>1.15</td>
<td>[0.70, 1.56]</td>
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<td><strong>HF</strong></td>
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<td>1 Year</td>
<td>No Contact vs. Contact</td>
<td>1.09</td>
<td>[0.58, 1.60]</td>
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<tr>
<td>90 Day</td>
<td>No Contact vs. Contact</td>
<td>1.37</td>
<td>[0.76, 1.98]</td>
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Discussion

There is little evidence to suggest that the TelAsk system implemented within the SHR has had any effect on reducing the readmission rate of patients leaving hospital with a diagnosis of either ACS or HF. Even when accounting for the inability to reach certain patients within the TelAsk group, the intervention has had a negligible effect on readmission rates. The one significant difference detected in the study is the higher readmission rates of ACS patients not managed on the Cardiology ward. This result most likely reflects an increased disease burden for patients with ACS who were managed outside of Cardiology, as those patients likely had significant co-morbidities that caused them to be treated within a different unit. Without further information about disease burden for these patients there is little of value to be drawn from this result.

There are shortcomings with this paper, stemming largely from the use of administrative data. The two control groups (non-cardiology patients and pre-implementation patients) are the best available controls for the study, but are not an optimal control group to compare to. Non-cardiology unit patients that are discharged with a diagnosis of ACS or HF may have more comorbidities than cardiology-unit patients and provide little of interest as a control group. The pre-intervention group is a better control for the TelAsk group, but variations in the patient population, the healthcare practitioners managing these patients and the policies within the SHR could all influence management practices and ultimately readmission rates, an effect that cannot be easily captured in this type of retrospective analysis. The TelAsk group also contained people that may not have been contacted, and the analysis could not account for additional follow-up service these patients may have received.

The TelAsk program is very cheap compared to the cost of readmission. The current bill for TelAsk follow-up is $40,000 per year, plus nurse clinician telephone calls related to the system, compared to an estimated $5,000 per stay for HF admission [5]. Patients not managed with TelAsk are either not followed up at all, or are called by a Nurse Clinician, substantially increasing the costs in a non-TelAsk system. These facts combine to suggest that even the smallest effect of TelAsk would be a valuable addition to the patient population, but currently no effect is being detected.

The results of this analysis have driven the initiation of a randomized control trial to formally evaluate TelAsk. Patients from the cardiology unit that consent to participation will be randomized to follow-up with TelAsk or with traditional non-TelAsk care, and at the end of the study the effectiveness and cost implications of TelAsk will be evaluated. The new study has received approval from the University of Saskatchewan ethics board and will be initiated in 2015, with results expected in the early part of 2017. This new study will demonstrate definitively whether TelAsk is cost-effective in reducing readmission rates for HF patients.

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Analysis and Typology of Global eHealth Platforms – A Survey on Five Continents

Karl A. STROETMANN a,b,1
a empirica Communication and Technology Research
b School of Health Information Science, University of Victoria

Abstract. Driven by the diverse needs for exchanging patient, other healthcare and health system data with the aim to improve the overall quality and efficiency of healthcare provision, regions and countries globally have been developing electronic platforms to gather and exchange such data. Based on an initial sample of more than 50 potential cases, eight such platforms were analysed in detail. This covered issues like core public health policy goals pursued, and major patient and other healthcare data access and exchange characteristics driving the platforms surveyed. This allows for arriving at an initial, pragmatic typology of such platforms. It provides for a better understanding of the main objective(s) and the major thrust of the underlying national (or district-related) health policy to develop and implement such infrastructures.

Keywords: eHealth, platform, interoperability, global good practice, strategy

1. Analysing Platforms in a Global Context

1.1 Context

The research upon which this paper is based was performed as part of the ISAES – Interoperable eSystems for Africa Enhanced by Satellites – Study [1]. The study gathered global empirical evidence, described, and analysed interoperability opportunities and challenges towards designing a generic eHealth platform. The final goal is to initiate and support the implementation and sustained operation of national or district eHealth platforms facilitating the access and exchange of patient and other health data towards delivering improved healthcare [2, p. 6].

1.2 Analysing Global Good Practice

In an attempt to obtain a better grasp of global initiatives and ventures to provide for district or national level eHealth platforms, a global scan of good practice of such eHealth platform development and implementation was undertaken [3-5], including exchanges with global experts and web searches. From a list of more than 50 candidate
examples, the following eight were selected for a detailed description and analysis, covering the wide variety of such platforms observable globally:

1. The Australian Nation-wide eHealth Platform and its Personally Controlled eHealth Record (PCEHR)
2. The Belize Health Information System (BHIS)
3. SIGA Saúde - The City Health Information System of São Paulo, Brazil
4. The Canadian Nation-wide eHealth Platform and its interoperable Electronic Health Record (iEHR)
5. The pan-European eHealth framework and ICT infrastructure for Smart Open Services for European Patients – epSOS
6. Estonia’s national eHealth platform and nationwide EHR system
7. District telehealthcare services platform in Gilgit-Baltistan, Pakistan
8. South Africa Western Cape primary Health Care Information System

The comprehensive case descriptions [1] focused on policy & strategic issues, governance & regulation, and interoperability approaches and implementations. Each case applied an accordingly structured information gathering instrument for descriptions of national or district efforts. These relied on detailed reviews of public eHealth/eGovernment or Information Society programmes, eHealth strategies, and other published results as well as contributions by local experts involved in such endeavours.

2. Typology of eHealth Platforms

When reflecting on the dynamic nature and fluidity of any of the platforms described, it becomes obvious that such a momentary classification can only attempt to classify them in a pragmatic, rough manner where a closer analysis would reveal that there are different grades and shades of meeting a certain dimension or not, or that with respect to different criteria it is not a yes-no situation, but rather one of a certain degree of meeting the criterion or not.

2.1 Patient Workflow Support System

When considering the overall complexity of the vision and objectives for some national eHealth platform strategies and plans, and the high-flying political goals policy makers and other stakeholders purport to support and justify such visions, the pragmatic character of some cases may come as a surprise.

The two cases of:

- South Africa Western Cape Primary Health Care Information System,
- District Telehealthcare Services Platform in Gilgit-Baltistan, Pakistan

...
and managing the flow of patients into and across healthcare services, thereby
benefiting both patients who receive quicker services at considerably reduced waiting
times [6], and healthcare professionals who are enabled to much better cope with the
daily tribulations of looking after hundreds and thousands of patients. The technology
employed was built upon a proven, small but successful application, which was further
developed with own ICT personnel rather than buying of the shelf software.

In Gilgit-Baltistan, it was the need to deliver most urgently needed care services to
outlying areas, like for maternal health, which led to the analysis of how eHealth
applications could improve the situation [7]. Based on a thorough needs assessment,
priorities were established and dedicated eHealth applications were introduced to
support diagnosis and treatment from a distance, enhance human resource capacity of
health providers, and provide better support for the health service facilities. The main
objective of the initial project was to develop and maintain an eHealth link between
different levels of health centres for patient management, triage, and referral of
patients.

Both cases are situated in less well resourced or even, in the case of Gilgit, very
resource poor settings – and geographic regions which in themselves already pose
sometimes dramatic barriers to delivering adequate quality of services – if at all, where
meeting basic healthcare needs have highest priority.

An interesting observation is that in both cases the pragmatic approach taken
seems to have led to a relatively fast, efficient implementation of the basic platform,
leading to a comparatively early start of indeed delivering the type of services
promised.

2.2 Basic EHR-like System

A similar type of system as the one developed in Western Cape Province is the national

- Belize Health Information System (BHIS).

However, it is somewhat more complex and comprehensive, particularly with
respect to recording basic clinical information for each patient and certain
infrastructure components like a national ID master index.

Planned since 2003, it was deployed already in 2007 as a country-wide fully
integrated patient centred health information system with eight embedded disease
management algorithms and simple analytics. It provides every citizen with a basic
health record which facilitates also the tracking and monitoring of infectious diseases.

The BHIS was initially developed based on a proprietary system, but was then
built on open source components, given the low and middle income country context. A
remarkable feature is its replication technology that allows individual sites to operate
temporarily without network connectivity, a critical component for infrastructure-
challenged environments.

Again, it can be observed that the pragmatic approach, supported by dedicated
national and foreign individuals has led to a fast, efficient and successful
implementation which can already boost some remarkable impacts: maternal-child
transmission of HIV has dropped from around 40% to about 5%, hospitalizations for
people over 65 with hypertension have decreased by 25%, adverse drug reactions were
reduced by >90%, and even the national health budget costs could be reduced by 3%
[8].
2.3 Comprehensive, Complex Systems and Platforms

The following two systems are located at the next level of complexity and integration:

- SIGA Saúde - The City Health Information System of São Paulo, Brazil,
and
- Estonia’s national health information exchange platform and nationwide EHR system.

When assessing the development success of the SIGA Saúde system, two aspects are of particular relevance:

a) Healthcare services are provided by a central agency, the São Paulo City Dept. of Health (SPCDH); i.e. a top-down approach could be applied.

b) The system started on a very pragmatic, three-step approach, where the first step involved introducing “only” a basic patient workflow support system. The initial goal was to organize:

- patient flow and
- data capture for billing, then
- medication dispensation, and
- referral and counter referral to specialized levels.

Only after the primary care layer was completed, the medium complexity layer with specialized clinics received the software and, after that, the third layer with hospitals entered in the system. A remarkable feature of this system was that this approach allowed for a very fast implementation and continuous improvement of the system [9].

Similarly to SIGA Saúde, an important facilitating factor of the Estonian national platform is that the Estonian National Health Service is almost a sole provider of healthcare, whereas many other countries have mixed healthcare service economies. All of this has led to relatively fast, large scale utilisation of eHealth services across the country. Another remarkable aspect is that the eHealth infrastructure has not been developed in isolation, but rather was impacted by and makes use of overall nationwide policy planning for the development of the co-called Information Society, including a national eGovernment plan [10].

2.4 National Framework Systems with Common Components

A quite different type of national eHealth platforms are those which may be called national framework systems with common components. They do not provide one, integrated healthcare patient record for every person, but rather establish framework conditions to improve the overall quality of electronic medical and patient records, to instigate local or district connectivity, and to allow for certain clinical elements, like a patient summary, and/or administrative components, like patient or healthcare professional IDs, to inter-operate at the national level across a great variety of healthcare providers, insurance companies, and other health system organisations.
They are typical for larger and large countries, where healthcare services are provided by a large number of independent actors like GP and specialist offices, medical centres, hospitals, and other independent services like pharmacies, physiotherapists etc. All of these systems suffer from their inherent complexity. Many, if not most of the more developed countries have such eHealth systems on their drawing boards, which are usually quite ambitious, far reaching and multi-purpose, often without being dedicated to a specific public health policy priority, but rather aiming at a generic blueprint which is supposed to cover any and (almost) all health system needs where eHealth applications may be expected to be useful.

Here we classify these two platforms:

- The Australian Nation-wide eHealth Platform and its Personally Controlled eHealth Record (PCEHR), and
- The Canadian Nation-wide eHealth Platform and its interoperable Electronic Health Record (iEHR).

Australia is an almost prototypical global example with quite some history. Already in 1999 the first steps towards implementation of a National eHealth policy were taken with the establishment of a National Health Information Management Advisory Council (NHIMAC). A ‘grand plan’ for e-Health – Health Online – was conceived. Launched in November 1999, the main focus of the plan was a series of wide-ranging national action strategies. Based on funding of $128.3m over four years a secure national health information network was to be established. Australia published an eHealth strategy and attempted to implement a national summary health record (HealthConnect) and national ePrescription management system and medication record (MediConnect). Neither project progressed past pilot implementations due to lack of federal and state political commitment; they were virtually abandoned by the mid 2000s.

Further studies followed, and another organisation, The National E-Health Transition Authority Limited (NEHTA), was established in 2005 as a collaborative enterprise by the Australian Federal, State and Territory governments, to identify and develop once more the necessary foundations for eHealth. It was to develop the critical standards, infrastructure, software and systems required to support the connectivity and the ability of electronic health information systems to safely and securely communicate with each other across Australia.

And again, success was minimal, and yet another project was devised, the implementation of a Personally Controlled eHealth Record (PCEHR), endowed with a huge budget of $467 million [11]. It is a secure online summary of an individual’s health information, which does not replace the records that GPs and other health providers hold or the way they communicate with their patients. Rather it provides a summary of key medical information that may be very useful for other clinicians. The eHealth platform facilitates “only” the secure sharing of that information. However, in spite of the huge investment, by August 2013 only around 700,000 people signed up for such a record, and the large majority of these PCEHR records were still empty. And yet another review was scheduled to assess and judge the system’s “fit for purpose and cost effectiveness”.

Canada is another example of how complex, difficult and problematic the establishment of such national systems is: The national eHealth programme in Canada is the responsibility of the not-for-profit agency Canada Health Infoway Inc. It is to
accelerate the implementation of inter-operable solutions through directed investment programs for different functional aspects of inter-operable EHR systems, including the infrastructure needed for this. Since 2001 Infoway has received CA$ 2.1 billion in funds from the federal government and has allocated those funds across 12 structured investment programs. It has used these funds to co-invest with the provinces, territories and other partners in more than 380 projects focusing on such areas as electronic health records (EHRs), electronic medical records (EMRs), telehealth, public health surveillance, innovation and consumer health, as well as pan-Canadian projects for architecture and standards [12].

Work was started towards furthering the integration of electronic medical record (EMR) GP data, hospital, ambulatory care, and pharmacy systems data into a single national iEHR type of patient summary.

There have been public reviews of the work undertaken or initiated by Infoway, but other than in many countries Canada followed a relatively continuous, albeit slow development path towards integration.

2.5 International core patient data exchange service

A globally unique, cross-border eHealth system to make basic patient data available to healthcare providers in another country and in another language (and, if necessary, another alphabet) is:

- The pan-European eHealth framework and ICT infrastructure for Smart Open Services for European Patients – epSOS.

Its overarching goal has been to develop a practical eHealth framework and ICT infrastructure that will enable secure access to patient health information, particularly with respect to basic Patient Summary and ePrescription data, between European healthcare systems and their respective health services providers, particularly hospitals, GPs and pharmacies. It started in 2008, was partially funded by the European Commission, and preliminarily ended in 2014; it is expected that the Member States of the European Union will continue to further develop and expand these services. By now, 25 European countries are involved in this endeavour, and further countries are expected to join [13].

Conclusions: The Role of eHealth Platforms for Better Healthcare

National or regional eHealth strategies are, at least in principle, driven by diverse policy needs for exchanging and integrating/aggregating patient, other healthcare and health system data with the aim to improve overall quality and efficiency of healthcare provision. Given the page constraints of this paper, it is beyond its scope to analyse these strategies in any detail. Rather, its focus is on concrete instantiations of such strategies as evidenced by regional or national electronic platforms and infrastructures to gather and exchange such data. Nevertheless, it is surprising that hardly any national eHealth strategy document – and consequently also the case studies on how they were implemented - conceptualizes and discusses at any (greater) detail core issues of interoperability, like what it really means, why it may be desirable for which policy field and for which stakeholders, what degree of interoperability in which health
system domain should be accomplished, and what benefits to expect from the sometimes very substantial investment expenditures and sustainability costs.

Although the cases briefly sketched stretch from sometimes relatively small – both in scope and with respect to the number of citizens covered – systems to large, highly complex national systems, a few generic conclusions can be immediately derived. Perhaps the most evident conclusion of these global case analyses is that at any level successful, early results delivering eHealth interoperability platform initiatives are clearly demand driven. As was noted earlier, particularly in more resource restricted environments like those in Belize, Gilgit-Baltistan or Western Cape Province the focus of the initial applications was by necessity on well circumscribed health system needs and priorities, where relatively straightforward solutions could deliver early benefits to both professionals and patients.

A corollary of this conclusion is that rather than focusing during the planning stage on the overall broadness of potential modules and eHealth applications to be supported by such an eHealth platform, it is more important to focus on a scope that is commensurate to given situation. All good practices show that only a limited set of services is being implemented in a given instance.

The cases also underline that the more successful, faster implemented platforms can be found at the district (or small country) implementation level, but sometimes linked to and taking advantage of cooperation and agreements that are made at the national level. It seems that as the size and/or the scope of an eHealth infrastructure increases beyond a certain level, which may be more than 10 m inhabitants and a variety of disparate domain functionalities, it becomes very difficult to manage its complexity both at the technical and the organisational level.

Acknowledgements

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References


Meeting the Semantic Challenge of the Globally Unique Identification of Medicinal Products - The openMedicine Approach

Karl A. STROETMANN a,1,b
a empirica Communication and Technology Research
b School of Health Information Science, University of Victoria

Abstract. To better enable cross-border healthcare delivery, particularly the exchange of ePrescriptions, this global undertaking advances the unique identification of medicinal products (MPs) and patient safety in cross-border settings. Major stakeholders harmonise their respective efforts to deliver
• common data models for prescribed MPs
• a common vocabulary for unambiguous definition, description, and identification of MPs
• rules to harmonise practices of therapeutic and economic substitution
• a global roadmap for post-project actions and implementations
Based on earlier activities of standard development organisations (SDOs), use case scenarios are developed, where the identification of an MP is an issue, including pharmacological and pharmacokinetic attributes, clinical indications, and risks to be considered. Next, the univocal identification of MPs is addressed, for standard pre-packed ones as well as for special cases like MPs with multi-components, biologics, or special packaging. Impacts will be considerable for global healthcare services and systems as well as – through simplifying and speeding up the registration of new products and afterwards pharmacovigilance - for national and international regulatory agencies, the MPs industry, and, in particular, patients.

Keywords. Medicine, pharmaceutical product, univocal identification, ePrescription, interoperability, therapeutic and economic substitution, cross-border healthcare, standard development organisations - SDO, World Health organisation, European Medicines Agency - EMA

Context

Information and communication technologies (ICT) applied to health (eHealth) can increase the efficiency, safety and quality of health services, and unlock innovation in health markets [1]. In the context of telehealth, i.e. the provision of health services at a distance [2], delivering safe and efficient cross-border healthcare poses a specific challenge in this context - the “delivery” problem of ePrescription: the univocal identification of the medicinal product (MP), which was noted in a prescription from a given country, by a pharmacist dispensing it in another country. S/He must be able to

1 Corresponding author: karl.stroetmann@empirica.com, empirica Communication and Technology Research, Oxfordstr.2, 53111 Bonn, Germany
select from the pharmaceutical products available in that country the product that perfectly matches the prescribed pharmaceutical product for safe dispensation to the patient. Or, if and where substitution is permitted, the dispensation of a similar product in line with national regulation [3].

Global standard development organisations (World Health Organisation - WHO, Health Level 7 - HL7, International Organisation for Standardisation / European Committee for Standardisation [Centre Européen de Normalisation] - ISO/CEN, Global Standards 1 - GS1), the European Medicines Agency (EMA), EU Member State Competent and Regulatory Authorities, major stakeholders (industry, health professionals, patients) and partners in the USA will collaborate and harmonise their respective efforts to solve this problem.

1. Goal and Objectives

The overall goal is to enhance the safety and continuity of cross-border (and thereby also national level) treatment through interoperable ePrescriptions, and to develop concrete solutions to the challenges identified. Concrete objectives are to deliver:

- common data models for prescribed MPs
- a vocabulary for unambiguous description, and identification of MPs
- rules to harmonise practices of therapeutic and economic substitution
- a global roadmap for post-project actions and implementations.

2. Process and Activities

The work will benefit from earlier activities of regulatory agencies and global SDOs. The ISO 11615/11616/11238/11239/11240:2012 standards family on "Health informatics -- Identification of medicinal products [IDMP]" was created with the active engagement of regulatory agencies FDA and EMA, and intense debates in the ISO, HL7, CEN groups that engage in pharmacy standardisation. Meanwhile WHO, which maintains several coding systems including the Anatomical Therapeutic Chemical (ATC) Classification System, collaborates with the International Health Terminology Standards Development Organisation IHTSDO in various harmonization projects. There is need to bring these activities together, particularly also as EMA requires that medicinal product companies submit data using IDMP starting 2016. This is a big change both for EMA and the pharmaceutical industry. On the other hand, it is going to affect the information offered by the European Union Drug Regulating Authorities Pharmaceutical Database (EudraPharm), the database of medicinal products that EMA maintains. Also the experience of the European project to foster “Smart Open Services for European Patients - Open eHealth initiative for a European large scale pilot of patient summary and electronic prescription” (epSOS) [3] has shown that, particularly on the issue of cross-border ePrescription/eDispensation, further standardisation activities are urgently needed.

The unique contribution of this initiative will be to develop upon this earlier work, identify differences and inconsistencies across already existing standards, and thereby harmonise global standardisation. As a first step, the project develops a concise
conceptual framework to guide its work, based on the interoperability domain framework as depicted in Figure 1 and use case scenarios where the identification of an MP is an issue, including pharmacological and pharmacokinetic attributes, clinical indications and risks to be considered. Next, the identification and description of pharmaceutical products is addressed, not only for standard pre-packed medicinal products, but also for some special cases like MPs with multi-components, biologics, or special packaging as well as those cases where a prescription for a medicinal product only specifies a cluster or class of products. Furthermore, investigations are undertaken to clarify what attributes are needed for reverse identification of a medicinal product.

Figure 1. Interoperability domains

Substitution of medicinal products at the point of dispensation is a challenge in a cross-border setting due to widely divergent rules. Empirical evidence on the tension between maximising patient safety and maximising the probability that a cross-border prescription can indeed be adequately filled in another country is gathered and analysed to develop concrete solution proposals to overcome the challenges pinpointed.

3. Partner Organisations and Experts

The following organisations are core partners of this initiative:

- empirica Gesellschaft für Kommunikations- und Technologieforschung mbH, Germany
In addition, to enable direct involvement of interested third parties which cannot or may not want to become a direct contractual partner in a project supported by the European Union, the initiative co-opted two international regulatory agencies: the European Medicines Agency (EMA), London, UK, and the World Health Organisation (WHO - Geneva, and the WHO Uppsala Monitoring Centre - UMC). Direct cooperation with the US Food and Drug Administration (FDA) has also been established.

Furthermore, to allow for the input and involvement of further (national) regulatory authorities, SDOs like the International Health Terminology Standards Development Organisation - IHTSDO, and major stakeholders (industry, health professionals, patients) the initiative will be supported and advised by an Expert Council and selected individual experts.

4. Outcomes

This project will deliver practical solutions ready to be taken over and eventually implemented by countries across the globe to solve two key issues of cross-border prescription services: the univocal identification of medicinal products, and clear rules of how to deal with substitution when presenting a prescription abroad. These solutions concern:

- Data models for prescribed medicinal products developed cooperatively by regulatory authorities and global SDOs, validated by experts and government representatives. They will be based on the groundwork already undertaken by EMA, FDA and SDOs. The data models will include ways of clustering medicines according to their bioequivalence, in view of substitution, and pharmacovigilance needs. This will include agreement on an international standard to represent multiple (active) ingredients in medications and a way to identify changes in that composition; agreement on the way to prescribe a class of pharmaceutical products or a cluster of medicinal products instead of a specified product.
- A common vocabulary for unambiguous definition, description, and identification of medicinal/pharmaceutical products which will be developed and validated in a similar fashion.
- Clear rules for the cross-border handling of different practices of therapeutic and economic substitution in Europe
- A roadmap for post-project implementation of the solutions elaborated, including a proposal for the future structures, processes and funding for a
organisation to maintain, further develop and internationally coordinate technical and semantic interoperability assets, issues, and challenges.

Outlook

The impact on and benefits for patients, in particular those seeking healthcare services in another country, international travellers and those temporarily working and/or living abroad, will be considerable:

- Any patient can obtain seamlessly at least a medicine equivalent to the one prescript in another country
- Clinicians reviewing a foreign patient’s summary understand fully the medicinal therapy information contained
- Pharmacists can fully identify what is the most appropriate medicinal product in his/her country that fulfils the therapeutic requirements of the product prescribed abroad, in accordance with his/her country laws and substitution rules
- Different actors [regulators (e.g. EMA, AIFA); national/regional/local information systems; pharmaceutical companies; sponsors of clinical trials] are enabled to meaningfully exchange MP data and share the same source of information.
- Identifiers can be used by any actor in any country for obtaining the product’s “properties”

This work will also contribute towards fostering the innovation capacity of pharmaceutical companies by simplifying and speeding up the registration of new products and afterwards pharmacovigilance activities – innovations which contribute to patient safety and better healthcare.

Neither SDOs, national authorities, pharmaceutical companies or other stakeholders can solve the challenges indentified on their own – we need global cooperation. It is anticipated that the cooperation initiated by this project will serve as the game changer to the situation of global MP identification.

References

Re-thinking Models of Patient Empowerment

Aisha UMAR 1 and Darren MUNDY

Digital Media, University of Hull, United Kingdom

Abstract. The empowerment of citizens in relation to personal healthcare management includes consideration of a multi-faceted collection of elements. Simplistic forms of understanding which link empowerment to access provide limited acknowledgement of the requirement to facilitate a greater sense of health ownership in patients and collaborative working practices in practitioners. More complex attitudes to the delivery of empowered patients encompassing knowledge development, technological awareness and partnership approaches to healthcare delivery are steps in the right direction, but strain to fit currently emerging ideas around patient centered care. This paper posits that existing frameworks aimed at empowering patients for a patient centered ehealth system are insufficiently presented. The frameworks, which are mostly premised on an inequitable focus, fail to factor in the invaluableness of holism and technological innovation. Through a review of existing frameworks and an articulation of patient demands, weaknesses in current structures to support empowerment are explored, and key constituents of a framework for patient empowerment are determined. Consequently, the paper articulates a model focused around delivering an empowered patient in the 21st century healthcare system.

Keywords. E-health, empowerment, patient empowerment, patient empowerment frameworks, holism, iteration, technology support

Introduction

The presence and increase of challenges to ehealth in today’s society have begun to generate doubts about the capability of technology [2], especially with regards to issues of empowering patient [1,4]. Patient empowerment is roughly believed to be integral to any modern healthcare system [4]. Indeed, progress has been made with the development of models aimed to support the delivery of ‘empowered patients’ for better healthcare. Nevertheless, some patient empowerment frameworks/models have limited functionality through solely focusing on singular aspects of empowerment [5] and showing sign of age in an increasingly technological healthcare environment [1] (be this telehealth focused or part of wider technological reforms).

The contribution of this paper focuses around establishing weaknesses with current patient empowerment structures through critical analysis. A taxonomic analysis is used to explore current frameworks and connections are drawn between existing structures. The critical analysis provides a platform for presenting a new framework for patient empowerment, which builds on the strength of existing structures, but seeks to combine

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1 Corresponding author, Digital Media, Scarborough Campus, University of Hull,Y011 3AZ, UK; E-mail: a.umar@2011.hull.ac.uk.
patient efficacy, provider support, health management, and technological infrastructure (including more sophisticated telehealth services) in innovative ways to provide societal benefits.

The next section explores patient empowerment through a focus on information access, patient involvement, and self-management. This work includes critical analysis of existing state of the art frameworks and models. Limitations highlighted within these models coupled with an understanding of their strongest features are used in the development of a new model of patient empowerment, as presented in Figure 1.

![Framework for patient empowerment](image)

Figure 1. Framework for patient empowerment

This new model draws on aspects of systems theory such as holism, and iteration. In the final section of the paper we conclude by describing next steps and further work.

1. Patient Empowerment

In the health and medical literature, there is no consistent definition of patient empowerment [2]. Yet the concept universally carries a positivist function. Patient empowerment is generally about patients taking control or responsibility over their health, illness and treatment care [1] as well as the ability to participate in the consultation and decision making process [8].
In addition, patient empowerment facilitates patient self-management of not only specific periods of illness or long term conditions, but also of their health as a whole [5]. Furthermore, patient empowerment encourages pro-active health awareness and an expectation that patients will adhere to treatment. This contrasts with the traditional doctor-patient relationship, which is built on the concept of ‘compliance’ in which patients are required to do as they are told [9]. Here we find the hallmark of patient empowerment, it being a non-paternalistic approach to healthcare services. Thus a large amount of literature in the effort to explain patient empowerment stresses the difference between ‘adherence’ and ‘compliance’ [2,3,6,9].

Patient empowerment, however, is also linked to many functional elements such as access to information, patient involvement, and self – management. In this paper, we initially explore patient empowerment with respect to these functional elements.

1.1. Information Sharing

Information has been considered to have a vital role in the performance of healthcare systems around the world [2]. It is asserted that patient empowerment depends on the flow of health information [6]. There is no doubt that the act to provide greater public information sharing provides patients with a greater awareness and evidence about their health. Nonetheless, information alone may eventually disempower the patients by making them recipients thereby compromising the stated goal of patient empowerment.

1.2. Patient Involvement

Ensuring that patients’ views are heard at all levels and across all parts of the healthcare system is essential for delivering empowered patients for better health and care services [1]. The doctors are expected to engage patients in their treatment, which will encourage patients to get involved in their healthcare and treatment [2].

1.3. Self-Management

One of the functional elements that is most often linked to patient empowerment is self-management [2]. This may in some cases be referred to as patient personal development. This involves a range of activities that improve awareness about disease to support end of life pain management [3]. Undoubtedly, self-management facilitates a greater sense of health ownership in patients [1]. It may not place the patient as the facilitator of their own care, but it does increase their value in the care relationship [5].

2. Frameworks of Patient Empowerment

Existing frameworks regarding patient empowerment are often constructed in relation to a multitude of different categories. For example, frameworks exist related to community empowerment for health purposes, the empowerment of carers, family health empowerment, and individual health empowerment. Disease specific models have also been introduced to encourage empowerment in disease management and control circumstances, e.g. in the areas of diabetes [2], mental illness [3] and many more. We can break these categorizations down into the following generic themes:
Health-Centred; Patient-Centred; Provider-Centred; Technology-Centred and Hybrid models.

2.1. Health-Centred

A collection of empowerment frameworks [3,5,7] that guide patient empowerment through a focus on health related or disease focused conditions can be broadly defined as health-centred. Such health-centered frameworks present pathways through to patient empowerment as connected primarily to the management of health related conditions that arise from serious illness and disease, through to generic health condition management.

Undoubtedly, health-centred frameworks enable opportunities for the development of mechanisms designed to better support patients in coping with chronic illnesses like diabetes and many more [4]. However, they are restricted to chronic disease and can be limited to knowledge about specific illnesses [9].

2.2. Patient-Centred

Second-generation patient empowerment frameworks evolved from global health policy transformation in the early 21st Century [2]. The limitations of health-centred models required different approaches to be developed which shift the balance of power within healthcare relationships to enable patients to be seen as an expert with respect to their own health management [3]. Within this framework an important criterion of successful adherence to treatment is that a patient’s willingness, and experience with illness should be included in consultations.

From this perspective, patients have more control over their healthcare. Nevertheless the patient-centred framework can offer an illusory empowerment to patients with chronic disease [8].

2.3. Provider-Centred

The key concept behind provider-centred frameworks is on better enabling the empowerment process. Provider-centred frameworks seek to do this through promoting participation in the patient empowerment goal with providers and increasing provider willingness to participate in the implementation of patient empowerment. This can encourage providers to be active in helping the patient to understand their health and medical treatment, but at the same time a provider’s perspectives on care may often overrule patient self-efficacy and continue existing power relationships.

2.4. Technology-Centred

Technology-centred frameworks originated in the midst of substantial technological change [5]. These are generally centred on utilizing technology (both telehealth and wider computer based technologies) to deliver personalized healthcare. Technology-centred frameworks open avenues for continuous and readily accessible health data and can help to facilitate self-monitoring. However, current digital divides limit the full potential of technology to support patient empowerment [5].
2.5. Hybrid

A hybrid framework involves the integration of two or more of the above categories of framework, and the ideas presented therein, with the focus on developing a more holistic perspective on patient empowerment. Hybrid solutions can provide a balanced patient:provider:technology:health approach in line with their integration focus [3]. However, it can be argued that each perspective above has a role to play in patient empowerment – therefore an integrated framework encapsulating each idea may deliver a stronger solution.

3. Limitations of Existing Models

Current models/frameworks capturing health, patient, provider and technology roles provide a better understanding of the efficacy of patient empowerment in the healthcare system and influence utilization of approaches to deliver patient empowerment and greater ehealth integration. However, the above analysis indicates that the balancing of stakeholder roles in healthcare systems is unlikely to be addressed effectively by singularly focused initiatives; hybrid approaches combining conceptual ideas are a preferred option. The primary issue is that an over focus on singular areas may prevent optimum ehealth integration and use. Hence they have limited functionality and strength through: solely focusing on a singular aspect of empowerment whilst neglecting others [3]; missing vital elements [1]; and showing signs of age in an increasingly technological healthcare environment [2]. Consequently, a different approach is needed to have a clearer understanding of the patient empowered ehealth system. A number of studies have begun to establish the main elements of a framework for understanding this basis in the context of holism (looking at the system as a whole, rather than singular parts or singular stakeholders). The aim of this paper is to articulate a model, which would consider systems theory ideas to present a robust framework of patient empowerment for better ehealth integration. A robust framework is key to ensuring an empowered patient in the 21st century e-health system.

4. Developing a New Framework

In this section, we present a unified model of patient empowerment that is centred on understanding perspectives of multiple stakeholders in healthcare systems and vital aspects of empowerment. In this model, patient empowerment is understood as a shared and iterative process, whereby all stakeholders in the healthcare system work in partnership to enhance personalized healthcare management. Such partnerships seek to facilitate a greater sense of health ownership in patients and promote collaborative working practices through a series of iterative steps (towards an increasingly developed relationship) to maximize excellence. This more complete framework of empowerment brings together separate categories of patient empowerment models, contributing an integrated structure of empowerment. Consideration of the whole, in terms of aspects of empowerment, is more than merely the sum of its parts [5]. In this regard, all stakeholders in the healthcare system affect patient empowerment, and technology (including telehealth provision) is incorporated in every stage of the empowerment process. This model, presented in Figure 1, also acknowledges the importance of
iterative development in maximizing patient involvement in the development process and the promotion of empowerment for personalized healthcare.

4.1. Awareness-Access

The empowerment of citizens in relation to personal healthcare management has been linked primarily to an access to knowledge or services issue [2]. Such access provides a basic form of understanding patient empowerment [3]. Patient empowerment depends on access to the healthcare system and all health resources but access is not in itself enough to deliver patient empowerment. In the proposed framework, Figure 1, access and awareness are coupled as significant concerns at the base of the patient empowerment framework. There is no point in access if the patient is not aware, similarly awareness alone may promote requirements for access.

4.2. Understanding-Knowledge

Knowledge development is vital to the delivery of empowered patients, providing citizens with the information they need for their health decision-making processes. Development of patient knowledge involves a relationship between patients and their understanding of health information, as well as the ability to make effective use of the knowledge [3]. Understanding knowledge is about the degree to which a patient has the ability to obtain, process, and understand the health related information needed to make informed decisions [2]. This contributes to patients understanding in becoming active participants in the management of their health, which eventually has been shown to result in more efficient partnership work between patient and practitioner groups [3].

4.3. Partnership Application

One of the common functional elements to support the empowerment of patients is partnership care. This means the patient and provider should work in partnership to enhance patient involvement in their health and healthcare, illnesses, and treatment plan [8]. Partnership development can also contribute to enhance self-management, improve healthcare utilization and promote a greater sense of empowerment, which can boost patient self-efficacy and/or confidence to have more control of their care [3]. Thus partnership is not only vital to the development of a treatment care plan, but can also lead to a developed approach for empowering the patient [5].

4.4. Developed Approach of Self-Efficacy

Patient self-efficacy, which can be referred to as the extent of a patients’ belief in their own ability to take responsibility for their own healthcare, complete required tasks [5] and reach goals developed in their treatment plan (either personal or provider focused) [3], is one of the ingredients for patient empowerment to occur. For instance, it can enable personal initiative to be taken in one’s healthcare and may help patients to make beneficial choices that are more relevant to their personal care [7]. Thus the ultimate goal of personalized care is not just to improve the quality of life, but also to create a developed approach to care. Thus continuity is vital as it enhances an empowered patient.
4.5. Technology Including Telehealth as an Underlying Support Mechanism

Technology has been acknowledged for its potential in the delivery of the empowered patient [5]. However, technology does not exist as a singular aspect, it is multi-faceted and supports many different areas towards patient empowerment. For example, basic web access promotes patient engagement with health literature and can connect together patients with services. At the level of self-management, telehealth tools including mobile applications can help patients to understand their health conditions, engage in personal health monitoring, and construct dialogues for communication with their health providers for more developed partnership care. Therefore technology exists as an enabler within the framework supporting all aspects and increasing in maturity as the patient / provider relationships develop overtime. For example, a patient who decides to monitor their own healthcare through technology will increase over time their understanding and sophistication of use.

Conclusion

Patient empowerment approaches involve multiple elements that cannot be determined or explained by their component parts alone. Component parts in systems designed to support patient empowerment are intimately connected and can be understood only by reference to the whole. Thus the entire system should be considered in frameworks constructed to support the empowerment of patients. Iteration and technology are vital in empowerment processes, which require frequent monitoring of progress. Further work will focus on additional support for the proposed framework through healthcare stakeholder analysis, including exploration through qualitative questionnaires around patient empowerment principles. This will enable further levels of complexity to be analyzed and taken into consideration.

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