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Achieving Greater Consistency in Telehealth Project Evaluations to Improve Organisational Learning

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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

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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/HSPIL/). 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.

National Performance Frameworks	Relevant indicators and measures	Data sources
Australia College of Rural & Remote Medicine. (2012). ACRRM Telehealth advisory committee standards framework. http://www.ehealth.acrrm.org.au/system/files/private/ATHAC%20Telehealth%20Standards%20Framework_0.pdf	**Adequate performance of IT equipment and infrastructure**: 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. **IT risk management**: 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.	IT managers' service agreements and logs
Australian Commission on Safety and Quality in Health Care. (2012). Practice-level indicators of safety and quality for primary health care specification. http://www.safetyandquality.gov.au/wp-content/uploads/2012/02/consultation-paper-practice-level-indicators.pdf	**Appropriateness:** health summary; timely initial needs identification; client assessment; complete care plan and timely review; recalls and reminders; adherence to clinical guidelines; medication review **Effectiveness**: client improvement / stabilization; attainment of goals of care **Coordination:** referral process and content; allocation of care coordinator; timely communication with care team **Safety**: adverse drug reactions and medication allergies; documented(near misses or adverse events investigated and followed up; infection control.	Service providers' patient / client records
Australia's Health Performance. (2010). Chapter 9 National Health Performance Framework and Indicators. http://www.aihw.gov.au/WorkArea/DownloadAsset.aspx?id=6442452959	**Accessibility**: People can obtain healthcare at the right place, at the right time irrespective of incomes, physical location and cultural backgrounds. **Continuity of care**: Ability to receive uninterrupted coordinated care or service across programs, practitioners, organisations and levels over time. **Responsiveness:** Healthcare service is patient oriented. The client is treated with dignity, confidentiality and encouraged to participate in choices related to their care.	Service users' direct experiences
Australian Council on Healthcare Standards. EQUiP National Table. http://www.achs.org.au/media/38984/table_equipnational_standards.pdf	**Service delivery:** (6 elements) **Provision of care:** (4 elements) **Workforce planning and management:** (4 elements) **Information management:** (4 elements) **Corporate systems and safety:** (9 elements)	Board of Management reports

Table 2. Example of mapping indicators to measures for the Patient/Client group.

Patient / Client indicator	**Measure**	**Preliminary findings**
Accessibility	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)?	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.
Continuity of care	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?	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.
Responsiveness of care	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?	Patients/ clients were positive about all factors, both before and after the introduction of Telehealth.

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.

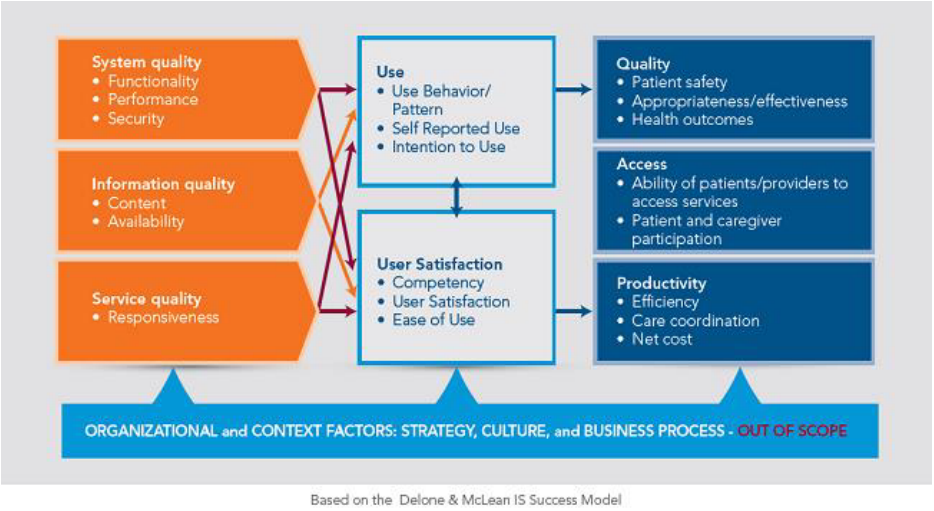

Figure 1. Canada Health Infoway Benefits Realisation Framework

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 Teleopthalmology 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.

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