



**GLOBAL DIGITAL HEALTH**  
PARTNERSHIP

# CLINICAL ENGAGEMENT IN DIGITAL HEALTH

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An international overview of enablers and barriers

## Acknowledgements

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We hope that this report provides both member and non-member countries with guidance on the key enablers that can lead to successful clinical engagement.

### About the Global Digital Health Partnership

The Global Digital Health Partnership (GDHP) is a collaboration of governments and territories, government agencies and the World Health Organization, formed to support the effective implementation of digital health services. Established in February 2018, the GDHP provides an opportunity for transformational engagement between its participants, who are striving to learn and share best practice and policy that can support their digital health systems. In addition, the GDHP provides an international platform for global collaboration and sharing of evidence to guide the delivery of better digital health services within participant countries.





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# NOTE FROM THE GDHP CLINICAL AND CONSUMER ENGAGEMENT WORK STREAM CHAIR

This report has been prepared on behalf of the Clinical and Consumer Engagement Work Stream to summarise international experiences and approaches to clinical engagement in digital health initiatives. It aims to provide an overview of the key barriers and the enablers that contribute to successful clinical engagement in the design and implementation of digital health programs. The report is based on the responses to two surveys, developed by Workstream participant countries and issued by the GDHP Secretariat. Special thanks to the Australian Digital Health Agency who undertook the data analysis and completed an analysis of the relevant literature.

The report identifies several common challenges to clinical engagement experienced by all GDHP participant countries, regardless of the scale of their current digital health program. However, there is also a high level of agreement about the factors that lead to successful clinical engagement. What is not so clear is how to measure successful clinical engagement, and why similar strategies applied in different contexts can have very different outcomes.

The report includes several case studies to illustrate the findings from the survey study and literature review. These provide references to a range of other resources that provide additional details on specific projects and approaches that have been deployed.

Lastly, I believe it is an important time now for the global digital health community to understand and discuss the significant challenges to clinical engagement. Addressing these challenges will impact on emerging digital health technologies such as the implementation of telehealth in remote and rural communities, technologies for health of children and mothers, public health technologies, technologies for the elderly, and health behavioural change technologies. Furthermore, investing in clinical engagement will be critical to addressing the issues of digital health technologies that can potentially worsen inequality or improve the health disparities of certain populations and international countries and regions.

I would like to thank all contributors for sharing their insights and experiences for this report, and trust that these findings will be of value to all GDHP member countries.

Shelagh Maloney  
Chair  
Clinical and Consumer Engagement Work Stream, GDHP  
Executive Vice President  
Digital Health Engagement and Marketing  
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# 1 EXECUTIVE SUMMARY

## 1.1 BACKGROUND

The clinical and consumer engagement work stream aims to develop an understanding of strategies that have worked to improve digital health literacy. It also aims to understand the role of co-design in addressing how digital health technologies can support the needs of clinicians in their efforts to support better care.

Digital health technologies, with the support of a national infrastructure, can assist in delivering solutions to global health challenges and support the advancement of the United Nation’s Sustainable Development Goals<sup>1</sup>. Emerging digital health technologies can improve the health outcomes of rural and remote communities using telehealth, improve the health of children and mothers, advance the international surveillance of communicable diseases, improve the health of frail and ageing populations of countries with varying economies, and improve the prevention of highly prevalent illnesses using behavioural information technologies. Lastly, inclusion and universal access to digital health is important to ensuring health outcomes are delivered equitably across different countries.

This workstream’s initial focus has been clinical engagement, however, many of the observations arising from this report are relevant to the challenges in engaging consumers effectively. It is the intent of this workstream to also explore these challenges and identify best practice, noting that clinical and consumer engagement in digital health is essential in achieving the aforementioned Sustainable Development Goals, specifically, Goal 3: to ‘Ensure healthy lives and promote well-being for all at all ages’<sup>2</sup>.

For the purposes of this report, clinical engagement is defined as the “active involvement of clinicians in problem definition, and the design, planning, implementation, adoption, optimisation, and use of digital health solutions through the application of clinicians’ knowledge and experience to ensure developed solutions are fit for purpose” (1).

The scope of this report is to summarise international approaches to clinical engagement in digital health initiatives. It includes the survey responses of a Delphi-like study issued to participants in the Global Digital Health Partnership (GDHP) on barriers to and enablers of engagement, an analysis of relevant literature, and a summary of key observations drawn from these two sources.

The report includes several case studies to illustrate the findings and to provide references to supporting resources that provide additional details on specific projects and approaches deployed.

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<sup>1</sup> <https://www.un.org/sustainabledevelopment/>

<sup>2</sup> <https://www.un.org/sustainabledevelopment/health/>



## 1.2 KEY FINDINGS

The key findings from the survey results and literature review are summarised below. These findings are discussed in Section 6 of this report.

**Successful engagement is multifaceted:** No one strategy for clinical engagement will work on its own.

**Solutions should focus on a clinical problem, not a management problem:** Clinicians are more likely to be engaged where the focus is better healthcare delivery and better patient outcomes.

**Engagement should be based on a shared need, and a common vision:** Engagement should be based around a need that is recognised and shared by all stakeholders, even if their perspectives about the consequences of those needs are different.

**Engagement is critical from the outset:** Clinical engagement should start by involving clinicians in defining the problem to be solved.

**Meaningful authority should apply to clinical decision-making:** For clinical engagement to lead to successful implementation, clinicians need to have joint ownership of any decisions made.

**Clinical governance underpins clinical engagement strategies:** Appropriate clinical governance underpins successful clinical engagement in digital health technologies.

**Workflow integration is key:** Clinicians will not engage with solutions that disrupt existing processes, negatively impact the time spent with patients, or add high administrative burdens.

**Localising the solution will build local engagement:** Focusing on local area solutions and engagement that build a sense of local ownership and use of peer networks and well-respected clinicians for promotion and advocacy is more effective.

**Demonstrated success by peers will drive engagement:** Clinicians are more likely to engage with digital health if a solution is being used and promoted by their peers.

**“Hands on” clinical champions are needed, not clinical figureheads:** Having clinical champions as “figureheads” for a project or initiative is not enough to drive clinical engagement.

**The engagement method should be people-to-people, not organisation-to-organisation:** Engagement cannot just be an exchange of marketing or technical information from a project management office to a clinical practice.

**Financial incentives alone are not enough:** Financial incentives do not work in isolation. There have to be incentives related to quality of patient care, and to improvements in workflow, performance, or other outcomes driving participation.

**Consumer expectations drive clinical engagement:** Countries that make an investment in consumer-facing digital health solutions are increasingly seeing the influence that consumers can have on clinical engagement in digital health.



**Systems should be intuitive and not need training:** Systems, if well designed, should not require extensive training, and that generic training in isolation of clinical workflows will not engage clinicians.

**Change management requires substantial focus and investment:** Change management requires substantial focus and investment from the outset and will be more effective if it is driven by clinicians and permeated through peer networks and tailored to the needs of individual groups.

**Change fatigue must be managed:** Change fatigue is a barrier to engagement. If there is not a clear picture of the end goal, but rather just a mass of seemingly unrelated projects, then engagement will be difficult.

**Do not set expectations too high:** Benefits take time to achieve and there will inevitably be issues that arise. Be realistic about what changes must occur to see a clinical benefit.

**Language must resonate with clinicians:** Communication must be clinical, not technical.

**Importance of health informatics professionals is a key factor:** Investment in developing the workforce capacity of health informatics professionals is needed to ensure clinical engagement with digital health solutions is harnessed in clinical workflows and service delivery.

**Learning about digital health technologies should be embedded in clinical educational curricula:** Specific curricula including digital health education must be embedded in all levels of tertiary education, starting from undergraduate and up to postgraduate levels.

**Engagement must keep pace with changes in clinical practice:** Engagement does not stop at implementation – there needs to be a mechanism for ongoing input and refinement aligned with evolution of clinical processes and practices.

**It is important to understand the socio-technical challenges inherent in digital health initiatives:** More research is needed to investigate the impacts of the interaction between the different dimensions of the socio-technical model on clinical engagement activities in digital health implementations.

### 1.3 RECOMMENDED NEXT STEPS

This report outlines a range of approaches to clinical engagement. It summarises the key factors that act as barriers to and enablers of clinical engagement drawing on the experience of several GDHP participant countries. An assessment of the literature review and Delphi-like study findings shows a common understanding of the approaches that need to be taken to ensure that clinicians are engaged in digital health. Yet, clinical engagement is still often identified as a significant problem.

Next steps should focus on improving clinical engagement in digital health that address significant healthcare challenges. For instance, challenges include supporting universal health care in different countries globally, improving rural health in countries, improving global children's health and maternal health, improving international public health surveillance systems, improving the health of ageing populations across different countries with varying economies, and improving health promotion to prevent the prevalence of common disease and illness globally.



To build on the findings of the country analysis and literature review and to further inform a framework for effective clinical engagement, it is proposed that the next steps for the clinical engagement work stream should be to:

- Define the parameters for clinical engagement for the purposes of the work stream;
- Define basic principles for clinical engagement;
- Define the core competencies and organisational conditions for clinical engagement – this may include considering a unified clinical governance framework that can be applied to varying digital health implementations;
- Develop an evaluation framework for clinical engagement;
- Identify opportunities to leverage consumer demands for digital health; and
- Undertake a similar research exercise to identify barriers to and enablers of consumer engagement.



## 2 AN INTERNATIONAL OVERVIEW OF CLINICAL ENGAGEMENT

### 2.1 OVERVIEW

The clinical and consumer engagement work stream aims to build an understanding of strategies that have worked to improve digital health literacy. It also aims to develop the role of co-design in addressing how digital health technologies can support the needs of clinicians in efforts to support better care. Digital health technologies include a broad range of products and services such as telehealth, electronic health records (EHRs), mobile applications, public health information systems, digital health technologies for the frail population, and preventive digital health services.

It is broadly accepted that co-design processes are critical in building systems that people need and want. Co-design involves clinicians who are actively engaged in the design of new digital health solutions. While this is accepted, the challenge is achieving levels of clinical engagement that will provide a strong foundation for a successful implementation, and even defining consistently what clinical engagement really means.

In a Health Foundation Report by Wilkinson, Powell and Davies (68), the authors concluded that increasing clinical engagement is “essential but as yet largely unrealised” and that “increasing clinician engagement is likely to remain difficult; non-engagement of clinicians is a long-standing, multifactorial and international problem.” The literature review shows that there is a diversity of views about what clinical engagement means. Additionally, there is no clear explanation of how successful engagement can be measured, as opposed to participation without buy-in.

There is a high level of consensus in the themes raised both in the country analysis and in the literature review on the barriers to and enablers of effective clinical engagement. There is little evidence about why the same strategies work in some contexts and not in others. Clinical engagement exists in a continuum, which ranges from pre-implementation to adoption and use. There are no clear, defined approaches for adapting clinical engagement strategies that align with the transition of projects from design to implementation, and then to meaningful use.

Much of the literature describes clinical engagement strategies related to design and implementation. However, it makes little mention of subsequent strategies to maintain the engagement to ensure meaningful adoption and increase maturity of use.

While there are several information system maturity models, such as the Electronic Medical Record Adoption Model of the Healthcare Information and Management Systems Society (HIMSS), there is little mention in the literature of approaches to measuring clinical engagement maturity and successful engagement for a variety of digital health applications targeting rural health, children’s health, or public health outcomes.



The Kings Fund has identified five levels of clinical engagement in relation to innovation and service delivery improvements (4). This can be equally applied to user engagement in digital health. The authors provided a framework for considering the types of barriers and enablers that may impact the progress from one level of engagement to the next. These levels of engagement are shown in Figure 1 below.



Figure 1: Levels of clinical engagement

## 2.2 SCOPE OF THIS REPORT

The scope of this report is to summarise international approaches to clinical engagement in digital health initiatives. It includes the responses to two surveys developed by work stream participant countries and issued by the GDHP Secretariat. The report identifies common barriers to and enablers of clinical engagement, an analysis of relevant literature, and a summary of key observations drawn from these two sources.

It is important to note that digital health technologies include a variety of small to large-scale projects. Large to medium-scale projects include the implementation of a national infrastructure that supports a more “connected-up” healthcare system, or public health surveillance information systems for a region. Smaller-scale projects include the implementation of telehealth clinics, or mobile health apps delivering health behavioural change content to specific consumers (e.g. improving respiratory health).

This report includes several case studies to illustrate the findings. It provides references to a range of other resources that provide additional details on specific projects and approaches that were deployed.

## 2.3 DEFINITION OF CLINICAL ENGAGEMENT

There are many different interpretations of the meaning of “clinical engagement”, ranging from passive acquiescence to active involvement in decision-making, design, and direction of digital health. Pannick et al. (1) point out that “engagement” can be an attitude, behaviour, or an outcome. It is not just clinical acquiescence to a proposed digital health system, but rather an active contribution to improving the performance of



clinical processes with the use of digital health solutions. Pannick et al. (1) also state that clinical engagement must be a two-way process. This requires organisations to establish an environment where clinicians can actively contribute, and to create opportunities for this to occur.

For the purposes of this report, clinical engagement is defined as follows:

***Clinical engagement***

*The active involvement of clinicians in the problem definition, design, planning, implementation, adoption, optimisation and use of digital health solutions, via the use of clinicians' knowledge and experience to ensure developed solutions are fit for purpose (1).*

While not explicitly described as such in the literature or country reviews, the issues and approaches discussed fall into two dimensions of engagement: engagement in design and implementation; and engagement in relation to ongoing use. The focus of the survey underpinning this report relates to the first of these – engagement in design and implementation.

The term “clinician” is used to include any medical practitioner, nurse, allied health professional or other health care practitioner involved in the diagnosis or treatment or care of patients.



# 3 METHODOLOGY

This section provides the description of the methodology used to understand the impact of strategies of clinical engagement in improving digital health literacy and implementation. We developed a Delphi-like study, and a rapid review study to investigate these aspects of clinical engagement. The program leads liaised with GDHP participants to gather relevant information to complete the Delphi-like surveys and questionnaires (full surveys and questionnaires are included in Appendices A and B).

## 3.1 DELPHI-LIKE STUDY ON KEY FACTORS OF CLINICAL ENGAGEMENT

The study was conducted in two rounds. The Delphi approach has been widely used in digital health and healthcare research as a method to establish a consensus on the most important issues among experts (5-7). Due to resource and time restrictions, an approach based on Delphi principles was used in the current study. The sampling of participants was selected during the study. A list of the survey respondents is provided in Section 4.2. Figure 2 shows the steps involved in the two-round Delphi-like procedure used in the current study.

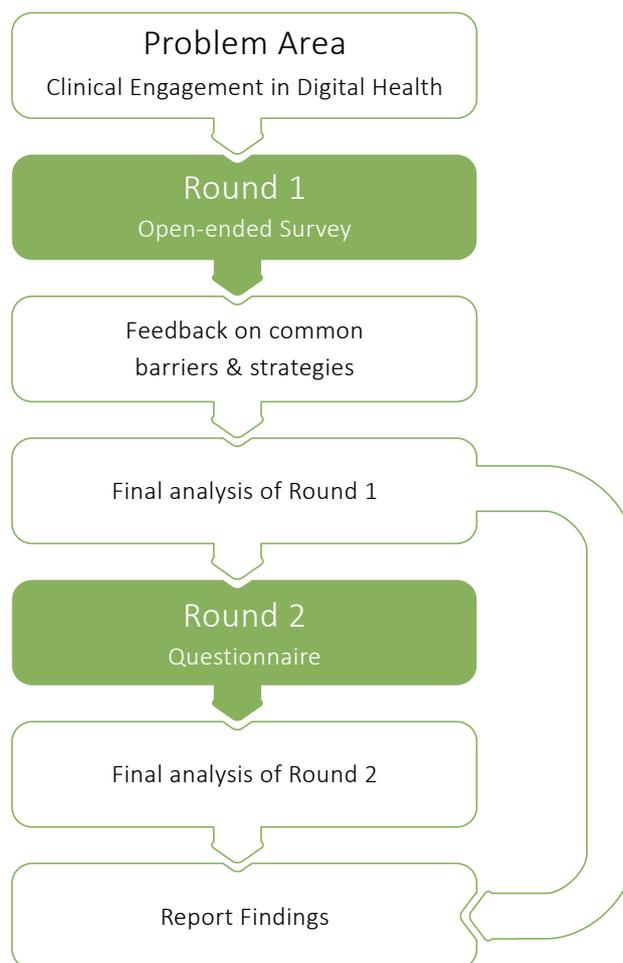


Figure 2: Steps showing the two-round Delphi-like process



Round 1 consisted of an open-ended questionnaire circulated by email in July 2018 asking respondents to identify the barriers to and enablers of clinical engagement in their respective countries. The aim of the first round of the Delphi-like process was to solicit specific information about content areas in clinical engagement from the GDHP participants (8). Questions included:

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**Q1** What factors do you consider are barriers to the successful uptake of digital health implementations, specifically as they relate to the engagement of clinicians?

*Factors might include workflow integration, system usability, clinical system functionality, patient and/or clinician experience, or patient safety. In your response could you include any resources or links to papers or websites that describe this?*

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**Q2** What factors do you consider are enablers to the successful uptake of digital health implementations, specifically as they relate to the engagement of clinicians, and what approaches you have employed that speak to these enablers?

*Please share any report, paper or website link if relevant.*

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**Q3** Do you have any other information that you'd like to share about clinician engagement, such as a report or publication, or what has made engagement successful or otherwise in your country?

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In Round 2, a questionnaire with qualitative and quantitative questions was circulated by email to GDHP participants based on the top themes in Round 1. Participants were asked to score the importance of each statement on a 5-point Likert scale ranging from “not important” to “very important”. Participants were also given opportunities to provide reasons for rating each theme. The responses from Round 2 were analysed and themes mentioned were ranked and summarised.

Data analysis of the Delphi-like study involved the calculation of means, standard deviation, and medians of all participants’ responses. Other descriptive statistical methods were used to represent the findings. Furthermore, content analysis was used to analyse the first round of questions, and the qualitative responses in the second round.

## 3.2 RAPID REVIEW OF INTERNATIONAL STUDIES ON CLINICAL ENGAGEMENT STRATEGIES

A search of both health and computer science databases was conducted to identify a broad range of literature on clinical engagement. This included PubMed, CINAHL, Web of Science, EMBASE, IEEE, and ACM in November 2018. The initial search consists of a combination of terms including: “Clinical Engagement”, “Strategies”, and “Digital Health” (a list of the search terms is included in Appendix C). The inclusion and exclusion criteria of the rapid review is listed below:

### Inclusion

- Studies that investigated digital health.
- Studies that evaluate a digital health program (i.e. case study, descriptive study, qualitative study, or others).



- Studies that investigated a degree of clinical engagement strategies in the implementation of digital health programs.
- Studies that described the implementation of the clinical engagement strategies. These findings may include a description of the impacts of the clinical engagement strategies (including barriers to and enablers of digital health).

### Exclusion

- Studies that did not investigate digital health.
- Studies that did not evaluate a digital health program.
- Studies that did not investigate “clinical engagement” strategies (i.e. researcher engagement, policy-maker engagement, and *only* consumer engagement).
- Studies that did not describe the implementation of clinical engagement.

A summary of the evidence of clinical engagement strategies was developed, as shown in Appendix D. Studies included in the rapid review are shown in Appendix D. Factors relating to clinical engagement, such as “*Where* does clinical engagement occur?” and “*What* type of clinical engagement is used in the implementation of digital health programs (i.e. systematic, non-systematic, other)?” were identified and are presented in Section 5. Finally, the category of studies based on the type of study (i.e. case analysis, qualitative descriptive, descriptive study, mixed-method, and quantitative descriptive) were summarised and are presented in Section 5.

It is worth noting that the literature in this area is not yet robust or adequate and the paucity of evidence suggests more research is needed.



## 4 KEY FINDINGS

### 4.1 CLINICAL ENGAGEMENT STRATEGIES – GDHP PARTICIPANT COUNTRIES: ENABLERS AND BARRIERS

Although the scale of digital health implementations across participant countries varies widely from facility based electronic medical records to national electronic health records, there was a high level of commonality in the factors that were raised as barriers to and enablers of clinical engagement across countries, regardless of level of maturity in digital health. Digital health implementations ranged from solutions for electronic medical records (EMRs) through to highly integrated national electronic health records (EHRs) and patient portals. While these are only a subset, other digital health solutions may include telehealth, health promotional mobile apps, and public health surveillance systems. The top enablers and barriers identified by each participant country are summarised below. Selected case studies are presented in this section. Additional case studies are provided in Appendix E.

This comparative summary is followed by an overview of the feedback provided by each participating country in the two rounds of the Delphi-like surveys. These surveys outlined the key barriers and enablers that have been experienced in the major implementations in each country.

Country	Enablers	Barriers
<b>Australia</b>	Clinical ownership; Change management; Peer networks and best practice.	Poor integration with workflow; Lack of trust in systems; Lack of incentives.
<b>Austria</b>	Leveraging best practice; Clinical ownership, co-design and peer networks; Change management.	Lack of trust in data; Lack of digital health in education; Time impacts.
<b>Canada</b>	Peer networks; Training, education and change management; Modernisation of remuneration models.	Remuneration; Lack of integration with current clinical workflow; Insufficient training, change management, education.
<b>Estonia</b>	Early engagement in design; Change management; Modernisation of remuneration models.	Lack of integration with clinical workflow; Remuneration and incentives; Time commitments and trust of data.
<b>Hong Kong SAR</b>	Clinical ownership; Peer networks; Change management.	Poor workflow integration; Lack of incentives.
<b>Japan</b>	Engagement with all levels of government and associations; Peer networks; Change management and communication of benefits; Financial incentives.	Increased clinician workload (time); Alignment with clinical workflow.
<b>Saudi Arabia</b>	Peer networks; Change management and training; Leveraging lessons learned.	Time impacts and poor integration between digital health and clinical workflow; Concern with risk of increased medical errors; Trust in data.



Country	Enablers	Barriers
<b>Singapore</b>	Change management and early engagement; Peer networks; Remuneration and incentives.	Private sector – insufficient training; Lack of trust in security of data; Time commitments required.
<b>Switzerland</b>	Communicating the benefits; Clinician leadership and participation; Peer networks; Financial incentives.	Time commitment; Solutions that do not meet clinicians’ needs and are poorly integrated; Lack of appropriate financial incentive.
<b>United Kingdom</b>	Clinician participation in design; Communication of benefits for the individual; Peer networks.	Poor integration with workflow; Inadequate training and change management; Time impacts.
<b>Uruguay</b>	Generational change within the clinical cohort, i.e. more “digital natives”; Communication of benefits.	Inadequate clinician training; Lack of incentive to engage with digital health; Lack of financial incentive to invest in IT.
<b>USA</b>	Single sign-on; Clinician involvement in acquisition and implementation; Maintaining currency of content.	Financial incentives phased out; Poor integration with workflow; Functionality with negative impacts (e.g. alert fatigue).

#### 4.1.1 AUSTRALIA

##### Context

Australia launched a national Personally Controlled Electronic Health Record (PCEHR) in 2012, with an opt-in registration process for individuals who wished to participate. The system was relaunched as the My Health Record in 2016. Currently, it is transitioning to an opt-out model following a trial that tested both opt-in and opt-out participation models. The trial demonstrated strong support by clinicians and consumers for an opt-out approach<sup>3</sup>. This secure online summary care record allows an individual to access their own health information, control its content and control who is able to view it with a range of privacy and access controls. The information in the My Health Record system flows from connected and conformant clinical information systems in hospitals, general practices, pharmacies, specialists’ rooms, and pathology and radiology providers. It can be securely shared between these providers depending upon the privacy settings of the individual My Health Record recipient. It also provides access to a patient's MBS and PBS data, the Australia Immunisation register and the Australian Organ Donor Registry<sup>4</sup>.

Most Australian States and Territories have implemented electronic medical records (EMRs) across public sector hospitals, with the footprint growing across the private hospitals sector.

<sup>3</sup>

[http://www.health.gov.au/internet/main/publishing.nsf/content/A892B3781E14E1B3CA25810C000BF7C6/\\$File/Evaluation-of-the-My-Health-Record-Participation-Trials-Report.pdf](http://www.health.gov.au/internet/main/publishing.nsf/content/A892B3781E14E1B3CA25810C000BF7C6/$File/Evaluation-of-the-My-Health-Record-Participation-Trials-Report.pdf)

<sup>4</sup>

<https://www.digitalhealth.gov.au/get-started-with-digital-health/digital-health-evidence-review/international-overview-of-digital-health-record-systems>



## Barriers

Clinicians report that one of the most significant barriers to clinical engagement is the burden associated with the increasing administration of electronic health records (EHRs) and EMRs. This is further supported by the survey findings, suggesting that the increased administration burden is one of the bigger concerns regarding EHRs/EMRs.

There is a growing emphasis on how digital health systems are designed. This involves incorporating principles of human-computer interaction (HCI) and user-centred design (UCD) and acknowledging the importance of system co-design. Co-design entails clinicians being actively engaged throughout the system lifecycle to ensure better workflow integration. More still needs to be done to ensure systems are complementing workflows, and digital health systems are better integrated and usable for end users.

Payment incentives may succeed in the short term; however, it may not lead to a sustainable or even productive use of digital health systems. In the survey, incentives were found not to be a long-term strategy; rather a strategy used in concert with other mechanisms that improve usability and system integration.

From the Australian experience, clinicians also report training methods as a barrier during system implementation, suggestive of optimised training delivery methods as a more efficient approach. These barriers will be minimised when systems are more intuitive and do not require training from the outset, rather only to understand the more complex components (10).

Clinicians have noted that it is vital that these issues are addressed in the medium term to ensure engagement over the long term, in addition to ensuring data reliability and accuracy, with appropriate privacy protections for patients and consumers.

## Enablers

Communication of benefits is necessary as part of the narrative to engage clinicians to participate. Every digital health implementation represents a significant change in the way people do things – it inevitably leads to different processes. Technology does not always enable people to feel comfortable with these changes. The degree to which it is successful arises from how the change has been planned and understood before its implementation and how this is ultimately translated. This approach should be supported with a multi-channelled communication campaign ensures the benefits of the system can be heard in multiple forums.

Clinician peer networks and support are part of the lifeblood of the health system. Clinicians rely heavily on each other for support. Digital health systems will “live or die” relative to the degree of clinicians engaging as part of the process. In Australia, the sense of ownership of digital health solutions by clinicians is likely to lead to a successful implementation.



Incentives have worked well in the past to support initial implementations, such as with the General Practitioners (GPs) Practice Incentives Program (PIP) eHealth Incentive, administered by the Department of Health in Australia, and the Health Information Technology for Economic and Clinical Health (HITECH) Act in the U.S. However, incentives should not be necessary in the long term if systems are well designed and integrated into clinical workflows. The ongoing cost of supporting digital health systems is an identified issue which requires further exploration.

### Case study | Australia

## Evaluation of factors influencing engagement in the Australian Electronic Health Record

An Australian study by Pearce et al. (10) reviewed the factors that influenced engagement in the rollout of the PCEHR (now known as My Health Record). They identified that engagement requires a balance of the three aspects: need, incentives, and support. Having a relationship with the support of a local clinical support organisation, i.e. Medicare Locals, was identified as the most significant motivator for GPs to become involved in the PCEHR implementation. This was followed by the availability of financial incentives through the PIP eHealth Incentive. However, the study noted that financial incentives alone were not sufficient to engage clinicians when there is no perceived personal need. Intensive and context-focused support was more effective than online support and seminar-based communication. Key success factors were:

- Engagement must address clinical needs and bring about a change for the better to a process; and
- Engagement must address individual organisation dynamics and needs.



## 4.1.2 AUSTRIA

### Context

Austria began a phased implementation of an eHealth Infrastructure known as ELGA<sup>5</sup> (“Elektronische Gesundheitsakte”) in 2015. The first phase of ELGA allowed patients to opt out and healthcare providers to access ELGA documents and applications at public hospitals in the two first provinces Vienna and Styria. ELGA has been rolled out gradually since December 2015 with more public and private hospitals and nursing homes being progressively connected, up to the current coverage of 87% of total hospital beds, now also supporting the provision of a patient’s medication list, called e-Medication.

A specialised ELGA-law (“Federal Act on Data Security Measures when using personal electronic Health Data”<sup>6</sup>) was enacted by the Austrian Parliament in 2012 and regulates points such as the voluntarily (opt-out) participation of citizens (of whom three percent have opted out) and the mandatory participation of healthcare providers. The opt-out policy allows patients to object against the creation of data, object against access to data, view documents and view an access log.

Patients have access through the ELGA Patient’s portal<sup>7</sup>, including the possibility to opt-out of ELGA. This functionality was online one year before any data was stored into ELGA to allow citizens enough time to opt-out.

The next phase will improve existing ELGA clinical documentation and medication for data availability, usability and processes, and the rollout to private providers, laboratories, radiologists, pharmacies etc.

### Barriers

Solutions that are poorly integrated with clinical workflow are considered to create significant barriers to engagement. Barriers are also created if participation in an electronic health program requires a significant time commitment, or adds an administrative overhead. Clinicians are often time poor, and any activity that adds additional time pressures will cause a barrier to engagement. If solutions are not tightly integrated into the clinicians’ systems and workflow, then it will create additional time pressures which may encourage clinicians to disengage. Clinicians in Austria are not uncomfortable with technology, but they hardly engage with solutions that add to their workload.

In the past, Austria has had experience with poor responses to several registries (e.g. cancer, implants) whereby data submission was not integrated. Furthermore, it had to be entered through a web-interface. Clinicians would not undertake double entry of data.

Digital health is not adequately covered in the curricula in education and postgraduate training in Austria. This is seen as a barrier which can hinder uptake and acceptance of ELGA.

Payment of remuneration or incentives is considered a moderate barrier to engagement, with other factors being more significant. Incentives and remuneration were provided to

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5 ELGA “Elektronische Gesundheitsakte”: <http://www.elga.gv.at>

6 See online version in English language at

[https://www.ris.bka.gv.at/Dokument.wxe?Abfrage=Erv&Dokumentnummer=ERV\\_2012\\_1\\_111](https://www.ris.bka.gv.at/Dokument.wxe?Abfrage=Erv&Dokumentnummer=ERV_2012_1_111)

7 <https://www.gesundheit.gv.at/>



cover the initial provider costs in connecting to ELGA, but other factors were equally important barriers, such as usability, clinical benefit, and the general acceptance by clinicians of the need for such a digital health system.

The level of trust clinicians have in data was initially considered a very important barrier to clinical engagement. In Austria, these concerns were addressed through the process for development of the ELGA law. It required extensive negotiations and co-design with several parties, including the data protection commissioner and patients' advocate groups. The Austrian ELGA law strictly regulates privacy and data security of ELGA in the interests of consumers and patients. It can be reinforced through the Criminal Code. This has removed the lack of trust as a barrier in Austria.

## Enablers

In the GDHP survey, positive communication was identified as an enabler. Positive communication included change management, peer support, the application of best practice identified through other projects, ownership, financial incentives, and involving clinicians in designing the solution architecture.

Implementing digital health is a big change in the healthcare environment. Having good change management and comprehensive training programs in place is a very important enabler for a digital health project. This is because it creates confidence among stakeholders, and it removes real (and also perceived) risks of the project, and it also helps to build acceptance. An important part of this is communication of benefits that will be generated for healthcare providers, consumers, and patients. Demonstrating a positive opinion (publicly and internally) about the digital health project is a very important factor in managing (sometimes politically motivated) critical negotiations and discussions with clinical stakeholders.

The contribution of digital solutions to enabling best practice is viewed as a very important enabler in Austria. Designing Austria's eHealth infrastructure according to the "Integrating the Healthcare Enterprise" (IHE) profiled standards was a major factor in the success of the project. The reliance on the best-practice implied by IHE profiles, that had been validated through international case studies that followed the same IHE blueprints, significantly reduced the costs of the design, and supported stakeholder acceptance of the system.

Clinical ownership and inclusiveness are considered important in Austria. Digital health projects implemented before ELGA lacked acceptance because they were not co-designed with clinical users. The change to a co-design and co-production approach with ELGA has led to overall acceptance of the project. It also helped overcome barriers during the year-long course of implementing the project. The ELGA stakeholders have established a national competence centre for eHealth, which is responsible for coordinating implementation and further development of ELGA infrastructure on a national level. This has been a major factor in success.

The use of peer networks and support by peers is considered important in Austria, especially in efforts to standardise digital health infrastructure and medical content support.

Effective communication of benefits is seen as very important. Austria identified that communication with clinical stakeholders was not completely effective during the ELGA project. This resulted in critical situations whereby the resolution became unnecessarily complicated. Negative emotions like anxiety and fear due to a lack of information caused



change barriers and hindered physicians' acceptance of the national electronic health record (ELGA) in Austria. Fears of physicians were increased costs, additional (unpaid) workload and the possibility of surveillance without having advantages from using electronic health records in their daily practice.

Proper payment models or incentives are considered moderately effective enablers of clinical engagement, but they are not a sufficient driver for acceptance on their own.

### 4.1.3 CANADA

#### Context

Canada has well-established digital health solutions. These solutions have evolved from the foundations of electronic medical records, which involved a network of interoperable EHR solutions across territories and provinces that linked clinics, hospitals, pharmacies and other points of care. Initiatives to improve patient access to their health information are also being progressed, such as patient portals.

#### Barriers

A lack of time to commit to digital health is a significant barrier to clinical engagement. These barriers are seen in an environment where clinicians are coping with an increasing amount of more complex patients, additional administrative burdens, and health technologies that are not user-friendly.

The lack of integration of new systems into current clinical workflows presents a huge challenge in encouraging clinicians to adopt and to use any new digital tool available. In a busy environment, clinicians are expected to use multiple systems that are often not interoperable, and with multiple logins. These systems are seen to add time and frustration to clinical processes.

In Canada, remuneration for participation in digital health is a very significant issue. Existing remuneration structures do not reflect advances in technology and do not provide incentives for clinicians to communicate electronically, or to make the investment needed in digital tools that could reform the way services are delivered to patients. Canada's experience has been that unless payor remuneration models in public payor contexts are appropriately structured for the provision of virtual care patient consultation services, then adoption and practice workflow integration will be slow. Clinicians are not reimbursed, or feel they are not reimbursed appropriately, for adoption and integration of digital health services.

Discomfort with technology is not a significant issue in Canada. The bigger issue for engagement of clinicians is the usability of digital tools. It is very difficult to engage clinicians with digital tools that are not user-friendly, intuitive and co-designed by clinicians with the end user in mind. Co-design with clinicians is seen as critical, but it is seen as not occurring as often as it should.

Inadequately resourced training, education, and change management support creates a big challenge for engaging clinicians effectively in the adoption, use, and optimisation of digital tools. There is very little content relating to digital health taught in medical, nursing, or pharmacy school curricula in Canada. To address this, Canada Health Infoway is working with universities to raise awareness of digital health.



The issue relating to trust of data becomes more prominent only when clinicians have concerns over misuse of data. If clinicians have concerns over the security of the data involved in digital health transactions, or the commercialisation or misappropriation of data, then challenges with engagement and adoption will surface. Education, training, change management, non-commercial governance of digital health assets, and communication efforts can alleviate these types of concerns.

### Enablers

Engaging with clinicians early in the development of an initiative and actively involving them in decision-making processes that shape new digital health initiatives is critical. Using techniques to co-design wherever possible is essential to establishing a sense of ownership and ensuring that solutions fit with clinical workflows.

The use of peer networks is a critical approach in Canada. Clinicians are more likely to adopt digital health solutions promoted by their peers. The networks also provide a pool of clinician subject matter experts who can provide essential feedback on what is working, and what is not working. An example of where peer networks have had strong success is the Clinician Peer Network funded by Canada Health Infoway and provincial/territorial government partners. These networks were instrumental in convincing clinicians that digital health tools (such as EMRs) could add value to their practices and improve the quality of patient care, provided that they are implemented appropriately.

Change management and training is critical in engaging clinicians in promoting best practice. Since 2011, Canada Health Infoway has partnered with the Association of Faculties of Medicine Canada, Canadian Association of Schools of Nursing, and the Association of Faculties of Pharmacy Canada in an effort to increase the awareness and instruction of digital health concepts in the various clinical curricula.

Communication of benefits (other than benefits to their own clinical practices) and public opinion is not seen as a strong enabler in Canada as clinicians, particularly physicians, tend to be sceptical about suggested benefits that have not been initiated or validated by clinicians. For this reason, communication of benefits and public opinion may help to raise awareness of digital health in the general population of Canadians at large, but it is less likely to act as an enabler of increased clinical engagement with digital health.

Modernisation of Canada's remuneration models is seen to have a major potential to provide incentives to clinicians to adopt, use, and optimise new technologies to benefit both clinicians and patients, but bringing about this change is a significant challenge.



## Impact of financial incentives on engagement in Canada

This case study outlines the story of a clinician ‘champion’ who abandoned the technology as it was affecting her income (12).

In July 2016, the Federal Health Minister launched the MyHealthNS, an online portal (tool) to enable patients living in Nova Scotia, a province in Atlantic Canada, to view medical test results via their smartphones. Over the previous three years, more than 30 family doctors and 6,000 patients had been involved in a pilot project to test the system. The results were very positive with 98 per cent of patients saying they wanted to continue receiving their results online and 100 per cent of doctors saying sharing the results online was valuable or extremely valuable to their patients. One of Canada’s most eloquent patient advocates, the late Alexa Thompson of Halifax, said it best: “What digital health has done to my life is empower me to become a partner with my doctor.”

Dr Ajantha Jayabarathan was an early adopter of the system. About 900 of her 1,400 patients were using the system. She said her Halifax clinic showed an increase in capacity of 22 per cent when she started using MyHealthNS. In 2017, she said the challenge for her is that she and others were not being paid to see those patients because the current fee for service model only covers face-to-face visits. Jayabarathan said she had faith the rules surrounding compensation would change once it was proven successful, but twelve months later negotiations had not progressed. “The way the rules are set up, a doctor only gets paid when they see a patient face-to-face. So, by using any kind of telephone or email or a PHR (Personal Health Record), you don’t get paid”. In July 2017, Jayabarathan wrote an email to her patients saying she was “pulling the plug”. While she had seen tremendous improvements in her ability to care for patients from using the tool, it had also meant an 18 per cent reduction in her income and hours of unpaid work. ‘Doctors Nova Scotia’, the provincial medical association said they fully back the MyHealthNS tool, changes to the funding model are necessary to make it successful.



## Strategies for engagement in the Wait Time Information Systems project – Canada

### Scope of the program

Carr et al. (13) documented the approach taken to clinical engagement when implementing a Wait Time Information System (WTIS) in Ontario.

Canada appreciated the stakeholder engagement difficulties it was facing. The deployment of the WTIS required engaging thousands of individuals across the healthcare sector, many of whom were known to be sceptical and resistant to the change. To gain their support and to motivate them, the project team felt they needed to address the business reasons for change, including the emotional reactions to it. They divided their stakeholder engagement into three iterative and cyclical phases.

### The clinical engagement exercise

The creating awareness phase was a communication-led effort to educate stakeholders about the project and generate momentum. This required committed communication resources from the start of the project. It involved engaging directly with stakeholders at every level of health care, whereby efforts focused on a few key concepts targeted to each stakeholder group. Their audiences were given clear information about what to expect. These communication resources included: clinical champions, communication and change management professionals, maintaining ongoing contact with their assigned stakeholder groups, treating clinicians as “clients”, and supporting them throughout the digital health system deployment.

The building support stage moved from creating awareness to preparing people to begin working in a different way. The focus moved from the broad sweep of healthcare stakeholders to those identified as most affected by the system change, including clinicians and their office staff. The engagement consisted of identifying areas of resistance and then organising government and hospital “agents of change” to assist in addressing this resistance. The WTIS project team saw the clinicians were worried about the amount of funding given to accessing health care generally in the province. The government was able to work with the WTIS team and the clinicians to develop wait time funding models that had commitments from both government and clinicians. Once wait times started being reported, clinicians were concerned about the accountability of sharing disparate wait times across different facilities. The WTIS team worked with clinicians and hospitals to clarify that only aggregate data was reported to the government. Hospitals would only access granular data as part of a review working with clinicians to address the root causes, including commitments to examining operating room resourcing requirements.



## Case study 2 (cont.) | Canada

Through the building support stage, targeted and tangible efforts were made to turn the biggest areas of resistance into areas of value for clinicians. This required having the right people in the right places. Clinical leads were used as early adopters. For instance, clinical champions were identified within hospitals, and communications sessions were held onsite with the people most affected by the change. The building support stage required identifying where government and hospitals had the capacity to join the project team and where clinicians could themselves become “agents of change”. This addressed areas of concern which made sure the desired outcomes were achieved for everyone.

The final stage was making the change real. This stage involved the bulk of the training. The outcome was not only to give the clinicians the opportunity to use and track wait times; it also tangibly demonstrated that the functionality described in the communications efforts was being delivered. Before the training effort started, the WTIS team developed an adoption assessment profile tool which was used to identify the profile of a hospital. Training was provided to staff, and indicators were identified to show whether the training and deployment was successful. Training plans and materials were constantly reviewed after use. These were scaled and customised to the language and processes of the clinical group. In addition to these materials, trainers were given a “sandbox” build that trainees were able to use in practice and explore potential opportunities. Training was delivered face-to-face and it supported arrangements from the WTIS operations teams which were in place to give daily advice to users.

The above stages were iterative and were reworked across the rollout of the WTIS. The clinical engagement involved 82 hospitals and over 2,500 clinicians. The integration of the clinical engagement process took place across the life of the project. Furthermore, the planning that went into clinical engagement was the key feature that contributed to the success of the delivery of the WTIS.



## Success factors in clinical engagement in large clinical information system implementation in British Columbia, Canada

Detwiller and Petillion (14) provide an analysis of key success factors in a project to transition 18,500 staff from multiple best-of-breed systems onto a single clinical information system. This was an extensive change management effort involving clinicians in all stages of process optimisation and system design and implementation. The key success factors identified were:

- Leading change through committed leadership that is visible to everyone from start to end.
- Every change team led by a clinical sponsor.
- Creating a shared need and providing a compelling reason to move away from the status quo that is obvious to everyone.
- Key messages that take well-known pain points and show how new solutions would align better with current clinical practice to better support patient care.
- A vision that was clearly understood by everyone. The result had to be measurable and “appeal to the head and heart”. All stakeholders had to believe in the value of the system. The communication campaign was very important to achieve this, including newsletters, clinicians going on site visits, and key messages addressing “what does this mean for me?”
- Messages were themed from clinical input and tailored to meet the needs of individual clinical groups.
- Involving clinicians in selection and design to ensure integration with workflow.
- A clinical consulting team was used that included a clinical leader, two clinical consultants and six staff development educators.
- Implementing a framework of clinician working groups and focus groups with all disciplines, programs and service areas. A clinical advisory group was formed to address multi-disciplinary issues.
- If there were issues, then implementation was delayed. The issue was resolved and then implementation was continued to prevent loss of clinical engagement because of poor functionality.
- On-site clinical support was available. Clinicians were given reduced ordinary duties, so they could focus on their roles of champions and support.



#### 4.1.4 ESTONIA

##### Context

Estonia has a nationwide EHR which integrates data from different health providers to create a common record that allows doctors to access records from a single file, including image files. Every person who has seen a doctor has an EHR. All patients can access their record online via an e-Patient portal. Also, patients can access the records of their underage children and other people who have given authorisation. Estonia's EHR is one of many national digital services enabled by the X-Road. This is an infrastructure that allows the nation's e-services databases access across the public and private sectors to achieve interoperable communication.

##### Barriers

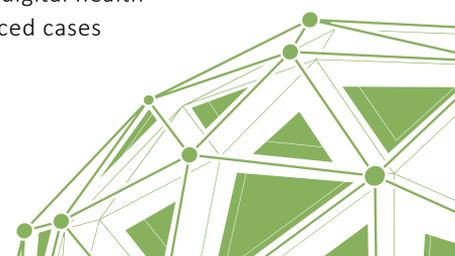
Although digital health solutions are well-embedded in Estonia's health system, there remains challenges for clinical engagement. The major challenge is caused by solutions that impose additional time to complete tasks without delivering benefits and efficiencies in other areas. A central problem is the resistance to digital health solutions that are not seamlessly and successfully integrated into clinical pathways and workflows. Clinical engagement is difficult to achieve if digital health solutions create a time-commitment burden, especially if the solution is not seamlessly integrated into clinical workflows. Although hospital information systems in Estonia met the required standards for connecting to the central e-health system, the ease of use of these information systems varied significantly with some systems not user-friendly for doctors.

Estonia has a high level of digital services in all facets of life. The role of digital systems is well-embedded across all types of services. There is generally a positive view of digital technologies. However, there have been some challenges with engaging older clinicians in the early stages of implementation but this has not been a significant barrier for Estonia.

##### Enablers

The core enablers of successful engagement for Estonia are early and consistent involvement of clinicians, the use of peer networks, and demonstrating evidence of success. Clinicians are involved in the development of digital health solutions to ensure that solutions are easy to use and integrated into the workflow of clinicians. This is an important success factor. Key to clinical engagement in digital health includes: ease of use of systems to minimise the extent of training needed; delivering the level of training needed to ensure clinicians are comfortable with systems; and successful change management. Maintaining clinical schedules and the constant renewal of medical knowledge leaves little time and energy for the adoption of new digital technologies. A significant investment must be made into change management to promote uptake.

The involvement of peers and clinical communities to promote digital health has a positive effect on motivation to use digital health solutions in Estonia. Demonstration of scientific evidence and evidence of success from other countries outside Estonia can have a positive impact on digital health implementation and clinical engagement. As part of Estonia's national digital services strategy, public opinion can act to drive clinical engagement and affect uptake of digital health solutions, especially if it becomes public knowledge that patients are missing out on certain benefits from the use of digital health data (or if clinical errors are made due to lack of data). Estonia has experienced cases



where negative examples of consequences of clinicians' failure to using digital health solutions have been more effective than positive examples of compliance.

In Estonia's experience, it has been important to have working payment models and incentives in place to ensure clinical engagement with digital health services. Reimbursement schemes must be in place. Creating incentives for clinicians and providers is an important factor in their digital health engagement.

For clinicians to be actively engaged in digital health, data must also be trusted and reliable. There also needs to be confidence in the measures taken to protect data security and privacy.

#### 4.1.5 HONG KONG SAR

##### Context

Hong Kong SAR launched the Electronic Health Record Sharing System (eHRSS) in 2016 to support the exchange of health information across clinical services. eHRSS provides the infrastructure for two-way sharing of information between the public and private health sectors. Sharing is subject to the consent of patients. The system has been developed in close collaboration with clinicians to consider clinical and workflow needs to ensure the system is user-friendly and sustainable. The response to eHRSS appears to be positive, with participation of more than 730,000 patients in just two years by April 2018 (15). eHRSS was rolled out in phases beginning with the development of a sharing platform connecting participating providers. The second phase involved the enactment of the Electronic Health Record Sharing System Ordinance (eHRSS Ordinance) to provide a legal framework for protection of data privacy and system security. The government is currently enhancing the sharing system. This involves expanding the scope of shareable data (e.g. radiology images and Chinese medicine) and developing a patient portal for direct access of patients to eHRSS. Only one-third of private clinics have connected to eHRSS as of July 2018. Outpatients are not yet participating in eHRSS.

##### Barriers

From the recent GDHP survey, the key barriers identified resulted from solutions that have a negative impact on clinical practice by increasing time and administrative effort in record keeping. This was caused by poor usability and insufficient integration with workflow. Lesser barriers included financial incentives, lack of training, and concerns with data quality.

The cohort of healthcare workers in Hong Kong SAR who are not comfortable with digital technologies is steadily decreasing. As a new generation of clinicians enters the workforce, there is an expectation that digital solutions will be in place to support clinical practice. While the system has been developed in close collaboration with clinicians, poor workflow integration will make any digital health solution unsustainable. Therefore, poor workflow integration was identified as a primary barrier. Although training can help clinicians to exploit digital technologies to obtain the fullest benefit, it was thought that a well-designed system should not require extensive training.

In Hong Kong SAR, a lack of trust in data is rarely seen as an issue. However, the converse – too much faith in electronic data – is sometimes an issue.



## Enablers

In Hong Kong SAR, the ownership of the design and implementation of solutions by clinicians is critical. There is a focus on a digital health system that reduces time and administrative commitments. Increasingly, consumer expectations are driving change. In an environment where Hong Kong SAR consumers are increasingly dependent on digital solutions in all aspects of their lives, there is an expectation health care and digital health will be similar. There is also an expectation of consumers embracing digital health solutions.

In Hong Kong SAR, health care is a very peer-driven industry. It is clear that developing a culture of digital health and seeing evidence of peers using technology successfully is a powerful enabler.

It was noted that while incentives are important, these do not necessarily have to be financial incentives. The non-remunerative incentives of better workflow, enhanced quality, better support for patient care are more effective and sustainable in engaging clinicians.

An appropriate level of investment in change management was identified as vital to success. However, solutions should be designed with the objective of requiring minimal training.

While in Hong Kong SAR there is much value in learning from the experiences of others in deploying digital health tools, it should be noted that most systems are very sensitive to local conditions and characteristics. Furthermore, it should never be assumed that a successful approach in one place will necessarily translate to success in a different environment.

### 4.1.6 JAPAN

#### Context

In Japan, each healthcare provider manages its Electronic Medical Record (EMR) systems, and EHRs are not aggregated at a national level. At a local level, since the 2000s some areas have developed health record network as a result of voluntary effort by healthcare institutions and local governments. Japan is currently taking steps to develop a nationwide network which would enable healthcare providers to share patients' medical information towards the 2020 financial year.

#### Barriers

In the recent GDHP survey, three factors were identified as barriers to EMRs by Japan: increased workload for clinicians; an EMR system that does not align with clinical workflow; and the cost-effectiveness of the EMR system. In particular, cost-effectiveness became a barrier because revenue did not correspond to expenses.

The impact of digital health on a clinician's time was a significant barrier. They found that, due to time constraints of doctors, if the design did not support efficiency and workflow, then the system did not work.

Trust in data is a critical factor in Japan. In order to address the issue, the data requirement guidelines which are formulated by government specify requirements



around authenticity, storage property readability, and availability which should be met in all clinical information systems.

### Enablers

Engagement and collaboration with the many levels of government and associations was identified as key enablers to the uptake of the EMRs. There was a strong focus on the role that local governments, local medical associations, etc. play. Some areas have already implemented collaboration using the nation-wide network. Case studies demonstrating the operation of regional health information networks are posted on the government web site (in Japanese only).

The role of the local level in engaging clinicians is significant, not just in the use of regional health information networks, but also in the promotion and communication of benefits by individual councils in each region. In Japan, it has been highlighted that solutions must meet the specific needs and the conditions of each local area. Additionally, clinicians must be engaged at a regional level to determine the optimal model in each region.

Disseminating proper guidance on legislation regarding consent on medical record sharing, is another enabler for clinician engagement. In addition, financial incentives can promote participation of health care providers. For example, if a health care provider communicates with another health care provider in Japan by uploading diagnostic images of a patient to an EMR, then the corresponding health care provider can receive additional reimbursements via the public health care insurance schemes.

#### 4.1.7 KINGDOM OF SAUDI ARABIA

### Context

The Ministry of Health of the Kingdom of Saudi Arabia has identified eHealth to be a key enabler, as well as a primary transformation agent to support the implementation of its business strategy and plan. The program of work includes over 70 projects, including implementation of primary care and hospital systems, provider and resident portals, and supporting infrastructure.



## Barriers

One of the major barriers identified by the Kingdom of Saudi Arabia is the additional time burden on clinicians, especially when clinicians cannot see a direct benefit to themselves from adopting digital health solutions. Where digital health programs require an additional time commitment, clinicians were reluctant to engage even when they recognised there were benefits that would be gained by others, such as their patients.

The level of integration between digital health and clinical workflow has in the past been highlighted as a moderate risk in Saudi Arabia. The level of workflow integration and clinician adoption has been a major issue in the rollout of previous digital health initiatives. Learnings from a more recent implementation have placed a large focus on user experience. As a result, clinicians saw this as being a minor issue for themselves.

In the Saudi Arabian context, lack of incentives is not considered a significant issue in engaging clinicians.

There is a perception among some clinicians that medical errors might be increased via the use of digital health solutions. This view does create a barrier to participation.

In the GDHP clinical engagement survey, training was highlighted as a moderate risk in Saudi Arabia. There has been a significant focus on investing in training in recent implementations, which has reduced the risk of insufficient training. This is now not highlighted as an issue by clinicians.

## Enablers

The key enablers identified by the Kingdom of Saudi Arabia are the use of peer networks, change management and training, and leveraging the lessons learned from other Saudi Arabian and international implementations.

Saudi Arabia is currently doing limited co-design/co-production as it balances the need for standardisation across sites and speed of rollout. The main techniques to build a sense of ownership of solutions and inclusiveness among clinicians are the involvement of clinicians in governance structures, targeted communication strategies, and the use of pilot programs. Peer networks are essential to successful implementations. They are employed as a significant part of major change management programs. Change management and appropriate training are critical for clinical engagement.

As there is an extensive rollout program of digital health technologies that is underway, Saudi Arabia has been leveraging the lessons learned from other implementations within Saudi Arabia and internationally to identify effective engagement strategies. This also includes the ability to use newer technologies to engage and support clinicians (e.g. Cloud to optimise support).

Saudi Arabia is concurrently rolling out mobile consumer applications (e.g. booking, clinical advice). This is having a definite impact as it is creating an increased public expectation that clinicians will have digital health capabilities. Saudi Arabia is rolling out telehealth and home health capabilities which anticipate that this will continue to drive a community expectation that clinicians will be active users of this technology.

Payment of incentives is not seen as an enabler for clinical engagement in Saudi Arabia.



## 4.1.8 SINGAPORE

### Context

Singapore launched its National Electronic Health Record (NEHR) in 2011 to support the goal of “One Patient, One Health Record”. It commenced as a voluntary system for both providers and patients. The system has had a high level of utilisation among public healthcare providers, but there is more limited uptake among the private sector. In 2017, the government announced plans to introduce new legislation that would make it mandatory for healthcare providers to use the NEHR.

### Barriers

The primary factor that limits engagement of clinicians in digital health projects is the time commitment that is required. This is seen as a significant barrier. The adoption of IT may lengthen the time taken to complete certain processes (e.g. electronic clinical documentation). To mitigate this, strategies are put in place to implement functionality that will increase overall productivity (e.g. automated claims) and enhance clinical safety (e.g. clinical decision support).

Singapore does not have structured incentives for clinicians to engage with technology, and most are investing their personal or professional time to be involved. While this is not a major barrier in the public healthcare sector, it is a barrier to engaging private healthcare providers/clinicians and this can slow down IT adoption.

Similarly, insufficient training is not seen as a barrier in the public healthcare system. Training in all digital solutions is provided to all staff on commencement in the public sector. This is a bigger barrier in the private sector.

Lack of trust in data is considered an impediment to engagement. While data quality is generally considered acceptable for continuity of care, trust in data security in the current environment is a bigger concern. Singapore believes data security requires a significant effort in user education.

### Enablers

In Singapore, the key strategy to effectively engage clinicians is to begin at the very start of any digital health program. This involves clinicians in active leadership roles. Clinical champions are identified at the start of a project. All projects have clinical sponsorship. Peer networks play an important role in driving engagement across networks. Train the trainer approaches are used in conjunction with peer networks to familiarise clinicians with digital health. It provides a network of support that is provided by peers. Change management activities are tailored to be relevant to different clinical groups, and they also leverage clinicians to drive the change.

There is a strong and growing community of health informaticians in public health care who play a key role in supporting and engaging other clinicians. These clinicians inform best practice in relation to design, workflow, integration, and implementation approaches. Communication of the benefits of digital health is an important component of Singapore’s approach to clinical engagement. The use of financing policies, grants, and other financial incentives does have a positive impact in driving engagement.



The increasing empowerment of patients leads to expectations that clinicians will use technology. Patients are empowered if they can view their own results and use digital systems to manage their own health. Coupled with increasing levels of comfort among clinicians with technology generally, this reduces resistance of clinicians and patients.

#### 4.1.9 SOUTH KOREA

##### Context

South Korea has widely implemented facility level electronic health records, with varying levels of functionality, but a low level of interoperability between systems. In a national survey conducted in 2015, Young-Gun et al (69) found that 11.6% of South Korean teaching and general hospitals had a comprehensive EHR and 46.5% had a basic EHR. This reflects a 21% increase in EHR utilisation in the period from 2010 to 2015. The survey found that the greatest barrier to implementation was the cost associated with procurement and implementation. Other barriers included lack of interoperability between the 70 plus vendors in the market, resistance to implementation by clinicians, concerns about the return on investment and recurrent costs and the lack of adequate IT support staff. Consensus has not yet been reached on a national standard that would support core functionality and interoperability between the more than 70 vendors operating in South Korea. The only standardised national medical record system in South Korea at this time is for Drug Utilisation Review, which aims to prevent adverse drug interactions.

##### Barriers

The most significant barrier to clinical engagement identified in the South Korean response was the additional time burden created by the use of electronic health records, followed by concerns about financing the implementation of systems. Insufficient training/change management, discomfort of clinicians with technology and poor integration with clinical workflows were reported as moderately significant barriers. Lack of trust in data by clinicians was not seen as a significant barrier to engagement.

##### Enablers

No responses were provided for the questions on enablers.

#### 4.1.10 SWITZERLAND

##### Context

In 2013, the Health2020 Strategy was launched. This included greater use of eHealth as a priority. In 2015, Switzerland passed a new federal law relating to patients' electronic health records (EHRs). The reform required hospitals to adopt interoperable EHRs to facilitate data sharing and collaboration between healthcare providers to improve quality of care and efficiency in the health system. Adoption is voluntary for non-admitted services and private practices. Private providers can determine the health information they are prepared to share. The law came into force in 2017.



## Barriers

Four key factors were identified as barriers by Switzerland: the time commitment involved in digital health; solutions that do not meet clinicians' needs or are poorly integrated; the lack of appropriate financial incentives for implementation; and the level of trust in data.

The Swiss GDHP survey response described a recent study they undertook. Forty-five per cent of healthcare providers expressed concerns about the higher administration and time commitment that was required in digital health programs. This is compounded when solutions are poorly integrated and do not suit clinicians' needs, which also required extensive training. However, the same study also showed that the majority of clinicians (58 per cent) in general had very positive (12 per cent) or positive (46 per cent) attitudes towards digital health technology. There were not enough good examples of implementations of digital health solutions that have been effectively integrated with clinical practice to demonstrate the delivery of quantifiable benefits.

Financial incentives are a significant issue for engagement and adoption. There are no specific financial incentives for healthcare providers to implement digital solutions. Federal laws on health insurance do not cover reimbursement for providers adopting EHRs (17). Insurers, who play a key role in financing, can benefit from the efficiency gains from the adoption of EHRs. However, there was no active involvement because it is not always evident at the start of a project whether the digital solution will lead to efficiency gains, as well as because of concerns over access to health data.

In the study mentioned above, 51 per cent of clinicians indicated that having trust in the data was a critical consideration in their decision to engage with digital health.

## Enablers

Participation of clinicians is essential for acceptance of and engagement in digital health. Solutions must be seen to be beneficial to clinical practice, and not just another burden imposed on them. If there is a clear benefit evident for clinicians, then they will engage and be more prepared to adopt digital health solutions. Peers are very important in communicating these benefits. Clinicians are much more inclined to be engaged in digital health if it is promoted by clinicians than if it is promoted by bureaucrats.

Clinicians are more likely to be easily engaged with systems that are easy to use, without the need for extensive (or any) training. This is more likely to occur when clinicians are engaged early in development, and they are active participants in design.

Payment incentives that reimburse clinicians for the costs involved in implementing digital solutions would also help to drive adoption. Clinicians will often recognise the potential impacts of digital health on models of care delivery.



#### 4.1.11 UNITED KINGDOM

##### England

##### Context

In 2002, a National Programme for IT in the NHS was launched, with the aim of reforming the way that the NHS in England used information. While some parts of this National Programme were delivered successfully, there were delays in developing and deploying the detailed care records systems.

In 2007, a consumer facing website called nhs.uk was launched. As one of the world's biggest health websites, it currently receives over 43 million visits per month. The site provides overviews of diagnoses and treatments, offers advice on self-care, and publishes information comparing different health services.

More recently, in December 2018, the NHS app was launched to provide better access for patients to their health care record, expanding on a range of existing primary care services. This app enables patients to book appointments, order repeat prescriptions, and manage long-term conditions.

Also in 2018, a code of conduct for data-driven health and care technology was published, following a period of public consultation. This document describes 10 principles to enable the development and adoption of safe, ethical and effective data-driven health and care technologies and a vision for digital, data and technology in health and care was published.

##### Barriers

Digital technology can transform the way services are run, improving the lives of clinicians and service users alike. To be successful, however, clinicians must be convinced of the opportunities to co-design the tools and to re-configure their workflow so that efficiencies can be realised. It is therefore critical that clinicians are present at decision-making meetings so that they can ensure that the technology is fit-for-purpose.

In the UK, clinicians are generally comfortable with the use of technology in their practice; however, many of the interfaces that they use are poorly designed. As a result, they can act as a barrier to adoption and may impact negatively on staff morale. If a technology does not meet the needs of those who are expected to use it, there is a high risk of clinicians creating work-arounds that impact on the wider use of the system, for example through poor data quality.

High quality digital tools should be intuitive. Where training is required, it is often difficult for clinicians to prioritise this demand on their time above other work commitments.

Trust in the use of data can also be a barrier. Following the initiation of a program called "care.data" to link information from different NHS providers, a National Data Guardian was appointed in 2014. One of her first tasks was to conduct a Review of Data Security, Consent and Opt-outs. Important lessons were also learnt programme scope, communications and stakeholder engagement.

##### Enablers



We have identified several conditions and prerequisites for successful clinical engagement:

#### Conditions to promote successful clinical engagement

- User-centred design of digital systems
- Digital systems and service transformation working hand-in-hand
- Digital systems that either meet a genuine clinical need or else which add efficiencies or productivity gains and are well communicated

#### Prerequisites

- Organisational capacity to implement common standards and to share expertise
- Time for clinicians to familiarise themselves with the system and its applications coupled with the availability of easily accessible ongoing training and learning support
- Meaningful engagement with clinicians and practice staff through different channels throughout the development and deployment phases, including setting out and communicating a clear vision of the goals and benefits
- Specification of the digital system to be driven by clinicians with input from patients.
- Financial investments in digital systems.
- Incentives both to design the deployment correctly and to use as envisaged. These incentives can include clinical benefits from using the technology such as improved safety and efficiency.



## Clinician and Citizen input to digital developments in England

The National Information Board (NIB) was established to put data and technology safely to work for patients, service users, citizens and for the professionals who serve them. In 2014, the NIB published Personalised Health and Care 2020, which acts as a framework for action to support frontline staff, patients and citizens to take better advantage of the opportunities presented by digital technology.

A sub-group of the NIBC called the Strategic Clinical Reference Group (SCRG) ensures that the policies, priorities, standards and guidance of the NIB support and synchronise with clinical priorities to improve the quality of care and experience for patients and service users in England. The NIB and the SCRG were key to the development of the digitally-enabled care elements of the NHS Long Term Plan, which sets out an ambitious programme of work over the next 5-10 years.

A key priority for the health service is to involve, engage and work with different groups and people on what a digital NHS should look like, and how best it can empower people to manage their own health and care. We involve patients, the public, and our staff in all aspects of our work – from developing our digital strategy to digital product development, through to approaches for implementation and uptake. We have a team of expert Patient Public Voice partners, which we involve in our ‘Uptake and Adoption Steering Group’ and our ‘Digital Stakeholder Forum’. We are also establishing networks of ‘NHS digital citizen champions’ and ‘digital clinical champions’. And we hold engagement roundtables with patient representatives’ bodies and national healthcare charities.

We recognise that not everyone has the skills or confidence to use digital health tools; therefore, our ‘Widening Digital Participation Programme’ is working with thousands of people from 14 excluded groups to reduce digital exclusion and to ensure that people have the skills they need to access relevant health information and services online.



## 4.1.12 UNITED STATES OF AMERICA

### Context

The Health Information Technology for Economic and Clinical Health (HITECH) Act was passed in 2009 with the goal of establishing meaningful use of EHRs throughout the U.S. HITECH established the Meaningful Use program which offered incentive payments to eligible healthcare providers and hospitals that adopt and demonstrate meaningful use of EHRs. The Act also created additional programs for workforce training and funding to establish communities of clinicians, hospitals, and consumers to promote the improvements that can result from meaningful use.

The U.S. healthcare system has become substantially digitised over the last 10 years. Moreover, this digitisation has been more progressive within hospitals than among individuals or small clinical practices. A digitised ecosystem exists among different hospitals and small practices which uses various locally hosted and maintained systems, or cloud-based remote hosted solutions. These systems evolved around billing and other reporting requirements that satisfy the Meaningful Use program incentives at the federal level. This has provided the impetus for the transition to digital health care. At the state level, additional requirements, such as those for verification under the prescription drug monitoring program, are established.

### Barriers

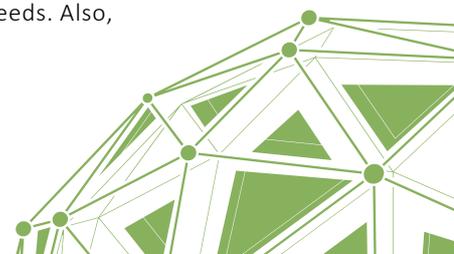
The U.S. has identified several engagement tactics that originated as enablers but have transformed into barriers over time. For example, financial incentives for participation were offered in early implementation. These transitioned over time to the introduction of penalties for non-participation after the financial incentives were completed (“carrot followed by stick”). This transition occurred in a relatively short time period. Nominally successful, it has resulted in a sense of clinician burden and significant dissatisfaction on the part of clinicians and patients. This issue is partly due to the value of the system. The value proposition of the individual clinicians in the U.S. are neglected and not properly identified. In this relatively short timeframe, the individual clinician found himself or herself taking on many tasks formerly performed by others on the healthcare team. This is because of regulatory requirements or institutional decisions seeking to identify a return on investment for their digital health investments.

Other aspects of the value proposition are conceptually good but, in practice, have created barriers for ongoing clinical engagement:

- Ubiquitous access from any venue means providers are effectively constantly on duty.
- Decision support was found to be ineffective, and time-consuming false alerts have resulted in alert fatigue.
- Interoperability problems led to encounter-based content to be hidden elsewhere in the record. This required time and effort to locate. Furthermore, additional effort is required to synthesise and reconcile these problems.

Other factors that are barriers to clinical engagement are:

- Enterprise solutions that do not support specialty workflows or integration of data from ancillary equipment or diagnostic tools, or do not support integration of departmental solutions which have been customised to meet specialty needs. Also,



attempts to implement single solutions, and then expecting them to accommodate all users, are problematic.

- Inadequate support to individual clinicians or small practices to manage the technical and regulatory requirements associated with privacy and security needs.

### Enablers

The following strategies have been effective in engaging clinicians with digital health:

- The use of single sign-on followed by using the Clinical Context Object Workgroup (CCOW) standard for switching applications if needed. Clinicians increasingly rely on clinical data from disparate sources and then became disengaged if they are required to maintain multiple logins. Institutions should work to limit the amount of different sign-ons clinicians need to access and use data from different systems.
- Organisations should have downtime procedures in place. Clinicians need to know and regularly practise how to complete medical care procedures when health IT is not available.
- Health IT should automate as much as possible to reduce “click burden” on the clinician. This includes developing clinical tools such as order sets. “Favourite” functionality should also be prioritised to help clinicians tailor their workspace to meet the clinical workflows they commonly encounter.
- Clinical content in health IT should be regularly reviewed and updated. Health IT contains a great deal of clinical content that is subject to change as the field advances. Features like clinical decision support rules, order sets, and other treatment protocols should be regularly maintained by designated clinical staff. It should also be updated to meet the current standard of care.
- Clinicians should be involved in the acquisition and implementation of health IT. Clinicians are ultimately the end users of any health IT systems acquired by an organisation. It is essential that appropriate clinical staff representatives are involved during the acquisition and implementation of health IT to ensure that products are selected that are fit for purpose. It should also be implemented in ways that meet the clinical workflow needs of the clinical staff.
- Patient electronic messages should be managed in a team-based fashion to prevent messaging overload for clinicians.



## Clinical engagement in the Immunisation Information Systems (IIS) pilot project – United States

### Scope of the program

The Office of the National Coordinator for Health Information Technology launched the Consumer Engagement for Immunisation Information Systems (IIS) pilot project, a program that sought to provide patients with access to their immunisation information directly through an online portal. The objective was to overcome the challenges faced by patients in accessing accurate and up-to-date information about their immunisation status, which are caused by changes of addresses, and multiple practice visits. This also includes the difficulty in having information requests fulfilled by providers, particularly at peak times such as enrolment or back-to-school season. The role of the clinical providers was to register and upload immunisation information to the portal. Furthermore, clinical providers were to encourage their patients to register and use the portal to access their information. The project started in 2013 and is ongoing with the portal being rolled out to additional states. A review was conducted in 2017 which led to several findings.

### The clinical engagement exercise

Clinical engagement formed part of the wider IIS communication and marketing plan. A key component of this was the environmental scan. The scan included interviews and focus groups with healthcare providers and practice managers. Based on the findings of the scan, the provider engagement targeted the twin messages of increasing consumer engagement and decreasing administrative burden.

Using published materials and communication toolkits, the engagement teams targeted the recruitment of providers in the pilot states. The initial provider recruitment was challenging, but the provider uptake increased across the length of the program. Some initial evidence showed a 'snowball' effect taking place. The key lessons learned in the program are discussed below.



Key findings

**Benefits need to be tangible, and this takes time**

Providers were more likely to engage in the process when they could see value for both themselves and their patients. The difficulty is that these benefits take time to become apparent. For providers in the IIS project, they needed to elect to register themselves, and then encourage their patients to both register and use the IIS portal before the efficiencies were realised. The review of the IIS project noted that it took until second year for the larger providers to see the decreased administration burden, and for clinicians to receive positive patient feedback that came from using the IIS portal. For smaller providers, this may take even longer. It was noted that despite the lag time from the start of the project, the tangible benefits witnessed by the providers aided in keeping them engaged with the program.

**Dedicated resources, dedicated champions**

The IIS project found that the strength of the clinical engagement project relied on the resources engaged to develop and implement provider outreach plans.

The Immunization Information Systems (IIS) project – a project in the United States which piloted an online portal giving patients access to their immunisation records – found that the strength of the clinical engagement exercises relied on the resources engaged to develop and implement provider outreach plans.

The IIS project found that because the complex project involved the delivery of a new portal, operated by a large population of users, engaging *full-time* and *project-specific* marketing and resources was of significant value. Resourcing was a focus prior to each clinical engagement planning stage, and included an analysis of the required marketing and engagement resources needed to fit the scope and scale of each individual engagement exercise.

The resource planning process was underpinned by a recruitment process which aimed to select both the right number of people and the right kind of people. The recruitment of people with a clinical background, and in particular clinical champions, was instrumental in addressing the fact that providers were often reluctant to participate in the program citing, for example, the time it took to register themselves on the IIS portal and then market to and register their patients. Specific states of the U.S. that used dedicated health provider champions were shown to have better success at recruiting both providers and consumers. In particular, the successful champions were the health providers with a background that allowed them to explain the benefits of the program to their peers. The IIS project shows that ample consideration needs to be given to who the messengers should be, as well as what message they are giving.



### 4.1.13 URUGUAY

#### Context

Uruguay introduced a national EHR system in 2014. This was governed by national legislation which covered areas including reimbursement of eHealth services, patient safety and quality of care, privacy and security, the sharing of health information between healthcare providers, and the individual's rights in relation to their health information. Primary, secondary and tertiary care facilities have access to the EHR.

#### Barriers

A barrier identified during and after the rollout of Uruguay's national EHR is the lack of availability of training in digital health for clinicians. This inhibits the take-up and use of the EHR across the health system. Clinicians are reluctant to discontinue their paper-based and local records if there is a lack of understanding of how the EHR is used. This includes what role it plays in the wider move towards a digitised health care system.

In Uruguay, a bimonthly study is carried out on the use of IT in the health sector. The study gathers data from organisations, healthcare professionals, and users of the health system. According to the 2017 Measuring IT and Health report, one of the main barriers perceived by professionals is the lack of training. This includes the lack of motivation by professionals to engage with digital health. These two issues make change difficult because planning the integration of new IT projects into the health sector relies on good quality organisational change processes. As emphasised by Handler (19) in the Gartner report "Organisational Readiness Is Key to Successful EHR and Digital Care Delivery Programs", the main cause of failure was the lack of a proper evaluation of change from the previous integration of technologies.

The other significant barrier identified by the 2017 Measuring IT and Health report is the lack of financial resources for investments in new technologies. Restricted financial resources across different sectors of health care included the size and location of the clinical delivery facilities. The lack of technological investments compounded the existing difficulties in receiving fast and consistent internet speeds. So much of the digital health landscape in Uruguay depends on the good quality connectivity. Indeed, slow speeds and internet "black holes" can provide a technological barrier. It can also increase a clinician's frustration and lead to their losing motivation to embrace digital processes.

#### Enablers

In 2018, the Uruguayan digital agency (Agesic) held two events around the development of a community of change agents in digital health. Participants from 20 health organisations participated. This process revealed many of the core enablers of clinical engagement.

A key factor identified in this process for enabling clinical engagement was the generational change that is taking place within the clinical cohorts. As more "digital native" clinicians enter the workforce, these types of clinicians are coming in with technical skills and greater expectations of digital service delivery. These clinicians are more willing to participate in digital change. This tends to bring their peers and colleagues along with them which can lead to increased participation rates.



Another key enabler is the benefit clinicians receive through EHRs and the digitisation of health information. The EHR project is helped by the perception of greater readability and availability of clinical information. The Uruguayan experience has reflected the important focus on clinicians seeing the benefits for their patients as well as themselves. This includes the perception of greater efficiency in promoting the patient's security, which includes decreasing incidents of mistakes by health personnel. The ease of access to databases and IT supports has improved decision-making, which has decreased uncertainties in the diagnosis and treatment process.

Finally, there is a legislative drive for clinicians to engage with the delivery of digital health processes. Uruguay's Urgency and Emergency Law requires the exchange of health information for decision-making in emergency assistance processes. This is greatly supported by the rapid dissemination of information through digital processes. Clinicians can most effectively fulfil their requirements under the law by engaging closely with EHR and digital health delivery projects.



## 4.2 AN INTERNATIONAL OVERVIEW OF CLINICAL ENGAGEMENT

The comparative analysis is based on the responses of various member countries of the GDHP. Analysis of the Delphi-like study examined the similarities and differences among countries in their understanding of strategies to improve digital health literacy among clinicians.

### Delphi survey round 1

Five of a possible eight countries responded to the first round of the survey conducted in May 2018. Participants that responded to the survey and questionnaire were Australia, Canada, United Kingdom, United States and Uruguay. All participants responded to all survey questions. An analysis of the responses identified several common themes. These are summarised below:

#### **Clinician Barriers:**

- Administrative and time commitments burden
- Clinician adoption and optimised use of digital health technologies
- Remuneration/incentives (lack of)
- Discomfort with technology/insufficient training
- Lack of workflow integration/usability

#### **Enablers to Clinician Engagement in Digital Health:**

- Ownership and inclusiveness
- Peer networks/support
- Engagement and empowerment
- Change management and training
- Co-design and co-production

These common themes were translated into a series of statements on important barriers and enablers of digital health for clinical engagement. These statements were included in the second Delphi-like round.

### Delphi-like survey round 2

The second Delphi-like round, conducted in May 2018, incorporated statements on important barriers to and enablers of digital health for clinical engagement, as identified in round 1, into a questionnaire. Eleven of a possible 18 countries responded to the second survey round.

The participants who responded to the survey and questionnaire were Australia, Canada, Hong Kong SAR, South Korea, Saudi Arabia, Singapore, Switzerland, Japan, the United Kingdom, Estonia and Austria.



## 4.3 BARRIERS TO AND ENABLERS OF DIGITAL HEALTH CLINICAL ENGAGEMENT AMONG GDHP PARTICIPANTS

### Barriers

Based on 11 responses received, simple descriptive statistics outlining the mean, median and range of scores are presented for the statements considered important barriers by participants at the end of round 2 of the Delphi-like study, shown below in Table 1. Respondents were asked to use a Likert scale, rating barriers from 1 (not important) to 5 (very important), and the frequency of results (the count of raw numbers) for the 11 responding countries is shown in Figure 3.

*Table 1: Descriptive statistics for statements considered important barriers by participants following round two of Delphi-like study (n=11)*

Important BARRIERS to digital health clinical engagement				
5-point scale: 1=not important, 2=slightly important, 3=moderately important, 4=important and 5=very important				
	Mean	Median	Range (minimum, maximum)	
			min	max
Poor clinician adoption of digital health technology (lack of workflow integration)	4.36	5	3	5
Administration and time commitments burden	3.73	4	2	5
Lack of remuneration or incentives	3.55	4	1	5
Trust of data	3.45	3	1	5
Insufficient training	3.36	4	1	5
Discomfort with digital health technology	2.55	2	1	5



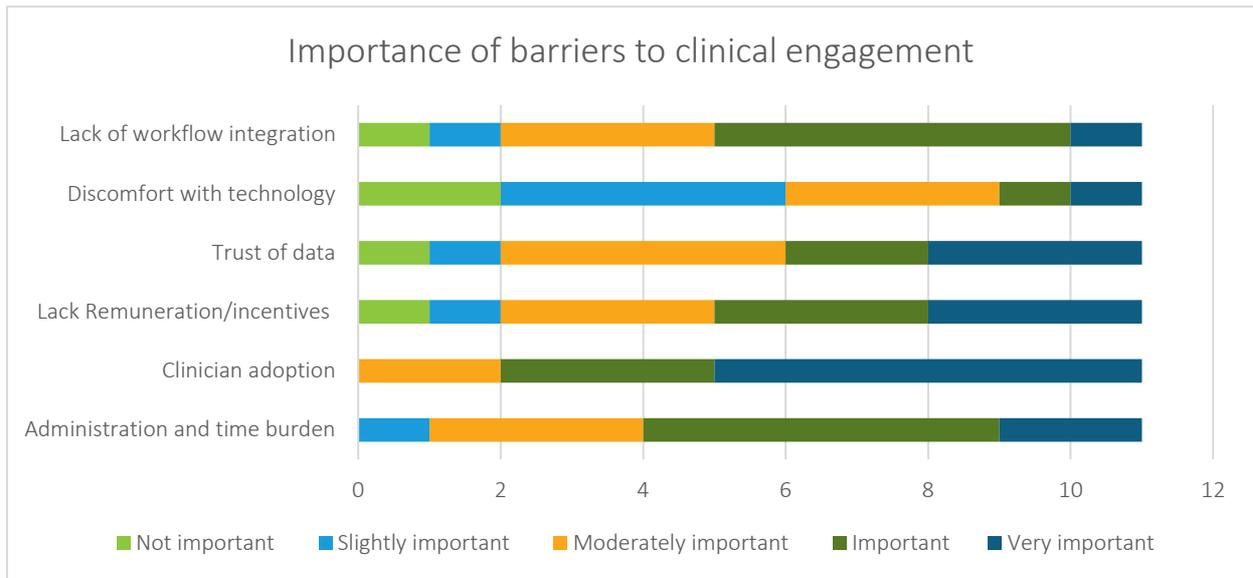


Figure 3: The importance of barriers to clinical engagement identified by participants at the end of round two of the Delphi-like study (n=11)

There was general consensus that poor workflow integration was an important barrier for clinicians in the uptake of digital health (median = 5, range 3-5). The reasons given for this include “multiple logins into different services”, “lack of seamless integration with clinical pathways”, “poor software and data interoperability”, and “poor user experience and user interface design”. Participants found “administration and time commitments burden” (median = 4, range 2-5), “lack of remuneration or incentives” (median = 4, range 1-5), “trust of data” (median = 3, range 1-5), and “insufficient training” (median = 4, range 1-5) to be moderately important barriers to clinical engagement in digital health.

However, the median rating for “discomfort with digital health technology”, was only slightly important, (median = 2, range 1-5). Participants’ reasons for this rating include “the belief that clinicians are technology savvy”, “comfort is not an issue because of the younger generation of clinicians”, and “the belief that clinicians have a general positive attitude towards digital health”. The level of agreement or consensus for statements considered important barriers by participants after round 2 are given in Table 2 (represented as percentages).



Table 2: Level of agreement or consensus for statements considered important barriers by level of importance (n = 11)

Important BARRIERS to clinician engagement in digital health			
5-point scale: 1=not important, 2=slightly important, 3=moderately important, 4=important and 5=very important			
	<i>Very Important / Important</i>	<i>Moderately important</i>	<i>Not important / slightly important</i>
Poor clinician adoption of digital health technology (Lack of workflow integration)	81.82%	18.18%	0%
Administration and time commitments burden	63.64%	27.27%	9.09%
Lack of remuneration or incentives	54.55%	27.27%	18.18%
Insufficient training	54.55%	27.27%	18.18%
Trust of data	45.45%	36.36%	18.18%
Discomfort with digital health technology	18.18%	27.27%	54.55%

The Delphi-like study found greater than 60 per cent agreement on the importance of “poor clinician adoption of digital health technology” and “administration and time commitments burden” as barriers to clinical engagement in digital health. However, there was agreement of less than 60 per cent on the importance of “lack of remuneration or incentives”, “trust of data”, “insufficient training”, and “discomfort with digital health technology”.

### Enablers

Based on 10 responses received, simple descriptive statistics outlining the mean, median and range of scores are presented for the statements considered important enablers by participants at the end of Round 2 of the Delphi-like study, shown below in Table 3. Respondents were asked to use a Likert scale rating of barriers from 1 (not important) to 5 (very important), and the frequency of results (the count of raw numbers) for the 10 responding countries are shown in Figure 4.



Table 3: Descriptive statistics for statements considered important enablers by participants following round two of Delphi-like study (n=10)

Important ENABLERS of digital health clinical engagement				
5-point scale: 1=not important, 2=slightly important, 3=moderately important, 4=important and 5=very important				
	Mean	Median	Range (minimum, maximum)	
			min	max
Ownership & inclusiveness (co-design & co-production)	4.50	4.5	4	5
Change management and training	4.50	5	2	5
Peer networks and support	4.20	4	3	5
Communication of benefits or public opinion	3.90	4	2	5
Best practice in digital health technologies	3.50	3	2	5
Payments models or incentives	3.50	3.5	2	5

Participants considered “ownership and inclusiveness (co-design and co-production)” (median = 4.50, range 4-5), “change management and training” (median = 5, range 2-5), and “peer networks and support” (median=4, range 3-5) to be important enablers for clinicians to engage with digital health technology.

However, participants found “communication of benefits or public opinion” (median = 4, range 2-5), “payments models or incentives” (median = 4, range 2-5), and “best practice in digital health technologies” (median = 3, range 2-5) to be only moderately important barriers to clinicians’ engagement in digital health. Qualitative findings suggest participants’ reasons include “communicating benefits of digital health is critical to negotiations and discussions with involved parties”, “payment incentives are strategies that improve short-term outcomes but not long-term outcomes”, and “best practices may be sensitive to the local conditions of the implementation and may not translate to different environments”.



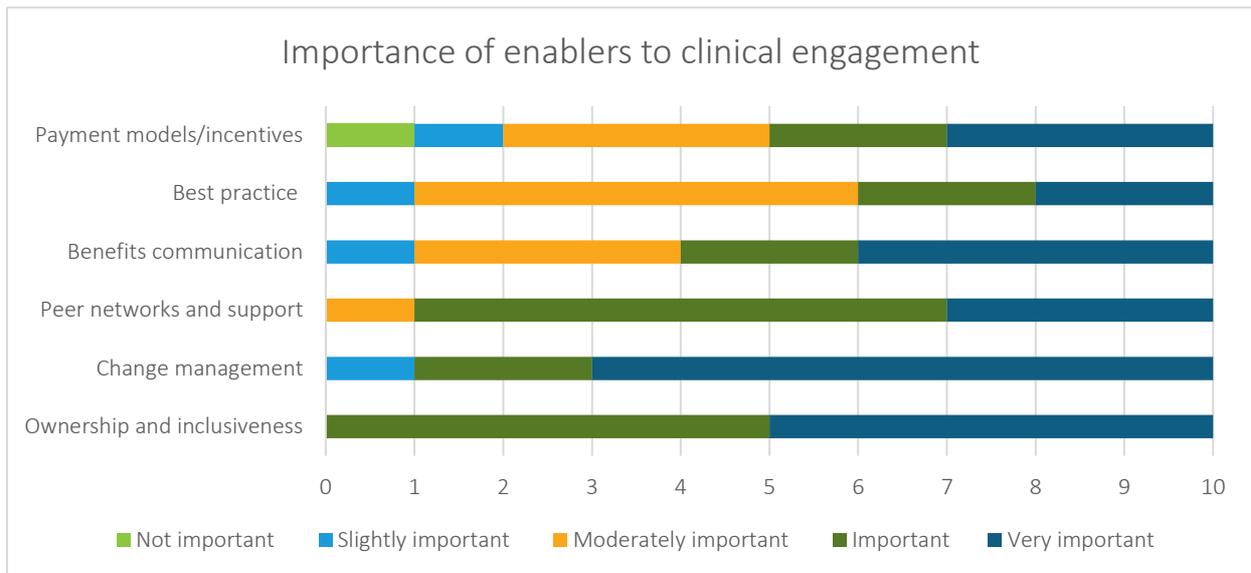


Figure 4: The importance of enablers to clinical engagement identified by participants at the end of round two of the Delphi-like study (n=10)

For statements on “ownership and inclusiveness”, “change management and training”, and “peer networks and support”, the agreement was above 90 per cent on their importance as enablers of digital health engagement. Table 4 shows the level of agreement or consensus (represented as percentages) for statements considered important enablers by participants after round 2. Interestingly, the high levels of agreement among statements were skewed towards being important or very important with little discrimination among themes. This may suggest that participants strongly believed that the majority of the factors were important enablers of digital health.



The statement on “communication of benefits or public opinion” reached an agreement of 60 per cent as to its importance as an enabler of clinical engagement in digital health. However, statements on “payments models or incentives” and “best practice in digital health technologies” reached levels of 50 per cent or lower agreement about their importance.

*Table 4: Level of agreement or consensus for statements considered important enablers by participants (n = 10)*

Important ENABLERS of digital health clinical engagement			
5-point scale:			
1=not important, 2=slightly important, 3=moderately important, 4=important and 5=very important			
	<i>Very Important / Important</i>	<i>Moderately important</i>	<i>Not important / slightly important</i>
Ownership and inclusiveness (co-design and co-production)	100%	0%	0%
Change management and training	90%	0%	10%
Peer networks and support	90%	10%	0%
Communication of benefits or public opinion	60%	30%	10%
Payments models or incentives	50%	30%	20%
Best practice in digital health technologies	40%	50%	10%
Change management and training	90%	0%	10%



## 5 LITERATURE REVIEW: FINDINGS ON CLINICAL ENGAGEMENT STRATEGIES

The findings of the literature review were analysed to determine the key themes of clinical engagement strategies in digital health. Six main themes were identified: co-design and co-production; change management and training; peer networks and support; communication of benefits or public opinion; payment models or incentives; and best practice in digital health technologies. Several sub-themes emerged from the six main themes identified in the literature review.

Fifty studies were identified through the rapid review. The studies employed the following methods: 19 case study analyses; 21 qualitative descriptive studies; four descriptive studies; three mixed-method studies; and three quantitative descriptive studies. Figure 5 shows the rapid review flow diagram which outlines the details of the results of the review process and the included studies.

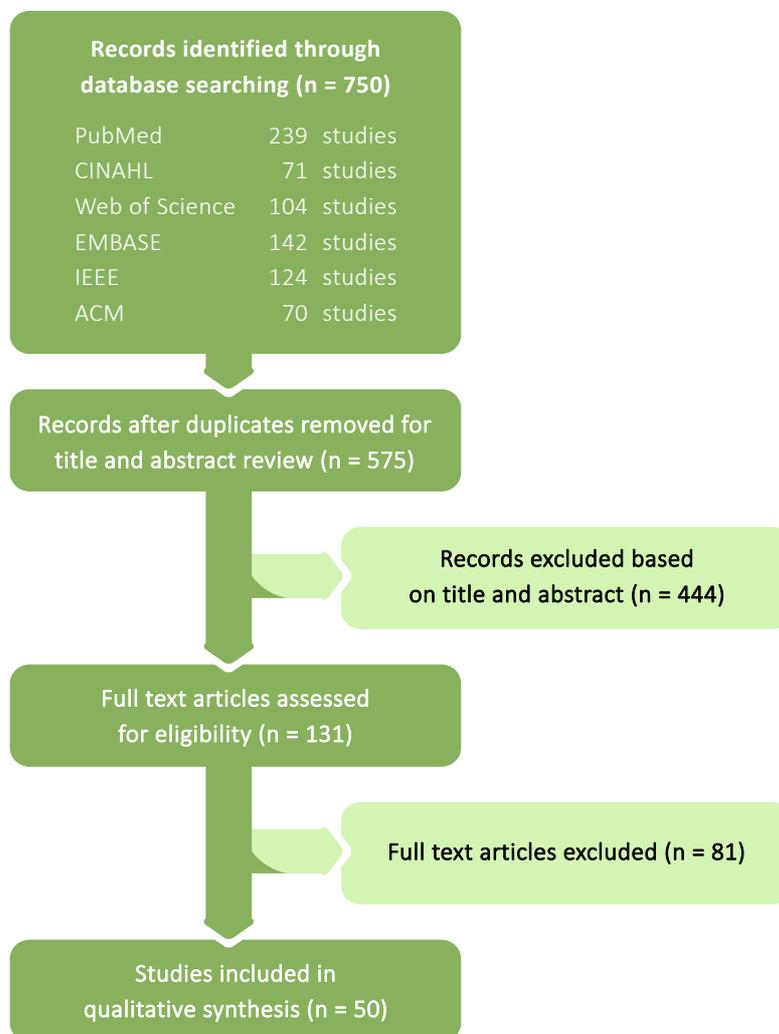


Figure 5: Flow diagram of rapid review



## 5.1 CO-DESIGN AND CO-PRODUCTION

### Impact of co-design and co-production

Several studies examined the impact of co-design and co-production. Ashraf et al. (20) described multi-stakeholder dialogues (MSD) to increase stakeholder engagement in policy-making and implementation of a national eHealth and mHealth strategy for Bangladesh. MSD was used to identify broad health system domains where digital technology can contribute to, and identify barriers and challenges to, collaboration across stakeholders, identify mechanisms to maximise efficient information sharing, improve data quality, and improve access and scaling of health informatics strategies. Clinical engagement approaches included one-to-one stakeholder interviews to identify meeting agendas, facilitator training, MSD goal-setting sessions, and small group brainstorming exercises for consensus building. Key outcomes of MSD included identifying policies and initiatives, and the challenges of scaling up IT in Bangladesh. Recommendations included improved leadership and policy, improved quality and coverage of care, and more meaningful engagement of all stakeholders and initiatives.

Raman et al. (21) provided findings from the proceedings of a meeting with academia, government, industry, and professional societies for leveraging EHRs. Learnings from implementation in Denmark, Singapore, Sweden, and the United Kingdom were discussed. Some of the challenges of targeting clinical engagement included: the sharing of learnings from clinicians about daily practice to allow the development of appropriate study protocols for clinical engagement; providing site leadership for clinicians to feel supported; and using pragmatic trials of EHRs that used clinicians as the backbone of data collection. Doolan et al. (22) examined case studies of five U.S. hospitals. The case analysis examined the use of formal and informal mechanisms that capture timely feedback from clinicians. All sites recruited clinicians with medical, nursing, or therapy backgrounds. They found ownership by an expert physician or clinical groups was important for implementation.

Fraser et al. (23) used co-design strategies to plan and design a project involving EHRs. They found adherence to the use of EHRs was very high – between 68.4 and 100 per cent adherence. Lessons learned included the importance of: a flexible design process; increased awareness of health system IT work processes; understanding language and communication differences between the IT team and clinicians; adapting the EHRs to different work processes; managing privacy; better understanding of the clinical context; and understanding clinical workflow problems. Gilbertson-White et al. (24) used a mixed-method technique to engage stakeholders in the development of a web application to manage patient symptoms with advanced cancer living in rural areas. Overall, participants responded positively to all twelve aspects of the web application.

### Early stakeholder engagement and consultation

Early and active stakeholder engagement in co-design was used in the implementation of digital health systems (25-27). This level of engagement is an important factor in the co-design process. For instance, Glynn et al. (28) examined Normalisation Process Theory in the implementation of a smartphone application to promote physical activity in primary care in Ireland. The study found effective strategies included roles and responsibilities to support active engagement, and a comprehensive evaluation of the digital health intervention in the routine care environment, such as a pragmatic trial. Janssen et al. (29) examined the use of an adaptive methodology to capture the design of a web-based



knowledge portal in cancer. Approaches included stakeholder consultations to inform the design of the portal.

Co-creation and collaborative research approaches were used in two Canadian studies. One study found collaborative research approaches brought diverse groups of participants together, such as academic researchers and clinicians (30). The other study by Whitehouse et al (31) found a co-creation approach to developing an eHealth platform for youth improved uptake by 99 per cent (79 out of 80 individuals) and increased survey completion by 99 per cent. Participants also found the program to be easy to understand (92 per cent), easy to use (92 per cent), and efficient (80 per cent). However, this study was done on a sample of 80 participants without a comparison group.

### Novel techniques of co-design

Person-centred design systems with meaningful stakeholder engagement helped to build a mobile care coordination system for the management of complex chronic disease in the United States (32). While it was unclear, “meaningful” stakeholder engagement may include novel co-design techniques. There have been some experiments with design thinking techniques and the findings of these techniques have been reported in a few studies (33-35). Visualisation techniques have also been used with good effect, including blueprints, storyboards, and customer journey maps, and prototyping techniques, such as walkthrough and role-play (34).

Similarly, another study found design thinking techniques to be useful for stakeholder groups although concerns were raised about the adequate representation of complex concepts emerging from the workshop (33). Lastly, Lupton (35) conducted a digital health stakeholder workshop in Canberra, Australia. While generally positive, researchers found mechanisms were needed to facilitate consultation between various stakeholders, especially patients and carers. Mechanisms will address members of some social groups being currently excluded from full participation in the digital health ecosystem.

### Resource-intensity of clinical engagement

While co-design and co-production were predominantly advocated in the literature, some studies found early, and ongoing stakeholder engagement was resource-intensive to a level which presented challenges. Particularly, case studies in low-income countries found levels of engagement with users and stakeholder to be an issue (36, 37). Furthermore, these projects required an iterative process to ensure successful implementation of their digital health system (36, 37). Case studies on the implementation of digital health technologies in Bangladesh, Mali, Uganda, Mozambique, and Namibia required time and effort to develop a level of capacity to enable appropriate clinical engagement (37). Similar findings were suggested in case studies on the implementation of EHR systems in three southern Africa countries. However, they all also emphasised that “full” stakeholder engagement is critical for sustainability of a digital health system (36). These issues were also identified in a clinician workshop on electronic clinical quality measures (eCQMs) in the United States (38).



## 5.2 CHANGE MANAGEMENT AND TRAINING

### Training and clinical leadership

Several studies examined training and clinical leadership strategies as a change management process. Paina et al. (39) examined how and why theory of change (ToC) is facilitated in the implementation of intervention design and stakeholder engagement in health systems research. Reflexive group meetings were used in a consortium for delegates from Bangladesh, India, and Uganda. The study found ToC provided stakeholders with an opportunity to reflect critically on context and programs, to re-evaluate assumptions of programs, to facilitate internal and cross-team communication, and to improve organisational learnings. Lee et al. (40) examined ePrescribing toolkits for NHS hospitals in the United Kingdom. Participants described novel uses of toolkits may include interactive and visual capabilities. This can offer in-situ simulation training or videos for clinicians.

Blumenthal et al. (41) used a multi-stakeholder team comprised of different clinical lead staff in five hospitals in the United States. Clinical lead staff included an executive sponsor (i.e. hospital leadership), allergy/immunology clinical lead, infectious disease clinical lead, pharmacy lead, nursing lead, and data analyst. Additionally, computerised support through EHRs and a multi-pronged education campaign were developed. The study found refinements were able to be made to the digital health technology with the multi-stakeholder team. Monthly conference calls by clinical leads (i.e. “clinical champion”) between sites allowed for sharing of ideas, challenges, and best practices. Practice guidelines integrated into the EHR allowed work processes to be measured (such as website usage and traffic).

Another study in Canada by Ghany and Keshavjee (42) found real-time practice guidelines issued to health providers at the point of care to be a scalable solution. However, several limitations were identified among several key stakeholder groups. Further recommendations included a single monthly reporting dashboard for hospital staff. Similar experiences with clinical leads were outlined in the study by Sobel et al. (43). The study described the build and deployment of a tool for clinical initiatives within a “community of practice”. The study found the use of clinical leads championed the change and led to education dissemination. While the process was described as ad hoc, the tool fostered collaboration among clinical initiatives within a community of practice.

Interestingly, two studies outline some important lessons learned about clinical involvement in the rollout of a national health record in Denmark and New Zealand (44, 45). The study by Hostgaard et al. (45) found clinicians were grouped into social groups, which led to divisions between IT-professions involved in the implementation of the system. Power dynamics among these social groups were observed which became a significant barrier in terms of building consensus and making decisions on various aspects of any digital health implementation. Similar power dynamics are observed in participatory design workshops with consumers and carers (35). Indeed, similar social dynamics and divides have been observed in implementation in other countries, such as New Zealand (44).



## Change management

Several studies examined directly change management for digital health implementations. Takian (63) reported on the development, implementation process and stakeholder experiences of EHR software (Millennium) at an NHS general hospital in the United Kingdom. The study found the implementation of an EHR system seized the opportunity to transform clinical behaviours and improve work practices. Project managers described the implementation of the EHRs as a change management process rather than an information technology project. They also noted that implementation must be an evolving change management process.

Other studies also outlined that training needs for the workforce were key to introducing new technologies into medical practices, such as mobile devices (46, 47). Four other early benefits were realised during the implementation: online order communication; real-time patient follow-ups; improving patient workflows; and ability to book outpatient clinics and send discharge summaries to general practices electronically. Realising these benefits helped to build enthusiasm and engagement among clinicians.

Many studies indicated change management to be important for the adoption of digital health by clinicians (48-50). In Australia, strong clinical leadership and change management strategies at departmental level, committed project management, and involvement of staff with appropriate training was essential for post-adoption of clinical information systems in public hospitals (48).

The study by Kowal et al. (49) provided qualifiable results of the Agile Project Management model, which is a proactive communication and engagement plan. The model was used to deliver a statewide Intensive Care Clinical Information System in New South Wales, Australia. The study found active participation in the design and build phase (400 per cent increase in active voluntary participation). The success of the system was contingent on active engagement of clinicians to deliver the system on behalf of clinicians, which benefited patient care and clinician satisfaction. Fanta et al. (50) suggested important factors, such as sound management support. In addition, specific change management strategies were important, such as providing training to support staff. These factors were critical for the implementation of a health management information system in Ethiopia.

## 5.3 PEER NETWORKS AND SUPPORT

### Peer support

While the term “peer support networks” is not explicitly mentioned in the literature, several related concepts were raised in several studies. Some countries established dedicated government-funded organisations providing support services to health providers to assist in adopting change in medical practices. Pearce et al. (10) surveyed 84 staff from 74 practices in Melbourne, Australia. The aim of the survey was to understand the factors affecting the introduction of the national health record into general practices into specific areas of Melbourne. Main factors for practices to engage with eHealth were leadership provided by Medicare Locals which are government-funded organisations that provide support for general practices and allied health providers. Specific factors included: strong existing relationships of practices with Medicare Locals; access to financial incentives for participation; a desire to see their practices be early adopters; and leadership by interested individual GPs within their practices.



## 5.4 COMMUNICATION OF BENEFITS OR PUBLIC OPINION

### Communication with clinicians

Millonig (51) used presentations on health technologies and professional perspectives of health services, question and answer sessions, and group discussions to convene a diverse group of stakeholders on medication therapy management systems. They found participants created a unique stakeholder dialogue for a wide range of stakeholders. Furthermore, strong clinical engagement was used in the implementation of SNOMED CT subsets for physiotherapists in the United Kingdom (52). The study found communicating with physiotherapists in ongoing discussions benefited the development of the standardised terminology by discussing practical benefits of the system. The process led to active stakeholder discussion on how to record patient care they provided, and how to use SNOMED CT to enable benchmarking of existing health services. Tailored documentation was an important clinical engagement tool in the implementation of a clinical support system in hospitals in the United States (53). The use of appropriate documentation to help communicate workflows to clinicians, patients, and caregivers were noted as important. These findings on using documentation as a communication tool for clinicians were consistent with studies that examined novel communication techniques for clinical engagement (54-56).

### Visualisation as a communication tool

Several researchers have experimented with using visual aid tools to enhance clinical engagement in implementation of digital health programs. Two studies from the United Kingdom and Australia found the use of visualisation tools or “healthcare simulations”, such as pictures, diagrams, maps and flow charts, produced some desirable effects (55, 56). While findings were narrative, the use of visual models were found to lead to higher levels of engagement and group understanding (55, 56). The study by Jenkins and Wilson (55) stated that “using animation with clinicians provided a visual “probe” to support a more proactive and discursive localised approach to end-user concerns.” Brailsford et al. (54) provided basic guidelines to “healthcare simulations (i.e. pictures, diagrams, maps and flow charts)”. Guidelines included:

- Before a modelling meeting, identify a local champion who might be able to recruit others who might be definitive stakeholders.
- Use modelling tools that match up with the problems that the stakeholders appear to have.
- Draw pictures, diagrams, maps and flowcharts to assist in seeking clarification.
- Work in smaller groups. This works better than one large group (perhaps no more than 6 people in each group).

Several studies found communication to be critical for the co-design and co-production process. Two studies in Australia used design thinking techniques, brainstorming sessions with post-it notes, and video recordings as data collection tools to facilitate ideas within a group of stakeholders involved in digital health (33, 35). Furthermore, one study in Norway used presentations, service journey modelling language, and visualisations to communicate service improvements about an EHR system (34).



## 5.5 PAYMENT MODELS OR INCENTIVES

### Financial and non-financial incentives pertaining to clinical engagement

Strachan et al. (57) used a range of incentives to motivate and retain community health workers delivering an Integrated Community Case Management system. The system used information and data management and mobile health technologies. Several financial and non-financial incentives were proposed. Financial incentives included micro credit strategies for health workers, self-managed collective funding arrangements, a flat fee per service, revolving funds (predetermined amount of money), and offering paid roles.

Non-financial incentives proposed by Strachan et al. (57) included creating professional pathways and skills development through visits, providing health workers with tools to perform the job with an emphasis on reimbursing expenses and travel costs, supplying mobile phones and airtime in lieu of salary, and possible food and commodities as incentives for meeting attendance, taking the lead in establishing performance incentives, and promoting success. Overall, Strachan et al. found that financial and non-financial incentives should target two types of motivations of health workers: (1) “expectancy”, referring to the process where incentives are contingent upon the value placed by the worker and an expectation that actions will lead to its attainment; and (2) “equality,” referring to workers developing a natural belief their actions from the incentives created workplace fairness and equality.

## 5.6 BEST PRACTICE IN DIGITAL HEALTH TECHNOLOGIES

### Toolkits presenting best practice

Best practice strategies, such as toolkits, were used to educate clinicians about digital health programs and implementation. Studies suggest that the use of toolkits provided a pragmatic framework for scaling up digital health development (32, 58). Furthermore, toolkits were a preferred inexpensive clinical engagement approach for national governments, such as the NHS in the United Kingdom, or multinational institutions, such as the World Health Organization (40, 58, 59).

The survey conducted by Lee et al. (40) found 40 per cent of National ePrescribing Symposium delegates in the UK acknowledged the existence of NHS-relevant toolkits, while 58.6 per cent either did not know or were unsure if such tools or toolkits existed. Most of the symposium delegates were in favour of using toolkits across NHS hospitals. Toolkits also had to be easy to use, have quality of content, and breadth and depth of content to be useful. Finally, studies recommended toolkit content needed to address local needs of the countries, or be tailored to specific areas, sectors and specialities (40, 59).



More generally, Leath et al. (60) highlight a Telehealth EcoSystem model for a rural under-served community in the United States. The model is based on “best practice” from the literature, empirical observations, and real-world experiences. The model uses existing public and private organisational capacities to address healthcare and social service delivery through stakeholder engagement. Several best practices in “digital connectivity, HIPAA [Health Insurance Portability and Accountability Act] requirements, electronic health records (EHRs), and eHealth applications, such as patient portals and mobile devices, were emphasised.”

Stroetmann (61) provided a scoping study of global good practices on the national and district implementation of an eHealth platform in sub-Saharan Africa. Results suggest local needs and opportunities must be identified to successfully implement the eHealth platform at a district, national, and global level.



## 6 DISCUSSION

This section summarises the key themes and observations arising from the country analysis, and literature review that identified key barriers and enablers of clinical engagement in digital health programs around the world. Although the focus of this review is clinical engagement, many of the observations about enablers and barriers are also relevant to the challenges of effective consumer engagement. It is important to note that clinical engagement is understood differently in various countries including in countries with emerging or developing economies.

### Successful engagement is multifaceted

No one strategy for clinical engagement will work on its own. Successful clinical engagement strategies start by defining the problems that resonate with clinicians (and have been identified by them), and incorporate co-design from the start (of systems, processes and workflow). Successful clinical engagement strategies also include strong change management, good communication, implementing design around local networks, well-respected local champions to drive change in practice, feedback and input mechanisms, adjustment of workloads to allow for meaningful participation, and a mixture of incentives. It was clear from the evidence that these factors were important for different digital health projects ranging from national digital health infrastructure to telehealth apps and mobile health apps for prevention.

### Solutions should focus on a clinical problem, *not* a management problem

Clinicians are focused on better healthcare delivery and better patient outcomes. Digital health projects whose primary objective is financial, or policy-driven, will run into difficulties fast. This is especially the case if the digital health program involves more intensive workflows, additional bureaucracy, and increased burdens on clinicians to record data. Clinicians want to see how systems will allow them to make more informed and faster decisions, make diagnoses easier, make treatments more effective, and to support their patients by providing them with information and tools to help them proactively take control of their own health care.

The most effective way to achieve this is involving the clinicians in defining and wording any clinical requirements. Clinicians must understand the benefits of the digital health solution during the design and planning stage. This ensures these benefits are identified early and are meaningful to clinicians. Clinical expectations are also communicated and managed by this process.

### Engagement should be based on a shared need, and a common vision

Engagement should focus on a need that is recognised and shared by all stakeholders. A shared understanding should be achieved despite the different perspectives of various clinicians on a single digital health solution. All stakeholders should have a shared view that there is a compelling need to change the status quo. They must have had a role in defining the problem and proposing any potential solutions.



### Clinical engagement is critical from the outset

Clinical engagement should start by involving clinicians at the problem definition stage. Engagement will be more difficult if a proposed solution does not respond to an identified clinical problem. Clinicians must be involved in framing the problem and defining relevant solutions. These solutions can be implemented in many contexts and environments, including health services of rural and remote communities, children's health such as immunisation, existing public health programs, and health care for the frail and ageing populations.

### Clinicians should have meaningful authority in decision-making

A recurring theme is that clinicians need to have joint ownership of any decisions made, and to be given the authority, support, and understanding of the process to have a real influence on all stages of a digital health project. Input to the design, without real ownership of the process and the decisions, will limit clinical engagement when it comes to implementation and use of any digital health solution.

### Clinical governance underpins clinical engagement strategies

Clinical governance underpins successful clinical engagement. While it was not explicitly mentioned in the research, various aspects of the literature seemed to support clinical governance as a framework for clinical engagement. Further development of, and investigation into, the use of clinician guidelines is needed to support various digital health implementations in clinical practice. These guidelines and the governance of implementing these guidelines will need the support of practicing clinicians.

### Workflow integration is key

The ongoing use of collaborative, co-design and co-production principles is integral to ensure that systems are integrated into workflows to avoid inefficient and time-consuming workflows, multiple logins, and inappropriate and ineffective alerts. Clinicians will not engage with any digital health solutions that disrupt workflow, negatively impact the time spent with patients, or add high administrative burdens.

### Localising the solution

Several case studies of effective engagement have raised the value of using peer networks and well-respected clinicians. These are clinicians who are known in the area where the implementation is to occur. They can promote initiatives and drive the design of digital health systems in the local context. This approach builds a sense of local ownership, which supports a snowball effect during implementation. Clinicians can see the adoption by their peers which diffuses the use of the digital health innovation among them. Solutions can range from small-scale projects that implement telehealth solutions in clinics located in rural towns and regions, to large-scale projects involving national digital health infrastructure of an entire country.

Focusing on local area solutions and engagement that build a sense of local ownership and use of peer networks and well-respected clinicians for promotion and advocacy is more effective.



### Demonstrated success by peers will drive engagement

Clinicians are more likely to engage with digital health if a solution is being used and promoted by their peers. They can see the impacts through site visits, mentoring, peer networks, and case studies that are relatable to their environment.

### Clinicians should be “hands on” clinical champions, *not* clinical figureheads

Having clinical champions as “figureheads” for a project or initiative is not enough to drive clinical engagement. Clinicians need to have time to actively work on process improvement and design, advocacy among their peers, participation in design decisions, and on-site support at implementation. This cannot happen without an adjustment to their ordinary workload.

### The engagement method should be people-to-people, *not* organisation-to-organisation

Engagement cannot just be an exchange of marketing information from a project management office to a clinical practice. There needs to be a well-considered communication plan that engages with clinicians face-to-face.

This involves an intensive resource-load with dedicated engagement and change management professionals who can organise focus groups and interviews. Additionally, it involves clinical champions who are able to engage with clinicians in a more informal and “grassroots” manner. There is also evidence that projects can benefit from clinicians being able to engage directly in dialogue with other stakeholders across different project areas. Clinical engagement should not be an imposition by a government agency or administrative body.

### Financial incentives alone are not enough

Financial incentives do not work in isolation. Several countries noted they experienced an initial benefit from offering financial incentives when engaging clinicians. However, in the long term, this was not sustainable, nor was it effective unless clinicians have other incentives. These incentives could include a shared understanding of high-quality patient care, or improvements in workflow, performance or outcomes that drive their participation. Many countries outlined further issues with incentives where existing remuneration structures did not reflect advances in technology. There were also no incentives provided to clinicians to communicate electronically or to make the investment needed in digital health tools that could reform the way services are delivered to patients. Canada’s experience was that unless payer remuneration models are appropriately structured for the provision of virtual care patient consultation services, then adoption of digital health and practice workflow integration will be slow.

### Consumer expectations drive clinical engagement

Countries should be making an investment in consumer-facing digital health solutions. Findings suggest that there was a growing appetite by consumers to use digital services in general. This was evident among consumers who are actively using digital tools in all aspects of their lives. For example, these include healthcare apps that target changes in behaviour to prevent the impacts of health problems in ageing, or digital health services that connect remote and rural health services in poorly resourced communities and regions.



Countries that make an investment in consumer-facing digital health solutions are increasingly seeing the influence that consumers can have on clinical engagement in digital health.

#### Systems should be intuitive and not need training

Systems, if well designed, should not require extensive training, and that generic training in isolation of clinical workflows will not engage clinicians.

#### Change management requires substantial focus and investment

Change management requires substantial focus and investment from the outset and will be more effective if it is driven by clinicians and permeates through peer networks, and is tailored to the needs of individual clinical groups.

#### Change fatigue must be managed

Change fatigue is a barrier to engagement. If there is not a clear picture of the end goal and a mass of seemingly unrelated projects, then clinical engagement will be difficult. There needs to be a strategic goal that tackles local problem areas. This provides an incentive for health services and individual providers to become involved.

#### Do not set expectations too high

Do not set the expectations of clinicians too high; benefits take time to achieve and there will inevitably be issues that arise. If immediate improvements are expected and do not materialise, then even committed clinicians can become disengaged. Be realistic about what change must occur to see a clinical benefit and how long this may take.

#### Language must resonate with clinicians

It is difficult to engage clinicians by presenting them with technical specifications and using the language of project management. Communication must be clinical, not technical. This is a language that most clinicians can relate to and with which they can foster engagement. The role of health informaticians can also act as a bridge between IT and clinical staff. Informaticians have been found to have a positive impact on several implementations.

#### Importance of health informatics professionals

Investing in developing the workforce capacity of health informatics professionals is needed to ensure clinical engagement in digital health solutions is harnessed in clinical workflows and service delivery. Informatics professionals play a unique role in building confidence in using digital health tools to innovate and improve health services to consumers.



### Embedding learning about digital health technologies in clinical educational curricula

There needs to be an increased focus on embedding information about digital health in the curricula, especially in all clinical degrees. This approach will raise awareness about the use of digital health as a tool in patient care.

### Keeping pace with changes in clinical practice

To maintain a high level of clinical engagement, digital health systems need to be able to be maintained to keep pace with changes in clinical practice. Changes should not be focused on one solution, especially when the current global digital health ecosystem is diversifying with specific digital health services targeting health inequality among diverse population groups. Engagement does not stop at implementation; there needs to be a mechanism for ongoing input and refinement aligned with evolution of clinical processes and practices.

### It is important to understand the socio-technical challenges inherent in digital health initiatives”

It was clear from the research that most of the empirical studies on digital health implementation partially applied the social-technical framework. Sittig and Singh (2) propose a revised “socio-technical model” for the study of health information technology (HIT), such as electronic health records (EHR). It is an eight-dimensional model which brings together all of the relevant elements required to successfully implement any HIT initiative. Sittig and Singh note that “... the 8 dimensions are not independent, sequential, or hierarchical, but rather are interdependent and interrelated concepts similar to compositions of other complex adaptive systems,” and importantly, that the “... key to the model is how the eight dimensions interact and depend on one another.” Furthermore, Sittig et al. (3) suggest improving the safety of health information technology requires shared responsibility between developers and clinicians. Clearly, more research is needed to investigate the impacts of the socio-technical model on clinical engagement activities in digital health implementations.



## 7 RECOMMENDED NEXT STEPS

This report outlines a range of approaches to clinical engagement. It summarises the key factors that act as barriers to and enablers of clinical engagement in GDHP participant countries. A review of the literature and Delphi-like survey findings showed a high level of consistency in the themes that were raised. This includes a common understanding of the approaches that need to be taken to ensure that clinicians are engaged in digital health projects. The research also suggests clinical engagement is still often identified as a significant problem. While many articles documented the strategies used during implementation, there was limited commentary on whether the implementation was successful. Furthermore, there was limited discussion on whether there was ongoing positive reaction by clinicians using a digital health solution for improving patient care.

The literature review showed that there were diverse views about what clinical engagement actually means, and how successful engagement can be measured. There was a high level of consensus in the themes raised about the barriers to and enablers of effectively engaging clinicians. However, there was little evidence about why similar strategies work in some contexts and not in others. Clinical engagement strategies seemed to occur in various stages of a digital health project: from pre-implementation to adoption, and then to meaningful use. Indeed, there were no clear and decisive methods to improve engagement of clinicians. Particularly, there were no clear methods in managing the nature of clinical engagement to align with the changing focus of digital health projects moving from design to implementation, and then to meaningful use. Most of the literature described clinical engagement strategies relating to design and implementation; however, there was little mention of subsequent strategies to maintain clinical engagement to ensure meaningful adoption or increase maturity of use.

To address some of these issues, it is proposed that the next steps for the clinical engagement work stream could be to:

### Define the parameters for clinical engagement for the purposes of the work stream

Agree on the definition, scope, and purpose of clinical engagement. Define the focus of the work stream (problem definition, design and implementation, adoption and use, or the full continuum of engagement from initial concept to business as usual).

### Define basic principles for clinical engagement

Based on the evidence identified and the experience of GDHP participants, define the basic principles that should follow effective engagement with clinicians. The rationale for these principles should be clear to inform policy-makers of the critical aspects of clinical engagement in the implementation of digital health programs.

### Define the core competencies and organisational conditions for clinical engagement including a unified clinical governance framework for digital health

Identify any competencies or conditions that may support clinicians to engage more effectively in digital health. For example, consider factors such as a greater focus on digital health in educational curricula, skills in leadership, time away from clinical duties, feedback loops and processes to resolve issues rapidly, and governance structures that



give clinicians real decision-making authority. An example of clinical governance in digital health is the report by Wachter (62) that was published by the NHS in the United Kingdom. The report suggests a unified approach to clinical engagement in information technology underpinned by a clinical governance structure that can guide clinicians to provide effective and safe treatment for patients.

#### Develop an evaluation framework for clinical engagement

Development of a standard approach to evaluate the effectiveness of the different strategies that can be used to engage clinicians is suggested. While other frameworks exist (2), well-validated frameworks (such as the socio-technical model) will need to be applied appropriately, and evaluated rigorously to avoid the absence of clinical engagement activities. Additionally, it will also be necessary to identify the various contextual factors that impact the effectiveness of these strategies when implemented in different environments. This should include the development of a criterion to be used to measure what success in clinical engagement looks like.

#### Identify opportunities to leverage consumer demands for digital health

Several GDHP participants noted that clinicians can be more motivated to engage with digital health when there is a high level of consumer participation in digital health. This includes the expectation of consumers that the clinicians they consult will have a similar enthusiasm for and engagement with digital health. According to the survey findings, GDHP participants believe there is some value in considering the possible impacts of consumer-generated demand on digital health and how this can be leveraged to gain clinical engagement in digital health programs.

#### Undertake a similar research exercise to identify barriers to and enablers for consumer engagement

The focus of this review has been on clinical engagement. However, many of the observations about enablers and barriers are also relevant to the challenges of effective consumer engagement. There will be value in undertaking a similar research exercise to identify examples of best practice in consumer engagement in digital health.

#### Undertake a similar research exercise on consumer digital health literacy

A future focus, acknowledging engagement levers available to increase the quality and clinical adoption of digital health, should be consideration of how providing consumers' access to their health information can empower consumers and lead to better health outcomes. In light of this, gaining a greater understanding of how participant countries are working to improve digital health literacy amongst all consumers, particularly hard to reach groups is considered key.



## 8 APPENDIX A | DELPHI-LIKE ROUND 1 SURVEY

### Questionnaire 1

1. **What factors do you consider are barriers to the successful uptake of digital health implementations, specifically as they relate to the engagement of clinicians?**  
*(Factors might include workflow integration, system usability, clinical system functionality, patient and/or clinician experience, or patient safety. In your response could you include any resources or links to papers or websites that describe this?)*
2. **What factors do you consider are enablers to the successful uptake of digital health implementations, specifically as they relate to the engagement of clinicians, and what approaches you have employed that speak to these enablers?**  
*(Please share any report, paper or website link if relevant).*
3. **Do you have any other information that you'd like to share about clinician engagement, such as a report or publication, or what has made engagement successful or otherwise in your country?**

Please send your responses to: [GDHP@digitalhealth.gov.au](mailto:GDHP@digitalhealth.gov.au)



# 9 APPENDIX B | DELPHI-LIKE ROUND 2 QUESTIONNAIRE

## Questionnaire 2

### Purpose

Thank you for your participation in our questionnaire on governmental policies and initiatives of digital health for clinician engagement. These questions follow on from the findings of the first clinician engagement questionnaire that was conducted on the 25th of July 2018.

We now seek your response to a few questions relating to key areas of clinical engagement, so that we can determine important barriers and enablers to digital health.

This questionnaire should take approximately 5-10 minutes to complete. Please submit your responses by 7th of November 2018 to [gdhp@digitalhealth.gov.au](mailto:gdhp@digitalhealth.gov.au)

### Barriers

Please rate what you consider are important key BARRIERS of digital health for clinician engagement on a 5-point scale, where 1=not important, 2=slightly important, 3=moderate important, 4=important and 5=very important.

#### *Administration and Time Commitments Burden*

Not Important ▶  1  2  3  4  5 ◀ Very Important

Please provide a reason for your rating (box below):

#### *Poor Clinician Adoption of Digital Health Technology (Lack of Workflow Integration)*

Not Important ▶  1  2  3  4  5 ◀ Very Important

Please provide a reason for your rating (box below):

#### *Lack of Remuneration or Incentives*

Not Important ▶  1  2  3  4  5 ◀ Very Important

Please provide a reason for your rating (box below):



***Discomfort with Digital Health Technology***

Not Important ▶  1  2  3  4  5 ◀ Very Important

Please provide a reason for your rating (box below):

***Insufficient Training***

Not Important ▶  1  2  3  4  5 ◀ Very Important

Please provide a reason for your rating (box below):

***Trust of Data***

Not Important ▶  1  2  3  4  5 ◀ Very Important

Please provide a reason for your rating (box below):

***Communication of Benefits or Public Opinion***

Not Important ▶  1  2  3  4  5 ◀ Very Important

Please provide a reason for your rating (box below):

Please send your responses to [gdhp@digitalhealth.gov.au](mailto:gdhp@digitalhealth.gov.au) before 7 November 2018



# 10 APPENDIX C | SEARCH TERMS USED IN RAPID REVIEW

(\*) = wildcard

Clinical Engagement	Strategies	Digital Health
<ul style="list-style-type: none"><li>• Clinical + Engag*</li><li>• Clinical + Involve*</li><li>• Clinical + Interact*</li><li>• Clinical + Tak* part</li><li>• Clinical + Initiat*</li><li>• Clinical + Follow*</li><li>• Clinical + Introduc*</li><li>• Clinical + Conduc*</li><li>• Learning + Organisation</li></ul>	<ul style="list-style-type: none"><li>• Strateg*</li><li>• Polic*</li><li>• Intervention*</li><li>• Program*</li><li>• Regulation*</li></ul>	<ul style="list-style-type: none"><li>• Digital + Health*</li><li>• eHealth</li><li>• mHealth</li><li>• Health + Informat*</li><li>• Electronic + Health + Record*</li><li>• Personal + Health + Record*</li><li>• Clinical +Information + System*</li><li>• Clinical + Support + System*</li></ul>



# 11 APPENDIX D | RAPID REVIEW

## Co-design and co-production

### Impact of co-design and co-production

Ashraf et al. (20)	
<b>Title:</b>	Overview of a multi-stakeholder dialogue around shared services for health: the digital health opportunity in Bangladesh
<b>Setting:</b>	Shared services in health – The digital opportunity (Dhaka, Bangladesh)
<b>Purpose:</b>	Increase stakeholder engagement in policy-making and implementation of a national ICT or electronic or mobile health (eHealth or mHealth) strategy
	<b>Participants:</b> n = 43
<b>Study-design:</b>	Qualitative Descriptive Study
<b>Clinical engagement strategies:</b>	One-to-one stakeholder interviews to identify meeting agenda, facilitator training, MSD goal-setting sessions, small group brainstorming exercises for consensus building using sorted cards.
<b>Key findings:</b>	Key findings of MSD include identifying policies and initiatives, challenges of scaling up ICT in Bangladesh, and recommendations such as improved leadership, policy, improved quality and coverage of care, more meaningful engagement of all stakeholders, and government initiatives covering patient care, provider education and training, behaviour change interventions, and facility management applications. These include global changes that affect Bangladesh, such as collective accomplishments, infrastructure developments, health systems changes, and local programmes.

Raman et al. (21)	
<b>Title:</b>	Leveraging electronic health records for clinical research
<b>Setting:</b>	Leaders from academia, government, industry, and professional societies for leveraging EHR for Clinical Research (Washington DC, USA)
<b>Purpose:</b>	To identify the most pressing challenges facing the integration of EHR systems and data into clinical research
	<b>Participants:</b> 5 hospitals
<b>Study-design:</b>	Qualitative Descriptive Study



Clinical engagement strategies: Meeting proceedings

**Key findings:** Stakeholders identified several challenges facing clinician engagement. Learnings from clinicians about daily practice need to be shared to allow the development of feasible study protocols for clinician engagement. Site leadership is important for clinicians to feel supported. The use of pragmatic trials using EHR and using clinicians as the backbone of data collection methods can be beneficial. Non-financial incentives or certification programs are needed. Practical activities include introduction letter outlining benefits of participation, site visits to talk with frontline workers, training sessions, regular schedule of ongoing activities, and return visits to underperforming sites.

#### Doolan et al. (22)

**Title:** The use of computers for clinical care: A case series of advanced U.S. sites

**Setting:** Case studies of five hospitals, including inpatient, ambulatory and emergency units (USA)

**Purpose:** To describe advanced clinical information systems in the context in which they have been implemented and are being used.

**Participants:**  
5 hospitals

**Study-design:** Case Analysis Study

Clinical engagement strategies: Interviews, observations, and document analysis

**Key findings:** Formal and informal mechanisms to capture timely feedback from clinicians. All sites recruited respected clinicians from medical, nursing, and therapy backgrounds (with some informatics experience). Ownership by an expert physician or clinical group was important for an implementation. The authors found successful implementation required leadership and long-term commitment, a focus on improving clinical processes, and gaining clinician involvement and maintaining productivity.

#### Fraser et al. (23)

**Title:** Electronic health records as a tool for recruitment of participants' clinical effectiveness research: Lessons learned from tobacco cessation

**Setting:** Ten to twelve primary care or family practice clinics in south Wisconsin (USA)



<b>Purpose:</b>	To describe how one translational, smoking cessation clinical trial was conducted in primary care clinics, using EHRs as a recruitment and communication platform.	<b>Participants:</b> n = 1071
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Co-design (project planning and design)	
<b>Key findings:</b>	A high adherence to the EHR during the clinical trial (100-68.4% adherence). Lessons learned include flexible design process, awareness of health system IT work process, language and communication differences between IT team, adapting the EHR to work processes differently, privacy, better understanding of the clinical context, and clinical workflow problems. Researchers found incorporating EHR applications into research can significantly reduce patient recruitment time and cost. EHR as recruitment method provided a rare opportunity for efficient and replicable implementation of treatment procedures across health care settings.	

#### Gilbertson-White et al. (24)

<b>Title:</b>	Engaging stakeholders in the development of an eHealth intervention for cancer symptom management for rural residents	
<b>Setting:</b>	Three settings: a rural medical oncology clinic, a rural radiation oncology clinic, and a tertiary care medical centre with a large referral base from rural areas (USA).	
<b>Purpose:</b>	The purpose of this study was to engage stakeholders about the needs and opinions regarding symptom management concerns for patients with advanced cancer living in a rural area.	<b>Participants:</b> n = 10 (clinicians)
<b>Study-design:</b>	Mixed Method Study	
<b>Clinical engagement strategies:</b>	Mixed-methods design. A semi-structured interview protocol with open-ended questions (phase 1), interviews and focus groups with stakeholders for developing a web application (phase 2), usability surveys (phase 3).	
<b>Key findings:</b>	Patients and clinical staff (n = 26) participated in phase 1. Three major themes were identified. They were “symptom experience”, “symptom management”, and “technology”. Usability testing with 126 stakeholders demonstrated that the web application was easy to use, contains important content, and contained pleasing graphics. There were no differences found among patients, family/friends, and staff. Both frequent and infrequent internet users of the web application showed positive feedback.	



## Early stakeholder engagement and consultation

### Haynes and Kim (32)

<b>Title:</b>	A mobile care coordination system for the management of complex chronic disease	
<b>Setting:</b>	Health care for cardiovascular disease include patients, family caregivers, nurse care coordinators, advanced practice nurses, a cardiac rehabilitation specialist, a cardiologist, and a primary care physician (USA).	
<b>Purpose:</b>	The study used principles of stakeholder engagement and user-centred design to develop a mobile application for person-centred care coordination for cardiovascular disease.	<b>Participants:</b> n = 25
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Interviews	
<b>Key findings:</b>	The study explores potential limitations to adoption of the technology: technology literacy, health literacy, privacy concerns and patient trust, no or intermittent connectivity, no access to a care coordinator or provider assisting with the creation of shared goals or a long-term care plan or multiple coordinators representing health system or payer. Meaningful stakeholder engagement will help to create a compelling and person-centred system that can improve health, decrease costs, and enhance patient accountability and autonomy.	

### Glynn et al. (28)

<b>Title:</b>	Implementation of the SMART MOVE intervention in primary care: a qualitative study using normalisation process theory	
<b>Setting:</b>	General practices as part of Clare Primary Care Network within the Western Research and Education Network (WestREN) (Ireland)	
<b>Purpose:</b>	The aim of this qualitative evaluation of the SMART MOVE trial was to conduct a theoretically informed analysis, using normalisation process theory, of the potential barriers and levers to the implementation of an mhealth intervention to promote physical activity in primary care.	<b>Participants:</b> n = 14 (clinicians)
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Focus groups	



**Key findings:** Four themes emerged from the analysis: personal and professional exercise strategies; roles and responsibilities to support active engagement; utilisation challenges; and evaluation, adoption and adherence. It was found the new intervention needed a comprehensive evaluation of the intervention itself, and also the environment in which it is to operate. Despite the obstacles found by the authors, the study showed the intervention had strong usability attributes for both the researchers and target users. It coheres strongly with the core objectives and culture of the health care environment in which it is to operate.

### Janssen et al. (29)

<b>Title:</b>	The Sydney West knowledge portal: Evaluating the growth of a knowledge portal to support translational research	
<b>Setting:</b>	Sydney West Translational Cancer Research Centre (SW-TCRC) is a network of cancer care professionals and researchers (Western Sydney, New South Wales, Australia)	
<b>Purpose:</b>	To measure the design and growth of a web-based knowledge portal for increasing individual awareness of translational research and to build organisational capacity for the delivery of translational research projects in cancer.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	An adaptive design method involving stakeholder consultation.	
<b>Key findings:</b>	Knowledge portal membership grew consistently for the first 18 months. Analysis of site metrics revealed members were most likely to visit portal pages. This was followed by pages that disseminated educational material. Overall, the researchers found the study's data to support knowledge portals which may be beneficial tools for translating new evidence and fostering an environment of communication and collaboration.	

### Mercer et al. (30)

<b>Title:</b>	Using a collaborative research approach to develop an interdisciplinary research agenda for the study of mobile health interventions for older adults
<b>Setting:</b>	System designers, healthcare providers for older adults, mobile technology professionals and disease-specific advocacy organisations.



<b>Purpose:</b>	This paper shares experiences using an NGT with interdisciplinary researchers and healthcare stakeholders to develop an interdisciplinary research agenda for mHealth	<b>Participants:</b> n = 32
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Rapid-style presentations, group discussions, and Nominal Group Technique (NGT)	
<b>Key findings:</b>	Overall, the collaborative approach was a very successful strategy to bring together a diverse group of participants with the same end goal. Specifically, 32 participants generated 119 items in total. The top questions related to; 1) adoption, 2) need for high-quality tools, and 3) digital divide. Strong sub-themes included privacy and security, engagement and design. The NGT also helped bring perspectives from non-academic researchers that would not have been captured if the process had been limited to the academic teams.	

**Whitehouse et al. (31)**

<b>Title:</b>	Co-creation with TickIT: Designing and evaluating a clinical eHealth platform for youth	
<b>Setting:</b>	Two teaching hospitals (Canada)	
<b>Purpose:</b>	Report findings from an eHealth initiative undertaken to improve uptake of psychosocial screening among youth	<b>Participants:</b> n = 6
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Open-ended interviews about application development, and group sessions with physicians, nurses, social worker, and developmental psychologist	
<b>Key findings:</b>	The independent pilot feasibility study included 80 adolescents, 12-18 years, and 38 medical staff- residents, inpatient and outpatient paediatricians, and surgeons. Youth uptake was 99% (79/80), and survey completion 99% (78/79; 90 questions). Youth found it easy to understand (92%, 72/78), easy to use (92%, 72/78), and efficient (80%, 63/79 with completion rate < 10 minutes). Overall, the research found the co-creative method with stakeholders was effective for informing the design and development processes to leverage effective opportunities. It was also found continuing stakeholder engagement fostered platform development which met system goals.	



### Goodyear-Smith et al. (27)

<b>Title:</b>	Screening for risky behaviour and mental health in young people: the YouthCHAT programme	
<b>Setting:</b>	Mental health workers and representatives from Maori indigenous population (New Zealand)	
<b>Purpose:</b>	This article outlines the development, utilisation and ongoing evaluation and implementation strategies for YouthCHAT.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Design	
<b>Clinical engagement strategies:</b>	Co-design participatory research approach	
<b>Key findings:</b>	The early detection of concerns and facilitation of evidence-based interventions has the potential to lead to improved health outcomes, particularly for under-served indigenous populations. The article demonstrated the development and utilisation and ongoing implementation strategies for screening tool on a small scale. The researchers are aiming to scale up the implementation, using a co-design participatory research approach to evaluate the acceptability and feasibility with the rollout to clinics.	

### Kim and Driver (26)

<b>Title:</b>	Teleophthalmology for First Nations clients at risk of diabetic retinopathy: A mixed methods evaluation	
<b>Setting:</b>	First Nations (aboriginal Canadians) community members and health workers (Canada)	
<b>Purpose:</b>	To develop, implement, and evaluate a service delivery model for teleophthalmology screening and follow-up for at-risk and diabetic First Nations clients.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Design	
<b>Clinical engagement strategies:</b>	Co-design participatory research approach	



**Key findings:** All 51 First Nations communities on Vancouver Island expressed interest in receiving teleophthalmology services. During the 1-year project, teleophthalmology clinics were held in 43 of 51 communities on Vancouver Island. During these clinics, 524 clients were screened and 140 of those clients were referred to a general ophthalmologist, family doctor, retinal specialist, optometrist, or other provider. Ratings of teleophthalmology system quality, information quality, service quality, and system usage were positive. Satisfaction with the teleophthalmology project was high among clinicians involved with the project. Satisfaction was also high among health providers in First Nations communities, with clinic scheduling identified as a potential area of improvement moving forward.

**Yip et al. editors (25)**

<b>Title:</b>	Stakeholder engagement in early stage product-service system development for healthcare informatics	
<b>Setting:</b>	Health information and communication technology product-service system development (United States)	
<b>Purpose:</b>	This paper focuses on discussing the findings from four case studies on stakeholder engagement in new health information and communication technology product-service system development.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Design	
<b>Clinical engagement strategies:</b>	Co-design participatory research approach	
<b>Key findings:</b>	Along with the proposition of a four-level framework to guide stakeholder identification for new product-service system development, three stakeholder engagement propositions that are based on the degree of connectivity are developed. The authors found two types of connectivity; 1) data and 2) process. It can be characterised by how much the new system is connected with the environment. Depending on the connection with the environment, the stakeholder engagement needs in early stage development varies.	



**Woods et al. (33)**

<b>Title:</b>	Partnering in digital health design: Engaging the multidisciplinary team in a needs analysis	
<b>Setting:</b>	An acute hospital campus comprising a public hospital, private hospital and outpatient clinic (Australia)	
<b>Purpose:</b>	To define the features to perceivably support self-management and the clinical requirements in preparation for implementation of a mHealth application for heart failure as an adjunct to existing multidisciplinary care.	<b>Participants:</b> n = 6
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	“Rose, Thorn, Bud” interviews from Design Thinking, and brainstorming sessions with post-it notes	
<b>Key findings:</b>	Six sixty-minute interviews and one email exchange with seven clinicians produced 154 data points in total; 97 relating to self-management support and 57 to clinical relevance. Analysis of these data points resulted in design implications articulated in a design brief for use in subsequent co-design workshops. Technique appears to be useful for this stakeholder group although concerns of adequately representing complexity emerged. This method was considered inadequately comprehensive for use in the needs analysis with stakeholders. The authors encourage further research evaluating in-hospital processes for co-designed health technologies.	

**Lee (34)**

<b>Title:</b>	A service design thinking approach for stakeholder-centred eHealth	
<b>Setting:</b>	eHealth service design workshops – researchers, managers, developers, interaction designers, nurses, medical doctors, psychologist, clinical advisor, technical advisor, and health secretaries (Norway)	
<b>Purpose:</b>	To evaluate a message exchange module in an electronic health record (EHR) system and to gather ideas for future improvement.	<b>Participants:</b> n =
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Three service design workshops – presentations, service journey modelling language (SJML), usability testing, focus group, and visualisations	



**Key findings:** Involving different types of service customers during design process of eHealth services is essential to encourage the service customers to identify problems with the current service and to facilitate suggestions for service improvement from the service customers' point of view. Including secondary service workers in design process of eHealth services is needed, because they interact with service customers indirectly, thus participating in the service process. The visualisation techniques include service blueprint, storyboard, and customer journey map, while the prototyping techniques include desktop walkthrough and role-play. Desktop walkthrough and role-play often require workshop settings and documenting of the results can therefore be challenging. Service blueprint does not seem to provide formats where the relationships between actors can be presented clearly. Even though both storyboard and customer journey map seem better for describing the full scale of service processes, storyboard might be time-consuming to illustrate all the detailed situations in a sequence.

### Lupton (35)

<b>Title:</b>	Digital health now and in the future: Findings from a participatory design stakeholder workshop	
<b>Setting:</b>	Digital health stakeholder workshop was held (Canberra, Australia)	
<b>Purpose:</b>	To address two key questions: 1) What is currently working and not working in digital health? and 2) Where should digital health go in the future?	<b>Participants:</b> n = 25
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Participatory design activities – video recordings as data collection tool	
<b>Key findings:</b>	Participants of some social groups are currently excluded from full participation in the digital health ecosystem. Mechanisms for facilitating further consultation between the various stakeholders involved in digital health, including patients and carers, need to be established. The rights and responsibilities of the different stakeholders involved in connected digital health also need to be better identified and highlighted. At the same time, personal data privacy and security need protection.	



## Resource-intensity of clinician engagement

### Herndon et al. (38)

<b>Title:</b>	Digital health now and in the future: Findings from a participatory design stakeholder workshop	
<b>Setting:</b>	Digital health stakeholder workshop was held (Canberra, Australia)	
<b>Purpose:</b>	To address two key questions: 1) What is currently working and not working in digital health? and 2) Where should digital health go in the future?	<b>Participants:</b> n = 25
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Participatory design activities – video recordings as data collection tool	
<b>Key findings:</b>	Participants of some social groups are currently excluded from full participation in the digital health ecosystem. Mechanisms for facilitating further consultation between the various stakeholders involved in digital health, including patients and carers, need to be established. The rights and responsibilities of the different stakeholders involved in connected digital health also need to be better identified and highlighted. At the same time, personal data privacy and security need protection.	

### Konduri et al. (37)

<b>Title:</b>	Digital health technologies to support access to medicines and pharmaceutical services in the achievement of sustainable development goals	
<b>Setting:</b>	Implementation of digital health technologies for five selected case studies in Asia, Francophone Africa, East Africa, Lusophone Africa, and Southern Africa (Bangladesh, Mali, Uganda, Mozambique, and Namibia)	
<b>Purpose:</b>	The study aimed to describe the conceptual and implementation approach of selected digital health technologies in various resource-constrained countries.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Process mapping and requirements, process optimisation, infrastructure strengthening, beta testing, user acceptance testing, and training and support.	



**Key findings:** The level of engagement with users and stakeholders was resource-intensive and required an iterative process to ensure successful implementation. Ensuring user acceptance, ownership, and a culture of data use for decision-making takes time and effort to build human resource capacity. The authors suggest the next stage of research should examine ways to triangulate data from patients, commodities, geomapping, and other parameters of the pharmaceutical system. Country and regional-level dashboards should be developed to detect early warning system to mitigate stock-outs and wastage of medicines and commodities.

**Moucheraud et al. (36)**

<b>Title:</b>	Sustainability of health information systems: a three-country qualitative study in southern Africa	
<b>Setting:</b>	Electronic Health Information Systems (EHIS) implementation in three countries originally supported by the United States President’s Emergency Plan for AIDS Relief (PEPFAR) (Malawi, Zambia, and Zimbabwe)	
<b>Purpose:</b>	This study uses a sustainability framework to inform a case study about the potential sustainability of electronic health information systems.	<b>Participants:</b> n = 58
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Semi-structured Interviews	
<b>Key findings:</b>	Three main factors were identified: program/project -specific factors; organisational factors; and contextual factors. The study found full stakeholder engagement is likely to be crucial for sustainability, as well as integration with other activities within the health system and those funded by development partners. Additionally, technical resource constraints may limit the digital health system sustainability. The authors emphasised time and attention are likely to enhance long-term outcomes.	



**Training and clinical leadership**

**Paina et al. (39)**

<b>Title:</b>	Using Theories of Change to inform implementation of health systems research and innovation: Experiences of Future Health Systems consortium partners in Bangladesh, India and Uganda	
<b>Setting:</b>	Future Health Systems Research Programme Consortium (Bangladesh, India, and Uganda)	
<b>Purpose:</b>	Reflect on the experiences and shed light on outstanding debates about Theories of Change (ToC) tool in technology and health care.	<b>Participants:</b> 3 teams
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Reflective group meetings	
<b>Key findings:</b>	Participating groups found reflective group meetings on ToC provided stakeholders an opportunity to critically reflect on context and programmes, to re-evaluate assumptions of programs, to facilitate internal and cross-team communication, and to improve organisational learnings. Case examples included Bangladesh, India, and Uganda. The group meetings fostered channels for both internal and external communication among members and with key stakeholders. This process challenged the initial assumptions based on the new evidence and experience whereby improving accountability purposes.	

**Ghany and Keshavjee (42)**

<b>Title:</b>	A platform to collect structured data from multiple EMRs.	
<b>Setting:</b>	Stakeholders represented nine key categories, including: healthcare providers, patients, researchers and academics, the Ontario Ministry of Health, eHealth Ontario, OntarioMD, EMR vendors, the Privacy Commissioner’s Office, guideline implementers, and non-governmental organisations and association (Canada)	
<b>Purpose:</b>	The objective was to design a scalable platform for capturing structured, evidence-based data from all EMRs across Canada for research and other purposes.	<b>Participants:</b> n = 90
<b>Study-design:</b>	Case Analysis Study	



Clinical engagement strategies: Electronic guidelines

**Key findings:** After incorporating the feedback of all stakeholders, the authors developed the design for a scalable platform for capturing structured, evidence-based data from all EMRs in Canada for research, health system management, clinical decision support and other purposes. The publication discusses the design specification for the proposed solution and explains how, using clinical forms, not only structured, high-quality data from multiple EMRs can be captured, but also real-time guideline advice can be provided to providers at the point of care. The scalability of this proposed solution across multiple diseases and multiple EMRs is also explained. The authors further discuss the benefits and limitations of this proposed solution to several key stakeholder groups and address issues of privacy and security.

#### Blumenthal et al. (41)

**Title:** Addressing inpatient beta-lactam allergies: A multi-hospital implementation

**Setting:** Five hospitals within a single healthcare system (Boston, USA)

**Purpose:** To identify key principles in designing guidelines and understand the lesson learned from implementing computerised guidelines for allergies.

**Participants:**  
3 hospitals

**Study-design:** Case Analysis Study

**Clinical engagement strategies:** Multi-stakeholder teams including executive sponsor (i.e., hospital leadership), allergy/immunology clinical lead, infectious disease clinical lead, pharmacy lead, nursing lead, and data analyst. Computerised support through EHR and multi-pronged education campaign were developed.

**Key findings:** Improvement of the system was completed incrementally through subsequent refinements. The integrated EHR approach allowed process to be measured (such as website usage and traffic). Recommendations include a single monthly reporting dashboard for hospital staff. Monthly conference calls by clinical leads (i.e. “clinical champion”) between sites allow for sharing of ideas, challenges and best practices.



## Change management

### Takian (63)

**Title:** Envisioning electronic health record systems as change management: The experience of an English hospital joining the National Programme for Information Technology

**Setting:** Nationwide implementation of integrated EHR systems in hospitals was at the heart of the National Programme for Information Technology (England, United Kingdom).

**Purpose:** This paper reports the arrival, implementation process, and stakeholders' experiences of one EHR software (Millennium) at an NHS general hospital.

**Participants:**  
N/A

**Study-design:** Case Analysis Study

**Clinical engagement strategies:** Semi-structured interviews.

**Key findings:** The system seized the opportunity to transform clinical behaviours and improve work practices. Project managers described the implementation of the EHRs as a change management process. Implementation must be an unfolding change management process. Lastly, four early benefits were realised during the implementation: online order communication; real-time patient follow-ups; improving patient workflows; and ability to book outpatient clinics and send discharge summaries to general practice electronically.

### Sobel et al. (43)

**Title:** Adaptation of a published risk model to point-of-care clinical decision support tailored to local workflow

**Setting:** Multiple medical centres in Kaiser Permanente (KP) Northern California (United States)

**Purpose:** The study describes the ad hoc social and technical collaboration needed to build and deploy the tool. The tool complements a clinical initiative within a community of practice, and is correlated with appropriate use of nuclear imaging.

**Participants:**  
N/A

**Study-design:** Case Analysis Study

**Clinical engagement strategies:** Clinical leads



**Key findings:** The authors recreated the model and integrated it into their workflow, accessing it from their EHR with patient-specific data and facilitating clinical documentation if the user accepted the model results. Clinical leaders championed the change and led educational dissemination efforts. The authors describe the ad hoc social and technical collaboration needed to build and deploy the tool. The tool complements a clinical initiative within a community of practice, and is correlated with appropriate use of nuclear imaging.

#### Turner (47)

<b>Title:</b>	Use of mobile devices in community health care: barriers and solutions to implementation	
<b>Setting:</b>	National Health System (NHS) Trust (United States)	
<b>Purpose:</b>	Describing the productivity, efficiency and clinical staff benefits to patient care using mobile devices.	<b>Participants:</b> N/A
<b>Study-design:</b>	Descriptive Study	
<b>Clinical engagement strategies:</b>	Training needs and clinical engagement	
<b>Key findings:</b>	Clinical engagement with frontline staff is essential to ensure the staff feel valued, listened to, and fully involved to ensure any change to existing practice is successful. Moreover, the training needs of the workforce require careful consideration. There was variable interest in mobile devices among clinical staff indicating that benefits may need to be communicated more.	

#### Weeks, editor (46)

<b>Title:</b>	The successful implementation of an enterprise content management system within the South African healthcare services sector	
<b>Setting:</b>	Implementation of an enterprise content management (ECM) system at the Khayelitsha Hospital in the Western Cape (South Africa)	
<b>Purpose:</b>	The research study was directed at determining the factors that contributed to the successful implementation of an ECM system.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Training needs and clinical engagement	



**Key findings:** In consultation with clinical staff, all standard forms were barcoded to facilitate the labelling and indexing of content. Training of medical practitioners in the use of the system is greatly enhanced from a time perspective. An important finding was that the ability to integrate a traditional health care culture of paper-based clinical records with an electronic medical record system was one of the key determinates that gave rise to the successful deployment of the system for the Khayelitsha Hospital in the Western Cape, South Africa.

#### Hostgaard et al. (45)

<b>Title:</b>	How are clinicians involved in EHR planning? A process analysis case study of a region in Denmark	
<b>Setting:</b>	National EHR implementation (Denmark)	
<b>Purpose:</b>	The purpose was to study “Why are not all Danish physicians overjoyed by the introduction of EHR?”	<b>Participants:</b> N/A
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Local clinician involvement	
<b>Key findings:</b>	The EHR project management's strategy meant that there was no workload reduction. This was seen as one of the main barriers for the physicians to achieve real influence. History shows that clinicians on the one hand and administrators on the other have different perceptions of the purpose of the patient record and that they both have struggled to influence this definition. To date, the administrators have won the battle. This was the major reason for the approach chosen for the EHR planning process in North Jutland, Denmark. It explains the conditions made available for the physicians, which led to their role being reduced to clinical consultants rather than real participants.	

#### Protti (44)

<b>Title:</b>	Local clinician involvement in clinical information systems: luxury or necessity? – a review of two international experiences	
<b>Setting:</b>	National EHR implementation (Denmark and New Zealand)	
<b>Purpose:</b>	This article investigates lessons to be learned about clinician involvement from successful centrally directed nationwide (vs national) rollouts from Denmark and New Zealand	<b>Participants:</b> N/A
<b>Study-design:</b>	Qualitative Descriptive Study	



Clinical engagement strategies: Local clinician involvement

Key findings: Similarities and differences were found across Denmark and New Zealand.

### Peer networks and support

#### Pearce et al. (10)

**Title:** Effectiveness of local support for the adoption of a national programme – a descriptive study

**Setting:** The Inner East Melbourne Medicare Local (IEMML) is situated in the metropolitan east of Melbourne, servicing 174 member practices across a catchment of 620,000 people (Australia).

**Purpose:** This study describes the processes undertaken and the experiences of introducing the Personally Controlled Health Record (PCEHR) into 74 general practices in specific areas of Melbourne.

**Participants:** n = 84

**Study-design:** Qualitative Descriptive Study

Clinical engagement strategies: Survey

**Key findings:** Eighty-four staff from 74 practices responded to the survey (82% response rate). Main factors for practices to engage with eHealth were leadership provided by Medicare Locals. Specific factors include: practise strong existing relationship with Medicare Locals; access to financial incentives for participation; a desire to see their practices be early adopters; and leadership by interested individual GPs within their practices. Outstanding barriers include inadequate patient and broader community engagement, time required for doctors to use the national health record, and inadequate remuneration for time devoted to use the national health record system.



### Detwiller and Petillion (14)

<b>Title:</b>	Change management and clinical engagement: critical elements for a successful clinical information system implementation	
<b>Setting:</b>	Four-year initiative that moved Interior Health (IH) from multiple, inconsistent databases to a single database that incorporates evidence-based standards, improves patient safety, is user-friendly, and supports clinical workflow (British Columbia, Canada).	
<b>Purpose:</b>	The focus of this article was to outline the strategies and methodologies used and the lessons learned.	<b>Participants:</b> N/A
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Change Acceleration Process is GE's proprietary framework for actively preparing for, leading, managing, and participating in change.	
<b>Key findings:</b>	Effective strategies for change include; leading change or sponsor and champions, creating a shared need, shaping a vision, mobilising commitments, making change last, monitoring progress, and changing systems and structures. Standard data collection and measurements were used. Lessons learned included ensuring vision for the initiative is attainable, taking time to develop standards across large health authority, difficult to free up clinical staff time, identify right people to be involved, strong facilitation and coordination skills, understanding the difficulties to standardise systems, understand how technical functionality affects standards, and leadership/management support is essential.	

### Kowal et al. (49)

<b>Title:</b>	A high-performance team delivering a state-wide Intensive Care Clinical Information System (ICCIS) for NSW	
<b>Setting:</b>	Agency for Clinical Innovation (ACI) Intensive Care Services Network, eHealth ICCIS Program Team and iMDsoft (Sydney, Australia)	
<b>Purpose:</b>	The ACI ICCIS Working Group was established in 2013 to provide clinical leadership for the project and production phases.	<b>Participants:</b> N/A
<b>Study-design:</b>	Mixed Method Study	
<b>Clinical engagement strategies:</b>	Agile Project Management model – a proactive communications and engagement plan	
<b>Key findings:</b>	Clinician engagement has increased throughout the ICCIS Program with a 400% increase in active voluntary clinician participation from the initial clinical evaluation group (n= 18) to the establishment of the ACI ICCIS Working Group and specialty subgroups (n= 70) in the design and build phase. Effective engagement with the broader ICU	



community through proactive communications was demonstrated by an increase in viewer hits from 400 in 12 months (2013 first video release) to 480 in two weeks with the second video release in 2014. The success of the ICCIS Program’s clinical leadership and engagement demonstrates the impact of a high-performance collaborative team. The success of the ICCIS Program is contingent on active engagement of intensive care clinicians to deliver ICCIS on behalf of clinicians for the benefit of patient care and clinician satisfaction

**Fanta et al. editors (50)**

<b>Title:</b>	Organisational dynamics of sustainable eHealth implementation: A case study of eHMIS	
<b>Setting:</b>	Implementation of electronic Health Management Information System (eHMIS) (Ethiopia)	
<b>Purpose:</b>	This study presents the research methodology, theoretical background of organisational and technological factors of eHealth implementation, dynamics of techno-organisational elements, conceptual framework, and organisational dynamics of an eHealth implementation.	<b>Participants:</b> N/A
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Focus groups, and semi-structured open-ended questionnaire	
<b>Key findings:</b>	Organisational factors of eHealth implementation include; organisational outcome on use (improving intention to use), management support on use (providing sound management support), change management on use (include providing training and assessing user satisfaction), and rejected users on culture.	

Communication of benefits or public opinion

**Millonig (51)**

<b>Title:</b>	Mapping the route to medication therapy management documentation and billing standardisation and interoperability within the health care system: meeting proceedings
<b>Setting:</b>	The American Pharmacists Association (APhA) conference (Maryland, USA)



<b>Purpose:</b>	To convene a diverse group of stakeholders to discuss medication therapy management (MTM) documentation and billing standardisation and its interoperability within the healthcare system	<b>Participants:</b> n = 70
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Presentations on health information technology trends, perspectives, health care quality, workflows in EHRs, and current practices, Q&A sessions, and group discussions.	
<b>Key findings:</b>	Participants viewed the meeting as highly successful in bringing together a unique, wide-ranging set of stakeholders, including the government, regulators, standards organisations, other health professions, technology firms, professional organisations, and practitioners, to share perspectives. They strongly encouraged the APhA to continue this unique stakeholder dialogue.	

**Sheehan et al. (53)**

<b>Title:</b>	Informing the design of clinical decision support services for evaluation of children with minor blunt head trauma in the emergency department: A sociotechnical analysis	
<b>Setting:</b>	Eleven sites participating in the study were part of either the Paediatric Emergency Care Applied Research Network (PECARN) or the Clinical Research in Emergency Services and Treatments (CREST) network. Sites were academic hospitals and community hospitals (Northern California, USA).	
<b>Purpose:</b>	The objective of this study was to describe the sociotechnical environment in the ED setting to inform the design of a clinical decision support system.	<b>Participants:</b> n = 11 (clinical sites)
<b>Study-design:</b>	Mixed Method Study	
<b>Clinical engagement strategies:</b>	Workflow observation, focus groups, and interviews	
<b>Key findings:</b>	Three sociotechnical dimensions identified with associated Clinical Support Decision System design implications. These include organisational factors such as using flowsheets, mobile tools and development tools. Human factors dimensions include data validation alerts, risk information, and pop-up alerts. The article emphasises “documentation” was important for workflow and communication. For instance, obtaining minimal documentation up front, support inter-disciplinary data sharing, support shared decision-making, using current summary screens, support new views, and tailor documentation and system to patient/caregiver needs.	



## Visualisation as a communication tool

### Brailsford et al. editors (54)

Title:	Stakeholder engagement in health care simulation	
Setting:	Policy, strategic, and operation stakeholders in NHS (United Kingdom)	
Purpose:	To develop a methodology for more effective stakeholder engagement with simulation modelling.	<b>Participants:</b> N/A
Study-design:	Descriptive Study	
Clinical engagement strategies:	Healthcare simulation (i.e. pictures, diagrams, maps and flow charts)	
Key findings:	Basic guidelines to assist modellers were outlined; 1) before the meeting identify local champion who might be able to recruit others who might be definitive stakeholders, 2) use modelling tools that match up with the problems that the stakeholders appear to have, 3) drawing picture, diagrams, maps and flowcharts to assist in seeking clarification, and 4) work in smaller groups to work better than on large one (perhaps no more than six people in each group).	

### Brailsford et al. editors (54)

Title:	Stakeholder engagement in health care simulation	
Setting:	Policy, strategic, and operation stakeholders in NHS (United Kingdom)	
Purpose:	To develop a methodology for more effective stakeholder engagement with simulation modelling.	<b>Participants:</b> N/A
Study-design:	Descriptive Study	
Clinical engagement strategies:	Healthcare simulation (i.e. pictures, diagrams, maps and flow charts)	
Key findings:	Basic guidelines to assist modellers were outlined; 1) before the meeting identify local champion who might be able to recruit others who might be definitive stakeholders, 2) use modelling tools that match up with the problems that the stakeholders appear to have, 3) drawing picture, diagrams, maps and flowcharts to assist in seeking clarification, and 4) work in smaller groups to work better than on large one (perhaps no more than six people in each group).	



### Jenkins and Wilson (55)

<b>Title:</b>	The challenge of electronic health records (EHRs) design and implementation: responses of health workers to drawing a “big and rich picture” of a future EHR programme using animated tools	
<b>Setting:</b>	The Durham and Darlington EHR (DuDEHR) project (United Kingdom)	
<b>Purpose:</b>	To investigate the use of animation tools to aid visualisation of problems for discussion within focus groups, in the context of healthcare workers discussing EHRs.	<b>Participants:</b> n = 10
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Focus groups, and visualisation tools	
<b>Key findings:</b>	The animator facilitated discussion about EHR issues and these were thematically coded as: workload; sharing information; access to information; record content; confidentiality; patient consent; and implementation. The animator provided a visual “probe” to support a more proactive and discursive localised approach to end-user concerns. This could be part of an effective stakeholder engagement and communication strategy for EHR or health informatics implementation programmes. The findings raised salient issues and concerns related to implementation.	

### Curry and Prodan (56)

<b>Title:</b>	Using visual tools to improve clinical engagement and group understanding of complex IT concepts	
<b>Setting:</b>	Unknown (Australia)	
<b>Purpose:</b>	Paper relates to the improved use of chemotherapy unit resources.	<b>Participants:</b> N/A
<b>Study-design:</b>	Descriptive Study	
<b>Clinical engagement strategies:</b>	Visual tools	
<b>Key findings:</b>	Clinical staff involved in the development of these visual models demonstrated significant levels of engagement and group understanding of the complete service delivery cycle and the impact of required improvements. The outcomes presented in this paper strongly suggest that engagement and group understanding of complex IT concepts (computer simulation in this instance) can be significantly improved through the deliberate and sustained use of tools that produce highly visual outputs.	



### Hayward-Giles and Millar (52)

<b>Title:</b>	UK approach to developing SNOMED CT subsets for physiotherapists to use as part of the electronic health record	
<b>Setting:</b>	National Health Service (England)	
<b>Purpose:</b>	A national UK body for physiotherapy has undertaken work to produce a methodology for developing SNOMED CT subsets, based on two pilot areas, demonstrating that it is possible to undertake the development in a timely manner, at realistic cost, with strong clinical engagement, and reproducibility for subsequent implementation in other clinical areas.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Stakeholder consultation with physiotherapists.	
<b>Key findings:</b>	The process has been valuable in engaging physiotherapists in discussion about the benefits of standardised terminology and electronic health records and their active participation, rather than leaving vendors of electronic systems to define professional requirements. Additionally, by leading the work on behalf of the profession, the CSP has been able to provide a foundation which can be built on further locally. Implications: The pilot process can be applied to a variety of clinical specialties. The process itself engages clinicians in active discussions about how they record the care they provide, so widespread use of SNOMED CT will have secondary implications such as enabling service to benchmark themselves using standardised terms.	

### Payment models or incentives

### Strachan et al. (57)

<b>Title:</b>	Interventions to improve motivation and retention of community health workers delivering integrated Community Case Management (iCCM): Stakeholder perceptions and priorities
<b>Setting:</b>	Recruited stakeholders were academics and non-governmental organisation (NGO) workers (Europe, North and South America, Africa, and Central Asia).



Purpose:	The aim was to establish an overview of intervention ideas and approaches that community health workers felt had the potential for impact.	<b>Participants:</b> n = 15
Study-design:	Qualitative Descriptive Study	
Clinical engagement strategies:	Semi-structured interviews	
Key findings:	Interventions included cross-cutting approaches aimed at increasing motivation and retention, recruitment strategies, training certification and pathways, supervision, and a range of financial and non-financial incentives. Non-financial incentives should aim to promote credibility and status of the community workers. Community consultation with health workers is recommended as the first step to be conducted to identify appropriateness, motivations, and feasibility of sustain funding. Non-financial incentives include creating professional pathways and skills development through visits, providing health workers with tools to perform the job with a particular emphasis on ensuring a reliable supply of drugs, reimbursing expenses and travel costs, supplying mobile phones and airtime in lieu of a salary, and possible food and commodities as incentives for meeting attendance, taking the lead in establishing performance incentives, and promoting success, and maintain their supplies. Incentives should target two types of motivations of health workers: (1) expectancy and (2) equality.	

### Best practice in digital health technologies

#### Hamilton (59)

Title:	The WHO-ITU National eHealth Strategy Toolkit as an Effective Approach to National Strategy Development and Implementation	
Setting:	World Health Organisation (Europe, Denmark)	
Purpose:	The development of World Health Organisation-International Telecommunication Union (WHO-ITU) National eHealth Strategy Toolkit	<b>Participants:</b> N/A
Study-design:	Descriptive Study	
Clinical engagement strategies:	Toolkit	



**Key findings:** A toolkit based on national context of a country perception of the “established ICT environment” and the “enabling environment for eHealth”. The national eHealth strategy toolkit provided a pragmatic framework by addressing the strategy development process. The toolkit illustrated the vision of the eHealth components of a country. The toolkit allowed the proposal of an action plan and recommendations to execute the vision. Lastly, the toolkit outlined national approach to monitoring and evaluating outcomes of national eHealth programs.

### L'Engle, Plourde (58)

<b>Title:</b>	Evidence-based adaptation and scale-up of a mobile phone health information service	
<b>Setting:</b>	The Mobile for Reproductive Health (m4RH) provides a case study of multiple aspects of scale-up: (I) vertical integration in Tanzania, (II) horizontal scale-up in Rwanda, Uganda, and Tanzania, and (III) global scale-up. (Rwanda, Uganda, and Tanzania)	
<b>Purpose:</b>	The scale up and adaptation of an evidence-based mHealth intervention.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Stakeholder engagement; ongoing monitoring, evaluation, and research including extensive content and usability testing with the target audience; strategic dissemination of results; and use of marketing and sustainability principles for social initiatives.	
<b>Key findings:</b>	Early engagement with stakeholders allowed data collection to be provided in real-time for decision-making. The process demonstrated a horizontal scale-up of the digital health program, including possible vertical scale-up of the program, and including further toolkit development. Furthermore, the vertical scale found early engagement of stakeholders assisted in developing content for the toolkit at a national-level reach. Key to the success of horizontal and vertical scale-up of the system was ongoing data collection. Particularly, horizontal scale-up allowed the platform to be tailor to meet the needs of target population.	

### Lee et al. (40)

<b>Title:</b>	Using stakeholder perspectives to develop an ePrescribing toolkit for NHS Hospitals: a questionnaire study
<b>Setting:</b>	2013 National ePrescribing Symposium in (London, United Kingdom)



<b>Purpose:</b>	To evaluate how an online toolkit may support ePrescribing deployments in National Health Service hospitals, by assessing the type of knowledge-based resources currently sought by key stakeholders.	<b>Participants:</b> n = 84
<b>Study-design:</b>	Quantitative Descriptive Study	
<b>Clinical engagement strategies:</b>	Questionnaire, toolkit	
<b>Key findings:</b>	Twenty-eight participants (40.0%) acknowledged the existence of NHS-relevant toolkits, while the majority (n = 41; 58.6%) either did not know (n = 23; 32.9%) or was unsure (n = 18; 25.7%) if such tools or toolkits existed. The most frequently cited toolkit was NHS Connecting for Health (n = 7), followed by the Productive Ward Toolkit (n = 3) and Homecare (n = 3). As well as having the highest frequency of citation, the NHS Connecting for Health toolkit was viewed favourably by delegates who had used it, with ease of use (8/10), quality of content (7.8/10) and breadth and depth of its coverage (7/10) all obtaining high scores. Lastly, participants believed toolkits would address issues relating to ePrescribing knowledge management and knowledge transfer. Tensions between a designed-for-all toolkit versus one addressing local needs were further echoed in requests for content to be tailored to specific areas, sectors and specialities.	

**Leath et al. (60)**

<b>Title:</b>	Enhancing rural population health care access and outcomes through the Telehealth EcoSystem™ Model	
<b>Setting:</b>	Macon County, Alabama (United States)	
<b>Purpose:</b>	The article highlights the Telehealth EcoSystem™ model, a holistic cross-sector approach for socioeconomic revitalisation, connectivity, interoperability and technology infrastructure development to address health equity for rural under-served communities.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Best practice model including clinical engagement	



**Key findings:** Public and private organisational capacities are addressed by comprehensive healthcare and social service delivery through stakeholder engagement and collaborative decision-making processes. A focus is maintained on economic recovery and policy reforms that enhance population health outcomes for individuals and families who have economic challenges. Best practices in digital connectivity, HIPAA requirements, electronic health records (EHRs), and eHealth applications, such as patient portals and mobile devices, are emphasised. Collateral considerations include technology applications that expand public health services.

**Stroetmann, editor (61)**

<b>Title:</b>	Scoping global good eHealth platforms: Implications for sub-Saharan Africa	
<b>Setting:</b>	Interoperable eSystems for Africa enhanced by satellites study (Africa)	
<b>Purpose:</b>	The overriding goal is the description, analysis, and synthesis of global good practice examples of national and district eHealth interoperability and health information exchange platforms in order to learn from global good eHealth practice and derive implications for sub-Saharan Africa.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Stakeholder engagement	
<b>Key findings:</b>	Results are structured by five types of such platforms reflecting local needs and opportunities, and the key eHealth applications available are identified. The discussion focuses on key activity domains and their respective success factors, and the conclusions outline core implications for sub-Saharan African countries when contemplating, planning for, or expanding eHealth interoperability platforms to facilitate and support better quality healthcare services.	



Greenhalgh et al. (18)

<b>Title:</b>	Introducing a nationally shared electronic patient record: Case study comparison of Scotland, England, Wales and Northern Ireland	
<b>Setting:</b>	National Shared Electronic Patient Record implementation in Scotland, England, Wales, and Northern Ireland (United Kingdom)	
<b>Purpose:</b>	To compare the experience of the four UK countries in introducing nationally accessible electronic summaries of patients' key medical details, intended for use in emergency and unscheduled care episodes, and generate transferable lessons for other countries.	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Clinical and public engagement strategies to promote acceptance and use	
<b>Key findings:</b>	While all four programs shared a similar vision, they differed widely in their strategy, budget, implementation plan, approach to clinical and public engagement and approach to evaluation and learning. They also differed, for various reasons, in stakeholder alignments, the nature and extent of resistance to the program and the rate at which records were created.	

Myburgh et al. (64)

<b>Title:</b>	Implementation of an electronic monitoring and evaluation system for the Antiretroviral Treatment Programme in the Cape Winelands District, South Africa: A qualitative evaluation	
<b>Setting:</b>	A 12-step implementation process of a regional electronic register (South Africa)	
<b>Purpose:</b>	To describe experiences and use of the register, and to make recommendations for implementation in similar settings where standardisation of ART monitoring and evaluation has not been achieved.	<b>Participants:</b> N/A
<b>Study-design:</b>	Qualitative Descriptive Study	
<b>Clinical engagement strategies:</b>	In-depth interviews, and stakeholder engagement	



- Key findings:** The following themes were identified:
1. ease of implementation;
  2. perceived value of an electronic monitoring and evaluation system;
  3. importance of stakeholder engagement;
  4. influence of a data champion;
  5. operational and logistical factors;
  6. workload and role clarity; and
  7. importance of integrating the electronic register with routine facility monitoring and evaluation.

#### Casati et al. (65)

<b>Title:</b>	Implementation and use of electronic synoptic cancer reporting: An explorative case study of six Norwegian pathology laboratories	
<b>Setting:</b>	Seventeen public pathology departments (Norway)	
<b>Purpose:</b>	This study was undertaken to learn more about factors influencing implementation and use	<b>Participants:</b> N/A
<b>Study-design:</b>	Case Analysis Study	
<b>Clinical engagement strategies:</b>	Stakeholder model (5 levels)	
<b>Key findings:</b>	Most key informants had a positive view on synoptic reporting, and five departments had tested the electronic template. Of these, four had implemented the template while one department had decided not to implement it due to layout concerns. Of the four departments using the template in daily routine, one had compulsory use, two consensus-based use, while the fourth had voluntary use. Annual average usage of the electronic template in the three departments with compulsory or consensus-based use was 92% compared to 53% in the department with voluntary use.	

#### Sullivan-Taylor et al. (66)

<b>Title:</b>	Development of a draft pan-Canadian primary health care electronic medical record content standard
<b>Setting:</b>	Implementation of pan-Canadian primary health care (PHC) electronic medical record (EMR) content standard to be used in EMR applications across the country (Canada)



Purpose:	To understand the implementation of the standard.	<b>Participants:</b> N/A
Study-design:	Case Analysis Study	
Clinical engagement strategies:	Stakeholder engagement, information requirements gathering and adoption and implementation promotion of the common content standard for widespread use	
Key findings:	The jurisdictions and clinicians, supported by CIHI and Canada Health Infoway will continue to work together with other key stakeholders, such as vendors to support the adoption and implementation of this standard into future jurisdictional EMR vendor specifications.	

**Seymour et al. (67)**

Title:	Creating an infrastructure for comparative effectiveness research in emergency medical services (EMS)	
Setting:	Thirty-three EMS systems serve an estimated catchment of 1.2 million residents and are supported by nine hospitals with more than 525,000 admissions per year (United States)	
Purpose:	This article describes a regional effort to create a high-performing infrastructure in southwestern Pennsylvania addressing fundamental barriers	<b>Participants:</b> N/A
Study-design:	Case Analysis Study	
Clinical engagement strategies:	Community stakeholder engagement	
Key findings:	Local EMS stakeholders emphasised the limits of single-agency EMS research and suggested that studies focus on improving cross-cutting, long-term outcomes. Guided by this input, more than 95% of EMS records (2,675 of 2,800) were linked to hospital-based EHRs. More than 80% of records were linked to 2-year mortality, with more deaths among EMS patients with prehospital hypotension (30.5%) or respiratory distress (19.5%) than chest pain (5.4%) or nonspecific complaints (9.4%).	



## 12 APPENDIX E | ADDITIONAL CASE STUDIES FROM CANADA

### Physician remuneration

Unless payer remuneration models in public payer contexts are appropriately structured for the provision of virtual care patient consultation services, adoption and practice workflow integration will be slow. Physician and nurse practitioner payment models and practice operational structures (solo to inter-professional) vary across jurisdictions in Canada. Policy and negotiated physician agreements are not keeping up with the technology. Clinicians are not reimbursed or they feel they are not reimbursed appropriately for adoption and integration of digital health services. The first article below describes the variability of physician remuneration for remote virtual consults in Canada, where they exist. The second article tells the story of a clinician “champion” who abandoned the technology as it was affecting her income. The third highlights a provincial assessment of patient-initiated virtual visits in one Canadian province where physicians are primarily reimbursed under a fee for service model; a billing code exists that supports both practice-level offering of virtual video visits scheduled by the patient’s regular clinic; as well as patient-initiated visits – scheduled through an online provincially available service.

- [Physician Remuneration for Remote Consults: An Overview of Approaches across Canada](#)
- [‘At my breaking point’: Halifax doctor pulls out of online health care tool](#)
- [Virtual Visits and Patient-Centered Care: Results of a Patient Survey and Observational Study](#)

### Clinician adoption and optimised use of digital health technologies

Canada Health Infoway has conducted a number of clinician surveys and pan-Canadian studies to identify critical success factors, and specific barriers to/facilitators of clinician adoption and optimised use of digital health technologies. Each of the study reports below details evidence-based benefits with a dedicated section on critical success factors for clinicians – as well as other system and technology stakeholders.

1. [Connected Health Information in Canada: A Benefits Evaluation Study \(April 2018\)](#)
2. [The Emerging Benefits of EMR Use in Ambulatory Care in Canada – Full Report](#)
3. [The Emerging Benefits of EMR Use in Ambulatory Care in Canada – Summary Deck](#)
4. [Infoway’s Ambulatory Electronic Medical Record \(AMB EMR\) Program Lessons Learned](#)
5. [RPM Benefits Evaluation Study: Full Report](#)
6. [The Emerging Benefits of Electronic Medical Record Use in Community-Based Care: Full Report](#)
7. [Telehealth Benefits and Adoption: Connecting People and Providers \(Full\)](#)



Canada Health Infoway and the Canadian Nurses Association's 2014 and 2017 Canadian Nurses Survey found that working in a hybrid environment (paper and electronic patient information and documentation systems) and multiple login/sign-on requirements were the most significant barriers to nurses realising the full value of their use of electronic records/clinical information systems in practice. Engagement of nurses in the design, use and training were also deemed important factors to ensure digital health information systems appropriately meet clinical requirements of nursing practice. Canada Health Infoway's 2014 and 2016 surveys of community-based pharmacists also highlight current adoption and critical success factors, facilitators and barriers to advanced use and impact on practice productivity and quality of care.

- [2017 National Survey of Canadian Nurses: Use of Digital Health Technology in Practice](#)
- [2016 National Survey of Community-Based Pharmacists: Use of Digital Health Technology in Practice](#)
- [2014 National Survey of Canadian Nurses: Use of Digital Health Technologies in Practice](#)
- [2014 The National Survey of Canadian Community Pharmacists: Use of Digital Health Technologies in Practice](#)

### The power of clinical leadership, champions and effective change management

Change in the context of health care across any clinical practice setting is a challenge. Many clinicians are comfortable and have a routine that works well for them and their office staff and are challenged with adjustments to clinical workflow and practice integration of digital health technology. Initiatives that engage, identify and leverage clinical leaders and champions to support both local and broad system-wide impacts are critical. Canada Health Infoway's clinician education campaign and leading practice initiatives are outlined in the following resources:

- [Clinician Education Campaign Orientation Guide](#)
- [National LEADing Practice Initiative](#)
- [Knowing is Better for Clinicians](#)
- [The Only Constant is Change – Family practice leaders share how leading change is just business as usual in their practices - Webinar](#)
- [Clinical Analytics in Primary Care White Paper \(Full Report\)](#)

### Demystifying the practice impact

Many physicians have heard from their peers that adoption of electronic records – or other digital health technologies is difficult and time-consuming, interrupting practice patterns and potentially their practice operations, or billings. Highlighted below is a scientific study that examined the impact of implementing an EMR on physician billings in the primary care context. It found no long-term significant impact on physician remuneration, physician perspectives on direct patient access to laboratory results, and use of virtual visits in British Columbia.



### Clinical peer networks

Infoway's Clinical Peer Network is a peer-to-peer program that promotes the active engagement of healthcare providers involved in the implementation of digital health systems across Canada. The network brings together natural leaders – physicians, nurses, pharmacists and other healthcare providers to:

- Share best practices and build new knowledge;
- Provide clinical leadership to develop expertise and facilitate learning; and
- Identify common and unique barriers to the implementation of change and clinical transformation.

More information about the clinical peer network programs can be found here:

<https://www.infoway-inforoute.ca/en/communities/clinical-peer-network>

### Faculty peer network

Canada Health Infoway, in partnership with the Association of Faculties of Medicine (AFMC), the Association of Faculties of Pharmacy (AFPC) and the Canadian Association of Schools of Nursing (CASN), has developed the Digital Health Faculty Associations Content & Training Solutions (FACTS) initiative. This unique program is designed to advance digital health in education by developing informatics competencies and associated resources to support clinical faculty and students in Canada. The Digital Health FACTS program engages faculty and students from 17 faculties of medicine, 10 faculties of pharmacy and 94 schools of nursing to:

- Scale and spread and understanding of digital health within faculties of medicine, nursing and pharmacy in Canada;
- Promote interdisciplinary and cross-sectoral approach; and
- Develop practical resources for faculty and students to integrate digital health towards inter-professional, collaborative patient care.

See: [Infoway's Faculty Peer Network Program and Related Resources](#)

### Change management

Change management supports people as technology is implemented and includes a wide range of activities such as workflow adaptation, and behavioural and cultural transformation. Successful implementation of digital health solutions occurs when a technology is effectively embedded into daily workflows and results in widespread adoption and other long-term benefits, including improved patient care and productivity gains. Canada Health Infoway has developed a [National Change Management Framework](#) that outlines six core change management elements.

See also:

- [Infoway's Faculty Peer Network Program and Related Resources](#)
- [A Framework and Toolkit for Managing eHealth Change](#)



## 13 REFERENCES

1. Pannick S, Sevdalis N, Athanasiou T. Beyond clinical engagement: a pragmatic model for quality improvement interventions, aligning clinical and managerial priorities. *BMJ Quality & Safety*. 2016;25(9):716-25.
2. Sittig DF, Singh H. A new sociotechnical model for studying health information technology in complex adaptive healthcare systems. *Quality & Safety in Health Care*. 2010;19 Suppl 3(Suppl 3):i68-i74.
3. Sittig DF, Belmont E, Singh H. Improving the safety of health information technology requires shared responsibility: It is time we all step up. *Healthcare*. 2018;6(1):7-12.
4. Department of Health (Government of Western Australia). *Dial E for Engagement – Are clinicians on hold?* Western Australia Department of Health; 2015.
5. Avery A, Savelyich B, Sheikh A, Cantrill J, Morris C, Fernando B, et al. Identifying and establishing consensus on the most important safety features of GP computer systems: e-Delphi study. *Journal of Innovation in Health Informatics*. 2005:9.
6. Jorm AF. Using the Delphi expert consensus method in mental health research. *Australian & New Zealand Journal of Psychiatry*. 2015;49(10):887-97.
7. Turner S, Ollerhead E, Cook A. Identifying research priorities for public health research to address health inequalities: use of Delphi-like survey methods. *Health Research Policy and Systems*. 2017;15(1):87-10.
8. Hsu C-C, Sandford BA. The Delphi technique: Making sense of consensus. *Practical Assessment*. 2007;12(10):1-8.
9. Gawande A. Why doctors hate their computers. *The New Yorker*. 2018 November 12, 2018.
10. Pearce C, Bartlett J, McLeod A, Eustace P, Amos R, Shearer M. Effectiveness of local support for the adoption of a national programme: A descriptive study. *Informatics in Primary Care*. 2014;21(4):171-8.
12. Grudic J. 'At my breaking point': Halifax doctor pulls out of online health care tool 2017 [Available from: <https://globalnews.ca/news/3580435/at-my-breaking-point-halifax-doctor-pulls-out-of-online-healthcare-tool/>].
13. Carr D, Howells A, Chang M, Hirji N, English A. An integrated approach to stakeholder engagement. *Healthcare Quarterly (Toronto, Ont)*. 2009;12 Spec No Ontario:62-70.
14. Detwiller M, Petillion W. Change management and clinical engagement: Critical elements for a successful clinical information system implementation. *Computers, Informatics, Nursing: CIN*. 2014;32(6):267-73; quiz 74-5.
15. Ng G. Electronic health record sharing system 2018 [Available from: <https://www.legco.gov.hk/research-publications/english/essentials-1718ise09-electronic-health-record-sharing-system.htm>].



17. De Pietro C, Francetic I. E-health in Switzerland: The laborious adoption of the federal law on electronic health records (EHR) and health information exchange (HIE) networks. *Health Policy*. 2018;122(2):69-74.
18. Greenhalgh T, Morris L, Wyatt JC, Thomas G, Gunning K. Introducing a nationally shared electronic patient record: Case study comparison of Scotland, England, Wales and Northern Ireland. *International Journal of Medical Informatics*. 2013;82(5):e125-38.
19. Handler T. Organisational readiness is key to successful EHR and digital care delivery program. United States: Gartner; 2018.
20. Ashraf S, Moore C, Gupta V, Chowdhury A, Azad AK, Singh N, et al. Overview of a multi-stakeholder dialogue around shared services for health: The digital health opportunity in Bangladesh. *Health Research Policy and Systems*. 2015;13:74.
21. Raman SR, Curtis LH, Temple R, Andersson T, Ezekowitz J, Ford I, et al. Leveraging electronic health records for clinical research. *American Heart Journal*. 2018;202:13-9.
22. Doolan DF, Bates DW, James BC. The use of computers for clinical care: A case series of advanced U.S. sites. *Journal of the American Medical Informatics Association: JAMIA*. 2003;10(1):94-107.
23. Fraser D, Christiansen BA, Adsit R, Baker TB, Fiore MC. Electronic health records as a tool for recruitment of participants' clinical effectiveness research: Lessons learned from tobacco cessation. *Translational Behavioral Medicine*. 2013;3(3):244-52.
24. Gilbertson-White S, Yeung CW, Saeidzadeh S, Tykol H, Vikas P, Cannon A. Engaging stakeholders in the development of an eHealth intervention for cancer symptom management for rural residents. *The Journal of Rural Health: official journal of the American Rural Health Association and the National Rural Health Care Association*. 2018.
25. Yip MH, Phaal R, Probert DR, editors. Stakeholder engagement in early stage product-service system development for healthcare informatics. 2013 Proceedings of PICMET '13: Technology Management in the IT-Driven Services (PICMET); 2013 28 July-1 Aug. 2013.
26. Kim J, Driver DD. Teleophthalmology for First Nations clients at risk of diabetic retinopathy: A mixed methods evaluation. *Jmir Medical Informatics*. 2015;3(1).
27. Goodyear-Smith F, Martel R, Darragh M, Warren J, Thabrew H, Clark TC. Screening for risky behaviour and mental health in young people: the YouthCHAT programme. *Public Health Reviews*. 2017;38:20.
28. Glynn LG, Glynn F, Casey M, Wilkinson LG, Hayes PS, Heaney D, et al. Implementation of the SMART MOVE intervention in primary care: A qualitative study using normalisation process theory. *BMC Family Practice*. 2018;19(1):48.
29. Janssen A, Robinson TE, Provan P, Shaw T. The Sydney West knowledge portal: Evaluating the growth of a knowledge portal to support translational research. *Journal of Medical Internet Research*. 2016;18(6):e170.
30. Mercer K, Baskerville N, Burns CM, Chang F, Giangregorio L, Tomasson Goodwin J, et al. Using a collaborative research approach to develop an interdisciplinary research



agenda for the study of mobile health interventions for older adults. *JMIR mHealth and uHealth*. 2015;3(1):e11.

31. Whitehouse SR, Lam PY, Balka E, McLellan S, Deevska M, Penn D, et al. Co-creation with TickiT: Designing and evaluating a clinical eHealth platform for youth. *JMIR Research Protocols*. 2013;2(2):e42.

32. Haynes S, Kim KK. A mobile care coordination system for the management of complex chronic disease. In: Sermeus W, Procter PM, Weber P, editors. *Nursing Informatics 2016: Ehealth for all: Every level collaboration – from project to realization. Studies in Health Technology and Informatics*. 2252016. p. 505-9.

33. Woods L, Cummings E, Duff J, Walker K. Partnering in Digital Health Design: Engaging the multidisciplinary team in a needs analysis. *Studies in Health Technology and Informatics*. 2018;252:176-81.

34. Lee E. A service design thinking approach for stakeholder-centred eHealth. *Studies in Health Technology and Informatics*. 2016;228:177-81.

35. Lupton D. Digital health now and in the future: Findings from a participatory design stakeholder workshop. *Digital Health*. 2017;3:2055207617740018.

36. Moucheraud C, Schwitters A, Boudreaux C, Giles D, Kilmarx PH, Ntolo N, et al. Sustainability of health information systems: A three-country qualitative study in southern Africa. *BMC Health Services Research*. 2017;17(1):23.

37. Konduri N, Aboagye-Nyame F, Mbirizi D, Hoppenworth K, Kibria MG, Doumbia S, et al. Digital health technologies to support access to medicines and pharmaceutical services in the achievement of sustainable development goals. *Digital Health*. 2018;4:2055207618771407.

38. Herndon JB, Aravamudhan K, Stephenson RL, Brandon R, Ruff J, Catalanotto F, et al. Using a stakeholder-engaged approach to develop and validate electronic clinical quality measures. *Journal of the American Medical Informatics Association*. 2017;24(3):503-12.

39. Paina L, Wilkinson A, Tetui M, Ekirapa-Kiracho E, Barman D, Ahmed T, et al. Using theories of change to inform implementation of health systems research and innovation: Experiences of Future Health Systems consortium partners in Bangladesh, India and Uganda. *Health Research Policy and Systems*. 2017;15.

40. Lee L, Cresswell K, Slee A, Slight SP, Coleman J, Sheikh A. Using stakeholder perspectives to develop an ePrescribing toolkit for NHS Hospitals: A questionnaire study. *JRSM open*. 2014;5(10):2054270414551658.

41. Blumenthal KG, Shenoy ES, Wolfson AR, Berkowitz DN, Carballo VA, Balekian DS, et al. Addressing inpatient beta-lactam allergies: A multihospital implementation. *Journal of Allergy and Clinical Immunology: In Practice*. 2017;5(3):616.

42. Ghany A, Keshavjee K. A platform to collect structured data from multiple EMRs. *Studies in Health Technology and Informatics*. 2015;208:142-6.

43. Sobel JL, Baker CC, Levy D, Cain CH. Adaptation of a published risk model to point-of-care clinical decision support tailored to local workflow. *AMIA Annual Symposium proceedings AMIA Symposium*. 2015;2015:1157-63.



44. Protti D. Local clinician involvement in clinical information systems: luxury or necessity? – a review of two international experiences. *British Journal of Healthcare Computing & Information Management*. 2003;20(10):28-30.
45. Hostgaard AM, Bertelsen P, Nohr C. How are clinicians involved in EHR planning? A process analysis case study of a region in Denmark. In: Safran C, Reti S, Marin HF, editors. *Medinfo 2010, Pts I and II. Studies in Health Technology and Informatics*. 1602010. p. 121-5.
46. Weeks R, editor *The successful implementation of an Enterprise Content Management system within the South African Healthcare Services Sector*. 2013 *Proceedings of PICMET '13: Technology Management in the IT-Driven Services (PICMET)*; 2013 28 July-1 Aug. 2013.
47. Turner C. Use of mobile devices in community health care: barriers and solutions to implementation. *British Journal of Community Nursing*. 2016;21(2):100-2.
48. Yu P, Gandhidasan S, Miller AA. Different usage of the same oncology information system in two hospitals in Sydney: Lessons go beyond the initial introduction. *International Journal of Medical Informatics*. 2010;79(6):422-9.
49. Kowal D, Jacques T, Butcher R, Abbenbroek B, Weisbrodt L, Dellagiacomma T, et al. A high performance team delivering a state-wide Intensive Care Clinical Information System (ICIS) for NSW. *Australian Critical Care*. 2015;28(1):42-.
50. Fanta GB, Pretorius L, Erasmus L. Organizational dynamics of sustainable eHealth implementation: A case study of eHMIS. 2017 *Portland International Conference on Management of Engineering and Technology (PICMET)*; 2017 9-13 July 2017.
51. Millonig MK. Mapping the route to medication therapy management documentation and billing standardization and interoperability within the health care system: meeting proceedings. *Journal of the American Pharmacists Association : JAPhA*. 2009;49(3):372-82.
52. Hayward-Giles S, Millar J. UK approach to developing SNOMED CT subsets for physiotherapists to use as part of the electronic health record. *Physiotherapy (United Kingdom)*. 2015;1):eS550-eS1.
53. Sheehan B, Nigrovic LE, Dayan PS, Kuppermann N, Ballard DW, Alessandrini E, et al. Informing the design of clinical decision support services for evaluation of children with minor blunt head trauma in the emergency department. *J of Biomedical Informatics*. 2013;46(5):905-13.
54. Brailsford SC, Bolt T, Connell C, Klein JH, Patel B, editors. *Stakeholder engagement in health care simulation*. *Proceedings of the 2009 Winter Simulation Conference (WSC)*; 2009 13-16 Dec. 2009.
55. Jenkins KN, Wilson RG. The challenge of electronic health records (EHRs) design and implementation: Responses of health workers to drawing a 'big and rich picture' of a future EHR programme using animated tools. *Informatics in Primary Care*. 2007;15(2):93-101.



56. Curry J, Prodan A. Using visual tools to improve clinical engagement and group understanding of complex IT concepts. *Studies in Health Technology and Informatics*. 2013;192:1028.
57. Strachan DL, Kallander K, ten Asbroek AH, Kirkwood B, Meek SR, Benton L, et al. Interventions to improve motivation and retention of community health workers delivering integrated community case management (iCCM): Stakeholder perceptions and priorities. *The American Journal of Tropical Medicine and Hygiene*. 2012;87(5 Suppl):111-9.
58. L'Engle K, Plourde KF, Zan T. Evidence-based adaptation and scale-up of a mobile phone health information service. *mHealth*. 2017;3:11.
59. Hamilton C. The WHO-ITU national eHealth strategy toolkit as an effective approach to national strategy development and implementation. *Studies in Health Technology and Informatics*. 2013;192:913-6.
60. Leath BA, Dunn LW, Alsobrook A, Darden ML. Enhancing rural population health care access and outcomes through the telehealth ecosystem model. *Online Journal of Public Health Informatics*. 2018;10(2):e218.
61. Stroetmann KA, editor *Scoping global good ehealth platforms: Implications for sub-Saharan Africa*. 2014 IST-Africa Conference Proceedings; 2014 7-9 May 2014.
62. Wachter R. *Making IT work: Harnessing the power of health information technology to improve care in England*. United Kingdom: National Health Service; 2016.
63. Takian A. Envisioning electronic health record systems as change management: The experience of an English hospital joining the National Programme for Information Technology. *Studies in Health Technology and Informatics*. 2012;180:901-5.
64. Myburgh H, Murphy JP, van Huyssteen M, Foster N, Grobbelaar CJ, Struthers HE, et al. Implementation of an electronic monitoring and evaluation system for the antiretroviral treatment programme in the Cape Winelands district, South Africa: a qualitative evaluation. *PloS one*. 2015;10(5):e0127223.
65. Casati B, Haugland HK, Barstad GM, Bjugn R. Implementation and use of electronic synoptic cancer reporting: An explorative case study of six Norwegian pathology laboratories. *Implementation Science : IS*. 2014;9:111.
66. Sullivan-Taylor P, Flanagan T, Harrison T, Webster G. Development of a draft pan-Canadian primary health care electronic medical record content standard. *Studies in Health Technology and Informatics*. 2011;164:385-91.
67. Seymour CW, Kahn JM, Martin-Gill C, Callaway CW, Angus DC, Yealy DM. Creating an infrastructure for comparative effectiveness research in emergency medical services. *Academic Emergency Medicine : official journal of the Society for Academic Emergency Medicine*. 2014;21(5):599-607.
68. Wilkinson J, Powell, A, Davies H. *Evidence: Are clinicians engaged in quality improvement?* The Health Foundation. 2011.



69. Young-Gun K, Kyoungwon J, Young-Taek P, Seung JH, Hae JK. Rate of electronic health record adoption in South Korea: A nation-wide survey. *International Journal of Medical Informatics*. 101:100-107, 2017.



## 14 ABBREVIATIONS

<b>CINAHL</b>	Cumulative Index of Nursing and Allied Health Literature
<b>CIS</b>	Clinical Information System
<b>CCOW</b>	Clinical Context Object Workgroup
<b>ECR</b>	Emergency Care Record (Scotland)
<b>EHR</b>	electronic health record
<b>eHRSS</b>	Electronic Health Record Sharing System (Hong Kong SAR)
<b>ELGA</b>	Elektronische Gesundheitsakte (Austrian e-Health Infrastructure)
<b>EMBASE</b>	Excerpta Medica Database
<b>EMR</b>	electronic medical record
<b>GDHP</b>	Global Digital Health Partnership
<b>GP</b>	general practitioner
<b>HIMSS</b>	Healthcare Information and Management Systems Society
<b>HIPAA</b>	Health Insurance Portability and Accountability Act (U.S.)
<b>HITECH</b>	Health IT for Economic and Clinical Health (U.S.)
<b>IHE</b>	Integrating the Healthcare Enterprise
<b>IIS</b>	Immunisation Information Systems
<b>IT</b>	information technology
<b>MSD</b>	multi-stakeholder dialogue
<b>NEHR</b>	National Electronic Health Record (Singapore)
<b>NHS</b>	National Health Service (UK)
<b>PCEHR</b>	Personally Controlled Electronic Health Record (Australia)
<b>SCR</b>	Summary Care Record (UK)
<b>SD</b>	standard deviation
<b>SNOMED CT</b>	Systematized Nomenclature of Medicine – Clinical Terms
<b>WTIS</b>	Wait Time Information System (Canada)

