Week 7: Implementation of Health Information Systems

Overview

Once a system, or system component, has been designed according to stakeholder requirements and has passed all the relevant tests to assure it's fit for purpose, it is ready for **implementation**. This week will give you a general introduction what HIST implementation entails, what factors may increase the risk of implementation failure, and how you develop an implementation plan to mitigate that risk.

Learning outcomes

The materials for week 7 will contribute to your achieving the following learning outcomes:

- LO4: Be aware of **different approaches to system implementation** and understand **what factors influence implementation success**
- LO9: **Develop and critically appraise a system implementation plan**

How this topic relates to your assignment

As part of your assignment, you need to propose a plan for implementing the system you selected. This topic provides you with the knowledge and tools to develop that plan and identify the main issues that need addressing in order for the implementation to be successful.

Materials and activities

7.1 Introduction to implementation

For this activity, you will read another chapter from Coiera's book. It will provide you with a general introduction on HIST implementation.

7.2 Approaches to national implementation

On page 188 of Coiera's chapter 12 that you read for activity 7.1, he distinguishes different approaches for national or regional HIST implementations. You will read more about these approaches for this activity.

7.3 Factors that may influence implementation success

In general, a system has been implemented successfully if the targeted users are using the system without problems and as intended. For this activity, you will read about what types of factors may influence whether a HIST implementation is successful or not.

7.4 Developing an implementation plan

There are several theory-based frameworks available that you can use for planning the implementation of a health information system. You heard a bit about **Normalisation Process Theory** (**NPT**) on F2F day 3 and you will read more about this and another framework (**NASSS**)

for this activity.

7.5 Applying NPT for implementation planning - exercise

Complete this exercise to start thinking about the implementation plan for your assignment. Post your findings on the forum to ask feedback from others.

7.1 Introduction to implementation

For this activity, you will read another chapter from Coiera's book. It will provide you with a general introduction on HIST implementation.

In the context of this module, we define implementation as a **systematic, structured approach to effectively integrate a system into the workflows of a healthcare organisation**. It is clear from this definition that successful implementation requires a **thorough understanding of the context** –including workflows—in which the implementation takes place. Gaining this understanding is not an activity specific for the implementation stage, but rather something that happens continuously throughout the system development life cycle, e.g. as part of **user requirements engineering** or **functional testing**. Understanding workflows and other contextual factors also warrants continuous involvement of end-users and other stakeholders. At the same time, stakeholder involvement will increase their buy-in and support for the implementation, and thus the chances of it being successful.

First read chapter 12 from Enrico Coiera's Guide to Health Informatics (see reading list); you have read a chapter from this book previously. Chapter 12 provides a general introduction to implementation in the context of a complex adaptive system such as health care. After reading it, take some time to reflect on the following discussion points:

- What are potential explanations for variation in local implementation success when implementing the same off-the-shelf electronic health record system across different hospitals?
- What options are commonly available to further improve a system's fitness for purpose after implementation?
- What are risks of post-implementation adaptations and how could these be managed?
- How does the complexity of a system affect its fitness for purpose, and how could this complexity be minimised?

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7.2 Approaches to national implementation

On page 188 of Coiera's chapter 12 that you read for activity 7.1, he distinguishes different approaches for national or regional HIST implementations. You will read more about these

approaches for this activity.

Coiera distinguishes **three broad approaches to implementing a health information system or technology across multiple organisations** in a region or country:

1. **Top-down** – directed by national or regional government. Centrally procured, standardised health information systems and infrastructures replace existing local systems with a view to enable central storage and sharing of clinical data. The top-down approach assumes a 'one-size-fits-all' system, and is thus less sensitive to local context. So although this approach ensures interoperability of systems between organisations, it increases the risk of end-users not accepting the system as intended and creating workarounds to make it fit their needs.
2. **Bottom-up**– in this approach, local healthcare organisations can select systems that best fit their local context and needs, but they are also responsible for ensuring that the selected systems comply with interoperability standards, and for interfacing with other systems across the region/country. The large variety of local systems increases the risk of incompatible data models. This makes reconciling information across these systems complex, and creates uncertainty around whether data exchange will ultimately be achieved.
3. **Middle-out** – this approach has both top-down and bottom-up elements. It combines locally driven investments and solutions with national investment in legislation, infrastructure and interoperability standards and goals. Local healthcare organisations remain free to choose their own EHR systems and responsible for complying with national standards in order to exchange information with other healthcare providers. It requires compromise and consensus to balance local freedoms against constraints in order to have shareable digital information.

Now read the 2009 paper by Coiera called 'Building a national health IT system from the middle out' (see reading list). In this viewpoint paper, he further elaborates on the different implementation approaches and illustrates each of them with an examplar: the National Programme for IT in England (top-down); nationwide implementation of EHR systems in the US (bottom-up), and the programme for Internet-based Person-Controlled Electronic Health Records (P-CEHRs) in Australia (middle-out). Please note that Coiera is a clear advocate of the middle-out approach.

If you want to know more about the different implementation approaches: the 2011 paper by Morrison et al called 'Understanding contrasting approaches to nationwide implementations of electronic health record systems: England, the USA and Australia' discusses the approaches and exemplars in more detail; reading Morrison's paper is optional.

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7.3 Factors that may influence implementation success

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In general, a system has been **implemented successfully** if the **targeted users are using the system without problems and as intended**. For this activity, you will read about what types of factors may influence whether a HIST implementation is successful or not.

Categories of factors that may influence implementation success

Although more detailed definitions of success are likely to differ between different stakeholders, there are **three broad, interrelated and overlapping categories of factors** that contribute to implementation success:

1. **Organisational/contextual factors** – this broad category includes a wide variety of factors, including for example: the availability of sufficient financial resources; adequate internal communication structures; strong leadership; clear task-oriented (rather than output-oriented) work processes; and external factors, such as support from government bodies and a stable data governance landscape.
2. **Human factors** –includes user-related factors such as: user characteristics (e.g. digital literacy); user perceptions that using the system is beneficial, easy and not time-consuming; a limited need for training, time and effort for users to become familiar with the system and fit it into their workflows; and representation by a champion who liaises with technical staff and management on behalf of the users.
3. **Technical factors** – refers to all technical aspects of the system and of the context in which it is implemented, such as: the extent to which the existing IT infrastructure is able to assimilate the new system; the system's interoperability with other (external) systems; and its ease of maintenance.

A successful Epic implementation in Brigham and Women's hospital?

In 2015, Brigham and Women's hospital in Boston (USA) implemented Epic's electronic health record system. Three years later, one of their surgeons, Prof Atul Gawande, published an essay in the New Yorker where he reflects on the impact the system has had on his ways of working as a doctor. Please read his essay called 'Why doctors hate their computers' (see reading list) and then reflect on the following points:

- How would you summarise the three main impacts the system has had on clinical workflows?
- Taking into account the broad definition of implementation success provided in the first sentence of this section, would you consider the implementation of the Epic system a success? Why (not)? What do you consider the main reasons for this (lack of) success?
- If Brigham and Women's hospital would consult you on how best to take the Epic system forward, what post-implementation advice could you give them? What additional information would you need to support this advice?

Please note that at the top of the first page of the essay, there is an enjoyable one-hour audio-recording of the essay available for you to listen to while doing the dishes or going for your daily

walk.

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7.4 Developing an implementation plan

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NASSS framework

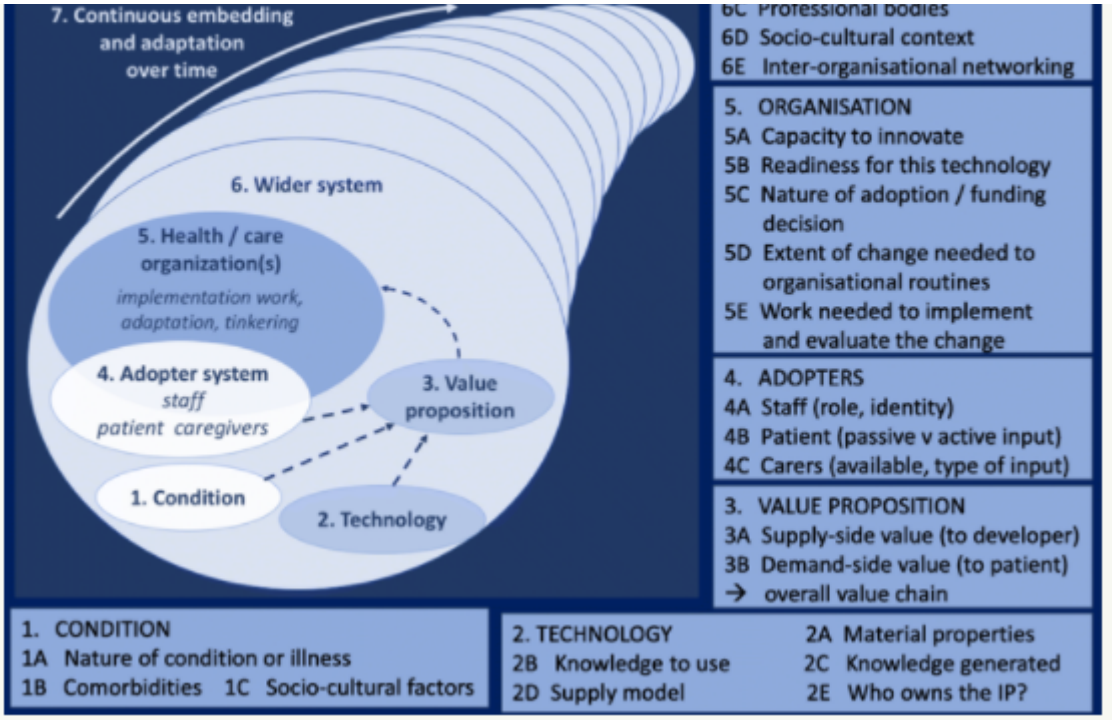
In previous modules, you may have already been introduced to one of them: **Greenhalgh's nonadoption, abandonment, scale-up, spread and sustainability (NASSS) framework**; the paper published in 2017 has been provided in the reading list for your reference.

The NASSS framework aims to **predict and evaluate the success of implementing a technology-supported health or social care programme**. As shown in the figure below and in Table 2 in the 2017 paper, it consists of 19 items across the following **seven domains**:

- the condition or illness,
- the technology,
- the value proposition,
- the adopter system (staff, patient, caregivers),
- the health or care organisation(s),
- the wider (institutional and societal) context,
- and interactions and adaptations over time.

Each item can be considered either

- **simple** (straightforward, predictable, few components),
- **complicated** (multiple interacting components or issues)
- or **complex** (dynamic, unpredictable, not easily disaggregated into separate components)



Empirical research has shown that complexity across multiple NASSS domains is often linked to implementation failure. Since the NASSS framework takes into account the wider context, it is particularly suitable for planning larger scale implementations.

The framework will support you with thinking through the different aspects of your implementation, identify areas of complexity, and include suggestions in your system implementation plan for how to reduce this complexity and/or address it preemptively. You can either use Table 2 in the original paper as a template, or try out one of the additional tools Greenhalgh has developed to support practical application of her framework (see 2020 paper in the reading list called 'The NASSS-CAT tools for understanding, guiding, monitoring, and researching technology implementation projects in health and social care: protocol for an evaluation study in real-world settings'). Especially the NASSS-CAT LONG may be a useful tool in the context of this module for developing your implementation plan (see multimedia appendix 3 in the 2020 paper).

Normalisation Process Theory (NPT)

Normalisation Process Theory (NPT) is another framework that may help with thinking through your system implementation. In the opening lecture on Day 3 of the F2F, Sabine explained how she used it to guide the implementation of routine collection of electronic patient-reported outcomes in renal services.

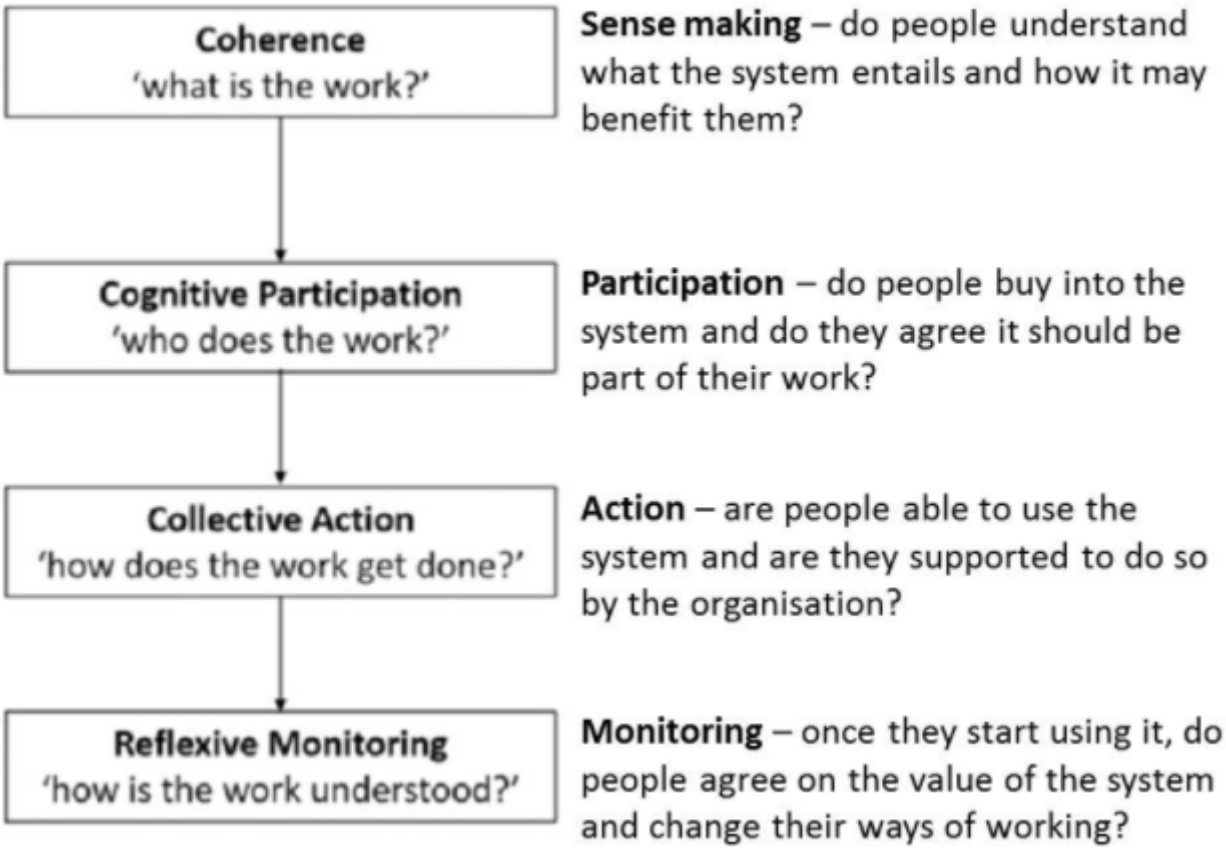
NPT explains how complex interventions in health care become embedded in practice by assessing a set of factors that promote and inhibit implementation. Compared to NASSS, there is less focus on the impact of wider contextual factors, and it is therefore particularly **useful for implementations at an institutional level**.

NPT has a strong focus on the integration of a system into existing professional relationships and environments, and the 'work' involved in doing this successfully. As shown in the figure below, NPT unpacks this 'work' into **four constructs**:

- **coherence** (work related to making sense of a system),
- **cognitive participation** (work to use knowledge from that sense-making to plan and initiate the implementation),
- **collective action** (work involved in the actual implementation)
- and **reflexive monitoring** (work involved in the evaluation of success and impact of the implementation and further refinement).

You can find more information on each of these four constructs on the NPT website (under 'What is NPT'). http://www.normalizationprocess.org/what-is-npt/

If you would like to learn more about how NPT was developed, read the 2009 paper by May and Finch called 'Implementing, embedding and integrating practices: an outline of normalization process theory' (see reading list); reading this paper is optional.



To apply NPT for planning a system implementation, there is an **interactive toolkit available on the NPT website**, with **16 variables** (**4 for each construct**) formulated as questions. Answering them will help you consider the different aspects of your implementation and identify any unknowns that require further investigations as part of implementation planning. The toolkit

also produces a **spider diagram** that shows the strengths you have assigned to each variable, with positive responses extending further out from the centre than negative ones. The diagram

thereby gives a good overview of which of the four areas may need further attention.

To give you an idea how the spider diagram may look for a particular system and how it may inform your implementation plans, have a look at chapter 7 of the APFT dossier (under 'Further resources') for a worked example.

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7.5 Applying NPT for implementation planning - exercise

Complete this exercise to start thinking about the implementation plan for your assignment. Post your findings on the forum to ask feedback from others.

Exercise

Complete the interactive NPT toolkit for implementation of the health information system you have selected for your assignment. Also read the instructions on the NPT website on how to interpret the resulting spider diagram.

Post your **spider diagram *_on the forum and include_ *1-2 potential implementation problems you identified through completing the toolkit and how you plan to preempt or address them**. You can ask your tutors for formative feedback on your implementation plan in order to further improve it for your inclusion in your assignment.

Please also use some of the recommended time for this activity to comment on what other people post in the forum for this exercise.

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