DHZ - Playbook for Promoting Digital Innovation in Hospitals

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1. INTRODUCTION

What is the aim of the playbook?
With this playbook we outline a systematic approach to successfully implement digital solutions in healthcare organizations such as hospitals.

Which are the target groups of the playbook benefiting from its application?
We developed the playbook for innovation and digitalization project managers, researchers, start-up representatives, and health professionals seeking support in initiating or implementing a funded research project. It does not provide guidance for project funding.

Which problems are addressed by the playbook?
The implementation of digital health solutions in hospitals is complex and challenging based on common barriers. These barriers include limited experience with digital health implementation projects, the involvement of multiple stakeholders, and a lack of knowledge about Medical Device Regulation (MDR) issues, as well as requirements for integrating into the existing IT environments of healthcare organizations.

How does the playbook help?
We provide a systematic and integrative step-by-step implementation plan for project managers that facilitates the implementation of digital health solutions in healthcare organizations based on experience from use cases. The playbook can guide digital health solution choices, enhance implementation efficiency, streamline processes and operations, and, based on this, contribute to improved patient care.

2. CONTEXT

How was the playbook created?

This playbook is a product of the project Digital Health Zurich (DHZ) which is funded by a grant of the DIZH. It aims to promote collaboration between Zurich's higher education institutions in the field of digitalization, thereby strengthening Zurich as a research and business location. The University of Zurich (UZH), the Zurich University of Applied Sciences (ZHAW), the Zurich University of the Arts (ZHdK) and the Zurich University of Teacher Education (PHZH) are systematically networking in the DIZH to advance research, innovation, and education in digitalization topics with interdisciplinary approaches.

Digital Health Zurich is based in Switzerland where decentralized healthcare systems operate with a mandatory health insurance framework that promotes regulated competition among private not-for-profit insurance providers. These insurers can lower premiums by offering higher deductibles. Funding for healthcare costs—approximately 30% each—comes from mandatory health insurance, the government (mainly through co-financing inpatient care and premium reductions provided by the cantons and the federal government), and private households, resulting in relatively high levels of private cost sharing (1).

Hospital inpatient payments are determined using relative cost weights, which reflect the resource requirements of Diagnosis Related Groups (DRGs) in comparison to the average inpatient treatment costs across the country. Actual payments are calculated by multiplying these relative DRG weights by a base rate, which is legally negotiated between hospitals and health insurers, informed by a national benchmark for “efficiently operating hospitals.” This benchmark is derived from a specific percentile among the average case-mix adjusted costs of all Swiss hospitals. Under the DRG system, Swiss hospitals receive lump sum payments that must cover all associated costs, including maintenance, investment expenses, and investments in digitalization initiatives (2).

University hospitals are characterized by their mixture of healthcare services, clinical research activities as well as their role as teaching hospitals. Although in daily practice, healthcare provision, bed-side teaching and clinical research are not clearly separated, they have different demands and regulations regarding data collection and data usage. This becomes especially relevant in the context of digital health implementations.

The University of Zurich has the largest Faculty of Medicine in Switzerland and is linked with four University Hospitals, one general hospital (University Hospital Zurich,) and three more specialized ones (Balgrist University Orthopedics, KISPI = Children’s Hospital and PUK= Psychiatry).

In this project we focus on two specific use cases. One use case takes place at the Comprehensive Cancer Center at the University Hospital Zurich. The second use case is integrated within the Spine Center of the Balgrist University Hospital.

2.1 Use Case Web-Based Application for Patient Reporting and Cancer Supportive Care Referral

Description: This web application is designed for people with cancer and nursing staff, enabling the collection of Patient-Reported Outcomes (PROMs) and facilitating

personalized referrals to supportive care services. Patients can report their health issues and emotional distress through a user-friendly interface. The collected data is then provided to nurses via a dashboard, allowing them to make tailored recommendations for further supportive care during consultations.

Primary Users:

- **People with cancer:** Report their symptoms and needs through the app.
- **Nursing staff:** Visualize patient reports during nursing consultations and refer patients to appropriate supportive care services.

Functionality:

1. Patients fill out health questionnaires before their nursing consultations.
2. The data is displayed on a dashboard for nursing staff to review.
3. Based on patients' responses, nursing staff provide referrals to additional care services.

Objective: Enhance supportive care for patients by integrating digital health data into the clinical workflow and promoting patient-centered care.

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Project Partners: University of Zurich (UZH), Zurich University of Applied Sciences (ZHAW), University Hospital Zurich (USZ)

Use Case Digital Pain Drawing: An Inclusive Web App with Integration into Clinical Systems

Description:

The digital pain drawing web application innovatively records and documents patients' back pain. Using a newly developed, gender-neutral, and anatomically precise representation, patients can remotely draw and describe the location, spread, and quality of their pain. The information is designed to be integrated directly into the clinical information system. This can lead to improved communication with professionals and contribute to more precise diagnoses and individualized treatment plans.

Primary users:

- **Back pain patients:** Can record their pain in the app anytime, anywhere, and download their drawings as a report.
- **Healthcare professionals:** Receive automated reports that are integrated into the clinical information system in real time, enabling them to support therapy planning and patient care.

How it works:

1. **Interactive pain drawing**: Patients use the intuitive app to document their pain before visiting the clinic.
2. **Automated reports**: The system generates reports that are available for patients to download and can be accessed by professionals in the clinical information system.
3. **Integration into clinical workflows**: Professionals use the reports directly for therapy planning and patient care.

Unique features:

- **Gender-neutral anatomy**: Based on iterative development with interdisciplinary feedback, a gender-neutral body outline was developed that is suitable for a broad patient population.
- **Open-source basis**: The anatomical illustrations and web app are made available as open-source software and can be flexibly expanded.
- **Integration of standards**: Linking of marked pain areas with SNOMED CT and integration via FHIR standards.

Objective:

The project aims to develop a user-friendly and inclusive solution for collecting patient-reported health data that:

- Supports better diagnostics and personalized therapies,
- Improves integration into clinical workflows, and
- Promotes data interoperability and reusability by standards such as SNOMED CT and FHIR.

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Project Partners:

Balgrist University Hospital (Balgrist), Zurich University of Applied Sciences (ZHAW), University of Zurich (UZH), Zurich University of the Arts (ZHdK),

3. USING THE PLAYBOOK

3.1 Which steps are included in the playbook?

We recommend a stepwise approach structured into five modules (see figure 1).
The first module (solution design) guides the selection of the most suitable scenario and helps answer the question: “Which regulatory issues and IT software considerations apply to the planned digital health solution/implementation?” By considering regulatory requirements, decisions on IT software can be better supported.

As the next step, gaining a better understanding of the hospital’s IT strategy (module 2) is recommended to foster an integrated implementation of the digital health project. This helps address the question: “In which IT setting will the digital health solution be implemented?” Based on these two modules, the core aspects of the project can be defined.

Modules 3 and 4 are recommended for application at a later stage. A deep dive into user and process requirements (module 3) focuses on the technical perspective of the implementation. It helps answer the question: “What are the technical and processual requirements for successful implementation?” Meanwhile, the development of a project-specific Digital Health Logic Model (module 4) helps to define an implementation strategy that accounts for the unique characteristics of the implementation setting. Both modules can be completed in parallel.

Because stakeholder engagement is complex and requires resources and coordination, we recommend a Stakeholder Engagement Plan (module 5). This plan complements the

logic model but can also be used independently. It addresses the critical issue: “Who should be engaged, and in what role, during the digital health implementation?”

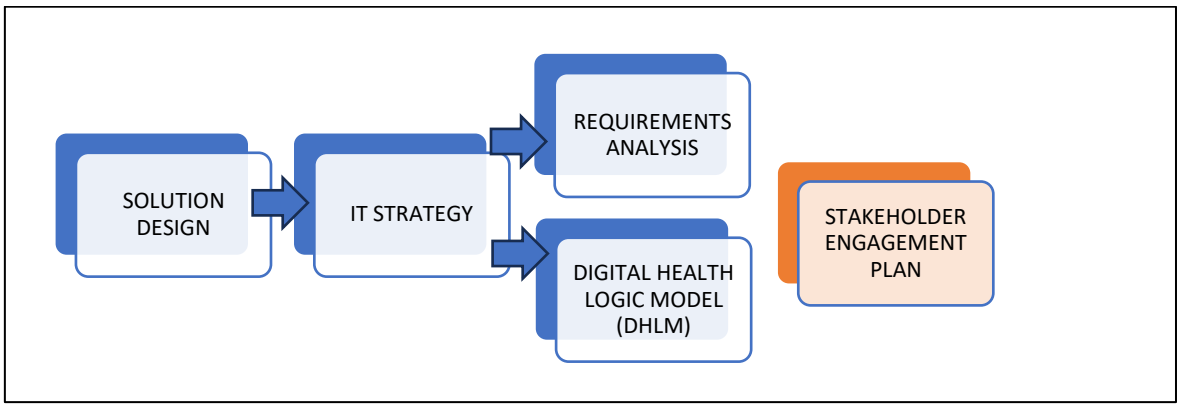

Figure 1: Stepwise approach with 5 modules

3.2 Module 1: Solution Design

Summary

To successfully design a digital health solution that aligns with the hospital's operational needs, it is essential to systematically address the project focus and data sources, and understand which regulatory requirements relate to the different scenarios. To support this, we developed the Solution Design Module, designed to be implemented early in the project planning phase.

Objective

The Solution Design module focuses on identifying the most suitable scenario for a given healthcare challenge. It supports decisions on the focus of the project, data sources and regulatory requirements.

Problem statement

Failing to systematically determine the most necessary application scenario and being unaware of the respective regulatory requirements—such as those outlined by Medical Device Regulation (MDR)—can lead to a misaligned digital health solution, ultimately jeopardizing the project's success.

Prerequisites / necessary resources

- Clear articulation of the healthcare challenge or opportunity the solution will address.
- Understanding of regulatory frameworks, including MDR and data privacy laws.
- Knowledge about the major regulatory and practical differences between patient care, research and quality management
- Knowledge about the necessary data sources
- Access to data or other necessary resources

Description of the tool

The Solution Design Module provides a structured process for making decisions on key aspects of the project. In our use cases, the primary focus was on implementing patient-reported outcome measures (PROMs) in a hospital setting. Therefore, we will use PROMs as an example to explain this module. Several project aspects—including the focus, required measurement time points, recipients of the results, the motivation for the project, and the available data sources—help distinguish between four common settings: (1) Research, (2) Quality Management, (3) Clinical Practice, and (4) Individual Patient

Journeys. Regulatory requirements vary based on the chosen setting, which also influences the selection of suitable software solutions.

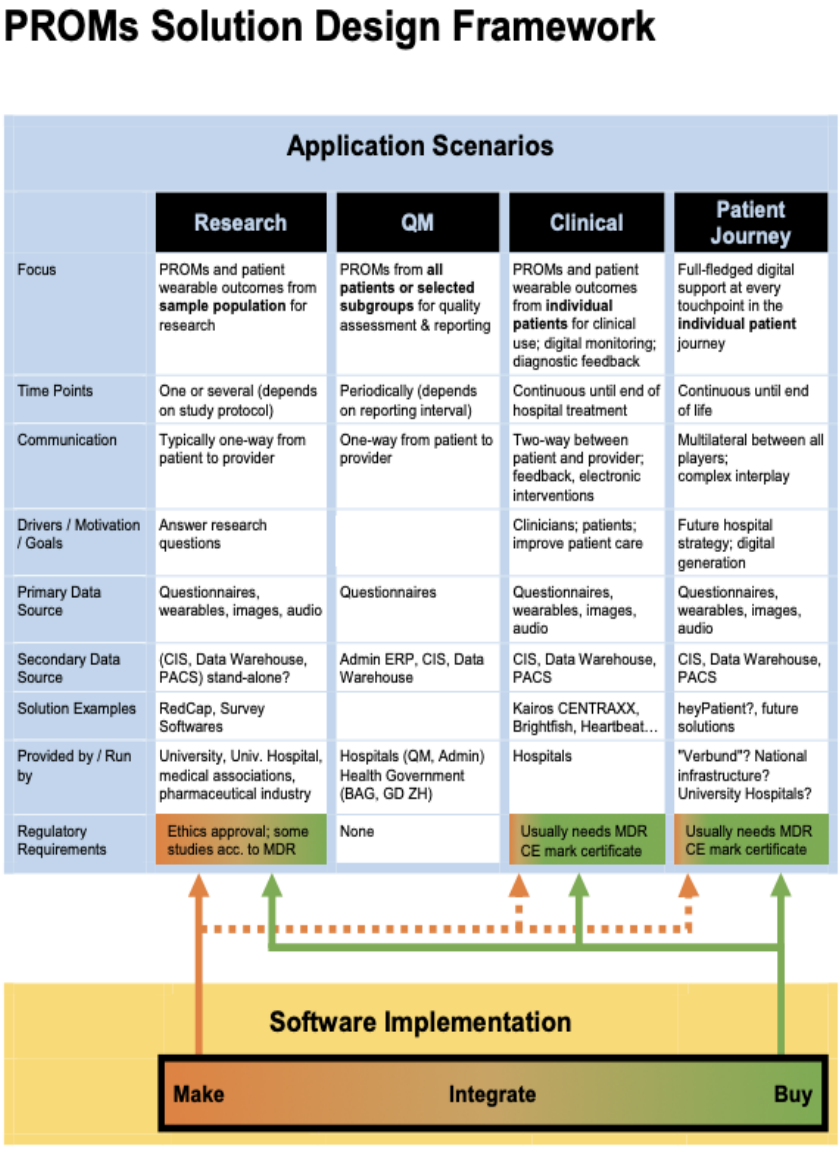

Figure 2: Scenarios for PROMs implementation

Strengths and weaknesses of the tool
Strengths:

- Provides a step-by-step guide for designing tailored, compliant, and feasible digital health solutions.
- Emphasizes goal, regulatory and technical alignment early in the process.

Weaknesses:

- Dependent on access to technical and regulatory expertise for the different scenarios.

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Document available at: PROM_Solution_Design_Framework.pdf

3.3 Module 2: IT Strategy

Summary
This module emphasizes understanding the hospital's IT strategy as a critical foundation for successfully implementing digital health projects. A thorough understanding of the hospital's IT environment and future plans for IT development ensures seamless integration, compliance, and alignment with institutional goals.

Objective
To provide guidance on assessing and aligning the IT strategy with digital health project implementation, ensuring integration into the hospital's existing IT environment and infrastructure.

Problem statement
Digital health solutions often fail due to a lack of understanding of the hospital's IT strategy, leading to difficulties with integration, interoperability, and compliance with existing or planned systems and policies. Common challenges include insufficient coordination with IT departments, unmet security requirements, and unclear alignment with IT priorities and strategies.

Prerequisites / necessary resources

- A detailed understanding of the hospital's IT infrastructure and architecture.
- Collaboration with IT leadership, including Chief Information Officers (CIOs) or equivalent roles.
- Familiarity with hospital IT policies, standards, and strategies, including interoperability frameworks.

Description of the tool

The IT Strategy module provides a structured approach to understanding the hospital's IT strategy while identifying key challenges and opportunities for the planned digital health solution. By emphasizing the strategic outlook rather than the current operational, it fosters a forward-looking perspective.

Figure 3: Assessment of the hospital's IT strategy (each aspect is evaluated and positioned on a spectrum between two defined anchor points)

Strengths and weaknesses
Strengths:

- Ensures that digital health projects are technically feasible and align also with future IT infrastructure.
- Reduces risks of system incompatibility and regulatory non-compliance.
- Strengthens collaboration between IT departments and project teams.

Weaknesses:

- Requires access to leadership and reliable information on strategic approaches

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Document available at:
https://github.com/DigitalHealthZurich/general/blob/main/docs/IT_Strategy.pdf

3.4 Module 3: Requirements Analysis

Summary

The Requirement Analysis focuses on identifying, analyzing, and documenting user and process requirements for digital health projects. A comprehensive understanding of the needs from different stakeholders' perspectives ensures that the digital solution aligns with clinical workflows, regulatory standards, and patient-centered goals.

Objective

To provide a structured approach for gathering and analyzing detailed user and process requirements support decisions on software development and implementation processes.

Problem Statement

Digital health projects often fail due to misalignment between the solution and user requirements. Challenges include inadequate stakeholder involvement, poorly defined workflows, and lack of integration with existing processes. Understanding the situation and addressing possible gaps early in the project lifecycle is critical for successful implementation and adoption.

Prerequisites / necessary resources

- Engagement of key stakeholders
- Familiarity with or access to knowledge about hospital's clinical workflows, and operational environment.

Description of the Tool

The Requirements Analysis module provides a stepwise approach to identifying and documenting requirements for digital health projects. The relevance and risks for processes, requirements, and features are assessed on a 0-100% scale. In the PROMs project, this was done for the different scenarios.

ROUGH QUALIFICATION: 0-100%
Relevance: importance for scenario; must have - nice to have
Risk: Mix of rating unclear requirements, uncertain user acceptance, technical dev risks, cost/benefit risks

		Research PROM		QM PROM		Clinical PROM		Patient Journey	
USER & PROCESS REQUIREMENTS	**Description**	**Relevance**	**Risk**	**Relevance**	**Risk**	**Relevance**	**Risk**	**Relevance**	**Risk**
Patient Journey Process									
Self-Onboarding		20%	60%	20%	60%	80%	50%	100%	60%
Prep @ home		0%	0%	0%	0%	70%	0%	100%	40%
Use @ general practitioner		0%	0%	0%	0%	0%	0%	60%	60%
Use @ waiting room		50%	0%	50%	0%	100%	0%	50%	20%
Use @ inpatient consultation		100%	0%	100%	0%	100%	0%	100%	40%
Use @ bedside / in bed	stationary, smart alarm button, …	0%	0%	0%	0%	100%	0%	100%	40%
Use @ outpatient therapy		0%	0%	0%	0%	70%	0%	60%	100%
Use @ home		50%	60%	50%	60%	70%	60%	100%	60%
Use @ senior living residence		0%	0%	0%	0%	0%	0%	0%	0%
Use @ hospice	for palliative care	0%	0%	0%	0%	0%	0%	0%	0%
Patient satisfaction feedback		0%	0%	0%	0%	50%	0%	0%	0%
Share with family		0%	0%	50%	60%	20%	10%	50%	80%
Healthcare Professional Process									
Questionnaire design	new questions, questions banks	100%	0%	100%	0%	80%	0%	100%	0%
Medical/Organisational approval	e.g., workflow support	100%	40%	100%	40%	100%	40%	100%	40%
Ethical approval		100%	40%	100%	40%	0%	40%	100%	40%
Questionnaire creation	technical impl./ UI design	100%	10%	100%	30%	20%	30%	100%	50%
Cohort selection	CIS workflow/integration	100%	50%	100%	50%	100%	60%	40%	10%
Patient Consent Agreement		100%	30%	100%	30%	40%	30%	10%	20%
Patient onboarding (techn.)		100%	30%	100%	30%	40%	30%	10%	20%
Data entry during/after consultation/teleconsultation		100%	10%	100%	10%	100%	10%	30%	10%
Remote data gathering	triggering online questionnaries	50%	50%	50%	50%	30%	50%	100%	80%
Continous monitoring	Dashboard, benchmarks	0%	0%	40%	40%	100%	40%	100%	40%
Automatic alarming	Clinical Decision Support	0%	0%	0%	0%	100%	0%	60%	0%
Remote clinical feedback	chat, notification	0%	0%	0%	0%	10%	0%	100%	0%
Data enrichment	from CIS, DW, …	60%	100%	80%	80%	100%	80%	100%	50%
Data analysis (integrated)		0%	20%	100%	20%	100%	20%	100%	20%
Singular dissemination	Scientific paper	100%	20%	100%	20%	0%	20%	100%	20%

Figure 4: Example of a requirement analysis

Strengths and weaknesses
Strengths:

- Ensures alignment between the digital solution and user needs.
- Reduces the risk of project delays and rework due to unclear or overlooked requirements.
- Fosters stakeholder buy-in and collaboration early in the project.

Weaknesses:

- Requires time and effort to engage stakeholders and document requirements comprehensively.
- Miscommunication or incomplete input may lead to inaccurate requirements.
- Continuous changes in requirements can complicate the development process.

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Template available at:
https://github.com/DigitalHealthZurich/general/blob/main/docs/PROM_Requirements.xlsx

3.5. Module 4: Digital Health Logic Model (DHLM)

Summary

We developed the Digital Health Logic Model (DHLM) as an adaptation of the Implementation Research Logic Model (IRLM), developed by Smith, Li and Rafferty (3). The IRLM is a framework designed to enhance the rigor and reproducibility of implementation research. It has been used in primary research across different types of studies and at various stages of the research process, including planning, execution, reporting, and synthesis (3). While we found the IRLM helpful in both use cases, we have adapted it to better suit digital health projects, as well as projects with less research focus, by incorporating iterative stages that span from design to evaluation into one model. This modification (DHLM) expands the original model's applicability in the digital health domain.

Objective

To support implementation by improving specification, rigor, reproducibility, and testable causal pathways of digital health solutions. Ultimately, the DHLM aims to facilitate a deeper understanding of how and why planned digital health solutions can work in real-world settings.

Problem statement

Digital health solutions are complex and heavily influenced by the specific healthcare settings in which they are implemented, which makes their implementation challenging. Typical project planning tools and research methods often fail to capture the nuances of implementing these solutions in real-world healthcare settings. While the original IRLM provides a valuable framework, it does not fully account for the iterative nature of digital health projects. Therefore, we developed an adapted version, the DHLM, as a structured framework to guide specifically through the iterative process of designing, testing, implementing, and evaluating digital health implementation projects.

Prerequisites / necessary resources

- Familiarity with implementation science concepts and terminology
- Access to the original IRLM publication (3)
- Basic understanding of digital health interventions and their unique characteristics
- Stakeholder engagement capabilities, including healthcare providers, IT professionals, and end-users
- Data collection and analysis tools for qualitative and quantitative research methods
- Sufficient time and resources to apply the adapted DHLM throughout the project

Description of the tool

The DHLM is a semi-structured, principle-guided tool that builds upon the original IRLM framework by Smith, Li and Rafferty (3). It keeps the key components of the original IRLM – determinants, implementation strategies, mechanisms, and outcomes – while adding several layers to account for the distinct phases of digital health projects: design, standalone testing, integrated testing, implementation, and evaluation. Each phase includes specific inputs, outputs, and feedback loops tailored to that phase.

The DHLM guides users through a systematic process of identifying barriers and facilitators, selecting appropriate implementation strategies, and measuring outcomes specific to digital health solutions.

Figure 4 shows an example of the completed DHLM from Use Case 2. In this example, we began by analyzing the specific determinants relevant to our project, categorized into intervention characteristics, inner setting, outer setting, characteristics of individuals, and process. This analysis provided important insights, such as identifying key stakeholders and recognizing the importance of involving them from the outset. We then planned the research phases step by step, ensuring that all essential implementation research outcomes were addressed and appropriately distributed across the different phases. This structured approach allowed us to maintain a clear overview of the research process, identify which outcomes needed to be assessed at each stage, and determine when and how to engage specific stakeholders effectively.

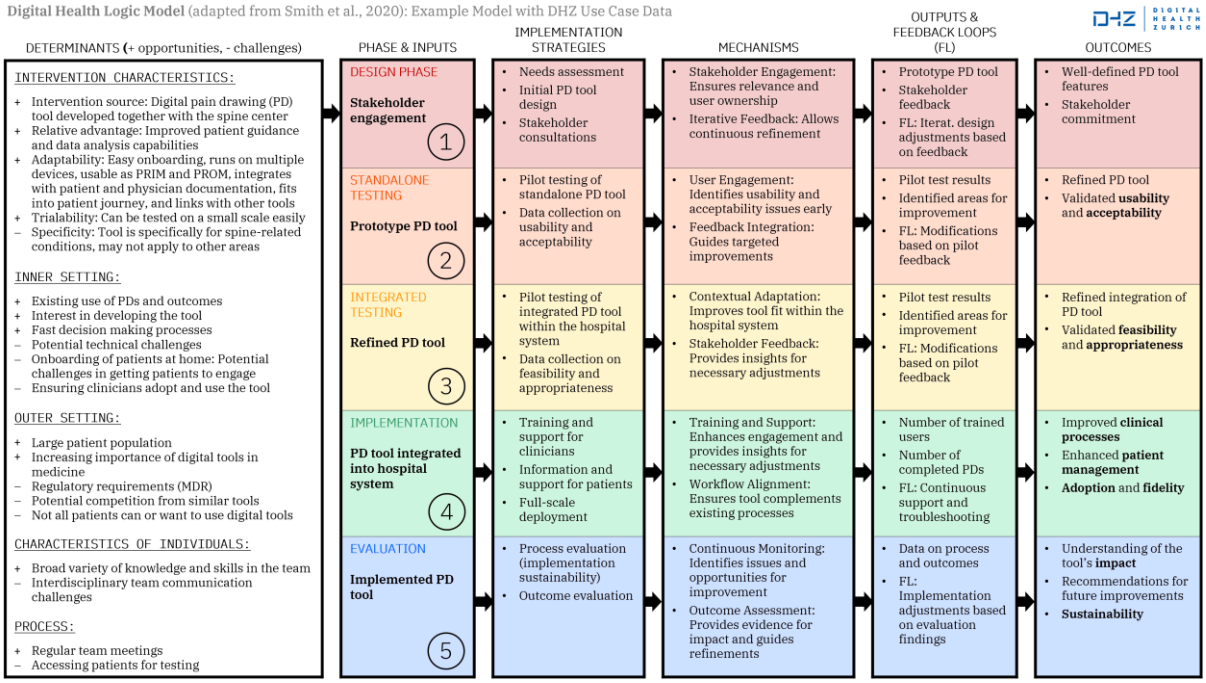


Figure 5: DHLM example model with data from Use Case 2.

Strengths and weaknesses of the tool

Strengths:

- Provides a comprehensive framework for digital health implementation research
- Improves specification and reproducibility of implementation projects
- Facilitates the identification of testable causal pathways
- Enhances understanding of how digital health interventions work in real-world settings
- Supports iterative development and evaluation processes

Weaknesses:

- Requires knowledge in implementation research
- Requires time and resources to apply fully
- Needs further validation in diverse digital health contexts
- May not capture all unique aspects of rapidly evolving digital technologies

Terms of use

Templates for the checklists are available in the Appendix.

Recommended readings

Smith JD, Li DH, Rafferty MR. The Implementation Research Logic Model: a method for planning, executing, reporting, and synthesizing implementation projects. Implementation Science. 2020 2020/09/25;15(1):84. doi: 10.1186/s13012-020-01041-8.

3.6 Module 5: Stakeholder Engagement Plan

Summary

The template focuses on participatory approaches and stakeholder engagement within the context of digital health. There are three checklists to help to frame a participative research project in digital health. The module consists of 3 checklists:

- Checklist 1 - Initial Open Questions: Supports a systematic reflection about the key aspects for engaging stakeholders.
- Checklist 2 - Stakeholder Mapping: Supports the systematic planning of key stakeholders and characterizing their involvement throughout the research process.
- Checklist 3 - Key Issues in Digital Health: Supports the systematic identification of key issues to address when engaging stakeholders.

Objective

To provide a tool for systematic stakeholder engagement within the context of digital health and more specifically digital solutions in healthcare organizations.

Problem statement

Digital health solutions are complex because they must be adapted to specific healthcare settings in which they are implemented. There is a broad consensus among scientists, health professionals, regulative bodies, and citizens that digital solutions are becoming increasingly important for supporting people's health and quality of life within person-centered care. At the same time, they should be designed to meet the needs, priorities, and values of all stakeholders (4-5). Consequently, in digital health, there is a need for a user-centric approach by using participatory methods and stakeholder engagement (4-9).

Prerequisites / necessary resources

- Familiarity with terms and concepts of participatory approaches and stakeholder engagement (9)
- Basic understanding of digital health solutions and their unique characteristics
- Data collection and analysis tools for both qualitative and quantitative research methods
- Sufficient time and resources to apply stakeholder engagement

Description of the tool

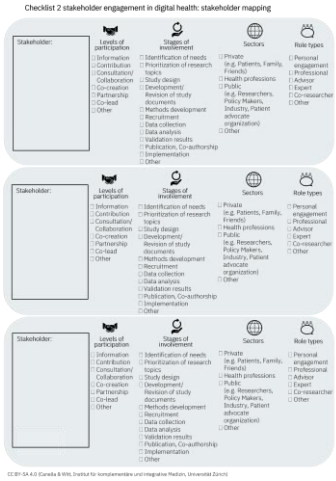
The module focuses on stakeholder engagement within the context of digital health and implementing digital solutions in healthcare organizations. Stakeholder engagement can use different formats including for example workshops, interviews, or focus groups.

There are three checklists to help frame a participative research project in digital health. Checklists 1 and 3 provide guidance for addressing key issues when engaging stakeholders in digital health research projects. Checklist 2 helps listing key stakeholders and characterizing their involvement throughout the research process.

Checklist 1 Initial Open Questions: Supports a systematic reflection about the key aspects for engaging stakeholders.

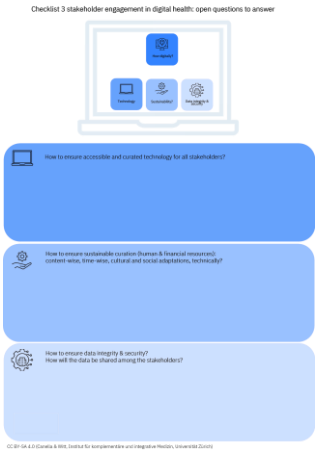
- Reflection about the basic “why”, “who”, “how”, “for whom” and “how to communicate” of the planned project.
- Decisions about who the key stakeholders are - who is particularly interested in and affected by the planned digital health solution?

Checklist 2 Stakeholder Mapping: Supports the systematic planning of key stakeholders and characterizing their involvement throughout the research process.



- List of key stakeholders. Identifying the sectors they represent. Trying to be as specific as possible by naming potential participants/co-researchers and identifying ideal characteristics.
- Reflection about the stakeholder's level of involvement: At what point on the spectrum from "informational" to "co-leading" should they contribute to the project?
- At what stages of the project should stakeholders be involved?
- What roles should stakeholders take on during the project?
- Keeping diversity and accessibility in mind

Checklist 3 Key Issues in Digital Health: Supports the systematic identification of key issues to address when engaging stakeholders.



The checklist guides answers on the following questions:

- Which technology is needed for the project?
- Which technology is already available in the specific research context?
- How to ensure accessible and curated technology for all the stakeholders?
- How to ensure sustainable curation (human & financial resources): content-wise, timewise, cultural and social adaptations, technically?
- How to ensure data integrity & security?
- How to ensure quality control and ethics?
- How will data be shared among the stakeholders?

Strengths and weaknesses of the tool

Strengths:

- Provides guidance in framing stakeholder engagement in digital health projects
- Provides guidance for listing key stakeholders and characterizing their involvement throughout the research process

Weaknesses:

- Requires additional time and resources

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Templates for the checklists are available in the Appendix.

Further online resources of other existing checklists and toolboxes for stakeholder engagement

- EUPATI (European Patients Academy for Therapeutic Innovation): Education That Empowers - EUPATI – Toolbox: Digital Health: Digital Health Archives - EUPATI Toolbox
- EUSEA (European Science Engagement Association): ToolKits – Eusea – European Science Engagement Association
- Swiss Academies of Arts and Sciences, Network for Transdisciplinary Research (td-net): td-net toolbox | Methods and tools for co-producing knowledge (naturalsciences.ch)
- Citizen Science Center Zurich – Citizen Science Checklist: Citizen Science Checkliste | Citizen Science Zürich | UZH

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