Additional file 3 - detailed strength and weakness analysis

Analysis				Assessment	
Technology Field	**Perspective**	**Framework**	**Stated Purpose**	**Strengths**	**Weaknesses**
Health Information Systems (HIS)	**Investment programs** for digital technologies (to guide evaluations)	Infoway benefits evaluation Framework [19]	1. Provide a high-level evidence based model to guide subsequent field evaluation	- Clear description of the purpose and addressed question (to evaluate benefits for investments) - Generalistic Health (business) settings described as a setting - Applicable for different health information technologies - Very well illustrated presentation of the model - Visualization of connections and relationships within the framework is given - Clear definition of terms with examples - Full transparency of the development process - Transferable (allows comparison of evaluation findings)	- No clear focus on a specific technology type - No specific application settings described - No application strategy for the framework - No guidance on interpretation of results - No discussion of weaknesses and limitations
Health Information Technologies (EHR)	**Universal perspective** (mainly influenced by health services research and informatics)	HITREF [20]	1. Conceptual tool for framing evaluations studies in assessing EHR-based implementations in organizational, systematic, and environmental contexts 2. Displaying evaluation criteria	- Clear description of the purpose and the addressed question - Clear description of specific technology (health information technologies (EHR)) - Universal approach by referring to different possible settings (hospital, ambulatory, community-based, public health) - Well-illustrated presentation of the model - Visualization of connections and relationships within the framework is given - Clear definition of key concepts and terms - Exemplary explanation for the application - Full transparency of the development process - Transferable to different settings	- No specific application settings described - No guidance on interpretation of results - Insufficient discussion of weaknesses and limitations
Hospital Information Systems	**Universal perspective**	HIS Success Framework [7]	1.Identification of Hospital Information System success and failure factors and the evaluation methods of these factors	- Clear description of the purpose and the addressed question - Clear description of the setting (hospital) - Clear description of the technology (hospital information systems) - Description of key concepts by presenting information on related sub factors and evaluation methods	- No visualization of the framework (table only) - No visualization of connections or relationships within the framework - No guidance on interpretation of results

				-	Presentation of recommended methods and example studies for individual evaluation factors - Full transparency of the development process - Limitations/weaknesses are sufficiently described - Transferability in the hospital setting is given		
Integrated Health Information Systems (IHIS)	**Healthcare Organisation**	DIPSA Framework [21]	1.Evaluation framework for hospitals utilizing IHIS to help identify any existing deficiencies in the system	-	Clear description of the purpose and the addressed question - Clear description of the setting (hospital) - Clear description of the technology (integrated Health Information Systems) - Description and definition of key concepts and terms with related questions (questions are not easily accessible) - Application strategy exists - Description of the development process is given - Transferable to other hospital settings	-	No visualization of the framework (table only) - No visualization of connections or relationships within the framework - Application of the framework only possible if the questions are available - No concrete instruction on how the results can be interpreted - Insufficient description of the limitations
Health Information Systems	**Healthcare Organisation** (focus on technology induced errors)	HOPT-FIT [22]	1. Evaluate HIS performance and efficiency 2. Systematically guide error evaluation 3. Describing the Human-Organisation-Process-Technology fit	-	Clear description of the purpose and addressed question - Applicable for different types of health organisations (setting) - Clear description of the technology (health information systems) - Well-illustrated presentation of the model - Visualization of connections and relationships within the framework is given	-	Setting unspecified (health organisation) - Insufficient explanation of the individual terms - No concrete application strategy and instructions for use. The framework is still to be tested in clinical settings - No instruction on how the results can be interpreted - Methodology of the development process not sufficiently described - Insufficient discussion of weaknesses and limitations - Unclear transferability due to weaknesses in the development methodology
Clinical Information Systems (CIS)	**Nurse's perspective**	CISSM [4]	1. Framework for evaluating CIS success from the nurse's perspective	-	Clear description of the purpose and the addressed question - Clear description of the setting (hospital) - Clear description of the technology (clinical information systems) - Very well illustrated presentation of the model	-	Discussion of weaknesses and limitations very short - Limited transferability of the framework to other settings

				- Visualization of connections and (statistically validated) relationships within the framework is given - Clear definition of key concepts and terms - Procedure, instruments, and evaluation matrix are given. A validation study has been carried out - Examples are provided to aid interpretation - Full transparency of the development process - Transferable to other hospital settings	
Information and communication technologies for nurses	**Nurse's perspective**	Adapted nursing care performance framework [23]	1. Illustrate how ICTs interventions influence nursing care and impact health outcomes	- Clear description of the purpose and the addressed question - Clear description of technology (information and communication technologies for nurses) - Broad (healthcare) setting related to nursing care - Well-illustrated presentation of the model - Visualization of connections and relationships within the framework is given - Detailed definition and explanation of terms and concepts based on the studies examined - Description of the analysis process is given - Discussion of the weaknesses, biases, and limitations - Transferability to different nursing contexts given	- No clear focus on a specific on a setting - Framework as an overview with no application strategy - Indirect explanation how results can be interpreted (by referring to analysed studies) - Development process: No independent framework - rather the examination of the transferability of indicators of a framework to ICTs in the field of nursing
Telemedicine Technologies	**Universal perspective** (user-based decision making, research)	MAST Manual [24]	1. Describe effectiveness 2. Contribution to quality of care of telemedicine applications 3. Produce a basis for decision making	- Clear description of the purpose and the addressed question - Universal setting approach (all telemedicine settings) - Clear description on specific technology (telemedicine technologies -application to other contexts still conceivable) - Clear definition of included domains (e.g. safety) with examples - Concrete application strategy and instructions for use is given including possible methods - High transparency of the development process - Limitations/weaknesses are sufficiently described - Transferability of the framework is described	- Setting undefined (telemedicine) - Moderate clarity of illustration - No visualization of connections or relationships within the framework - No guidance on interpretation of results

Telemedicine systems	**Universal perspective** (decision making for individuals, organisations, and communities)	Comprehensive evaluation framework for telemedicine implementation [18]	1. Summarising important themes for the evaluation of telemedicine systems 2. Support related stakeholders' decision-making by promoting general understanding, and resolving arguments and controversies	-	Clear description of the purpose and the addressed question Universal setting approach (all telemedicine settings) Clear description of the technology (telemedicine systems) Vivid illustration	-	Setting undefined (telemedicine) Lack of clarity of connections or relationships within the framework Insufficient definition of terms in the framework No concrete application strategy and instructions for use No instruction on how the results can be interpreted Methodology of the development process not sufficiently described Insufficient description of the limitations Unclear transferability
Telemedicine Interventions	**Universal perspective** (the focus on individual determinants changes throughout the development life cycle)	The layered telemedicine implementation model [17]	1. Detailed classification of the determinants of the success of future telemedicine implementations	-	Clear description of the purpose and the addressed question Universal setting approach (all telemedicine settings) Clear description of the technology (telemedicine interventions) Well-illustrated presentation of the model Visualization of connections and relationships within the framework is given Clear definition of key concepts and terms Instruction to choose a layered approach along the development life cycle. Different determinants should gain focus during the maturity of the telemedicine implementation Explanation of the development process is given Limitations/weaknesses are sufficiently described	-	Setting undefined (telemedicine) No concrete application strategy and instructions for use - only example studies and the advice to involve multiple stakeholders in the analysis. No instruction on how the results can be interpreted Unclear transferability (study provides only an overview of the determinants described in the literature)
Connected Sensor Technologies (including wearables. biosensors)	**Healthcare System Perspective** (users and other stakeholders)	Evaluation Framework for Fit-For-Purpose Connected Sensor Technologies [15]	1. Working evaluation framework that reflects different types of risks 2. Framework is conducted to better manage these risks 3. Make information on sensor	-	Clear description of the purpose, clear description of the addressed question (risk evaluation) Applicable for clinical or research settings Clear description of specific technology area (connected sensors) Clear illustration Clear definition of key concepts and terms Exemplary explanation for the application Sample threshold criteria for the interpretation of the results	-	No specific application settings described No visualization of connections or relationships within the framework No discussion of weaknesses and limitations

			technologies more comparable and understandable	-	Sufficient explanation of the development process - Transferable to different settings		
Digital Health Interventions (DHI)	**Universal perspective** (researchers and practitioners)	Design and Evaluation of DHI Framework [11]	1. Framework for the design and evaluation of DHI 2. Showing evaluation criteria and implementation barriers to be considered during the life cycle phases of DHI 3. Support researchers and practitioners from conception to large-scale implementations	-	Clear description of the purpose and wide variety of questions to be addressed to - Applicable for different care settings - Applicable for different digital health interventions (universal) - Clear definition of key concepts and terms - Description of the application based on different digital health intervention phases - Full transparency of the development process - Limitations/weaknesses are sufficiently described - Transferable to different settings and technologies	-	No clear focus on a specific a technology area - No clear focus on a specific setting - No visualization of the framework (table only) - No visualization of connections or relationships within the framework - No instruction on how the results can be interpreted
Digital Healthcare Services (mHealth, AI, and robotics)	**Healthcare System Perspective** (decision making)	Digi HTA [6]	1. Inform decisionmakers in order to better support the introduction of new health technologies	-	Clear description of the purpose and the addressed question - Applicable for different care settings - Applicable for different digital healthcare services (mHealth, AI, and robotics) - Evaluation categories (key concepts) are specified by means of questions - Application procedure is described - Grid for the interpretation of the results is presented (guidance on decision) - Full transparency of the development process - Transferable to different settings	-	Unspecified setting - No visualization of the framework (table only) - No visualization of connections or relationships within the framework - Insufficient description of the limitations
Digital Health Technologies	**Universal perspective** (multi-stakeholder approach)	Digital Health Score Card [10]	1. Multi-stakeholder approach to objectively evaluate digital health solutions	-	Clear description of the purpose and the addressed question - Applicable for different care settings - Applicable for different digital health technologies - Very well illustrated presentation of the model - Visualization of connections within the framework is given - Clear definition of key concepts and terms	-	No clear focus on a specific setting - No clear focus on a specific technology type - No concrete application strategy and instructions for use. The framework is still in the early stages of development and iteration is ongoing - No instruction on how the results can be interpreted - Development process not sufficiently described - Insufficient description of the limitations

						-	Unclear transferability
E-health programs	**Universal perspective** (included tools usable for managers, healthcare providers, and clients)	Khoja–Durrani–Scott Framework for e-Health Evaluation [16]	1. Comprehensive Framework to show relevant themes for e-health evaluation	-	Clear description of the purpose and the addressed question - Universal setting approach (e-health) - Broad spectrum of possible technologies to be evaluated (e-health) - Table illustrates the relationships in the framework based on the e-health life cycle - Important terms and concepts are defined - but not every term is sufficiently defined in the framework - Sufficient explanation of the development process - Transferable to different settings and technologies	-	Setting undefined (e-health) - No clear focus on technology area (e-health) - No visualization of the framework (table only) - No concrete application strategy and instructions for use (Specific evaluation tools were developed, but were not publicly available at the time of the review) - No instruction on how the results can be interpreted - No discussion of weaknesses and limitations
Clinical informatic interventions	**Healthcare Organisation** (implementation in organisational practice)	RE-AIM (expanded to clinical informatics) [25]	1. Used to design, implementation, evaluation, and reporting of clinical informatics with a goal of translation of research into practice	-	Clear description of the purpose and research question (how research can be translated into practice) - Universal approach (applicable for "clinical informatics") - Clear description of the framework concepts and terms - Examples for the application given - Example advice for interpretation – (not very concrete) - Development: Framework based on the original article and validated by clinical information case studies - Meta Framework (very transferable)	-	No clear focus on a specific technology area - No clear focus on a specific on a setting ("clinical informatics") - Illustration is a table - No visualization of connections or relationships within the framework - Insufficient discussion of weaknesses and limitations
Health Technologies	**Healthcare Organisation**	Health Technology Adoption Framework [8]	1. Framework with clear, user-validated criteria for evaluating new health technologies for adoption at the local level	-	Clear description of the purpose and the addressed question - Clear description of the setting (surgical context) - Clear description of the technology area is given (health technologies in the surgical context) - Vivid illustration with evaluation tool - Definitions of the domains, criteria and sub criteria provided (related questions provided) - Concrete application strategy and instructions for use is given by presenting an evaluation tool - Instruction on how the results can be interpreted is included in the evaluation tool	-	No visualization of connections or relationships within the framework - Transferability limited (limited to surgical context)

				- Detailed description of the development process is given - Limitations/weaknesses are sufficiently described - Transferable to other surgical settings	
Health and Care Technologies	**Universal perspective**	NASSS Framework [9]	1. Framework to help predict and evaluate the success of a technology-supported health or social care program 2. Help to design, develop, implement, scale up, spread, and sustain technology-supported health or social care programs by identifying key challenges in different domains and the interactions between them	- Clear description of the purpose and the addressed question - Applicable for different care settings - Broad spectrum of possible technologies to be evaluated (Health and care technologies) - Well-illustrated presentation of the model - Visualization of connections and relationships within the framework is given - Clear definition of terms and associated question within the framework - Detailed examples of usage possibilities - Classification system to interpret the results (simple, complicated, complex) - Sound science-based framework development - Limitations are sufficiently described - High transferability to a wide variety of settings through generalistic structure	- No clear focus on a specific technology type - No clear focus on a specific setting - The individual application strategy of the framework must always be reflected, as it is not a directly applicable or a formulaic instrument