IMPACT HTA

Toolkit including a list of relevant indicators to capture hospital performance variability

And

Toolkit to assess the transferability of evidence produced in other jurisdictions and decision-making levels

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Executive summary

This report constitutes deliverable D8.1 of WP8 of the IMPACT HTA project. Two new toolkits are presented to be used as guiding tools for hospital management in the adoption of health technologies by: 1) providing a comprehensive overview of the dimensions that constitute hospital performance to enable top management to assess simultaneously its most problematic areas and its causes, and 2) providing guidance in systematizing contextual variables that may affect the concrete implementation of health technologies.

The development of the two toolkits is based on results from three systematic literature reviews, multiple interviews and case studies, an online survey and web-based search of webpages of international healthcare agencies.

The two toolkits presented in this report are:

1) Toolkit to capture hospital performance variability, including a list of relevant indicators

2) Toolkit to assess the transferability of evidence produced in other jurisdictions and decision-making levels.

1 Introduction

Deliverable D8.1 presents two new toolkits to be used as guiding tools for hospital management in the adoption of health technologies by: 1) providing a comprehensive overview of the dimensions that constitute hospital performance and assess its most problematic areas simultaneously and 2) providing guidance in systematizing contextual variables that may affect the concrete implementation of health technologies. This second toolkit helps to explain whether and how HTA reports produced in other contexts are transferable to a specific hospital, in the light of its peculiar characteristics. In other terms, the usefulness of this effort lies in providing guidance on how to adapt HTA reports to organizational contexts, so to foresee the specific effects of a technology within the hospital.

In this vein, and for the sake of clarity, it is useful to summarize the dynamics described in the toolkits within a conceptual framework. This holds on the various steps of the research and on the various methods adopted in this WP, which should be interpreted jointly within the unique framework represented in Figure 1. The framework is aimed at supporting hospital management with a more complete picture of how the contextual factors of their hospital are likely to affect performance both directly and through the mediating role of the implementation and use of health technologies.

Figure 1: Conceptual framework of contextual factors' influence of performance and on transferability of evidence across hospitals.

1.1 Structure

After a general section describing the purpose of the deliverable, the tools developed and the background for the research presented in this report, the deliverable is divided into two separate parts as described below. The second part will be presented as a stand-alone document or manual that can be used and read without beforehand knowledge of the research described in Part 1.

Part 1: Methodology and results of empirical data collection describe the methodology used for the data collection to create the two toolkits as well as present results from the different studies, including results from systematic literature reviews, interviews, case studies and surveys. The first part is integrated by a short overall discussion of the results obtained from the various data collections.

Part 2: Toolkits and manual present an overall framework, the two toolkits as well as a manual on how to use them. Furthermore, the section describes the transferability of the results given by the toolkits as well as how data should be collected to use them correctly. Lastly, an analysis of the strengths and weaknesses of the toolkits is presented, as well as their possible future developments.

1.2 Purpose

The overall aim of this deliverable is to provide 1) a toolkit including a list of relevant indicators to capture hospital performance variability and a standard methodology to identify key organizational variables responsible for hospital performance and 2) a toolkit to assess the transferability of evidence produced in other jurisdictions and decision-making levels. The two tool kits are based on a mixed methods approach, including evidence contracted from systematic literature reviews, from web page of health care agencies searches, as well as from the users' (e.g., hospital managers, clinicians, health specialists) experience in the field through qualitative and quantitative analysis.

2   Background

It is well known that healthcare systems are under constant pressure to provide high quality services in an era of limited financial resources and increasing expectations from patients, government, and society (OECD 2017). Hospitals play a key role in health systems and are the most resource-consuming organizations within them (Gabutti et al., 2017). Given their key role in the delivery of care and their high functioning costs, it is fundamental to guide their performance in a fully aware manner. However, although hospital performance management is a consolidated discipline that has provided sound theoretical guidance to top management (Australian Government, 2016), there still seems to persist a gap in knowledge about how hospital contextual factors may affect overall performance both in direct terms and indirectly, by influencing the use of costly health technologies.

General organizational models such as Harold J. Leavitt's Organizational System Model (Leavitt, 1965) give an overview of the dynamic interactions in an organization when introducing change. The model is based on a dynamic and system-oriented organizational perspective that views organizational dimensions in a holistic way. Specifically, change in an organization (in this case in a hospital) can be described by the interdependent interaction of four main components: tasks, people, structure, and technology. Any type of change or re-design in one component will affect each of the other three. For example, any change in the structure of an organization (concept that we can lead back to the contextual factors assessed in this work), will affect the way in which technology is used, and *viceversa*. Performance is not directly included in the model of Leavitt. However, it can be viewed as the final outcome influenced by the different items in the model.

Figure 2. Leavitt's Model of Organizational Change
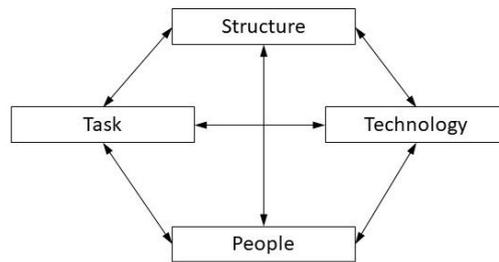
Source: Leavitt 1965

In a hospital setting these interactions and their effects on performance are particularly arduous to address given that hospital performance is a multi-faceted concept, involving many dimensions, moments of care and stakeholders. Indeed, the numerous stakeholders permanently involved in hospital activities (patients, mangers, doctors, policy makers, etc.), make it difficult to unanimously determine which facets of performance should be held crucial and with what priority (Dijkstra et al., 2006). Hospitals are complex organizational systems and their performance as well as the way technologies are utilized are largely dependent on their local-organizational (contextual) factors (Tarricone et al., 2017). This holds particularly true if we think of the variety of items and dimensions that constitute the "uniqueness" of a hospital, such as its physical, structural, managerial, and possibly cultural identity. Therefore, there is a clear need to investigate the impact of hospital contextual factors on overall performance both directly, as well as through their effects on the use of health technologies.

The implementation of Health Technology Assessment (HTA) activities and international guidelines have improved the adoption of health technologies (EUnetHTA Joint Action 2, 2016). Nevertheless, there persists a high variability in hospitals' concrete ability of using these technologies and in the impact that contextual dimensions exert on their effective utilization (Camberlin et al., 2019). Unfortunately, production and diffusion of HTA recommendations or national guidelines for the appropriate use of technologies does not automatically produce a change in uptake and clinical practice even in the most effective and efficient health care organizations (Kristensen, 2016). In fact, one of the greatest challenges for HTA is the operational implementation of recommendations in clinical settings and to assess whether HTA reports produced in other contexts are transferable to a

specific setting, in the light of its peculiar characteristics. Therefore, a large effort lies in providing guidance on how to adapt HTA reports to organizational contexts, in such a way as to foresee the specific effects the technology will have in the hospital.

Part 1: Methodology and results of empirical data collection

3   Methodology

This section will shortly describe the methods used for the development of the toolkits. To triangulate evidence, both quantitative methods and a case study approach (Yin 2013) are used with inspiration from mixed methods research (Creswell 2007). According to Yin, a case study is an empirical inquiry that: ''investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clear.'' The case study approach is exploratory and facilitates new understandings of the complex interaction between contextual factors on technology implementation and hospital performance.

Data is collected through: Systematic literature reviews (SLRs), web-page search of international health care agencies, interviews, and an online surveys. Due to the extensive empirical data collection involving multiple data collection methods, Figure 3 shows how the data sources will complement each other with the objective of triangulating the evidence provided by each, as well as how results from the data collection are used to produce the toolkits presented in this deliverable.

Figure 3. Conceptual Framework of data collection methods used to examine the association between contextual factors and hospital performance.
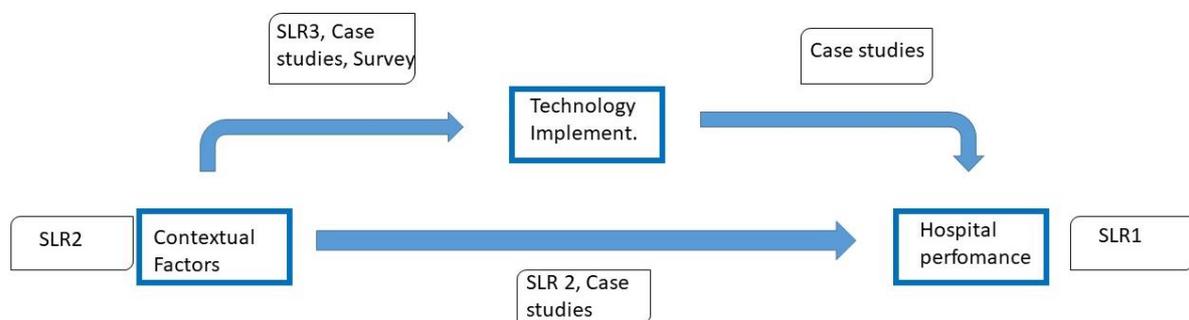
3.1 Systematic literature reviews

Three systematic literature reviews (SLRs) were carried out to explore:

- the main dimensions of hospital performance (SLR1)

- the main causal relationships occurring between hospital contextual factors and performance (SLR2)

- the effects of hospital contextual factors on the use of health technologies (SLR3)

3.1.1   The dimensions of hospital performance (LR1)

To examine the main dimensions of hospital performance, a systematic literature review was conducted on PubMed, Ovid, and Web of Science with time span January 2000 – March 2018. Keywords regarding hospital performance, indicators and outcome were combined in the search string. Articles were selected through the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and the following information was extracted and reported in a summary table: Authors/year/title; study design; objective; setting; duration; methods; results; dimension or sub dimension; indicators; definition of indicators; validity and limitations of indicators. A full description of the systematic literature review can be viewed in the publication (Carini et al., 2020).

3.1.2   The effects of hospital contextual factors on organizational performance (LR2)

A second study was performed in order to examine the effect of hospital contextual factors on organizational performance by performing an analytical review of specific healthcare management journals (e.g., BMC Health Services Research, Health Policy, Health Care Management Review, Journal of Healthcare Management) with time span January 2000 – March 2018. After title screening, the abstracts of all the selected articles were studied and pertinent ones were further selected for the literature review. All abstracts were reviewed and selected based on relevance. As part of the analysis of the selected articles, emerging themes were detected, and relevant topics were identified. Unclear topics or topics that could not be categorized under recurrent themes, were excluded from the analysis.

3.1.3 The effects of hospital contextual factors on the use of health technologies (LR3)

To examine the effects of hospital contextual factors on the use of health technologies, a systematic literature review on the relationship occurring between contextual factors and technology implementation at hospital level was carried out. A search on PubMed, Web of Science, Scopus, Ovid and EconLit was conducted according to the PRISMA statements and with time span January 2000 – May 2018. A search string was applied combining keywords regarding health technologies, implementation, and adaptation. This search query allowed for the distinction between drugs, medical devices, capital equipment, diagnostics and clinical procedures. Relevant articles were selected based on title and abstract review, followed by a full text review of selected articles. In the analysis of the articles, contextual factors were categorized as either impeding or facilitating the implementation of the health technology as reported by each study, and evidence was synthesized in a descriptive manner. A full description of the systematic literature review can be viewed in the publication (Grossi et al., 2021).

3.2 Webpage based search of health care agencies

A search on the web pages of international health care agencies' listing performance indicators was conducted to triangulate the results of the systematic literature review further and to collect a comprehensive list of performance indicators. Performance indicators concerning secondary health settings were selected and collected in a new database. The criterion for inclusion was indicators being nationally consistent and locally relevant. The indicators were finally aggregated by dimension and by medical specialty.

The International Agencies screened to detect a full set of hospital performance indicators were:

- National Agency for Regional Health Services, AGENAS (Italy);
- Australian Institute of Health and Welfare, AIHW (Australia);
- Canadian Institute for Health Information, CIHI (Canada);
- Agency for Healthcare Research and Quality, AHRQ (USA);
- National Health Service - MyNHS tool, NHS (England);
- Organization for Economic Co-operation and Development, OECD.

The full set of indicators is reported in ANNEX 1.

3.3   Multiple case studies

The relevant contextual factors affecting various dimensions of hospital performance and whether hospital contextual factors may affect an optimal use of health technologies were further investigated through a multiple case study approach.

An in-depth analysis of the relevant contextual factors and their effects on performance were assessed through individual interviews to key managerial figures in two hospitals.

These in-depth analyses were conducted in:

- Fondazione Policlinico Agostino Gemelli, Italy
- Odense University Hospital, Denmark

A semi-structured interview guide (Appendix 2) was developed based on the main results of the literature reviews. The questions asked were categorized in the following sections: Description of the hospital (Section 1), Organizational structure and other contextual factors (Section 2), Human Resource Management tools (Section 3), Effects of contextual factors on hospital performance (Section 4), Enablers and barriers to technology's full implementation (Section 5). These two hospitals were selected for an in depth-analysis due to their large dimensions and due to their reputation as centers of excellence within their countries. Due to the restrictions of the Covid-19 pandemic, the case studies in the two hospitals varied a bit in data-collection methods.

In the Agostino Gemelli University hospital in Rome six on-site interviews were carried out: one with the hospital's Chief Medical Officer, one with the Head of Human resources, four with experienced (more than 10 years working at the hospital) full-time employed physicians or surgeons. Two researchers carried out the interviews using the semi-structured interview guide. The Chief Medical Officer responded to sections 1, 2 and 4 of the interview guide while the Head of Human resources answered sections 3 and 4 (the latter only in reference to the effect of HRM tools). Physicians were asked to reply to section 5 only.

At the Odense University Hospital, the interview was performed using an online meeting facility (TEAMS) since it was not possible to perform on site visits due to safety and travel restrictions caused by the Covid-19 pandemic. Two researchers carried out an interview with a health economist and

specialist consultant in health technology assessment from the department of Innovation implementation at the hospital. The interview guide was sent to the specialist beforehand, so for her to be familiar with the research areas and to have the opportunity to collect additional information from relevant experts on all five areas of interest. The interview was taped, and key areas of interest was transcribed.

3.4   European hospital Survey

The sections below describe the development of a survey distributed to European hospitals, how data was collected and how the analysis was carried out. The survey, aimed at exploring whether hospital contextual factors may affect optimal technology implementation and use, was built around the implementation of three specific health technologies which will shortly be described below, namely: The **Da Vinci Robot** a robotic system that utilizes computational, robotic, and imaging technologies to enable improved patient outcomes compared to other surgical and non-surgical therapies; the **Transcatheter aortic valve implantation/replacement** which is a minimally invasive heart procedure, which allows an artificial aortic valve to be implanted, using a catheter, over a poorly functioning valve (aortic valve stenosis); and **Laparoscopic cholecystectomy** which is a minimally invasive surgical procedure for removal of the gallbladder (cholecystectomy).

The three technologies were chosen due to their diversity of use, the different periods of time needed for implementation and their availability and diffusion within the hospitals involved in the study.

3.4.1   Construction and validation of the survey

The questions in the survey were constructed based on the results of the literature reviews described above. The survey was made up of two parts. The first explored the characteristics of hospitals' contextual factors, as well as their direct effects on performance, and was addressed to hospital managers. The second explored barriers/enablers to the optimal use of one of the three health technologies analyzed and was administered to surgeons and nurses permanently employed in the hospital. Before its administration to respondents, the survey was sent to an expert panel for validation. The survey was validated through a modified version of the Delphi method, a qualitative research method that aims to reach a consensus among experts through a series of reiterated questionnaires. Twenty experts were identified and were contacted by e-mail and invited to

participate. Nine experts were invited for the managerial aspects of the survey, and eleven for the section related to the use of technology. Participants were selected to represent different levels and perspectives within the organization, and thus contribute to reaching a more holistic perspective on technology use. The overall list of hospitals involved in the study is reported in Appendix 1. The full version of the questionnaire and invitation to participants can be viewed in Appendices 2a to 2c.

3.4.2 Setting, data collection and participants

The survey was sent to 11 hospitals in 6 countries (Italy, Poland, Slovenia, Switzerland, Spain, and Portugal). Hospitals were selected and contacted by the partners of the project, who also provided the contact details of a reference person for each. Invitations to participate and all the supplementary information/forms were sent electronically to the reference person. Once the hospital had provided formal agreement to participate, the survey was sent via an email link (leading to its online version on SurveyMonkey) to the reference person, who then autonomously administered it to respondents. Each respondent was asked to provide written consent for the use of the data provided.

3.4.3 Analysis

Initially, a summary of the main results gathered from the online survey at hospital level were analyzed. The associations between selected contextual factors and barriers/enablers of technology implementation were examined through Chi-square (X^2) tests, and the statistical significance assessed by Pearson's correlation coefficient. All p-values less than 0.05 were considered statistically significant.

4. Results

4.1 The literature reviews

4.1.1 The dimensions of hospital performance (LR1)

From the search a total number of 682 records was subsequently screened and ultimately six reviews were included in the qualitative synthesis.

The dimensions in which the indicators of hospital performance were classified include: **Efficiency**, defined as the optimal allocation of available healthcare resources that maximize health outcomes for

society or, in other terms, as hospital optimal use of inputs to yield maximal outputs, given the available resources. **Clinical effectiveness** is the appropriateness and competence which allows to deliver clinical care and services with the maximum benefit for all patients. This dimension can be sub-classified in appropriateness of care, conformity of processes of care, outcomes of care and safety processes. **Patient-centeredness** concerns a set of indicators which pay attention to patients' and families' orientations. The main aim is to evaluate whether patients are placed at the center of care and service delivery. **Safety** refers both to patients and to professionals in terms of the ability to avoid, prevent and reduce harmful interventions or risks for them and for the environment. **Responsive governance** is described as the degree of responsiveness to community needs, to ensure care continuity and coordination, to promote health and provide care to all citizens and indicators are sub-classified in system integration/continuity and public health orientation. **Staff orientation** consists in the recognition of individual needs, health promotion and safety initiatives, behavioral responses. This dimension can be assessed through absenteeism, working environment satisfaction, overtime working, burnout and continuous education. **Timeliness** refers to the time needed to be addressed to specific treatments.

A full description of the results of the systematic literature review can be viewed in the publication (Carini et al., 2020).

4.1.2 The effects of hospital contextual factors on organizational performance (LR2)

A total of 45 relevant articles were selected and classified based on their focus on hospital contextual factors and on how they may affect performance. It emerged that management disposes of several drivers, which it must capably exploit to affect overall performance.

Firstly, its organizational chart is key in reaching hospital performance. Although there exists no "perfect" organizational chart, what is relevant is that it is coherent with the objectives (and overall strategy) the hospital has set (Lega and De Pietro, 2005). For example, if the hospital is shifting towards a patient-centered approach, it is of key importance that its organizational chart has at least a mixed asset, with transversal responsibility units crossing vertical clinical directorates (Gabutti et al., 2017).

Second, hospitals must implement a structured and effective managerial accounting system. There must exist a clear combination between organizational units and the responsibilities they hold (Groene et al., 2010). Consequently, budgeting, reporting systems, and costing tools must in turn be

coherent with units' responsibilities. Responsibility should not be assigned to a unit without systematically monitoring specific outcomes.

A third family of items that can affect performance are human resource management tools. People's selection, allocation, evaluation, reward, training, retain, and lay-off must be managed in an integrated way and the hospital must provide an effective competency modelling strategy, able to guide a strategic vision on the development, allocation, and retention of key competencies within the organization (Ribera et al., 2016).

A fourth dimension that determines performance has to do with the adoption and effective implementation of information communication technology tools. Not only must these be adequate to support the information flows requested, but they must also be adequately used by the right responsibility units and individual professionals (Fieschi, 2002).

4.1.3   The effects of hospital contextual factors on the use of health technologies (LR3)

A total of 33 studies were included, mostly addressing information and communication technologies. Four main contextual domains were highlighted as likely to affect the concrete use of health technologies within hospitals. The four domains are: hospital infrastructure and architecture; hospital's availability of financial resources; leadership styles; human resource management tools. Table 1 below shows the four domains and suggested sub-topics under each domain.

Table 1: Main contextual domains and sub-topics which exert an effect on the use of health technologies

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Hospital infrastructure and architecture

- University/ non-university hospital
- Architectural type of hospital

- Organizational chart of hospital (e.g., Vertical vs Horizontal)

- Patient pooling approach(es) to group patients within ward units

- Number of staffed beds in the hospital
- Current number of employees in the hospital
- Yearly number of discharges performed at hospital
- Number of ambulatory consultations at hospital per year
- Roles of hospital in the uptake territory (Hub/Spoke)
- Clinical pathways and itineraries for patients' categories (e.g., emergency pathway or mother and child pathway)
- ICT tools regularly used within the hospital

• Level at which electronic health records are fully integrated and coordinated • Health Technology Assessment activities or initiatives within the hospital • Presence of a dedicated Hospital Based-HTA unit in hospital
Hospital's availability of financial resources • Which responsibility centers hold an annual budget (e.g., departments, clinical wards, horizontal clinical pathways) • Assignment process of a budget to the various clinical settings (e.g., defined by top management, negotiation with clinical settings) • How the annual budget of the clinical setting is broken down • Use of a Balanced Scorecard or similar methods to evaluate key performance areas and indicators
Leadership styles • Top-down vs. bottom-up approach • Rigid vs. shared decision-making processes
Human resource management tools • Job evaluation activities • People evaluation activities • Performance evaluation activities • Activities aimed at evaluating human resources' potential

The results of the review suggest that several contextual factors play a major role in the actual utilization of health technologies at hospital level, even though data are mostly referred to ICT and not to the whole spectrum of health technologies. Evidence concerning medical and surgical health technologies is poor and future research should attempt to fill this gap.

4.2 Quantitative assessment of indicators

The International Agencies screened to detect a full set of hospital performance indicators are:

- National Agency for Regional Health Services, AGENAS (Italy);

- Australian Institute of Health and Welfare, AIHW (Australia);

- Canadian Institute for Health Information, CIHI (Canada);

- Agency for Healthcare Research and Quality, AHRQ (USA);

- National Health Service - MyNHS tool, NHS (England);

- Organization for Economic Co-operation and Development, OECD.

In the final dataset (Annex 1) 503 indicators were collected. The most addressed specialties included: Surgery (307 indicators; 57.8%); Cardiology (80; 15.1%); Emergency (62; 11.7%). The most frequently reported dimensions included Accessibility (133 indicators, 25,0%), Effectiveness (36, 6,8%), Safety (23, 4,3%).

4.3 The survey

4.3.1. The Experts' Validation

Thirteen experts (62%) participated in the first round. The participation rate varied as follows: 66% for management, 63% for surgery experts. The questionnaire at the first round contained 40 questions for the "management" category and 42 questions for the "surgical" category. At the end of the first round, results were processed as follows: if a question was rated as "totally agree" and "agree" by at least 70% of the respondents, it was directly included in the survey. If the question was rated as "totally disagree" or "disagree" by at least 70% of the experts, it was directly excluded from the survey. This last event, however, did not take place. In all other cases, questions were proposed again in the second round, along with the modifications suggested by experts, as well as with any further question suggested as relevant. Few changes were suggested in the managerial section, while more suggestions were present in the surgical one, as well as eight possible additional questions. Therefore, in the second round, the questionnaire contained 40 questions for the managerial section and 50 questions for the surgical one (including the questions that had been already validated). In the second round, the email was sent again to the twenty experts, and the response rate was 63%. The threshold for inclusion or exclusion of questions was 70% of experts. After the second round, the consensus was reached, and no further modifications were proposed. The final version of the survey, approved by all the experts, contained 40 questions for the "management category" and 50 questions for the "surgery" category (the full survey in its final version is provided in Appendices 2a to 2c).

4.3.2. The Results of the Survey

The survey was sent to 9 hospitals in 5 European countries (Italy, Poland, Slovenia, Spain, and Portugal). Sixty-nine healthcare professionals responded to the survey, divided in 16 top managers, 49 physicians and 4 nurses.

4.3.3. Description of participating hospital

Most of the participating hospitals are university hospitals. Most are publicly owned or providers of public services even if they are privately owned. The most frequent architectural type of hospital is the multi block or pavilion one, with separated buildings which are not directly connected to each

other. Most hospitals are large entities with more than 1000 staffed beds, more than 2000 employees, and more than 30.000 yearly hospital admissions. In the uptake territory, the hospitals most frequently play both the role of hub and a spoke, depending on the activity. Otherwise, they are mainly hubs. All hospitals use clinical specialties as the main patient pooling approach to group patients within ward units although they are horizontally driven by multiple pathways. Cancer pathways are the most frequent (see Table 2).

Table 2. Description of participating hospitals

Hospital infrastructure and architecture	%
University hospital?	83
Ownership of hospital?	
Public	67
Private not-for-profit	17
Private for profit	16
Architectural type of hospital	
Pavilion hospital	38
Single-block hospital	6
Multi-block hospital	50
Other	6
Number of staffed beds in the hospital?	
<500	17
500-999	17
1000-1500	49
> 1500	17
Current number of employees in hospital?	
<2000	25
2000-3900	25
4000-5999	42
>6000	8
Yearly number of hospital admissions	
<20.000	17
20.000 – 29.999	8
30.000 – 39.999	17
40.000 – 49.999	
>50.000	58
Roles of hospital in the uptake territory?	
1. Hub	27
2. Spoke	13
3. Hub AND spoke depending on activity	47
4. Does not belong to a hub and spoke network	13
Specific clinical pathways and itineraries for patients' (more than one answer possible)	
Emergency Pathway	56
Orthogeriatric pathway	38
Mother and child Pathway	50
Cancer pathway	75
Organizational chart of hospital	
Vertical model driven by specialties	33
Horizontal model driven by pathways	67

Model based on progressive patient care	
Mixed model (matrix)	

4.3.4. Technology

In most hospitals technology-innovation priorities are set by top management and middle management and it is top management and CEOs who take the final decision on adaptation/purchase of a new technology. In the uptake process of the technology, only physicians/middle management are systematically involved in the decision process (though they do not take decisions directly). Electronic Healthcare Records are implemented in all hospitals and ICT tools are fully integrated and coordinated at a hospital level in 75% of the hospitals, whereas for the rest, ICT tools are fully integrated at a ward level only.

4.3.5. Managerial accounting

Most hospitals use activity-based cost management tools and departments hold an annual budget which is broken into quarterly or monthly budgets. The budget is defined by top management negotiations with the clinical settings take place systematically. Job evaluation activities are systematically carried out in most hospitals for physicians and managers, using score and factor comparison methods. Only half of the hospitals have a dedicated health technology assessment unit, but HTA activities do take place in most hospitals to support managerial decision-making processes.

4.3.6. Enablers and barriers to technology use

As mentioned in the methodology section, questions regarding the uptake of three specific health technologies were included in the survey: the Da Vinci Robot, the Transcatheter aortic valve implantation/replacement, and Laparoscopic cholecystectomy. In relation to possible enablers or barriers to the full use of the technologies, the responding physicians have most often answered that reimbursement systems, availability of operation rooms, device costs, management schedules and conflicts with other professionals' priorities are barriers to the use of the technology. Informal training between colleagues and teams as well as the teams' technical competencies, formal training and formal procedures during surgery are most often valued as enablers of the technology use (see Table 3).

Table 3: Enablers/barriers of technology adoption

Enablers or barriers	Enabler (%)	Barrier (%)	Neither (%)
Formal training activities on the use of the technology	44	22	34
Informal training between colleagues and within teams	65	24	11
Formal procedures and guidelines during surgery	46	54	0
Moments of briefing/debriefing for team	41	24	35
Team's technical competencies	62	27	11
Device cost	6	67	27
Communication within team	30	22	48
Timely availability of patient clinical information	29	20	51
General organization at hospital level	32	51	17
Availability of medical equipment	27	56	17
Availability of operating rooms and/or other spaces	11	69	20
Management of schedules	10	66	24
Technical assistance	24	39	37
Conflict with other professionals' priorities	8	61	31
Reimbursement system	6	77	17

Tables 4-8 show the associations between selected contextual hospital factors and enablers/barriers to technology use as viewed by physicians.

The results of the survey show that operation room availability, management of schedule and reimbursement systems overall are viewed as barriers to the use of technologies, regardless of contextual hospital factors. Conflicts with other professionals' priorities is more often considered a barrier to the use of technologies in specialized, private/partially private hospitals, as well as in hospitals with a vertical organizational chart and few clinical pathways.

Technical assistance during surgery is more often seen as an enabler at general hospitals, hospitals with a mixed/horizontal organizational chart and at hospitals with more clinical pathways, whereas it

is more often seen as a barrier in other type of hospitals, characterized by vertical organizational models and few clinical pathways.

Table 4. The association between hospital contextual factors and conflict with other professionals' priorities

	Enabler/neutral (%)	Barrier (%)	P-value
Ownership of hospital			0.051
Public	**52**	48	
Other	22	**78**	
Institutional profile			0.003
General	**56**	44	
Other	7	**93**	
Organizational chart			0.005
Mixed/horizontal model	**54**	46	
Vertical model	8	**92**	
Proportion of clinical pathways			0.005
<= 49%	8	**92**	
>50%	**54**	46	
Highest level in which ICT tools are fully integrated			0.03
Clinical ward level	**55**	45	
Hospital level	21	**79**	

Table 5. The association between hospital contextual factors and operating room availability

	Enabler/neutral (%)	Barrier (%)	P-value
Institutional profile			0.033
General	7	**93**	
Other	41	**59**	
Organizational chart			0.064
Mixed/horizontal model	39	**61**	
Vertical model	8	**92**	

Table 6. The association between hospital contextual factors and management of schedule

	Enabler/neutral (%)	Barrier (%)	P-value
Institutional profile			0.014
General	48	**52**	
Other	7	**93**	
Organizational chart			0.03
Mixed/horizontal model	46	**54**	
Vertical model	8	**92**	
Proportion of clinical pathways			0.03
<= 49%	8	**92**	
>50%	46	**54**	

Table 7. The association between hospital contextual factors and technical assistance

	Enabler/neutral (%)	Barrier (%)	P-value
Institutional profile			0.02
General	**74**	26	
Other	36	**64**	
Organizational chart			0.04
Mixed/horizontal model	**71**	29	
Vertical model	39	**61**	
Proportion of clinical pathways			0.04
<= 49%	39	**61**	
>50%	**71**	29	

Table 8. The association between hospital contextual factors and reimbursement system

	Enabler/neutral (%)	Barrier (%)	P-value
Organizational chart			0.02
Mixed/horizontal model	32	**68**	
Vertical model	0	**100**	
Proportion of clinical pathways			0.02
<= 49%	0	**100**	

>50%	32	**68**

4.4 The multiple case studies

Multiple case studies were performed at the two university hospitals, The Agostino Gemelli University hospital in Italy and Odense University Hospital in Denmark.

The Agostino Gemelli University hospital in Rome is the second largest general hospital in Italy, with 1,575 beds. This setting was chosen because of its relevant dimensions and complexity, combined to the very modern technologies it has adopted. The hospital is currently organized into 21 areas grouped into 8 departments which are responsible of coordinating all clinical, training and research activities within their boundaries. It uses clinical pathways systematically to map, integrate, and assess every phase of providing care for key health pathologies. In 2015, almost 95,000 patients were hospitalized, and more than 45,000 surgical operations were conducted, while 80,000 patients were treated in the Emergency Department. Since 2015, the hospital has hosted one of the largest and newest hybrid operating theatres in Europe.

The interviews concerning the asset of contextual factors of the hospital and their effects on the use of technology and on performance produced evidence of a quickly evolving scenario. In particular, the Gemelli hospital is organized in a rather traditional way, with seven clinical directorates hierarchically subordinated to the Chief Medical Officer. Each clinical directorate includes several clinical wards and is generally quite autonomous in managing its resources and staff. Nevertheless, important organizational innovations have been implemented to pursue a strategic plan of organizational change, aimed at shifting towards a more horizontal organizational chart. In the first place, many resources have been centralized and are shared across clinical directorates. The most important example is the central operating theatre, which is led by a team of professionals who assign time slots to directorates, based on the priorities of efficiency and operating room saturation. Another example concerns nurses, who are led centrally by a dedicated function, which assigns professionals to directorates both based on their individual key competencies as well as pursuing effective and efficient allocations.

Second, the hospital has introduced a formal unit responsible of designing and managing clinical pathways for the major pathologies it treats. Currently, the pathways implemented are over 60. The

creation of clinical pathways around a disease requires multi-disciplinary teams led by the Clinical Pathway Unit and made up of representatives of all the major professionals involved in the different stages of the pathway. This means that multi-disciplinarity is given both by the different clinical directorates involved (i.e., different clinical fields) as well as by different types of professionals (e.g., physicians, surgeons, nurses). Through a permanent negotiation process, the pathway is formalized, and its performance indicators (and targets) are set. This means that a "transversal" evaluation integrates the typical setting-oriented one, with process indicators integrating the traditional clinical and financial ones (although the latter still play a much higher role in the overall performance evaluation). The team shares responsibility in the achievement of the expected results of performance. Although budgets are still assigned to clinical directorates and not to transversal clinical pathways, the participative nature of their teams makes it easier to commit clinical directorates to common objectives.

The hospital has formalized a Human Resource Management function which plays a relevant role within the organization, functioning as a strategic partner to top management. The HRM function is responsible of designing and providing training initiatives to staff but does so in cooperation with the requirements and suggestions coming from clinical directorates and from the nursing unit (which is independent from clinical directorates). Moreover, the HRM function has initiated a massive project of competency modelling, aimed at mapping and monitoring the set of competencies present and needed in most key managerial positions. This allows a timely assessment of possible discrepancies between the *as-is* and the *to-be* situation and allows to adapt training strategies consequently. Nevertheless, this effort is still relatively recent and items such as seniority and formal appointments to positions are still the main drivers of career advancement and financial gratification.

In reference to Information Communication Technology tools, the hospital adopts shared (between physicians and nurses) electronic health records, which allow any professional within the hospital to have timely access to all the clinical data of patients treated within it. Nevertheless, data integration is limited to the hospital level and there is no access to any data coming from outside its boundaries (i.e., from other hospitals or from general practitioners).

The contextual characteristics of the Gemelli hospital are held to play a key role in its overall performance. In particular, its organizational chart, based on clinical directorates, is held to have a direct impact on the excellency reputation the hospital has built, with outstandingly high scientific competencies that distinguish its professionals. In other terms, this model is held to improve a

"learning and growth" perspective, which can be measured, for example, through indicators such as number of scientific publications, number of presentations in international conferences, number of patents registered. The efforts of centralizing relevant resources is held to have a strong impact on efficiency, on utilization rates and on the financial dimension. In particular, ever since the introduction of the central operating theatre, the hospital has experienced much higher saturation rates than in the past, cutting wastes and relative costs dramatically. Moreover, the current organizational asset has variable effects on patient-centeredness. If on one side the patients who belong to a clinical pathway experience an integrated and coordinated continuum of care, on the other, those who are not inserted into a pathway may still experience rather fragmented moments of care. This is why the hospital is investing massively in the creation of integrated pathways.

In reference to clinicians' perception of enablers and barriers to a fully effective implementation and use of health technologies, there emerge two recurrent issues. In the first place and in reference to surgical equipment, physicians state that the actual access to modern technologies is frequently tied to the "power" and charisma of clinical directors. In other terms, depending on their negotiation and charismatic abilities, there may exist drastic differences in the amount and quality of modern health technologies introduced within the clinical directorate, as well as the actual opportunity of sharing their use between senior and junior physicians. Yet, these discrepancies seem to have been mitigated since the introduction of a hospital based HTA unit, which introduced a shared (across departments) technological strategy and more accountability for investments in health technologies. In other words, the traditional "power" of clinical directorates could be interpreted as an enabler or barrier to health technology depending on his/her charisma and negotiation ability with the hospital's top management. This (positive or negative) effect is, however, mitigated by the hospital based HTA unit, which increases equity in the introduction of technologies across the various directorates.

A second recurrent perspective, with particular reference to the use of healthcare information systems, is that there persists a major difficulty in implementing them effectively due to a high cultural resistance from operators and an inadequate "understanding" of the tools' functioning and usefulness. This means that although "transversal" information and communication tools are indeed introduced within the hospital to enhance its switch towards a horizontal organizational model, this may not reach its full potential due to the cultural rigidity of operators, tied to setting-centric accountability approaches. The impression of respondents is that the transformation from a vertical to a mixed organizational chart needs further support in terms of training and committing healthcare

professionals, who tend to perceive the new technologies as time consuming, without necessarily grasping their overall utility.

Odense University Hospital is the largest and most specialized hospital in Southern Denmark, with 1,039 beds. More than 35 different medical specialties are represented in it. Among these there is cardiology, clinical genetics, and orthopedic surgery. The hospital is well known for its innovative approach to technology use, implementation, and development. Every year more than 40.000 surgical operations are performed and 104.000 patients discharged from the hospital.

The hospital is organized in a traditional vertical department structure which is however mitigated by shared progressive patient settings (e.g., common settings among departments which host patients with similar intensity of care needs). This is the case, for example, of a separate building within the hospitals' campus aimed at hosting patients that are no longer in need of intensive assistance. Moreover, although departments are assigned with their own staffed beds, a "flexible culture" was introduced to re-allocate beds across departments in case of need. Furthermore, the hospital has introduced transversal clinical pathways, especially for oncological diseases. In each pathway, each patient is assigned with a reference person, who is responsible of assuring a timely access to settings and exams and an overall fluidity of the pathway's implementation. Nevertheless, clinical pathways are not in possess of their own budget or beds. This means that in terms of resources, they still depend on vertical departments. Rather, they can be seen as structured and sustained collaborations of different professionals who still respond to vertical centers of responsibility.

Human Resource Management has designed career ladders along the various responsibilities that can be held withing departments although, given the fact that the hospital is a university hospital, an academic/research track ladder is alternative to the typical managerial one and is, possibly, even more prestigious.

The hospital enjoys a very integrated information communication system at the regional level. Indicators are publicly available, and each hospital can compare its performance with other hospitals in the area (data is available at the aggregated level). Indicators at the regional, hospital, department, and clinical ward level are fully available. Among the available data collected, patient satisfaction is also measured and openly available. Moreover, ICT integration is also present at the hospital/general practitioner level. Although platforms are available and in use, though, these have still not reached their full potential in day-by-day activities.

Finally, all patients have an online integrated personal health record that is accessible to all providers of care in the region as well as to patients themselves. Whenever updated, the most recent information is simultaneously made available to all the actors who have access to the record.

The hospital disposes of an HTA unit which has the objective of supporting management in decision-making concerning technology adoption and disposal. Formally, final decisions are taken by a Board of medical directors, in top managerial positions. Nevertheless, the hospital's culture is more and more moving towards shared decision-making processes, which increase the weight of the opinion and the degree of accountability of departments and final users. The hospital HTA unit is also more and more called to intervene in support to departments and their responsibility on overall quality achievement.

The hospital does not face relevant challenges in the implementation of routine medical devices through incremental processes of change. Professionals' competencies are perfectly adequate and in general they are willing to sustain continuous improvement. Nevertheless, issues may arise in the implementation of larger and more challenging health technologies, which imply radical forms of change in daily activities. This, again, is not because of professionals' competencies which, on the contrary, are likely to constitute an enabling factor to technology uptake, but rather to inadequate or incoherent funding. In particular, the problem lies in the funding assigned to organizational units to implement the changes required by new technologies. These, usually, imply new procedures or complementary activities that require *ad hoc* funding. This incoherence between technology's implications and their funding has put the hospital in a situation in which only around 10% of technologies in the development projects are then concretely implemented. This aspect probably represents the most relevant barrier to technology implementation.

4.5 Summary of the results section

By triangulating evidence emerging from the different sources of data used in this study, some emerging themes arise in terms of the main contextual factors able to affect hospital performance, both directly and through their impact on technology implementation.

In the first place, the organizational chart of the hospital seems to play a key role in this sense. In particular, vertical structures (and in a complementary way horizontal ones) my both enable or hinder effective technology implementation and performance. This is because some technologies (and some areas of performance) are indeed tied to the department level, others to a transversal organizational

approach. Clearly, a high autonomy of departments increases their accountability and their orientation to full technology implementation and high performance. Nevertheless, other designations of performance and other technologies that are related to joint forms of inter-professional work, would benefit from mixed or horizontal organizational charts. In other terms, the organizational chart should be coherent with the main set of objectives and the typology of technologies privileged within the specific hospital.

Moreover, funding and financial coherence is key in the issues assessed. If the overall organizational consequences of technologies are not dealt with in advance and properly funded, the technology is likely to fail. This has to do with the first point concerning the organizational chart. Indeed, funding should be carried out in coherence with the assignment of (different types of) objectives to different types of organizational units. If, for example, a hospital is shifting towards privileging patient-centered care indicators, having transversal clinical pathways that do not hold a budget and a good degree of autonomy in decision-making processes on technology uptake may be problematic.

In general, human resource management and leadership styles are frequently considered effective in supporting both technology uptake and performance success. This is also strictly tied to the level of integration of information, that is likely to hinder success if reached only at the unit level, while is likely to support performance if developed at the organizational and inter-organizational levels.

Part 2: Toolkits and Manual

5 Introduction

Two toolkits are presented in this Part 2 of the deliverable. The first (TK1) provides a comprehensive overview of the dimensions that constitute hospital performance and the second (TK2), constitutes a guiding tool for hospital management in the adoption of health technologies. Both toolkits have been developed based on an extensive data collection of empirical data gathered as part of WP 8 as described in Part 1 of this deliverable. For the sake of clarity, it is useful to summarize the dynamics clarified by the toolkits within a conceptual framework. The framework described below aims at supporting hospital management with a more complete picture of how the contextual factors of their hospital are likely to affect performance both directly and through the mediating role of the implementation and use of technologies.

Figure 4. Conceptual framework of contextual factors' influence on performance and on transferability of evidence across hospitals
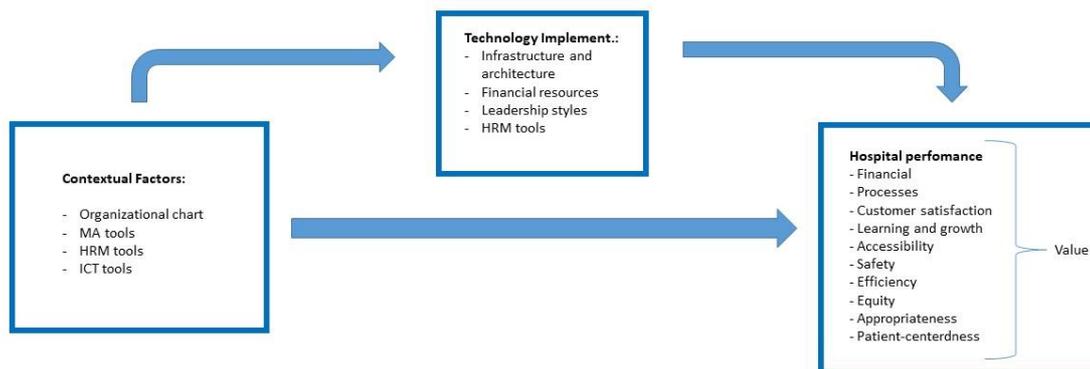
5.1 The conceptual framework and its domains

The conceptual framework builds on the evidence provided by the literature reviews carried out within this study. In particular, each review provides the specific contents of each of the framework's three domains: **Hospital contextual factors**, **Health technologies implementation**, and **Hospital performance**. The three domains are briefly described below.

5.1.1 Hospital contextual factors

In reference to hospital contextual factors, the first element that plays a key role in the delineation of the hospital's specific characteristics is its **organizational chart**. Hospitals are experiencing a gradual shift from rigid, vertical structures, to more horizontal ones. While the first are characterized by rigidly designed clinical directorates, which enjoy a high autonomy and a nearly exclusive power on their resources (whether financial, technological, human etc.), the second introduces horizontal organizational units that "cross" different clinical directorates and follow patients across the continuum of care. Although it is difficult to find hospitals that have implemented purely horizontal models (hospitals are frequently tied to stringent legislation and a shift from a model to another requires long-term incremental change), it is possible to classify them on a hypothetical continuum that goes from one model to another. If, in other words, the organizational chart is made up of clinical directorates exclusively, the model is vertical. If, on the contrary, the chart is indeed built on vertical clinical directorates, but also includes horizontal settings with a formal designation of responsibility, the model is mixed (and more patient-oriented). If, although this is difficult to find, the organizational chart is not based on clinical directorates but rather on horizontal settings, the model is horizontal.

The **managerial accounting tools** the hospital adopts are a second key item in the definition of their organizational context. Both the type of tools as well as the ways in which they are used are relevant. For example, whether indicators are measured and monitored at the department level only, or rather also in transversal units, is key. Moreover, whether all dimensions of performance are adequately taken into account, or rather only (or mainly) the "typical" clinical and financial ones, is emblematic of the hospital's managerial context. Finally, the coherence between the managerial accounting system and the organizational chart is key: if, for example, we are in presence of a rather horizontal chart but the MA system is tied rigidly to the measurement of clinical directorates' outcomes, this creates an incongruent organizational environment.

Another family of tools that describe the contextual scenario of hospitals are **Human Resource Management tools**. These include a vast range of tools used to cover all the phases of HRM: hiring, allocating, training, evaluating, incentivizing people. A fundamental topic here is the capability of a hospital of clearly designing roles and of providing people with the right competencies needed to cover them. A major problem within complex organizations such as hospitals has to do with the risk

of incurring into overlapping responsibilities or situations in which it is not clear who should be doing what. In this vein, a clear, exhaustive, and broadly accepted set of professional roles is crucial. Moreover, the organization's capability of assessing professionals' concrete competencies (and of monitoring them in time) is fundamental in running activities smoothly.

The set of its **Information Communication Technology tools** constitutes another major dimension that defines a hospital's contextual identity. Enhancing safe and effective communication flows is fundamental to reach high levels of performance. This, in a hospital, has to do with the transmission of clinical and administrative data, but also of information concerning other facets of its activity such as efficiency in processes, patient and staff satisfaction, etc. Communication flows should be able to guarantee that people are promptly in possession of the information they need when they need it. Delays in information access, incomplete information or irrelevant and redundant information may hinder a smooth functioning of the organization. Another crucial topic has to do with the level of integration of communication systems. Hospitals are necessarily part of a network of actors, whether they cover the role of hub or of spoke (or both) within this network. The challenge of creating fluid flows of communication not only within but also across settings and organizations is a major topic in the healthcare scenario worldwide. Such integration can and should occur across actors of the same network, in the same area or maybe also in the same region or country. This is of the utmost importance in an era in which patient mobility is encouraged and in which most healthcare systems are adopting patient-centered approaches, aimed at providing coordinated services across the continuum of care.

5.1.2 Implementation of health technologies

Four main families of contextual items have emerged as able to exert a direct impact on the effective implementation of health technologies.

The first family includes **hospital infrastructure and architecture**. Dimensions such as hospital size, hospital location and teaching vs. non-teaching status may exert an impact on the implementation of technology. Also, the affiliation to some universities or to a multi-hospital network is associated to HT implementation.

The hospital's **availability of financial resources** plays a key role as well. Financial support and adequate budgeting are of utmost importance for successful HT implementation. Resources are

identified as a barrier when hospitals face difficulties in obtaining funding for high-cost technology or in recruiting technical staff. The absence of a budget that is coherent with organizational units' technological assets may hinder the possibility of using them in concrete. Cost issues and lack of reimbursement policies are the main cause of a sub-optimal use of the HT.

Third, **leadership styles** exert a relevant impact. A persistent and sustained leadership by top management is a key element to implement a HT successfully. Factors such as managers' attitude and propensity to involve staff members in decision-making processes are a facilitator to full technology implementation.

Fourth, **human resource management** tools are key in technology implementation. HRM appears to cover a crucial role across many of its typical stages. In the first place, in the phase of staff supply and planning, due to the need of defining new roles, including those in charge of supporting the change necessary to implement the technology. Insufficient or inadequate human resources, staff shortages, lack of staff recruitment and contractual tensions are all barriers to HT implementation. Moreover, HRM is also essential to plan education. Indeed, to use a given technology effectively, it is often necessary to undergo an appropriate training program and many studies underline that the inability to satisfy training needs is a major barrier to implementation. It is important that HRM tools are coherent with the hospital organizational and technological asset and spur operators to "accept" the HT, addressing their concerns, including those related to workflow changes. A final dimension in which HRM makes a solid difference is the generation and allocation of specific behavioral competencies. In particular, team-working emerges as a key factor of HTs implementation.

5.1.3 Hospital performance

Hospital performance is a multi-faceted concept, involving many dimensions, moments of care and stakeholders. It is therefore important to adopt and implement managerial and evaluation tools that allow to "balance" its different facets. The domains of performance include the financial one, processes, customer satisfaction, learning and growth (which are some "typical" dimensions assessed in the industrial sector) as well as patient accessibility, safety, efficiency, equity, appropriateness, patient-centeredness (which are dimensions typically ascribable to the healthcare sector).

Finally, performance should ultimately be intended as "producing value", where value is defined as patient health outcomes achieved relative to the overall costs of care. It is crucial to measure both

health outcomes and costs not only in the short but also in the long run. In other terms, it is not possible to identify a single outcome that captures the results of care for a specific medical condition. On the contrary, one should assess a set of multidimensional outcomes that jointly constitute patient benefit, including survival, functional status, and sustainability of recovery. Cost, in the same vein, refers to the total costs involved in the full cycle of care for the medical condition (and not just to the costs involved during a specific episode of care) and include the full array of resources involved in caring for the patient, including inpatient, outpatient, and rehabilitative care, along with all associated drugs, devices, services, and ancillary equipment.

Therefore, accountability for value across the continuum of care should be shared among different professionals and providers who are involved in the treatment of patients at different stages of their clinical pathways. The problem arises insofar as providers (e.g., hospitals) tend to measure only the interventions they provide directly. This, in turn, produces incomplete and fragmented evaluations of the system's performance, usually failing to track outcomes over time such as sustainable recovery, need for ongoing interventions, or occurrences of treatment-induced illnesses. Typical hospital indicators, therefore, are surely fundamental but do not coincide with the measurement of outcomes. They should all be monitored within a clear picture of how they affect real value in the (long-term) perspective of patients and be integrated with data concerning the creation of health through time.

5.2   The toolkits

As mentioned earlier two toolkits are provided in this project.

5.2.1   Toolkit 1: A toolkit to capture hospital performance variability, including a list of relevant indicators

The first toolkit (TK1 – see Annex 3) provides a comprehensive overview of the dimensions that constitute hospital performance. Each dimension is composed of key indicators. The term "indicator" here is used in a broad sense. This means that it clarifies the items that should be used, but are subject to refinement in terms of the specific measure to be assessed. For example, many do not specify the time range to which they refer (per month, per year, etc.). This level of accuracy has been chosen in order not to anchor the interpretation of results to arbitrary indicators. Nevertheless, especially in the

case of inter-organizational benchmarking activities, these should be interpreted in coherent ways, so not to generate biased findings.

Each dimension of performance is further articulated into two different sections. The "core section" concerns all indicators generally measurable and assessable within practically any hospital. This section provides a "general assessment" of hospitals, independently from many of its characteristics (e.g., the clinical areas in which it operates). This section is generally referred to dimensions that are controlled (either directly or indirectly) by top management. It allows benchmarking activities across hospitals. These can be safely carried out across hospitals with similar characteristics (e.g., clinical areas covered, specialized vs. general hospital, urban vs. rural location), but also across hospitals that differ in some of these. The general character of the indicators makes it possible to perform such benchmarking activities as long as these are interpreted in the light of the main and most significant differences that characterize the hospitals.

The "specific section" of the toolkit is made up of sets of indicators specifically referred to hospitals' main clinical departments. This allows *ad hoc* evaluations of departments as well as inter-organizational comparisons across the same departments.

The modular nature of the tool allows its tailored use. If assessing a specific hospital's performance, the core section as well as all the relevant parts of the specific one should be used. In addition, hospitals can perform transversal comparisons by assessing all the parts of the tool that are relevant for the various hospitals involved (i.e., the core one and the relevant parts of the specific one). Furthermore, it can be used for *ad hoc* evaluations when, for example, hospitals may want to compare the performance of specific areas of their hospitals. This could be the case when, for example, a hospital must decide whether to invest in a certain clinical field and wants to assess its current performance compared to another hospital.

For each indicator within the sections that are under analysis, a target must be defined by top management. This must be reported in the columns "Target Value". If some sections are not of interest in the overall analysis of the hospital, these should be ignored and left blank. At the end of the period assessed (e.g., the year), the columns "Value" should be filled in with 0 if the target has not been reached, and with 1 if it has. The system will automatically provide a dashboard that assess the strengths and weaknesses of the hospital's ability of reaching the intended performance, both at the core and at the specific levels, as well as stratifying it by dimension. This provides an integrated and easy-to-read assessment of the most "problematic" set of indicators and guides management towards

setting the most urgent priorities. In the Main Dashboard, there is also the possibility to change the weight of the core indicators in relation to the proprieties of hospitals.

5.2.2   Toolkit 2: A toolkit to assess the transferability of evidence produced in other jurisdictions and decision-making levels

The second toolkit (TK2 – see Annex 4) constitutes a guiding tool for hospital management in the adoption of health technologies. The objective is to provide hospital management with a map to have a clear picture of which contextual factors are likely to hinder the full implementation of health technologies and in which managerial areas, on the contrary, one can expect a smooth support to technology use. This evaluation is performed based on the maturity of the various contextual items in the specific hospital assessed. A list of items and their interpretation is provided in the toolkit. Top managers can detect the most problematic issues on which to pay attention by defining each item as an enabler, neutral item or barrier to implementation, on a five - point Likert scale. For example, if ICT constitutes a bottleneck in the hospital, with departments and clinical wards struggling to share information across their boundaries, this may create a barrier to technology implementation. If, on the contrary, the hospital has widely adopted shared communication platforms that are regularly used by professionals across the organization (and perhaps outside it too), this is likely to enable a full implementation of health technologies.

This is an online tool in which top managers must provide an assessment of the extent to which each item is an enabler/barrier to the use of a specific health technology. This assessment is guided, item by item, by a short description of how it should be interpreted. The assessment may require objective data (e.g., the hospital's organizational chart), or data to be collected from other individuals (e.g., items concerning leadership styles).

The full toolkit and its practical guidance is available at: https://altems.unicatt.it/altems-ricerca-a-toolkit-to-assess-the-transferability-of-evidence-produced-in-other-jurisdictions

5.3   How to use the framework and the toolkits

The conceptual framework can be used in several ways. In the first place it constitutes a guiding element for scholars, providing evidence on the presence of relationships occurring between contextual factors, technology use and hospital performance. As mentioned, the need of stressing and explaining such relationships arises by the very poor attention that is usually laid upon the matter. Health technologies are assessed in other settings such as, usually, governmental institutions or research centers, but rarely a full assessment of their expected effects is carried out considering the specific characteristics of the context in which they are introduced. This has led, in time, to great unexplained hospital performance variability, with high uncertainty on the effects of investments for frequently very expensive technologies.

In the second place, the framework is also a managerial tool, insofar as it encourages managers to connect different conceptual areas of their organizations, leading to more reflective decision-making processes. The framework, which is at the basis of the toolkits provided in this WP, should accompany them so to justify their construct and support their validity.

Finally, the framework constitutes a powerful tool to raise awareness of the limits of current approaches to the assessment of technology's effectiveness. Such current approaches should, in time, be supported by parallel activities aimed at understanding and managing their contextualization.

Toolkit 1 constitutes a guiding tool to assess hospital performance and to carry out benchmarking activities across them. Not only is this tool relevant for hospital assessment *per se*, but also to monitor the effects of changes in contextual factors on a broad range of hospital performance dimensions. As a matter of fact, the risk of not monitoring performance in its various acceptations is that of tying organizational changes to specific effects in terms of performance (either through the mediating effect of health technologies or through direct effect), overlooking possible additional effects on other acceptations of performance. It is important, therefore, to dispose of a tool able to provide a comprehensive overview of the full array of effects of contextual factors and of technology use on performance. In this way, the toolkit can be applied either to a hospital and be monitored in time, so to assess changes in performance due to changes in contextual factors, or it can be applied to multiple hospitals to compare their performances. In the latter case, moreover, this can be done at various levels: at a general one by monitoring the set of core indicators, at the specific department level by monitoring the relevant specific indicators, or through and mix of levels, based on the characteristics of hospitals. Finally, the effects of changing contextual factors can be assessed both at the general (core level) as well as at the clinical directorate level in all those cases in which they are likely to affect a specific organizational area of the hospital in a particular way.

Toolkit 2 should be used as a check-list when introducing a major health technology in a hospital or assessing the effectiveness in the current use of an already adopted one. Each item of the check-list should be assessed as an enabler, neutral element of barrier to the full implementation of a given technology. The guidance to do so is provided in the descriptive part of the tool, aimed at explaining the interpretation of each item. Once each item has been assessed, management is in possess of a guiding map able to highlight the concrete main obstacles to an effective implementation. This, in turn, allows to define priorities in managerial interventions so to correct problematic contextual factors. Moreover, the tool has a predictive role, given that HTA reports may provide forecasts of technologies effects in general, failing to contextualize them in a particular setting. TK2, on the contrary, covers this gap and should be used in integration to traditional HTA reports.

5.4   Methods for data collection

Both toolkits require some data collection. The implementation of TK1 requires regular track of hospital key indicators. Most of these can be collected by typical hospital performance records. It is possible that for a minority of them, typical indicator collection systems may have to be integrated.

Data collection for TK2 requires the intervention of key hospital professionals in charge of covering specific roles. Although some data can be collected through typical hospital records or from openly available information (e.g., number of staffed beds, architectural type), other data require specific *ad hoc* collection. For example, human resource management tools can be described by the Head of the HRM function, budgeting processes can be explained either by top management or by clinical directors (and by the directors of equally relevant organizational units). Finally, other items, such as those related to leadership styles, require more detailed data collection through for example, perception surveys administered to staff at different levels of the hierarchy. Nevertheless, all data should be collected by a professional figure covering a position that allows him/her to have a clear picture and full understanding of the main organizational/managerial dynamics of the hospital. This professional may be either internal to the hospital or an external qualified consultant.

5.5 Future steps in the development of the conceptual framework

The conceptual framework at the basis of the toolkits provided may be further developed in future studies and research. Although its aim is to be exhaustive in terms of describing the conceptual links between contextual factors, technology implementation and performance, it does not address the impact played on these dimensions by the external environment. Both literature and practice widely testify that the external environment may affect all these dimensions and may, therefore, exert indirect effects through each. Moreover, the framework could be extended to a broader range of settings. Although it is, in its current form, suitable for hospital settings, it may be further stretched to cover all the actors involved in patients' continuum of care including, for example, primary care settings. This would allow an evaluation of, among other things, technologies' impact on inter-organizational clinical pathways.

Clearly, adding more variables to the framework increase its explicative exhaustiveness on one hand, but also its complexity on the other. It is important to find a reasonable balance between

exhaustiveness and complexity, in order not to incur into the risk of deriving from the framework practical toolkits that are too challenging to be used widely across hospitals in different nations.

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Appendix 1

List of participating hospitals

Country	Name of hospital	Address of Hospital
Slovenia	Maribor University Medical Centre	Ljubljanska ulica 5, 2000 Maribor, Slovenia
Poland	The University Hospital in Krakow	Mikołaja Kopernika 36, 31-501 Kraków, Poland
Portugal	Hospital Cruz Vermelha	R. Duarte Galvão 54, 1549-008 Lisboa, Portugal
Spain	Complejo Hospitalario de Poniente S. Público	Av. Almerimar, 04700 El Ejido, Almería, Spain
Spain	Sant Joan de Déu Barcelona Hopital	Passeig de Sant Joan de Déu, 2, 08950 Esplugues de Llobregat, Barcelona, Spain
Italy	Ospedali Riuniti Villa Sofia - Cervello	Viale Strasburgo, 233, 90146 Palermo PA
Italy	Careggi University Hospital	Largo Piero Palagi, 1, 50139 Firenze FI
Italy	Humanitas Research Hospital	Via Alessandro Manzoni, 56, 20089 Rozzano MI

Italy	Agostino Gemelli University Policlinic	Via della Pineta Sacchetti, 217, 00168 Roma RM
Italy	Federico II University Hospital	Via Sergio Pansini, 5, 80131 Napoli NA
Switzerland	Lausanne University Hospital	Rue du Bugnon 46, 1011 Lausanne, Switzerland
Denmark (in depth analysis only)	Odense University Hospital	J. B. Winsløws Vej 4, 5000 Odense, Denmark

Appendix 2a – Invitation to participants of survey

Research leaders: Prof. Americo Cicchetti - Altems, Università Cattolica del Sacro Cuore, Rome, Italy;

Dr. Marco Marchetti - Istituto Superiore di Sanità, Rome, Italy

Information for participants

Thank you for your participation in the research study titled 'Assessing the impact of contextual factors on technology uptake in hospitals'. This study is being done as part of the European project IMPACT HTA (https://www.impact-hta.eu/work-package-8) by researchers from The National Center for Health Technology Assessment of the Italian National Institute of Health and The Catholic University of the Sacred Heart, Rome.

This information sheet outlines the purpose of the study and describes your involvement and rights as a participant, if you agree to take part.

What is this research about?

Health technologies are well-known factors that can improve patient's health and drive hospital performance. Hospitals are complex organizational systems and the implementation and uptake of technologies partially dependents on the local-organizational contexts of the hospital in which they are implemented. However, little is known about the impact of hospital contextual factors (HCFs) on the implementation of health technologies. Therefore, the purpose of this study is to examine how hospital contextual factors influence the uptake of medical technologies in hospitals and how this might influence hospital performance. As part of this study, we will involve a number of professionals (hospital top managers physicians and nurses who use one of the technologies under analysis) in answering an online survey. Depending on the respondent's role, a different section of the survey should be answered. Top managers are asked to provide information concerning the hospital's organizational structure and managerial approach. Physicians are asked to provide information on the uptake and use of a specific health technology. Physicians should take part to this

study only if they use one of the following technologies systematically: Laparoscopy for cholecystectomy, Transcatheter aortic valve implantation or the Da Vinci Robot.

Do I have to take part and what will my involvement be?

The survey is voluntary and there are no repercussions for not providing any or all of the information requested. Nevertheless, if you decide to take part to this study, it is important that you provide careful and truthful answers. You will be asked to answer this online survey - with an estimated duration of 20 minutes. Afterwards no further commitment is required. However, your response is extremely important to us as we seek to both improve the understanding of what influences the uptake of health technologies but also to develop a toolkit of instruments aimed at analyzing the different organizational factors that can affect the variability in uptake. The toolkit will support local decision-makers in identifying those aspects which are most likely to enable an effective and appropriate use of health technologies.

Will my participation and data be kept confidential? Will it be anonymised?

The records from this study will be kept confidential and your data and responses will be used in an anonymised format – your name will not be used in any reports or publications resulting from the study.

What if I have a question or concern?

If you have any questions or concerns regarding this study please contact Irene Gabutti, on Irene.gabutti@unicatt.it. Please also send an email to this address if you want to receive a follow-up concerning the results of the study.

Thank you for your attention and for your precious support to this international project.

Americo Cicchetti, Marco Marchetti

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Appendix 2b – Online questionnaire – Managers

Thank you for reading this information and for considering taking part in this research

Please complete the survey by 30th November, 2019.

*1. If you agree to take part please click "Yes" below

○ Yes

○ No

*2. What is your main occupation in the hospital?

○ Top Manager
○ Surgeon using one of the following technologies: TAVI, Laparoscopic cholecystectomy, Da Vinci Robot
○ Nurse

3. Name of your hospital? _____

4. Country of hospital? _____

5. City of hospital? _____

6. At which organizational unit or department do you work? _____

7. What is your current position? _____
8. What is your hospital's institutional profile?
○ General
○ Specialistic
○ Focused factory (focused on one or few diseases)
○ Other (please specify) _____

9. Is your hospital a university hospital?
○ Yes
○ No

10. How would you characterize the ownership of your hospital?
○ Public
○ Private not-for-profit
○ Private for profit
○ Other (please specify) _____

11. Which of the following architectural types best describes your hospital?

- ○ Pavilion hospital (separated buildings which are not directly connected to each other)
- ○ Single-block hospital (one single building)
- ○ Multi-block hospital (more than one building, internally connected)
- ○ Other (please specify) _____

12. What is the number of staffed beds in your hospital?

13. What is the current number of employees in your hospital?

14. What is the yearly number of inpatient admissions performed in your hospital?

15. What is the yearly number of outpatient visits performed in your hospital?

16. Which of the following roles does your hospital play in your uptake territory?
- ○ Hub
- ○ Spoke
- ○ Hub AND spoke depending on activity
- ○ Does not belong to a hub and spoke network
- ○ Don't know

17. Is there any further comment or clarification you would like to provide in reference to the questions above?**_____**

18. How would you define the hospital's organizational chart?
- ○ Vertical model driven by specialties
- ○ Horizontal model driven by pathways
- ○ Model based on progressive patient care (patients are pooled on the basis of the intensity of assistance required)
- ○ Mixed model (matrix)
- ○ I don't know
- ○ Other (please specify) _____

19. Which kind of patient pooling approach(es) do you adopt in order to group patients within ward units? (more than one answer possible)
- ○ Based on clinical specialties
- ○ Based on intensity and complexity of care
- ○ Based on the age/sex of patients
- ○ Based on clinical processes
- ○ Mixed approach (please specify)
- ○ I don't know
- ○ Other (please specify) _____

20. In which of the following areas has your hospital adopted specific clinical pathways and itineraries for patients' categories? (more than one answer possible)
- ○ Emergency Pathway
- ○ Orthogeriatric pathway
- ○ Mother and child pathway
- ○ Cancer pathway
- ○ I don't know
- ○ Other (please specify) _____

21. Approximately, what is the percentages of patients treated in your hospital who are involved in clinical pathways?

22. Which of the following cost management tools are used within your hospital? (more than one answer is possible
○   Departmental costing
○   Activity-based costing
○   Time driven activity-based costing
○   I don't know
○   Other (please specify) _____

23. Which of the following responsibility centers hold an annual budget (more than one answer possible)
○   Departments/clinical directorates
○   Clinical ward
○   Horizontal clinical pathways
○   I don't know
○   Other (please specify) _____

*24. Which of the following scenarios best describes the assignment of a budget to the various clinical settings?
○   Budgets are defined by top management
○   Budgets are defined by top management but take into account a negotiation with clinical settings
○   Budgets are the result of a negotiation between top management and clinical settings
○   I don't know
○   Other (please specify) _____

25. How is the annual budget of the clinical setting broken down?
○   It is not (there is only an annual budget)
○   Into quarterly budgets
○   Into monthly budgets
○   Into semestral budgets
○   I don't know
○   Other (please specify) _____

26. Does your organization implement a Balanced Scorecard (BSC) or similar methods to evaluate key performance areas and indicators?
○   Yes
○   No
○   I don't know

27. Specify which of the following **job evaluation** activities are systematically carried out in your organization for each listed occupation (more than one answer per line is possible).

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	Job description	Job analysis	Job ranking	Score and factor comparison methods
Physicians	☐	☐	☐	☐
Nurses and other health care professionals	☐	☐	☐	☐
Managers	☐	☐	☐	☐

Other activities (please specify which and for whom)

28. Specify which of the following **people evaluation** activities are systematically carried out in your organization for each listed occupation (more than one answer per line is possible).

	Assessment center	360° evaluation	Competencies dictionary
Physicians	☐	☐	☐
Nurses and other health care professionals	☐	☐	☐
Managers	☐	☐	☐

Other activities (please specify which and for whom)
_____

29. Specify which of the following **performance evaluation** activities are systematically carried out in your organization for each listed occupation (more than one answer per line is possible).

	Comparison method	Forced distribution of performance	Management by objectives
Physicians	☐	☐	☐
Nurses and other health care professionals	☐	☐	☐
Managers	☐	☐	☐

Other activities (please specify which and for whom)

30. Does your organization systematically perform activities aimed at evaluating Human Resources' potential?
○ Yes
○ No
○ I don't know

![IMPACT HTA]

If yes, please provide a short description _____

31. Which ICT tools are regularly used within your organization? (more than one answer is possible)
- Electronic health records
- Visual mapping technologies
- Shared platforms
- Database direct access
- Common gateway interface
- Web services
- Patients access apps
- I don't know
- Other (please specify) _____

32. How are each of the following patient information collected and exchanged?

	Only through paper registers	Through a combination of paper registers and ICT tools	Only through ICT tools
Diagnosis and clinical problems	○	○	○
Medical images	○	○	○
Lab results	○	○	○
Discharge notes	○	○	○
Patients' procedures	○	○	○

33. How are each of the following managerial /administrative data collected and exchanged?

	Only through paper registers	Through a combination of paper registers and ICT tools	Only through ICT tools
Financial data	○	○	○
Shifts and other HRM information	○	○	○
Patient flows	○	○	○
Logistics	○	○	○
Procedures	○	○	○
Clinical research	○	○	○

Clinical guidelines

34. Which is the highest level in which ICT tools fully integrated and coordinated?
- Clinical ward level
- Departmental/clinical directory level
- Hospital level
- Regional level
- National level
- I don't know

35. Within your hospital, are there any Health Technology Assessment (HTA) activities or initiatives?
- Yes
- No
- I don't know

36. What is the objective of HTA activities in your hospital? (more than one answer possible)
- To inform clinical practice
- To support managerial decision-making process
- Other (please specify)_____

37. Does your hospital have a dedicated Hospital Based-HTA unit?
- Yes
- No
- I don't know

38. By whom are technology-innovation priorities set within your organization? (More than one answer possible)
- CEO
- Top management
- Middle management
- Hospital Based-HTA unit
- Physicians/healthcare personnel/operators/final users
- External entities (please specify)
- I don't know
- Other (please specify) _____

39. Which actors are systematically involved in the uptake process of a new technology? (More than one answer possible)
- CEO
- Top management
- Middle management
- Hospital Based-HTA unit
- Physicians//healthcare personnel/operators/final users
- External entities (please specify)
- I don't know
- Other (please specify) _____

40. Which professional figure(s) take the final decision in reference to the adoption/purchase of a new technology? (more than one answer possible)
- CEO

- o   Top management
- o   Middle management
- o   Hospital Based-HTA unit
- o   Physicians/healthcare personnel/operators/final users
- o   External entities (please specify)
- o   I don't know
- o   Other (please specify) _____

41. Is there any further comment or clarification you would like to provide in reference to the questions above?

*42. Is the Da Vinci Robot being used for surgical procedures in your hospital?
- o   Yes
- o   No

43. What year was the first Da Vinci Robot introduced in your hospital?

-2000	-2001	-2002	-2003	-2004
-2005	-2006	-2007	-2008	-2009
-2010	-2011	-2012	-2013	-2014
-2015	-2016	-2017	-2018	-2019

44. Please state how many Da Vinci Robots you have in your hospital specified by robot model.

The Da Vinci SI Surgical system

[▼]

The Da Vinci X Surgical system

[▼]

The Da Vinci XI Surgical system

[▼]

The Da Vinci SP[1] Surgical system

[▼]

45. Which surgical specialties are using the Da Vinci Robot? (more than one answer possible)
- o   Bariatric Surgery
- o   Cardiac Surgery
- o   Cardiac Thoracic Surgery
- o   General Surgery
- o   Gynecologic surgery
- o   Otorhinolaryngology surgery
- o   Thoracic surgery

○   Urology
○   Other specialties (please specify) _____

46. Please indicate if the hospital management has made restrictions or requirements for any of the listed areas regarding the use of the Da Vinci robot? (more than one answer possible)
○   Patient selection
○   Volume (either unit level or surgeon level)
○   Type of surgical procedures
○   Training program for surgical team
○   Training program for surgeon
○   Other specialties (please specify) _____

47. If possible, please provide the total number of surgical procedures performed in your hospital using the Da Vinci Robot for each of the listed years.

○   2014 _____
○   2015 _____
○   2016 _____
○   2017 _____
○   2018 _____

48. Is there any further comment or clarification regarding the use of the Da Vinci Robot that you would like to provide in reference to the questions above?

49. Thank you for taking part to this study. Your replies were registered correctly and your support is truly appreciated. You may contact us at any time for questions or doubts on:
irene.gabutti@unicatt.it

6 Appendix 2c – Online questionnaire – Surgeons

*1. What is your main occupation in the hospital?

- ○ Management
- ○ Surgeon using TAVI/ Laparoscopic cholecystectomy/ Da Vinci Robot
- ○ Nurse

2. Name of your hospital? _____

3. Country of hospital? _____

4. City of hospital? _____

*5. What is your medical specialty?

- ○ Bariatric surgery
- ○ Cardiac surgery
- ○ Cardio-thoracic surgery
- ○ General surgery
- ○ Gynecologic surgery
- ○ Otorhinolaryngology
- ○ Thoracic surgery
- ○ Urology
- ○ Other specialty, please specify_____

8. What is your position within your unit? _____

9. How many years since you finished your specialist training? _____

10. What year did your care unit start using the Da Vinci Robot? _____

11. Please state how many Da Vinci Robots you have in your hospital specified by robot model

12. Which of the following descriptions best characterize the organization of the Da Vinci Robot used in your care unit?

○   The Da Vinci Robot is placed in a robot center

○   The Da Vinci Robot is placed in a general operating theater where also conventional surgery is performed

○   The Da Vinci Robot is placed in a specific care unit

○   Other (please specify)

13. Please rank from 1-6 the importance of the following items when adopting the Robot Da Vinci (where 1 is the most important factor)

▼

To be able to give the patients the lesser invasive treatment

▼

To be able to accommodate difficult cases

▼

To be competitive with other hospitals, both nationally and internationally

▼

To be able to recruit and retain skilled staff

▼

To be able to recruit specific patient groups

14. What types of training activities are systematically provided or required by your hospital before being entitled to perform surgery with a Da Vinci Robot in your hospital? (more than one answer possible)

○   Theoretical training
○   Simulation training (physical or virtual)
○   Mentorship (acting as first assistant or performing segments of procedures in tandem with the attending surgeon)
○   Training in surgical team work and team communication

o   None of the above
o   Other (please specify)

15. Is a validation test in robotic console proficiency required in order to perform surgery with a Da Vinci Robot?

o   Yes
o   No

o   I don't know

16. What is the number of surgeons in your care unit?

17. What is the number of surgeons in your care unit who perform surgery using the Da Vinci Robot?

18. For each of the following items please give an estimate of how often they are being consulted by surgeons when using the Da Vinci Robot.

	Never	Rarely	Frequently	Always
Guidelines	○	○	○	○
Protocols	○	○	○	○
Checklists	○	○	○	○

19. Please indicate which types of surgical procedure are performed using the Da Vinci robot in your care unit (more than one answer possible)

o   Hysterectomy for benign diseases
o   Radical abdominal hysterectomy
o   Myomectomy
o   Pelvic evisceration
o   Other excision or destruction of lesion of uterus
o   Sacrocolpopexy
o   *Other (please specify)*

20. For the use of the Da Vinci Robot, do you have a case minimum per year/per care unit?

○   Yes
○   No

If yes, please indicate the case minimum

21. For the use of the Da Vinci Robot, do you have a case minimum per year/per surgeon?

○   Yes
○   No

If yes, please indicate the case minimum

22. On average, how many days per week is the Da Vinci Robot in use?

23. On average, how many hours per day is the Da Vinci Robot in use?

24. How many procedures have you personally performed using the Da Vinci Robot in 2018

○   0
○   ≤ 10
○   10-50
○   51-100
○   >100

25. Please indicate the number of operations that was performed with a Da Vinci Robot in 2018 for your care unit.

26. Did you reach the planned volume of surgeries performed with the Da Vinci Robot in your care unit in 2018?

○   Yes, we reached the planned volume
○   Yes, and we also exceeded the planned volume
○   We did not plan the volume of use in advance
○   No, we did not reach the planned volume
○   Other (please specify)

27. Do you believe that barriers to the full implementation of the Da Vinci Robot are:

○   Nonexistent, the procedure is always used optimally
○   Limited
○   Relatively frequent
○   Frequent and high
○   Other (please specify)

28. For each of the following items please specify whether they constitute a barrier or an enabler to the full use of the Da Vinci Robot , and to what degree.
○   Formal training activities on the use of the technology
○   Informal training between colleagues and within teams

- o   Formal procedures and guidelines during surgery
- o   Moments of briefing/debriefing for team
- o   Team's technical competencies
- o   Device cost
- o   Communication within team
- o   Timely availability of patient clinical information
- o   General organization at hospital level
- o   Availability of medical equipment
- o   Availability of operating rooms and/or other spaces
- o   Management of schedules
- o   Technical assistance
- o   Conflict with other professionals' priorities
- o   Reimbursement system

29. Please provide any further information on the organization or use of the Da Vinci Robot in your care unit that you might find important.

Only for Gynecologist

30. For hysterectomy performed with the Da Vinci Robot, please provide the average waiting time from admission to hospital until surgery, in 2018.

31. Please provide the proportion (%) of hysterectomies performed in your hospital using the Da Vinci Robot for each of the listed years.
2014 _____

2015 _____

2016 _____

2017 _____

2018 _____

32. For your care unit, please indicate the proportion (%) of hysterectomies performed with the Da Vinci Robot, in which conversion to open or laparoscopic surgery was necessary in 2018.

33. Please indicate the postoperative 30-day readmission rate (%) in 2018 for hysterectomies performed with a Da Vinci Robot in your care unit.

34. Please indicate the postoperative surgical related infections rate (%) in 2018 for hysterectomies performed with a Da Vinci Robot in your care unit

35.For your care unit, please indicate the average length of stay (days) for hysterectomy on benign indication performed with a Da Vinci Robot

36. For your care unit, please indicate the average surgery duration for hysterectomy on benign indication performed with a Da Vinci Robot