Evaluating Dissemination and Implementation Strategies to Develop Clinical Software

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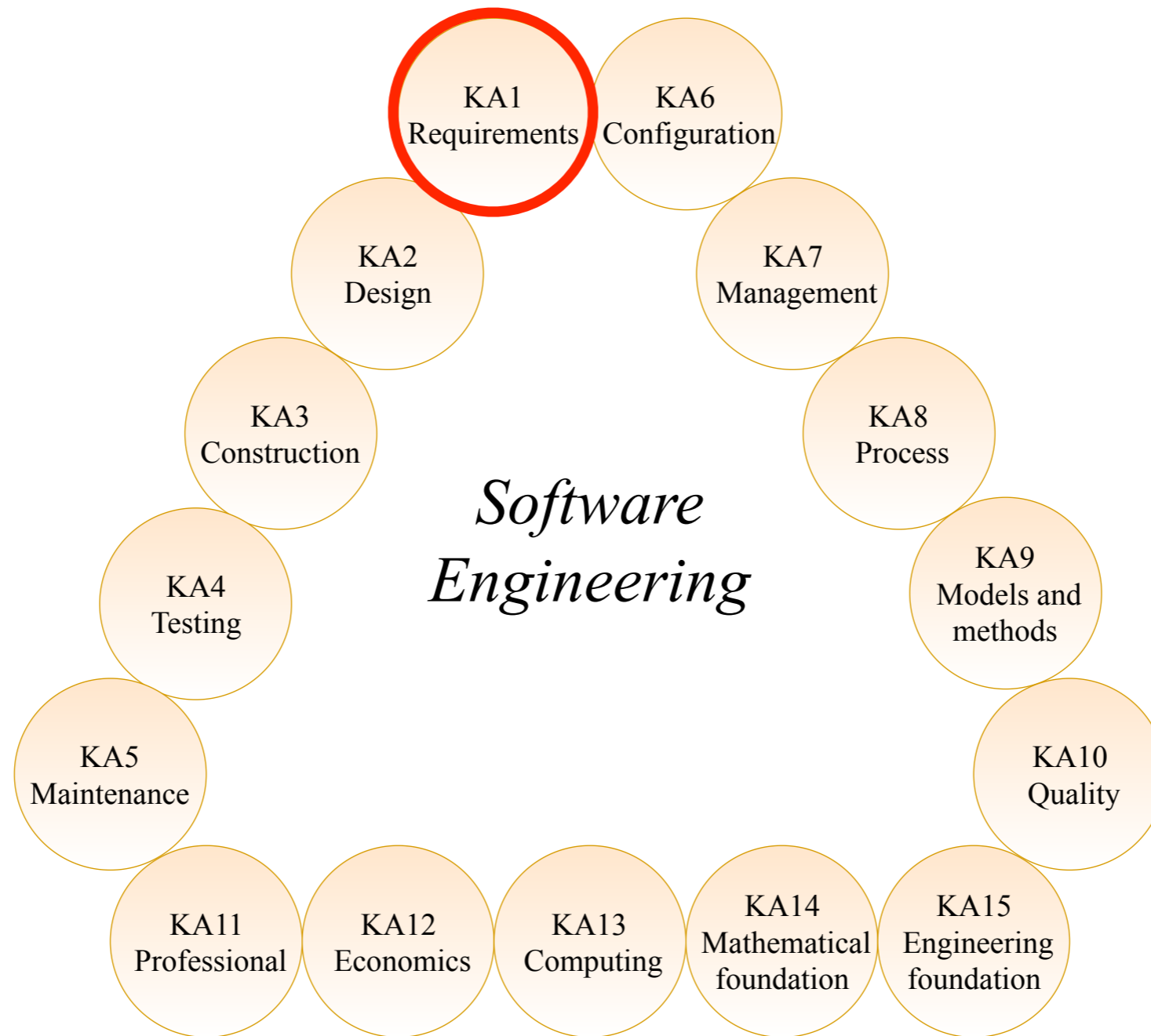
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Context

https://www.computer.org/education/bodies-of-knowledge/software-engineering

Context

- Software products have been helpful in supporting management and productivity in several economic sectors, including healthcare.

- Much of daily clinical work is supported by software that bridge several clinical processes from health care management to more specialized procedures, such as surgeries.

Context

- To develop clinical software, developers must often face several *challenges*.

  - Understand the *real clinical problem* that the software must address.

- The inadequate identification of clinical software requirements can lead to the *rejection* of the software and *reduce* clinicians' expectations.

Context

- This presentation describe a study about the perception of clinicians regarding a bed management software called SIGICAM, whose software requirements were elicited and defined using the D&I Framework.

- In this study we focused on evaluating SIGICAM's functionalities and tasks based on the usability expectation levels of clinicians using the Health-ITUES questionnaire.

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D&I Framework

- The D&I Framework is a technique that suggests guidelines to elicit requirements in order to contextualize the clinical problem that the software must address[1].
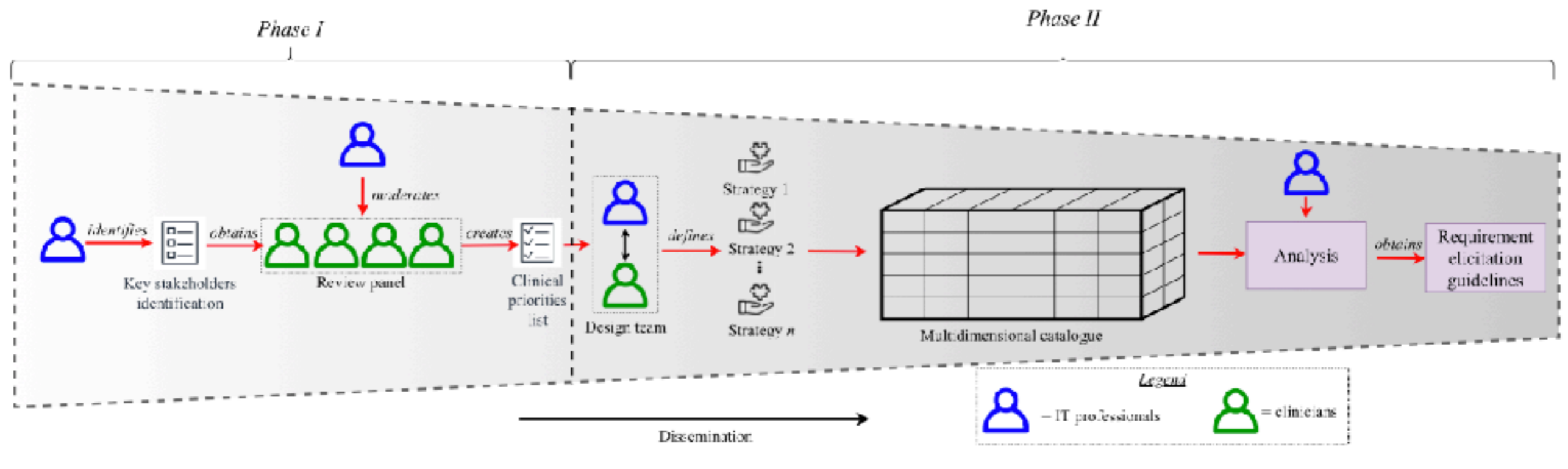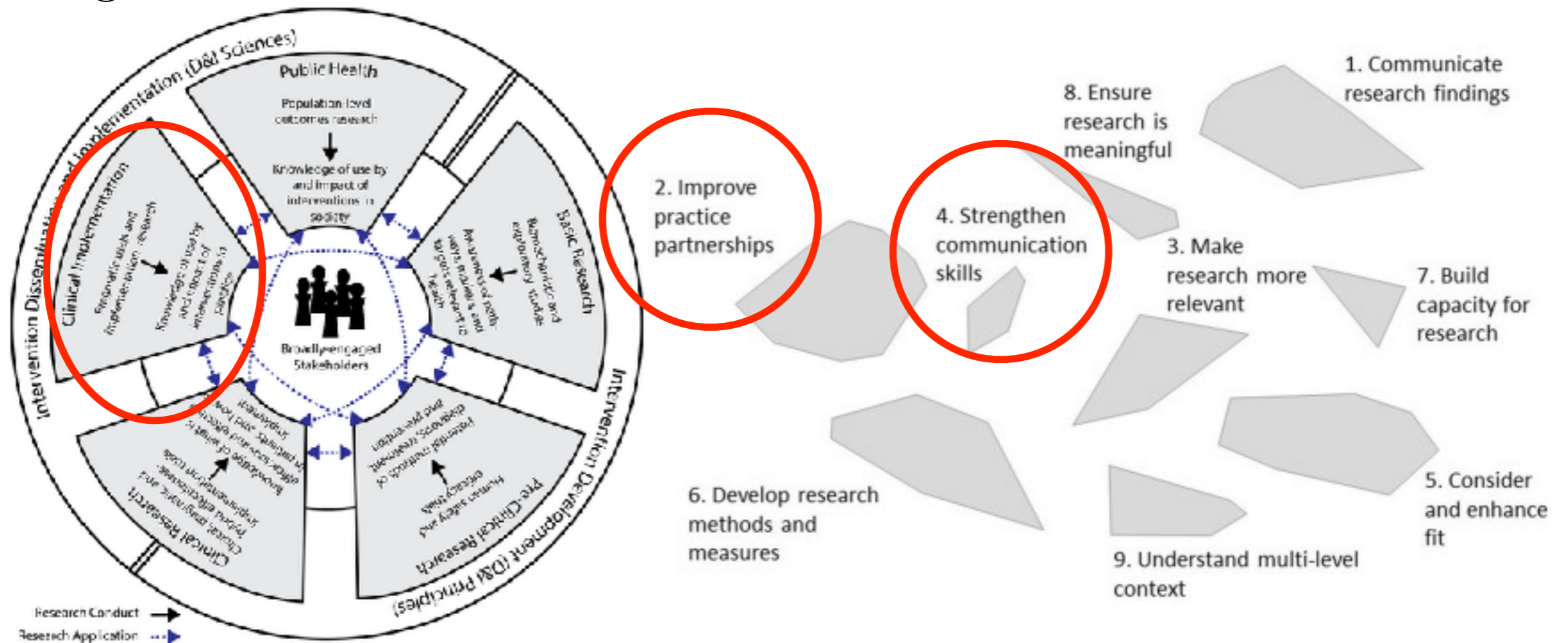
1. Márquez, G., & Taramasco, C. (2020). Using Dissemination and Implementation Strategies to Evaluate Requirement Elicitation Guidelines: A Case Study in a Bed Management System. IEEE Access, 8, 145787-145802.
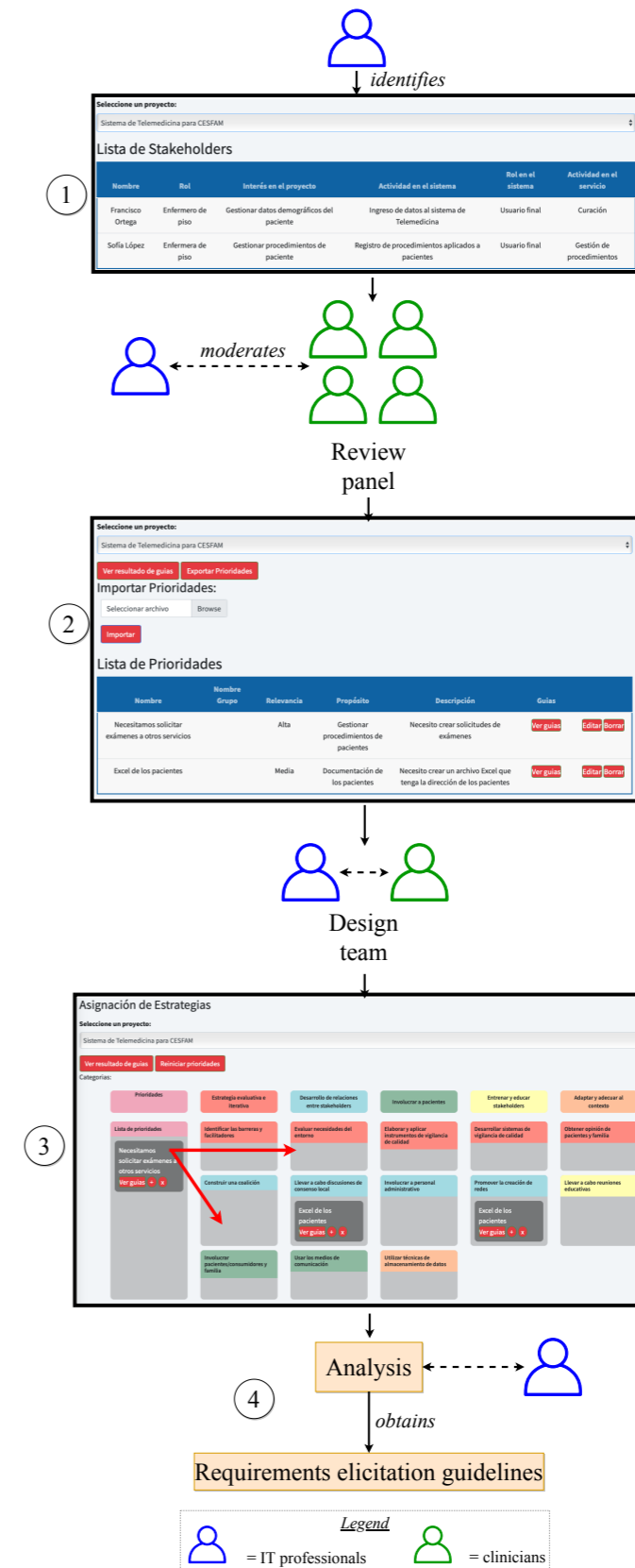
D&I Framework

- The D&I Framework combines requirement elicitation techniques and clinical intervention-based *implementation* and *dissemination* strategies[1,2].

1. Brownson, R. C., Colditz, G. A., & Proctor, E. K. (Eds.). (2017). Dissemination and implementation research in health: translating science to practice. Oxford University Press.
2. Leppin, A. L., Mahoney, J. E., Stevens, K. R., Bartels, S. J., Baldwin, L. M., Dolor, R. J., ... & Meissner, P. (2020). Situating dissemination and implementation sciences within and across the translational research spectrum. Journal of Clinical and Translational Science, 4(3), 152-158.

D&I Framework

- The framework considers four stages:

1. Identification of project stakeholders

2. Identification of clinical priorities

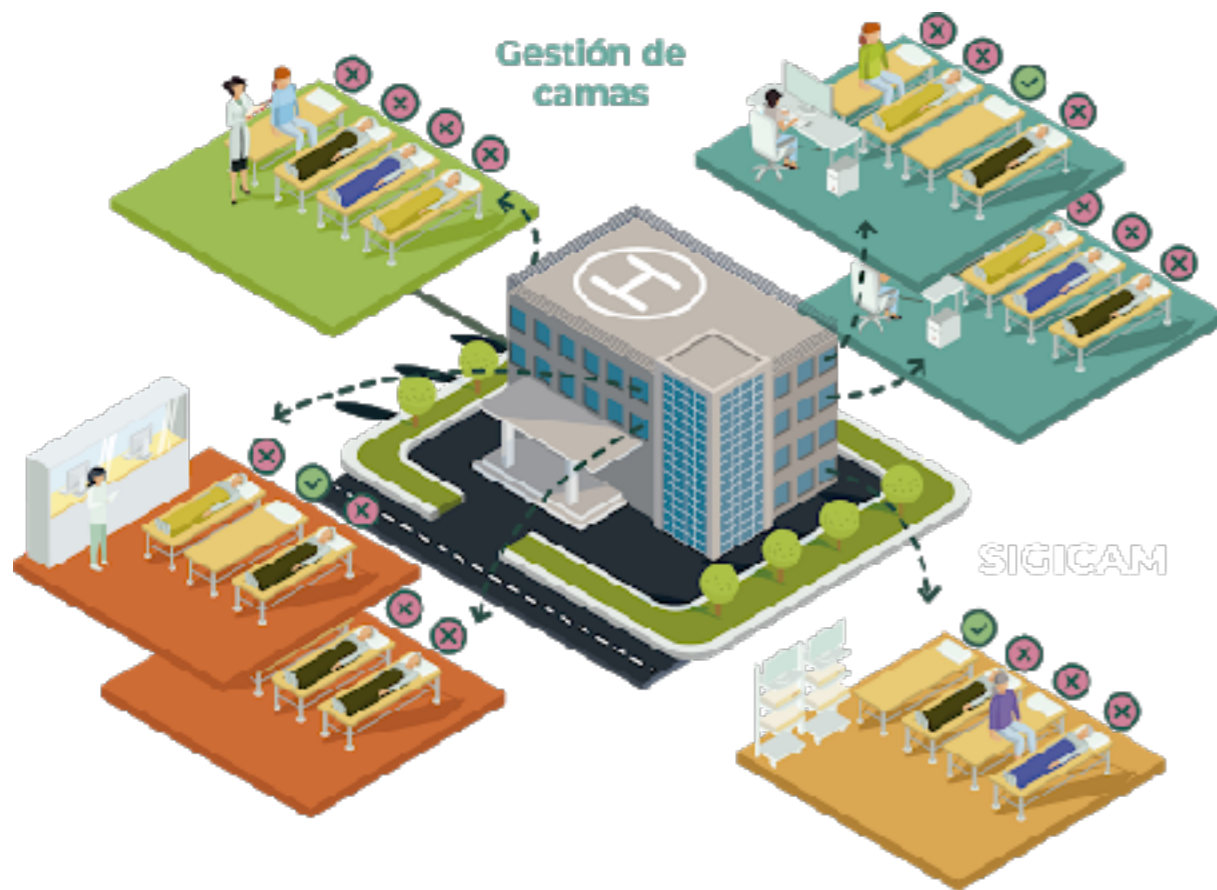3. Collaborative selection of implementation strategies

4. Analysis

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Case study (*Context*)

- SIGICAM[1,2]

1. Taramasco, C., Olivares, R., Munoz, R., Soto, R., Villar, M., & de Albuquerque, V. H. C. (2019). The patient bed assignment problem solved by autonomous bat algorithm. Applied Soft Computing, 81, 105484.
2. http://sigicam.cl

Case study (*Context*)

- During the development of SIGICAM, the D&I Framework supported the developers in the process of elicitation and description of requirements.

Release 1   Release 2   Release 3   Release 4

November 2018   March 2019   October 2019   February 2020
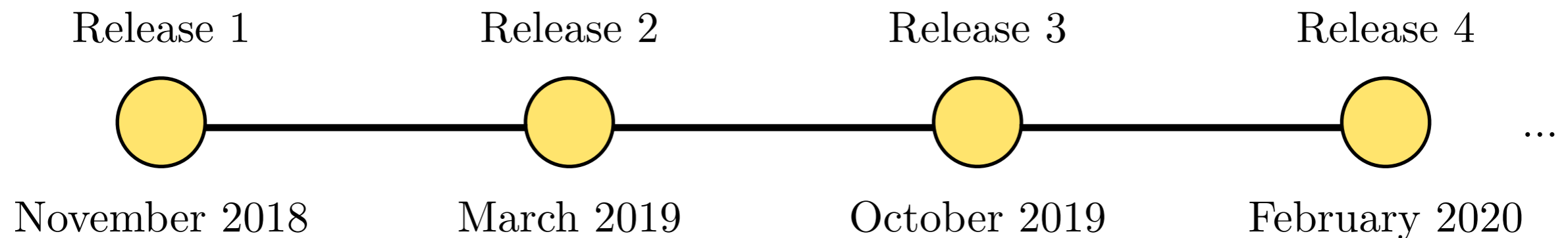
Case study (*Goal and Research Question*)

- Although the D&I Framework has supported the SIGICAM development team in each release, it is unclear if the end-users (clinicians) perceive such improvements in the system.

- Goal

  - <u>Analyze</u> the functionalities and tasks of SIGICAM <u>for the purpose of</u> evaluating the impact of using the D&I Framework <u>with respect to</u> the elicitation and description of software requirements <u>from the point of view of</u> clinicians <u>in the context of</u> bed management.

- Research question

  - *Is there a difference in clinicians' perception about SIGICAM's functionalities and tasks regarding the first release (November 2018) and the last one (February 2020)?*

Case study (*Case and Subject Selection*)

- The subjects participating in this case study correspond to emergency nurses, floor nurses, bed managers and service directors.

Hospital bed optimization

Central Bed Management Unit

Medical-Statistical Guidance Service

Reporting

Case study (*Data Collection*)

- We used the Health Information Technology Usability Evaluation Scale (Health-ITUES) to evaluate the usability of SIGICAM.

  - Quality of work-life (A)

  - Perceived usefulness (B)

  - Perceived ease of use (C)

  - User control (D)

| Factor	ID	Questions
Ⓐ	A1	I think SIGICAM has been a positive contribution to nursing work
	A2	I think SIGICAM has been a positive contribution to the hospital
	A3	The technology delivered by SIGICAM is an essential part of the bed management and analysis process
Ⓑ	B4	Using SIGICAM makes it easy to request available beds
	B5	SIGICAM makes it possible to manage beds more quickly
	B6	SIGICAM increases the probability of assigning or reassigning a bed to a patient
	B7	SIGICAM is useful for requesting beds and managing patients on waiting lists
	B8	I think SIGICAM presents a more equitable process for bed management
	B9	I am satisfied with SIGICAM for managing and analyzing the provision of beds in the healthcare network
	B10	I can perform bed management tasks promptly due to the use of SIGICAM
	B11	SIGICAM increases effectiveness in hospital waiting times
	B12	I am able to fulfill all my assigned tasks using SIGICAM
Ⓒ	C13	I'm comfortable with my ability to use SIGICAM
	C14	Learning to use SIGICAM is easy for me
	C15	It's easy for me to be proficient in the use of SIGICAM
	C16	SIGICAM is easy for me to use
	C17	I can always remember how to start and use SIGICAM
Ⓓ	D18	SIGICAM shows error messages that tell me clearly how to solve problems
	D19	If I make mistakes in SIGICAM, I can solve it easily and quickly
	D20	The information (such as online help, on-screen messages and other documentation) provided with SIGICAM is clear

Schnall, R., Cho, H., & Liu, J. (2018). Health Information Technology Usability Evaluation Scale (Health-ITUES) for usability assessment of mobile health technology: validation study. JMIR mHealth and uHealth, 6(1), e4.

Case study (*Analysis*)

- We compared the responses to the Health-ITUES questionnaire carried out in November 2018 and February 2020.

  - The first questionnaire was executed three months after the first release of SIGICAM into production; 50 clinicians participated in the questionnaire.

  - On the other hand, the second questionnaire was executed three months after the third release; 48 clinicians participated in this second questionnaire.

- To analyze the answers to both questionnaires, we used descriptive statistics.

- We first calculate the average of the answers for each question of the questionnaire.

- Then, we compared the averages of the answers of each question in both questionnaires.

- Finally, we determine whether there is a difference between the questionnaires' averages using the *t*-test.

Case study (*Results*)
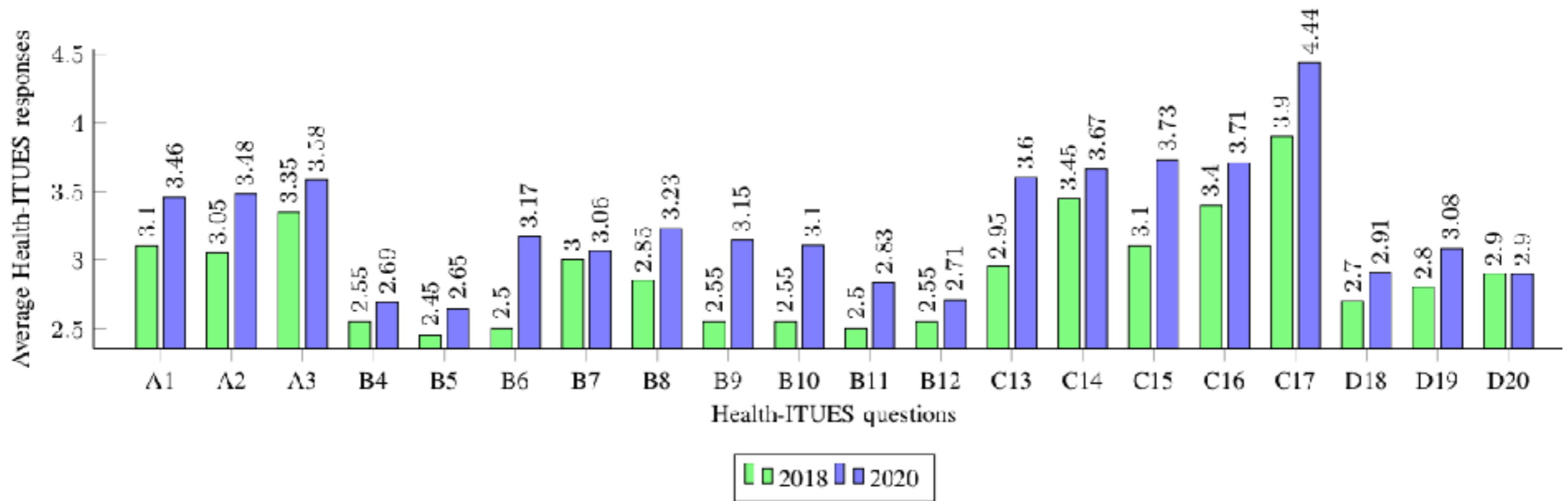
- According to the analysis, the difference between the responses of the two surveys is significant.

Case study (*Discussion*)

- The study results show a better perception of clinicians regarding the functionalities and tasks implemented in SIGICAM compared with 2018 and 2020.

- About the first release of SIGICAM, the developers appreciated the guidelines proposed by the D&I Framework to elicit requirements.

- Subsequently, in all the improvements implemented in SIGICAM, the D&I Framework was used to identify new requirements based on the clinical priorities concerning the hospital bed management process.

Case study (*Discussion*)

- Feedback from SIGICAM's developers and the study results also reveals that the implementation and dissemination strategies help intervene in challenging and rapidly changing contexts.

- The D&I Framework supported the developers in understanding how well an intervention (implementation or dissemination strategy) helps to have a positive effect on clinicians.

- The framework also helped to detect whether there are unintended consequences to implementing some strategies (and hence to the elicitation of requirements).

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Conclusions

- This presentation described a study that evaluates the functionalities and task of a bed management system called SIGICAM from the point of view of clinicians.

- The identification and description of these functionalities and task were conducted through the D&I Framework.

- The results of the study indicate that clinicians perceive an improvement in the system.

- To further our research, we plan to evaluate whether the D&I Framework has supported SIGICAM's developers in managing the COVID-19 contingency for bed management.

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