Methodological Procedures to Create Technological Health Products: A Systematic Review

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Abstract. This article presents a comprehensive literature review that explores the use of design methodologies as a basis for understanding and resolving health problems, particularly in their initial stages or root causes. The study analyzed 34 articles published in 2017 using a systematic and rigorous method to identify correlations and highlight key success factors in healthcare product design. The review found that leveraging market insights, trends, and user perspectives is crucial in the discovery and planning stages of healthcare product development. By adopting a user-centric approach that considers the needs and preferences of patients, healthcare providers, and other stakeholders, it is possible to design more effective, efficient, and user-friendly products. The study's findings have important implications for healthcare innovation and technology product development. By adopting a design-based approach that prioritizes user needs and preferences, it is possible to develop products that can help address some of the challenges facing the healthcare industry today. Such products can also lead to greater efficiency and cost savings for healthcare providers and improve patient outcomes. In conclusion, this article emphasizes the importance of using design methodologies as a basis for understanding and resolving health problems in their initial stages or root causes. The study's findings highlight key success factors that can inform the development of healthcare products and lead to more effective and efficient healthcare delivery.

Keywords. Framework, Health, Problem, Product Design

1. Introduction

User experience (UX) design has become increasingly important in product development, with a focus on understanding and interpreting the factors that motivate users to interact with products or services in different ways. Empathy and alterity have emerged as key concepts in UX design, providing designers and managers with opportunities to explore the user experience at a deeper level. Product design, which involves the intersection between UX design and business considerations, aims to create solutions that investigate the human relationship with "things".

In healthcare, design is practiced in a controlled manner, with new products requiring scientific validation and proven evidence of effectiveness before they are indicated for use by patients. However, the design process in healthcare has yet to fully consider the emotional vulnerabilities, habits, and socio-economic impacts of patients, making it difficult to generate a multidisciplinary communication and vision that includes family members and physicians in the search for solutions.

The need to integrate multidisciplinary profiles in the creation of health technology solutions is urgent, and the application of design methodologies that converge towards solutions of greater value is crucial. Current design frameworks in healthcare still have limited adherence to the challenges of the industry, and solutions created often fail to deliver what is expected to the end user. This impacts the chain in several ways, both in high costs and in the democratization of access to health, care, and well-being.

The design process provides foundations for creating products, services, businesses, and processes with a high degree of relevance to users and stakeholders. While the User-Centered Design System brings a more humanized approach, it still falls short of meeting the needs of the healthcare industry and the intricacies of the clinical ecosystem. This article aims to explore frameworks for understanding and resolving healthcare problems, specifically in the initial stages or root causes, using design methodologies as a basis. A systematic review of literature analyzing 34 articles from 2017 was conducted to identify key success factors such as leveraging market insights, trends, and user perspectives in discovery and roadmap planning.

The findings have important implications for healthcare innovation and technology product development, providing insights into the design process for healthcare products and the importance of considering the needs of patients and other healthcare actors.

2. Research Methods

2.1 Methodology

The creation of health technology products requires a systematic approach that involves identifying problems, understanding user needs, developing solutions, and evaluating their effectiveness. The process of product design in healthcare requires the application of specific frameworks and methodologies that help in deepening the understanding of the problem, creating solutions, and evaluating its efficacy. This review aims to identify the methodological procedures used in product design in healthcare and the challenges involved in the process. Based on the review, a specific framework will be developed for the creation of health technology products.

2.2 PICOC

- Population: Health and wellness product developers
- Intervention: Creation of Technological Products in Health with frameworks of deepening in problems
- Comparison: Not applied
- Outcome: To evaluate the use of methodological processes specific to the health area in the creation of new technological products
- Context: Not applied

2.3 Research Questions

1. What are the methodological procedures used during the creation of health products?
2. What are the objectives of using product design in healthcare?
3. Is it common to use standard frameworks in the creation of technological products in healthcare?
4. What are the challenges in the creation of health technology products?

2.4 Search String

(framework OR methodology)

AND (health OR healthcare)

AND (problem OR "root cause")

AND ("product design" OR "product development")

2.5 Sources

- Pubmed (https://pubmed.ncbi.nlm.nih.gov)
- Science@Direct (http://www.sciencedirect.com)
- Scopus (http://www.scopus.com)
- BVSalud (https://bvsalud.org/en/)

2.6 Selection Criteria

Inclusion Criteria:

- Studies dealing with methodological procedures for the creation of health technology products
- Studies that address frameworks for deepening problems in the creation of health products

Exclusion Criteria:

- Duplicated
- Grey literature
- Short paper
- Studies that are not in English
- Studies that are out of scope (frameworks that are not of application in healthcare)
- Studies that were published before 2016

2.7 Quality Assessment Checklist

Questions:

- Does the study identify and analyze methodological procedures used in the creation of health products?
- Does the study present objectives achieved with product design?
- Does the study evidence the use of generic frameworks in the creation of health products?
- Does the study describe the challenges in creating health technology products?
- Does the study present a well-described framework for the construction of a healthcare product?
- Does the study highlight the steps used to create a health product?
- Do the authors describe the limitations encountered during product creation?
- Does the study clearly correlate the use of design methodologies with the creation of health products?
- Does the study have a multidisciplinary approach for applying the methodological procedure?

Answers:

- Yes
- Partially
- No

2.8 Data Extraction Form

- Publication field
- The objective of the proposed methodology
- Evaluation after application of the methodology

3. Results

The initial search strategy yielded 513 articles. After the first filter, which involved analyzing the title, abstract, and conclusion, the number of articles was reduced to 33. Subsequently, the data extraction process, which involved validating the articles based on the questions, further reduced the number of articles to 15, which were then qualitatively analyzed.

3.1 Search Strategy

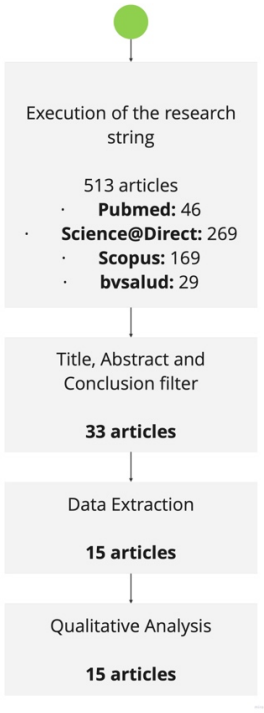

Fig. 1 - PICOC flow chart for the study

Further analysis of the articles revealed that there is a need for collaboration between different disciplines in the development of health technology products. The integration of healthcare professionals, designers, engineers, and other relevant stakeholders can lead to the creation of innovative products that meet the needs of patients and healthcare providers. The articles emphasized the importance of involving end-users in the design process to ensure that the products meet their specific needs and preferences. This user-centered approach can lead to the development of products that are more effective, efficient, and satisfying for the users. Additionally, the review highlighted the importance of rigorous evaluation methods to ensure the efficacy and safety of health technology products, which can lead to better health outcomes and improved patient experiences.

4. Discussion

The articles analyzed are critical for understanding the relationship between Design used in Health Products and Innovation. The review showed an overview of the methodologies used for the application of design fundamentals, although even the product creators don't have a clear idea about the use of the design approach.
This review spotlighted the necessity of Product Design in the health field, with clear stages, prototyping, experimenting, and validating with scientific rigor.

The systematic review of articles highlighted the importance of design methodologies in the health industry. The studies showed the need for a multidisciplinary approach and the impact of involving clinicians in the early stages of medical device innovation. The articles also demonstrated the importance of incorporating the user perspective in the design process, especially in the case of older adults and wheelchair users. While some studies used already validated methodologies from other industries, it was suggested that a health-specific framework should be developed, considering the unique complexities of the health ecosystem. Additionally, some studies lacked the validation of the products with various stakeholders, including patients, clinicians, and the health ecosystem, which could have provided a better approach. In conclusion, the integration of design methodologies into the health industry has shown promising results in enhancing the usability, human factors, and user experience of connected health systems and medical devices. However, further research is necessary to refine the design frameworks, including the perspectives of all stakeholders, to ensure that the products meet the needs of the health ecosystem.

The use of human-centered design (HCD) methodology has been shown to be effective in creating innovative and user-friendly healthcare products. This systematic review identified several studies that have successfully applied HCD methodologies in healthcare design, including the use of interviews, validations, and data analysis. One study focused on enhancing the usability of a mobile phone app in an integrated falls risk detection system for use by older adult users. The study used design methodologies to bring a better perspective for the user, and the researchers noted that the use of a specific framework defined for health users could have resulted in less re-work during the validations. Another study focused on improving the pelvic exam experience using HCD principles. The study described a well-defined methodology to enhance the pelvic problems, but also noted that using a health design framework could have helped to answer questions about what could be delivered better in the context of healthcare.

One important finding from this review is the convergence between the need for a multidisciplinary approach and the design skills required to identify, create, and validate a new product. The review highlighted the capability of a clinician to bring design skills during the application of a design framework, and the impact of this intervention on creating a better product. Additionally, several studies identified the need for co-creation methodologies to be applied with other perspectives, suggesting that involving a range of stakeholders in the design process can result in more successful outcomes.

Another important theme that emerged from this review is the need for a health-specific design framework that considers the perspectives of clinicians, patients, and other stakeholders. While several studies reviewed in this article applied design methodologies that have been successful in other fields, such as business or retail, they also recognized the need for a health-specific approach that considers the unique challenges and requirements of healthcare.

Overall, this review highlights the importance of using human-centered design methodologies in healthcare product design. By involving end-users in the design process, applying multidisciplinary approaches, and using health-specific design frameworks, healthcare products can be created that better meet the needs of patients and other stakeholders. Further research is needed to develop and refine these methodologies and frameworks to ensure that they are effective and appropriate for use in the complex and evolving landscape of healthcare.

5. Conclusions

Product design in healthcare requires the use of specific frameworks and methodologies that help in deepening the understanding of the problem, creating solutions, and evaluating their efficacy. The identified methodological procedures provide a systematic approach to the creation of health technology products. The challenges encountered during the process include identifying the root cause of the problem, understanding the user's needs, and ensuring the effectiveness of the product. Based on the review, a specific framework for the creation of health technology products can be developed to improve the process and ensure the creation of effective solutions.

6. References

BATE, Paul; ROBERT, Glenn. Bringing User Experience to healthcare improvement. Abingdon: Radcliffe Oxford, 2007.

Baxter, M. Product Design (1st ed.). CRC Press. https://doi.org/10.1201/9781315275246. 1995

BIRNBAUM, F; LEWIS, D; ROSEN, RK; RANNEY, ML. Patient engagement and the design of digital health. Acad Emerg Med., 2015.

BRASIL, Ministério da Saúde. Humaniza SUS: Política Nacional de Humanização. Brasilia: Editora MS. Serie textos básicos, 2004.

BÜRDEK, Bernhard E. Introdução à Metodologia do Design. In: História, teoria e prática do design de produtos. São Paulo: Edgard Blücher, 1975.

FREITAS, Ranielder Fábio de., CARVALHO, C. O. de, MENESCAL, R. E. Design Emocional e o designer como interpretador de desejos e necessidades: revisão de literatura. Revista Estudos em Design – PUC-RIO. Vol. 18.1., 2010.

HARTE, R.; GLYNN, L.; RODRÍGUEZ-MOLINERO, A.; BAKER, PM.; SCHARF, T.; QUINLAN, LR.; ÓLAIGHIN, G. A Human-Centered Design Methodology to Enhance the Usability, Human Factors, and User Experience of Connected Health Systems: A Three-Phase Methodology. JMIR Hum Factors, 2017.

_____. HISTÓRIA, teoria e prática do design de produtos. São Paulo: Edgard Blücher, 2006.

LUDMERER, K. M. Learning to heal: the development of American medical education. New York: Basic Books, 1985.

NORMAN, D.A. The design of everyday things. New York: Doubleday, 1990.

NORMAN, D.A. User Centered System Design: New Perspectives on Human-computer Interaction (1st ed.). CRC Press, 1986.

ROGERS, Yvonne; SHARP, Helen; PREECE, Jennifer. Design de interação. Bookman Editora, 2013.

SHNEIDERMAN, Ben. Designing the User Interface: Strategies for Effective Human-Computer Interaction (3rd. ed.). Addison-Wesley Longman Publishing Co., Inc., USA, 1997.

ZHENG, Pai; LIN, Tzu-Jui; CHEN, Chun-Hsien; XU, Xun. A systematic design approach for service innovation of smart product-service systems. Journal of Cleaner Production, Volume 201, 2018.

IDEO. Human Centred Design Toolkit, 2009.

Interaction Design Foundation (IxDF). What is User Experience (UX) Design?. (interaction-design.org).