



Systemic Design for Sustainable Healthcare: Designing for the treatment of chronic diseases

Impact Case Study

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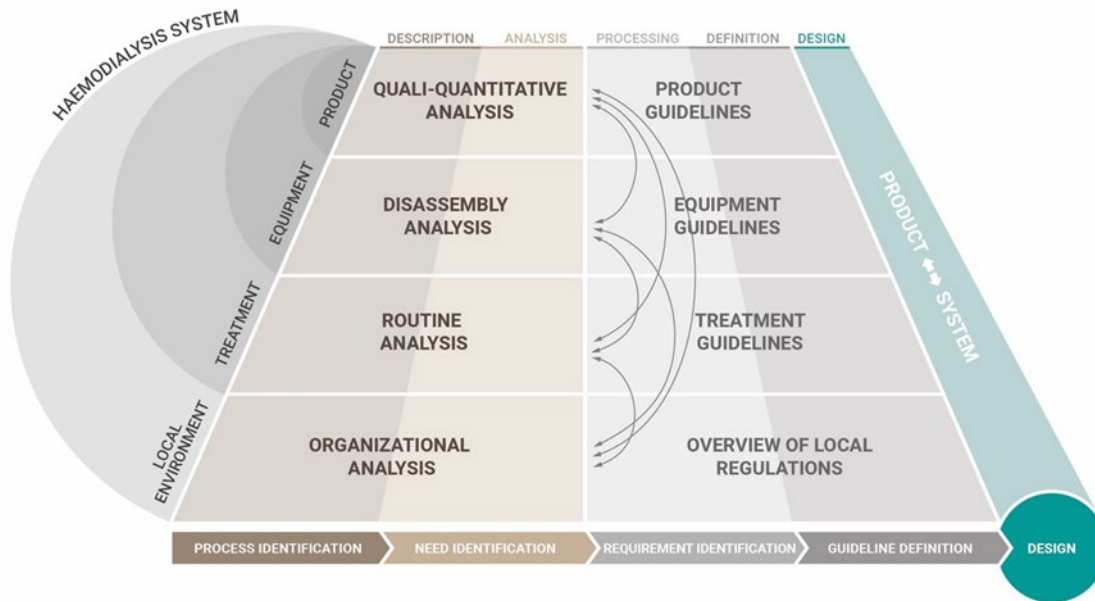
Politecnico di Torino

Department of Architecture and Design

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Discipline/field:	Systemic Design
Type of Doctorate (e.g. PhD, DDes, ArtD)	PhD
Supervisor(s)	Prof. Paolo Tamborrini Prof. Silvia Barbero

Abstract

Health systems are facing significant societal and organizational challenges that require enhancing their resilience and sustainability. The transition toward more sustainable health systems is both delicate and complex, and it needs radical changes of perspective as regards the holistic and multi-disciplinary approach to health care. Over the past years, interest in what is called Sustainable Healthcare has grown globally: there is no common definition, but all the approaches to this emerging domain focus on making health care environmentally, economically and socially viable. The present work aims at investigating the role of design towards Sustainable Healthcare, to propose, through case study experience, a systemic vision of the topic. The research methodology is deeply rooted in the framework of Systemic Design, aiming at defining how design strategies can improve the environmental sustainability of medical products, services, and systems, considering its close relationship with the social and economic aspects. Specifically, the research addressed the case study of chronic haemodialysis.



The thesis focuses on the definition and the analysis of the items which make up the dialysis system, by combining different approaches, borrowed from sustainable design and human-centred design. In order to establish a general frame, three different dialysis units and hospitals based in different European countries (Italy, Sweden, Denmark) were compared. This comprehensive analysis allowed to set specific guidelines for dialysis products, equipment, and treatment. The comparison of three international case studies highlighted how design should work on product and equipment to improve environmental sustainability on a global scale while addressing local systems to improve sustainability on a territorial level. The outcome of the research is a set of design strategies for the healthcare sector that take into account the technical, operational, social and environmental requirements of chronic treatments.

Summary of impact beyond academia

The PhD research addressed a radically new topic - Sustainable Healthcare - from a design perspective. Hospitals and companies involved in the case studies investigated in the PhD research showed interest towards the work.

In 2018, following the completion of the PhD, the doctoral researcher involved the regional Life Sciences Cluster (Polo BioPmed) in organising a first seminar entitled "Sustainable Healthcare. New strategies for the healthcare sector".



The researcher took her post-doctoral research further by collaborating with important bodies, such as the Nordic Center for Sustainable Healthcare. In 2020, the BioPmed Cluster asked her to support the drafting of a paper on Sustainable Healthcare and the design perspectives for the new Smart Specialization Strategy of the Piedmont Region (IT). In 2021, the researcher organised a new seminar "Sustainable Healthcare: towards the circular economy in the health sector" which involved more than 70 regional participants, including important public and private stakeholders. Also in 2021, her doctoral research evolved into a proposal for the EIT Manufacturing competitive call which was successfully evaluated and awarded funding. Today, the researcher is the Principal Investigator of the project Systema "Systemic Design and Sustainable Healthcare for MedTech Manufacturing" (EITM code 22111, 01/01/2022 - 31/12/2022, budget: 250.000 euro), which involves 6 partners from 4 European countries. The project is developing a training on Systemic Design for Sustainable Healthcare aimed at MedTech companies, with the ambition of laying the cultural and educational foundations for a new approach to the design of biomedical devices and services.

Underpinning research, context and summary of methodology

The research starts from the identification of an emerging need in healthcare professionals: the awareness of the unsustainability of their sector and the problems of waste and device management in healthcare treatments. In 2014, Dr. Amina Pereno (PhD researcher, Politecnico di Torino 2014 – 2017) supported by supervisors prof. Paolo Tamborrini (Full professor, Politecnico di Torino) and Silvia Barbero (Associate Professor, Politecnico di Torino), started from a literature review that showed how the contribution of design in the emerging field of Sustainable Healthcare was absolutely missing. The doctoral research therefore addressed this gap by answering two research questions:

1. How might design strategies improve the environmental sustainability of medical products, services and systems, considering its close relationship with social (people empowerment) and economic (feasibility) sustainability?
2. How does the system affect the products and the people (patient, clinicians, health staff, technicians, and other stakeholders involved in the system) that interact with them, considering environmental sustainability? How is the local system (ward/unit) influenced by the wider context (hospital, region, country)?

To address these questions, the PhD student defined a systemic methodology (see Figure 1 above) which was applied to the case study of chronic haemodialysis. The methodology addressed the four levels of a biomedical system (product, equipment,



treatment, local environment) and for each of them adopted specific design methods according to the following steps:

1. Process identification: Disassembly methods and qualitative-quantitative analysis were used for packaging, devices and machines; multi-user journey mapping (patient, nurse, physician) was used for treatment analysis; an analysis of regional and hospital organisation was made for the local environment.
2. Need identification: starting from step 1, specific needs in product and system design were identified in relation to the needs of the users and the local organisation.

The first two research steps has been carried out in three hospitals and regions in different European countries, so as to investigate the impacts of the context on the local system, and to ensure the validity of the design assessment: San Luigi Gonzaga University Hospital, Orbassano - Piedmont Region (Italy); Skåne University Hospital, Malmö - Skåne Region (Sweden); Frederiksberg Hospital, Frederiksberg - Hovedstaden Region (Denmark).

The correlation of the results made it possible to carry out the last two steps:

3. Requirement definition: Design needs are implemented into design requirements on the basis of cross-national results.
4. Guideline definition: The requirements allowed the definition of a set of design guidelines for eco-dialysis and a set of sustainable design strategies for the biomedical sector.

The results were supervised and validated by the Nordic Center for Sustainable Healthcare (Sweden), where the PhD student spent a visiting period.

References produced by researcher from/during doctoral research

Pereno, A., & Eriksson, D. (2020). A multi-stakeholder perspective on sustainable healthcare: From 2030 onwards, *Futures*, 122, 102605. Doi: 10.1016/j. futures. 2020.102605

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Barbero, S., Pereno, A., Tamborrini, P. (2017). Systemic innovation in sustainable design of medical devices. *Proceedings of the 12th European Academy of Design*



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Piccoli, G.B., Nazha, M., Ferraresi, M., Vigotti, F.N., Pereno, A., Barbero, S. (2015). Eco-dialysis: the financial and ecological costs of dialysis waste products: is a 'cradle-to-cradle' model feasible for planet-friendly haemodialysis waste management? *Nephrology Dialysis Transplantation*, 30(6), 1018-1027. Doi: 10.1093/ndt/gfv031

Pereno, A., Nazha, M., Tamborrini, P. (2015). Packaging design in the healthcare field: eco-guidelines for sustainable packaging and disposables in dialysis treatments. In: *Proceedings of the Third European Conference on Design4Health 2015*.

Systema project: <https://www.eitmanufacturing.eu/news-media/activities/systemic-design-and-sustainable-healthcare-for-medtech-manufacturing-systema/>

Details of impact

Design contribution in a completely unexplored field;

Sharing the know-how developed through the organisation of national seminars;

Invited speaker at relevant international conferences on sustainable healthcare topics;

Supporting local stakeholders to include sustainability issues for the health sector in the regional Smart Specialisation Strategy (2021-2027);

Implementing the PhD research through a structured, international and interdisciplinary research project, guided by a design approach: the Systema project funded by EIT Manufacturing

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