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Systemic design for sustainable community care for older adults: a case study in Turin, Piedmont, Italy

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The COVID-19 pandemic has significantly impacted various industries across the world, leading to changes in industries and the widespread adoption of teleworking networks. As countries transition from urban lockdowns to community lockdowns, community telemedicine has become a crucial agenda item. The pandemic has posed an unprecedented health challenge, particularly for older adults with chronic diseases due to its highly contagious nature and prolonged duration. The aim of this paper is to explore the impact and challenges of the COVID-19 pandemic governance model on older adults care in the Turin A.S.L.TO3 community. This paper was conducted within the methodology framework of systemic design, through literature review of the design approach to sustainable care development with the aim of identifying the gap in the current research, and semi-structured interviews with A.S.L.TO3 community care managers to ensure the accuracy of the data collected and the understanding of system issues from the manager's perspective, and cross-cutting multi-level analysis was conducted using case studies research methods in conjunction with the design tools community cross-scale model and stakeholder map, in order to understand the complexity of the community care system in its entirety and to clarify the relationships that occur in the system over time through strategic foresight. This paper explores key criteria for environmentally innovative sustainability decision-making interventions for community care transformation. This can help to govern and facilitate adaptive governance feedback systems in emergency situations from the perspectives of social, economic, environmental sustainability, and ageing inclusiveness when specific problems are identified.

Keywords: *community care; older adults; systemic design; COVID-19*

1 Introduction

Globally, more than 400 million people lack access to essential healthcare. Where it is accessible, care is too often fragmented or of poor quality. Consequently, the responsiveness of the health system and satisfaction with health services remains low in many countries (WHO, 2016). Healthcare touches virtually everyone at some point in their life (Patrício, 2020; Danaher, 2016). Among the world's emergencies, the COVID-19 pandemic have been one of the greatest threats to human health and community care in recent years. Italy was the first country where the outbreak exploded outside Asia



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(Capano, 2020) from 3 January 2020 to 30 March 2023, there are 25,695,311 confirmed cases of COVID-19 with 189,089 deaths (Salute umana e sicurezza, 2023). Older adults were the most plagued by the COVID-19 pandemic with a higher number of deaths than the European average: 3.1% against 2.4% (Paolini, 2021). 22 January 2020, issued by the Ministry of Health, established COVID-19 surveillance in Italy (Riccardo, 2020). Sebastiano Fadda (2021), Chairman of Inapp (National Institute for Public Policy Analysis in Italy), explained that during the COVID-19 pandemic, the factors affecting the death of older adults were not only their health status but also the vulnerability associated with different economic and social conditions. The pandemic has left more and more older adults vulnerable, especially older adults who did not receive adequate home care (Paolini, 2021). This highlights the need for a coordinated global response to address the impact of pandemics on vulnerable populations around the world.

The response to any crisis within a nation is rooted in the governance characteristics of that jurisdiction. The national response to COVID-19 can be divided into two paths, on one hand, a strict containment path with hard restriction was followed by, for example, South Korea, Hong Kong, Taiwan, Australia and New Zealand, which were able to minimize the transmission of the virus in relatively short time. On the other hand, a mitigation path was followed by countries that experimented with multiple and differentiated solutions to slow down the infections (Capano, 2020). Italy followed the second path; this is coupled with the fact that 20 regions have complete autonomy in organizing and managing healthcare services in their territories (Fiorentini, 2008). Thus, the management of the A.S.L. Città di Torino Health Authority is highly organized and autonomous, adapting strategies, governance models, services, etc. to the local community situation when dealing with community care in emergencies. The A.S.L. Città di Torino has recognized that the population most at risk is the older adults with chronic diseases and has activated telemedicine and psychological counselling services to ensure continuity of care. And has led to a hospital-regional integration model for older adult patients with chronic diseases to prevent medication interruption due to the pandemic. The use of special care continuity home management units, the creation of a temporary “New Coronary Pneumonia Hospital”, the field hospital module EMT2 (Emergency Medical Team), the Palliative Care Centre, the new Hospice Centre and the first Regional Operations Centre (COT) in Turin have all been instrumental in ensuring that citizens of Piedmont and Lombardy receive more effective rescue services. The A.S.L. Città di Torino has made operational changes to open up a model of shared access to healthcare resources, breaking down borders between Italian regions where the lack of sharing of healthcare resources creates a barrier to the rescue (SS.S Relazioni Esterne ASL Città di Torino, 2022). Although A.S.L. Città di Torino has made changes in care strategy, service modules, territorial borders, digital care, etc. in response to this emergency crisis, it still faces significant problems of shortages of health workers and weak supply chains, and continuity of care is also poor for many health conditions owing to weak referral systems (WHO, 2016).

In these years Italy was also affected by massive refugee movements that hit the public health system. For example, increasing the number of refugees is a source of stress in itself, while at the same time leading to the creation of a growing ethnically diverse population, with different languages, traditions, healthcare needs and prior levels of care is also a source of stress and will likely increase health inequalities (Mammana, 2020; Ingleby, 2015). Because of the Northern Ethiopia conflict crisis at the end of 2020, the Afghan health crisis in 2021, the Greater Horn of Africa Drought and food insecurity crisis in 2022, the Ukraine emergency, and the 12-year protracted political and socio-economic crisis in Syria have generated massive refugee movements into Italy, which has hit the country’s weak public

health system. These crises have highlighted the need for a coordinated global response to address humanitarian crises and their impact on public health systems worldwide. The vision of healthcare has evolved toward a more people-centred and integrated care system and ensures that they receive a continuum of healthcare throughout their lives (Patrício, 2020; WHO, 2016).

The characteristics of multi-causal, evolving, and ill-formed problems (Rittel, 1973) of conflict crisis, health crisis drought and food insecurity crisis in emergencies, political and socio-economic crisis, etc., should be held to the standard of wickedness. Systems thinking (resulting from its theoretical bias) promotes the understanding of complex problem situations independently of interventions or solutions (Peter, 2014). Systemic design as an emerging interdisciplinary continues to pursue an optimal or effective balance that integrates perspectives to improve and accelerate the resolution of complex social system challenges and adapts multi-level modes of inquiry and methodology to guide design practice in defining and including the containing systems and complex stakeholder relationships inherent in complex services and social systems (Peter, 2020).

However, research has shown that there are few systemic design interventions for the transformation of community care for older adults in emergencies in the context of the world's aggressive response to sustainability challenges to achieve the 17 Sustainable Development Goals (SDGs) for 2030, while at the same time, issues of inclusivity and responsiveness to digital care in emergencies have not been adequately addressed, but it cannot be ignored digital technologies can help older adults maintain healthy, productive lives and with opportunities to learn new skills and pursue social interaction, such as reduce barriers to care, maintain patient-provider communication, and promote disease self-management. And it has provided a safe alternative to in-person visits for vulnerable and home-bound patients, reduced travel burden, and facilitated communication with providers, such digital health technologies for healthy ageing are expected to mitigate the socio-economic effects of population ageing and improve the quality of life of older people (Iliescu, 2022; Mace, 2022; Cuffaro, 2020; Ienca, 2021). The paper develops key criteria for analyzing decision-making interventions for the transformation of community care and environmentally innovative sustainability systems to facilitate a move towards a new vision of community care for the complex and wicked emergencies of the future to continue to expand systemic design methodology.

2 Methodology

A three-step method was used to determine the Turin, Piedmont, Italy A.S.L. TO3(TO3) community care model for older adults based on the systemic design methodology framework. First, analyze and visualize the gaps in the current literature review of design and technology interventions for older adults' care through the Scopus literature database. Second, Semi-structured interviews with TO3 community managers about the community care system network, resources and waste, research and innovation projects and a review of general community data, community demographic data, economic data, and projects and activities data within the community. Third, visualize and cross-analyze the case studies of community care through a cross-scale model and a stakeholder map, in order to explore the impact and challenges of the COVID-19 pandemic governance model on older adults' care in the TO3 community. The visual process helps with remembering and internalizing large amounts of information, models, and solutions so that this can be worked with more effortlessly in a systemic design process (Sevaldson, 2022). Systemic design method and five principles are described in this paper, this can be used to determine the problem and challenges of the complex system in socio-

technical transformation, meanwhile can be used to gain comprehensive understanding complexity of the community care system while designing the appropriate solutions in the face of emergencies. This paper used a literature review, semi-interview and case studies research method based on the systemic design methodology framework, which integrative approach toward the output for the design was new systemic connections that were not imagined before bringing a long range of stakeholders together, because systemic design based on systems thinking, evidence analysis, and visualization is a powerful approach for strategic foresight as it clarifies relationships in a system that occur over a long period, the sustainable transition of large public sectors, such as healthcare, is a complex challenge that requires new environmental policy approaches to foster systems changes (Jones, 2020; Jones, 2013; Pereno, 2020). In fact, firstly this method framework is equivalent to a broad approach to complex problem-solving thinking but did not require the use of specific design tools and could be implemented straightforwardly through uniform criteria, followed by the current case studies lack of cross-sectional comparisons across multiple communities.

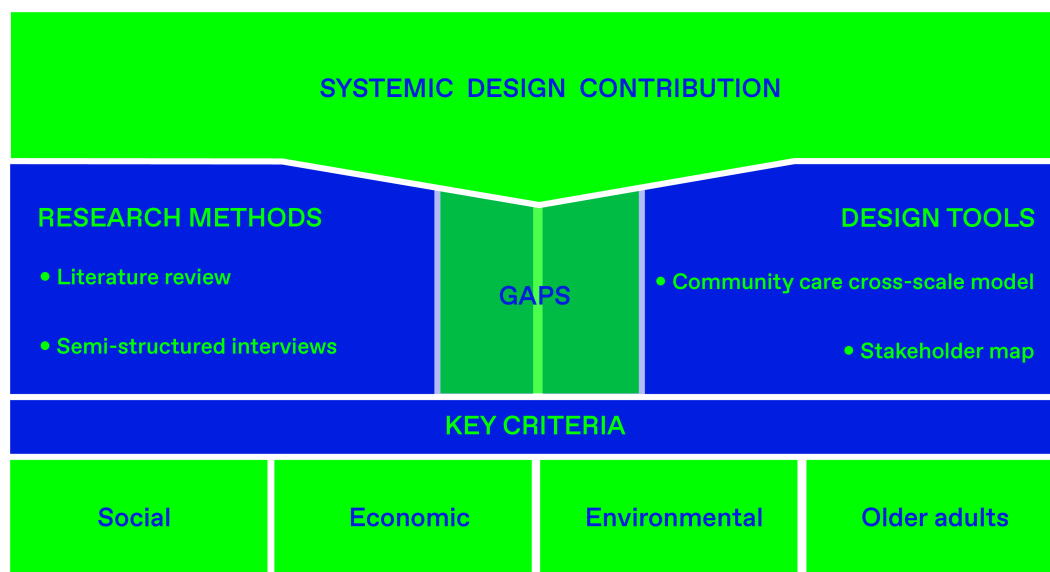


Figure 1. Graphical visualisation of the research methodology. Courtesy of the author

2.1 Systemic design methodology

In the early 2000's, a research group at the Department of Architecture and Design in Politecnico di Torino (Italy), in collaboration with ZERI Foundation, started to develop a systemic design approach as a step forward from eco-design to reach blue economy and circular economy (Battistoni, 2019). The systemic design approach is built around five key principles that contribute to environmental, social and economic sustainability (Barbero, 2017). In 2022, SYS, the systemic design Lab was founded in Politecnico di Torino in order to formalize the importance of systemic design research in this University and to enforce systemic design as a design discipline that provides practical tools to approach to complex scenarios with holistic perspective, while supporting active cooperation among the involved stakeholders.

Systemic design integrates systems thinking and theory with advanced design methods in an evolving interdisciplinary field to effect anticipatory change in complex sociotechnical systems, systemic thinking (resulting from its theoretical bias) promotes the understanding of complex problem situations independently of interventions or solutions (Jones, 2014; 2020). Complexity theory allows us to better understand systems as diverse as cells, human beings, forest ecosystems, and

organizations, that are only partially understood by traditional scientific methods (Park, 2017; Zimmerman, 2001). While it represents a relatively nascent field of study, it spans a wide variety of disciplines in the physical, biological, and social sciences, and has profound implications for the way we think about and acts within the world (Park, 2017; Schneider, 2006). This is especially important in studying organizations, organizational change, and leadership, where complexity theory can offer insights into how organizations become more sustainable, adaptive, and innovative (Uhl-Bien, 2007).

The systemic design approach has five principles to promote a paradigm shift, providing a new way to act (Bistagnino, 2011; Giraldo, 2020):

1. Outputs > inputs. The outputs (wastes) of a system become the inputs (resources) of another one (Bistagnino, 2011). And the process of outputs becomes the inputs for another process, developing continuous flows of matter, energy, and information.
2. Relationships. The relationships developed within the system generate the open system itself.
3. Autopoiesis. Autopoietic systems maintain and reproduce themselves by creating their own parts while co-evolving together with other systems, it also involves issues of community, politics, and democratic development, which are necessary to address when working with complex systemic problems (Maturana, 1972; Sevaldson, 2022).
4. Act locally. The local context is prioritized, enhancing its unique material, social, cultural and economic resources.
5. Humanity-centred design. Wicked and interrelated problems are seen through the lens of society and human beings, meant as part of a wider ecosystem (Norman, 2023).

Systemic design has emerged as a pragmatic, integrative approach toward resolving experienced critical concerns through means of human-centred and system-oriented design. Systemic design is situated in a pragmatic orientation to systems by crossing multiple levels and boundaries of system situations in research and application (Jones, 2020). The systemic design approach defined by the systemic design Lab of the Politecnico di Torino has based on the design methodology "the outputs of a system become the inputs for another productive chain" proposed by Luigi Bistagnino, founder of the Master of Science in Systemic Design, and has been refined over two decades and hundreds of projects to develop a systemic design methodology and tools dedicated to exploring environmental, social and economic sustainability. It is a design methodology consisting of five principles to promote a paradigm shift and alternating phases of divergence and convergence, with a visual design tool Gigamap to perform holistic diagnosis to identify systemic problems and design systemic solutions across multiple levels and boundaries of multiple systems. The systemic design methodology of divergent phase and convergent phase alternate has three steps and four key points (shown in Figure 2):

1. Framing problem. Addressing common social system issues, most of these are problem contexts susceptible to a wide variety of interpretations of value and risk, requiring design methods sensitive to surveying, understanding and resolving multiple conflicting desiderata and values.
- Understanding complexity. Through the holistic diagnosis method, a value chain and its fields are analyzed with a broad and detailed perspective. The flows of matter, energy, and information in specific contexts are mapped and related to the actors and the features of the territories, revealing their connections. The result is a complex map, which serves as a

reference point for the subsequent stages of the system project. The key points through interpretation to identify territory scope, system boundaries, system or territory problem and what to research.

- Tackling challenges. The complexity mapping tool allows the identification of challenges of the current situation and involves stakeholders in the process of co-design. Challenges are both problems and potential, which are characteristic of the system that has not yet been developed. Then, through in-depth research, using best practices and scientific literature can determine the possible solutions to each challenge.
2. Designing systemic solution. The design of a new systemic model based on relationships between processes and actors optimizes information, energy and material flows and gives value to waste as resources.
 - Designing the system. Systemic matrix, consisting of a set of parameters defined from the features of the context. Then, the solutions are implemented in the system, and a new reference model and its development over time are defined.
 3. Implementation. The system designed should be applied in a specific context and with real actors, so a series of actions in short, medium and long terms are defined.
 - Evaluating the system. The last key point makes it possible to quantify the outcomes of the systemic project, thus envisioning the possible impacts on different timeframes and scales. Lastly, the awareness acquired during the project allows for outlining a future vision of the system and imagining its long-term development.

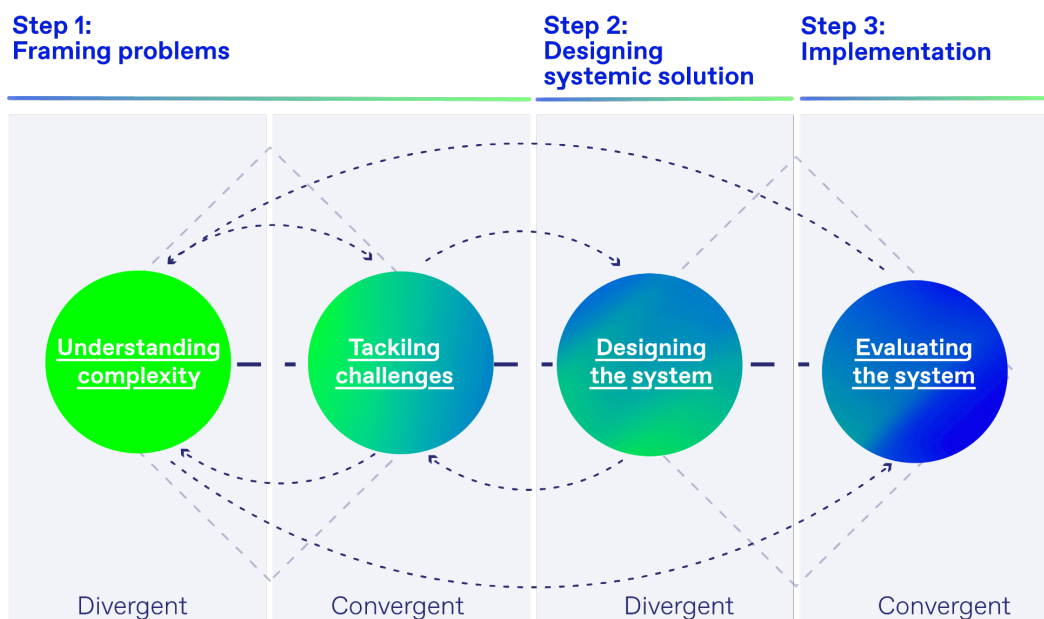


Figure 2. Systemic design Methodology. Source: Sys lab of Politecnico di Torino. Courtesy of the author.

2.1.1 Literature review

The scope of the literature review revolves around design and technology interventions for older adults' care and comprehensive analysis data of the literature review in this paper comes from two sets of search strings of the title, keyword, and abstract fields of the Scopus database as of March 22nd, 2023. The time frame of the data is 2015-2023, and the retrieved data includes articles,

conference papers, and reviews as shown in Table 1. The difference between the two search strings is that the first focuses on sustainable care with the intervention of different design approaches and the second on the techniques and best practices of older adults care. The total number of literatures searched through the specific search string is 224. The search procedure and results are shown in Table 2 cross-referencing was done using selection criteria, including 186 partial literature readings and 38 literature-intensive readings of the literature structure.

Table 1. Search parameters

	Data
Database	Scopus
Fields	Title, Keyword, Abstract
Search string	<p><i>TITLE-ABS-KEY 1</i></p> <p>(("Healthcare" OR " Care") AND ("Eco-design" OR "Sustainable design" OR "Systemic design" OR "Human-cente* design" OR "People-cente* design" OR "Systems oriented design") AND ("Sustainable" OR "Sustainability")) AND (LIMIT-TO (PUBYEAR, 2023) OR LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015)) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re") OR LIMIT-TO (DOCTYPE , "cp"))</p> <p><i>TITLE-ABS-KEY 2</i></p> <p>(("Healthcare" OR "Community care") AND ("Technolog*" OR "Case studies" OR "Good practice*" OR "Best practice*" OR "Medical waste" OR "Healthcare waste") AND ("Older Adult" OR "Elderly" OR "Older People" OR "Older Person") AND ("Sustainable" OR "Sustainability")) AND (LIMIT-TO (PUBYEAR, 2023) OR LIMIT-TO (PUBYEAR, 2022) OR LIMIT-TO (PUBYEAR, 2021) OR LIMIT-TO (PUBYEAR, 2020) OR LIMIT-TO (PUBYEAR, 2019) OR LIMIT-TO (PUBYEAR, 2018) OR LIMIT-TO (PUBYEAR, 2017) OR LIMIT-TO (PUBYEAR, 2016) OR LIMIT-TO (PUBYEAR, 2015)) AND (LIMIT-TO (DOCTYPE , "ar") OR LIMIT-TO (DOCTYPE , "re") OR LIMIT-TO (DOCTYPE , "cp"))</p>
Time frame	2015-2023
Type of retrieved publication	Article, Conference paper, Review

Table 2. Search procedure and results

Selection criteria	Data for Search parameters 1	Data for Search parameters 2
Total number of research	103	121
Title+Abstract+Keywords	47	65
Introduction+Conclusion	38	36

2.1.2 Interviews

Data were collected through semi-structured interviews and document review with TO3, Turin Local Health Authority, Italy Doctor Marta Alesina. The face-to-face interviews were conducted remotely, lasted 50 minutes and were conducted in Italian. Professor Pereno Amina and Master's student Maira Campanella collaborated for linguistic and cultural reasons. The interviews were recorded on video with the permission of the participants. No follow-up interviews have been conducted so far.

The document review was a supplement to the missing data, which consisted mainly of general data from the Turin Local Health Authority (A.S.L. TO3), community demographic data, economic data, and information on projects and activities in the community.

The video-recorded interviews were transcribed verbatim. However, the interview transcripts were not checked and commented on even for participants. The interviewers cross-checked the content of the interviews to ensure accuracy of the content. The purpose of this interview was to determine the number of older adults with chronic conditions receiving community care, to understand the autonomy and relationships of local health boards in terms of geographical context and regional directives, and to provide a vision for the future of the community care system. The topics included three sections on the community care system network, resources and waste, and research and innovation projects.

3 Results

3.1 Literature results

In the visualization of the results of the literature review in Figures 3 and 4, there are five parts of cross-gaps analysis:

1. Literature by country. Analyzing the distribution of countries researched in the literature, think about the research status and development trends in this field, As well as the contributions and advantages of different countries, in the research of digital care. China (include Hong Kong and Taiwan) is the highest research contribution and is now leading the way in the digital world, widely adopting new technology that ranges from mobile devices to innovative digital applications and tools (Xie, n.d.). The United Kingdom follows with 14.9%, then the United States with 13.22%, Italy with 11.57% and other countries. Regarding design intervention methods in different environmental dimensions, the United States contributed the most, reaching 33%, almost one-third of the world's research; and it is more related to sustainability in the treatment process. The United Kingdom contributed 9.7% and Italy 7.7%, while Europe is mainly concerned with the whole life cycle of healthcare.
2. Literature by Year. It is evident from the data that research on digital healthcare interventions and care model interventions in various types of care began in 2018. Research on design interventions in various types of care to address wicked environments began in 2019. COVID-19 has not had a particularly large impact on research in this area of literature, but rather advances in artificial intelligence technology have had a greater impact on the field of digital healthcare, which is currently mostly an assistive technology role. The first paper on machine learning techniques in healthcare was published in 1991 by Dr. Warner Slack at Beth Israel

Hospital in Boston, it was titled “Artificial Intelligence and Clinical Decision Making” and it described a system that used machine learning algorithms to diagnose patients with pneumonia (Sidey-Gibbons, 2019). Since then, machine learning has been used in many healthcare applications such as predicting diseases and developing efficient decision support (Shailaja, 2018). Furthermore, machine learning techniques in healthcare eliminate human involvement to some degree, which reduces the likelihood of human error (Berros, 2023).

3. Literature by discipline. In 2020-2023, the COVID-19 pandemic has impacted sustainable design in all countries and is concentrated in various disciplines. Most contributions are concentrated in medicine, engineering, environment, computer science and social sciences. The contribution of the arts and humanities is still very small, at 1.3% in search string 1 and 3% in search string 2. Design thinking interventions are still few and far between in the various research fields into digital healthcare.
4. Literature by research method. Among the research methods used and detected through the literature review, it mentioned the life cycle analysis, questionnaire research, cost-benefit analysis, review, care practice, interview, design thinking, systematic review, conceptual framework, qualitative research, and semi-structured interview. Systemic design interventions are still few and far between in the various research fields into digital healthcare.
5. Keywords in the literature. The size of the bubbles indicates the keyword share and the shade of the colour indicates the number of contributions for that keyword. Because keywords are crossed multiple times, the data in each bubble does not add up to the total. In Figure 2, there are five types of care: community care, followed by long-term care, primary care, elderly care, and to a lesser extent, home care. There is relatively more research on IoT and telemedicine within digital healthcare. Telemedicine has various names, such as telehealth, Mhealth, and Ehealth. The research in community care is divided into digital and non-digital care research and then research on the technologies and models of care, including video consulting technology, auxiliary equipment technology, a new type of rapid interaction assistance service, innovative and sustainable business models for digital hospital care, social inclusion of older adults through technology, connected health, exercise video games, database and information analysis, benchmarking, digital smoking cessation interventions, and telemedicine technology.

These digital healthcare and assistive technologies are only used in a small area and have not yet formed a standard for promotion and application. Non-digital care includes the care model, interactive model, care shortage issues, care finance issues, and policy issues. In Figure 3, there are eight design intervention methods and eleven different environmental dimensions. In various types of care, there are mainly eco-design, sustainable design, human-centred design, universal design and product design, and eco-design and sustainable design research also tend to be digital healthcare research. Still, community care aged care is relatively rare, and emergency healthcare services are rare. The systemic design has only 4 contributions (6.34%). Finally, the research shows that the above research focuses on sustainability in healthcare, but there are few design interventions in sustainability research on community care for older adults and few design research interventions in colleague emergencies.

Visualization of the results of the literature review 1

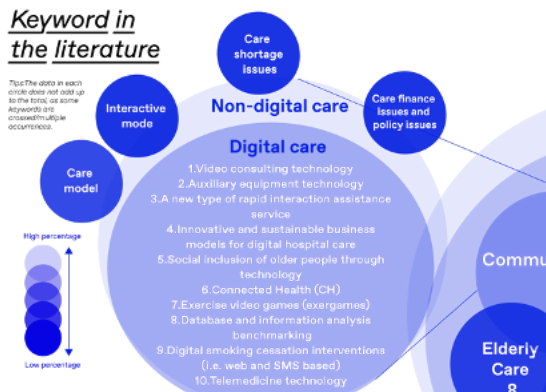
Conclude that research of digital health interventions and care model interventions in various types of care from 2018 onwards. During the period of 2020-2023, the epidemic situation in COVID-19 had an impact on the design for sustainability of various countries, and it was concentrated in various disciplines. Finally, research suggests that the information issues involved in the use of digital health in community care and home care, the issue of inclusivity have not been well addressed and the response to digital care in emergency situations has not been adequately researched.

TOTAL NUMBER OF LITERATURE

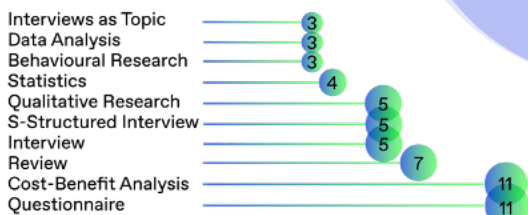
121

Keyword in the literature

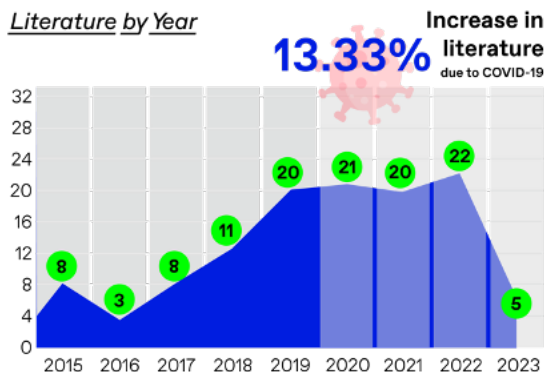
*The data in each circle does not add up to the total, as some keywords are crossed/multiple occurrences.



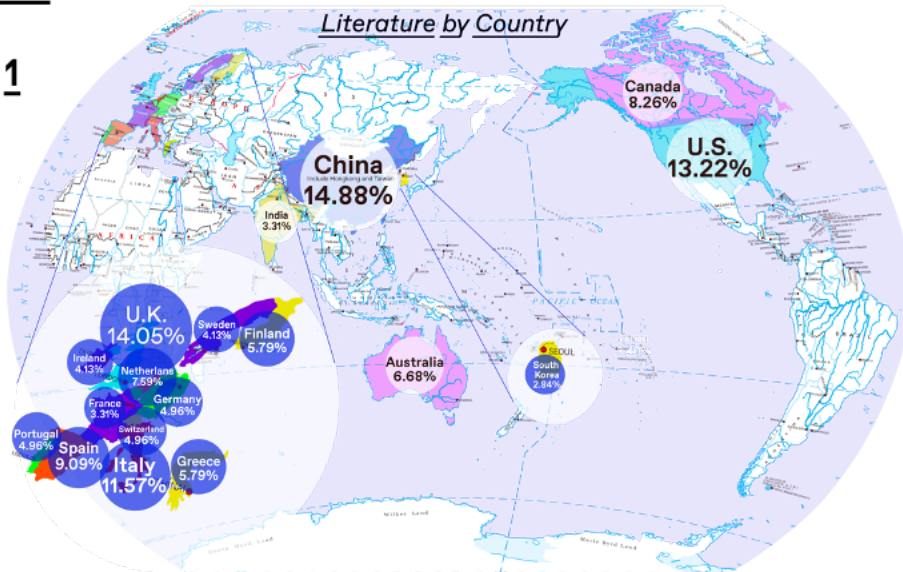
Research Methods



Literature by Year

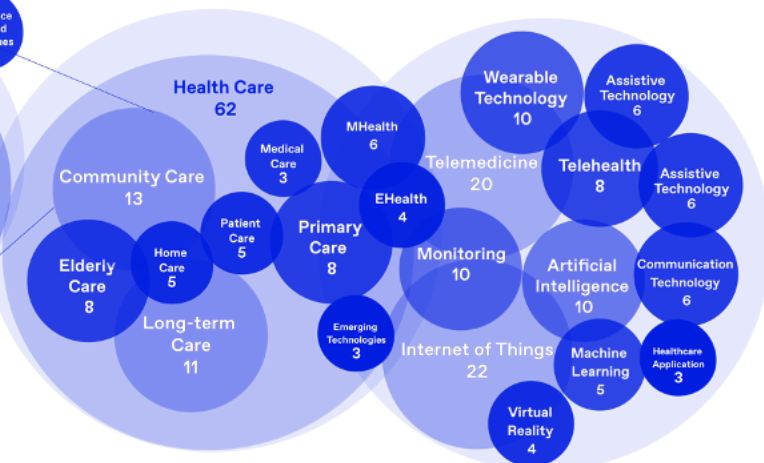


Literature by Country



66 Various types of care

65 Digital Healthcare



Literature by subject category

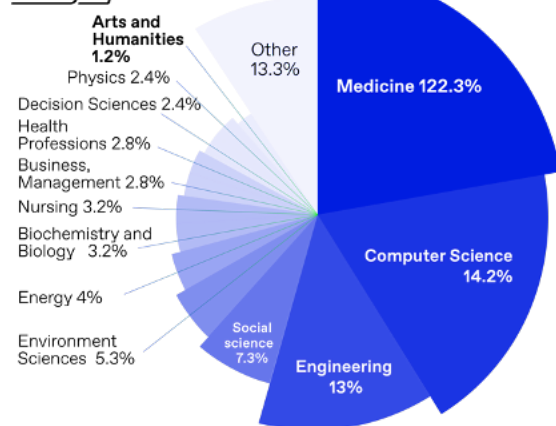


Figure 3. Visualization of the results of the literature review 1. Source: Scopus. Courtesy of the author.

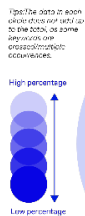
Visualization of the results of the literature review 2

Conclude that research on design interventions in various types of care to address wicked environments from 2019 onwards. During the period of 2020-2023, the epidemic situation in COVID-19 had an impact on the design for sustainability of various countries, and it was concentrated in various disciplines. Finally, the research shows that the above research focus on sustainability in healthcare, but there are few design interventions in sustainability research on community care for older adults, and few design research interventions in colleague emergencies.

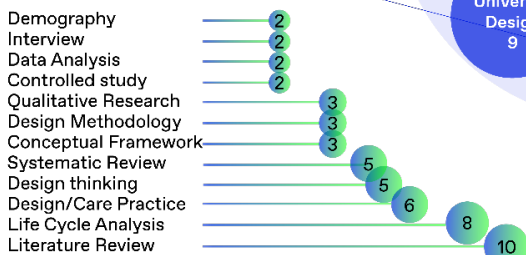
TOTAL NUMBER OF LITERATURE

102

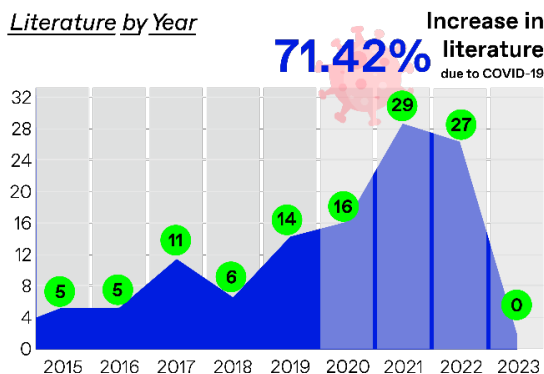
Keyword in the literature



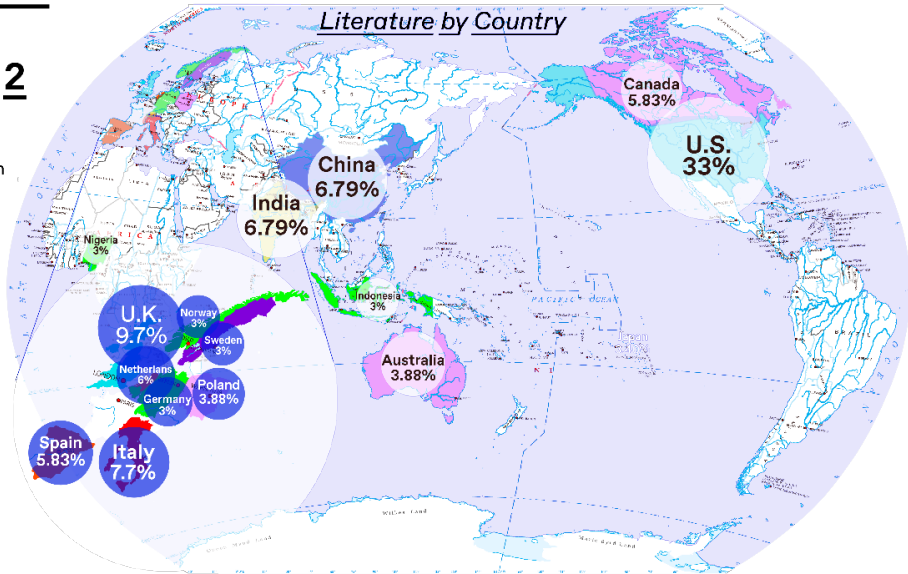
Research Methods



Literature by Year

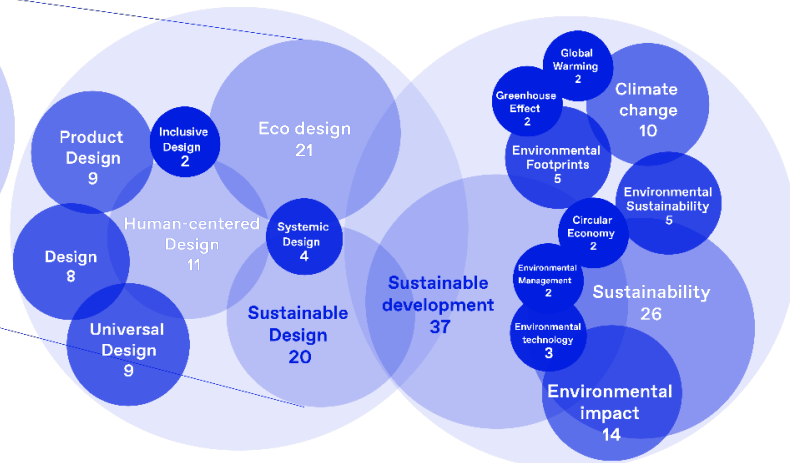


Literature by Country



63 Design intervention methods

57 Different environmental dimensions



Literature by subject category

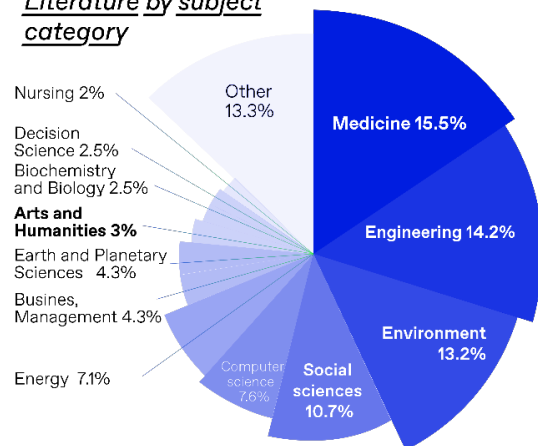


Figure 4. Visualization of the results of the literature review 2. Source: Scopus. Courtesy of the author.

Through the literature review, it was concluded that research on design interventions in various types of care has increased from 2019 onwards. Similarly, research on digital healthcare interventions and care model interventions in various types of care has been growing since 2018. During the period of 2020-2023, the COVID-19 pandemic had an impact on the design for the sustainability of various countries and was concentrated in various disciplines. However, the research shows that there are few design research interventions in sustainability on community care for older adults and colleague emergencies. Managing health is an iterative and ongoing process. Healthcare practices are seeking to integrate digital technologies and health records systems, and reduce cost overhead while providing better care to larger communities. Many so-called transformation programs have failed in the last decade because of the predictable systemic effects of social practices overcoming the best hopes of new technology or policy changes (Jones, 2013). Furthermore, the research suggests that the issue of inclusivity and response to digital care in emergencies has not been adequately addressed.

3.2 Case studies: A.S.L. TO3 community care

The case study is based on a semi-structured interview combined with two key points (understanding complexity and trickling challenges) from the first step of the systemic design methodology framing problem, cross-scale analysis using the cross-scale model and stakeholder map tools to trick common social-technical system issues. The TO3 community cross-scale model shown in Figure 5, the cross-scale model analyzes the social, economic, environmental, and older adults' criteria of TO3 at the macro scale (municipal care services), meso scale (residents), and micro scale (communities). A cross-sectional analysis of strengths and weaknesses was carried out. As shown in Figure 6, with the older adults as the key objects of the TO3 community, the values are carried around the community hierarchy, the city hierarchy, and the world hierarchy. It gives an overview of network relations (Stickdorn, 2010), and the tool “gives an overall picture of the network of actors and components in the system” (Morelli, 2007). It is also a key activity in humanity-centred design and design thinking processes, as it not only focuses on people from the beginning of a project but also identifies their relationships and connections, triggering the sustainable development process (Lu, 2022; Strumenti e pratica del design, 2022).

In Figure 5, the community cross-scale mode shows that the bubbles of strength are mostly clustered in the social criteria concentrated in social and economic criteria. The bubbles of weakness are clustered in each scale, most clustered in the older adults' criteria. This suggests that the current TO3 community interventions for older adults' care are weak and that the strengths in social and economic criteria are more prominent.

From the social criteria, a cross-tabulation analyze of TO3 community, residential and municipal care services in terms of social criteria. In conjunction with Figure 6 stakeholder map the CEOs of the various communities in Turin, including presidents, regional councils, and councils and commissions, although directly appointed and managed by the ASL Piedmont Regional Health Directorate, “define strategies for the area and then must reject these strategies at the operational level of the regional healthcare company”. During the COVID-19 pandemic, there was a high degree of organizational autonomy in community healthcare matters and “we had sufficient autonomy in the preparation of contracts. So, there were barriers to connectivity in the communities, particularly information. This obstacle is even more problematic in emergency situations, as evidenced by the high mortality rate of older adults in Italy during the COVID-19 pandemic. And the ASL Piemonte region will not sit idly by, in order to promote a functional integration of health and operational support services at the regional

level, optimizing health outcomes and organizational efficiency levels and “to be able to respond to health needs, a network exists between regional health institutions”(Interview), which was set up in October 2021, Azienda Zero was set up covering the entire territory of the Piemonte region with the support of the Compagnia di San Paolo Foundation and implemented a new experimental telemedicine project in four Turin communities (A.S.L. Città di Torino, A.S.L. Alessandria, A.S.L. Cuneo 1 and A.S.L. Cuneo 2) with nationwide healthcare assistance, allowing rescue operations to be carried out without borders between Piedmont and Lombardy and the immediate provision of aircraft and helicopters by the regions for rescue operations in Calabria and Sicily (SS.S Relazioni Esterne ASL Città di Torino, 2022).



Figure 5. Community care cross-scale model in A.S.L. TO3. Source: A.S.L. TO3 manager interview data. Courtesy of the author

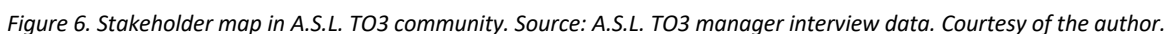
According to Istat and SIVeMP Veneto media reviews, in 2022 more than 4 million Italians (7% of the population) will be forced to abandon treatment due to long waiting times and the cost of treatment in the public health service. To reduce waiting times and "to relieve the pressure on the public health system, local health authorities have contracted with accredited private institutions to provide outpatient and inpatient services, as well as "several contracts with affiliated companies in Turin". Stakeholder map shows that the TO3 community currently has contracts with Cup "9 specialist outpatient centers, 3 hospitals, 5 health centers, 9 health homes, 10 clinics and no less than 2 private healthcare institutions". In cooperation with these institutions, it offers formal and informal care networks and have a cooperative in the field of "rehabilitation, functional recovery, physiotherapy and physiotherapy, offering home physiotherapy and post-operative physiotherapy" (Interview). The interviewees also mentioned that "there are too many bottlenecks, which are often determined by paper or a lack of timely information and communication, which ultimately delays the process of treatment [A.S.L.] local health authorities can enter into agreements with local health authorities who,

for example, lack or need diagnostic assistance to support pathology for specific diseases” and for multiple collaborators “there is a contract, an agreement that governs the relationship” (Interview).

From the economic criteria, the economic sources of community care “are budgeted, they are allocations from the Piedmont Region, which the Ministry of Health sends to each region, and each region distributes it to the local health agencies, according to the number of inhabitants of the community, so we have about 1 billion in the budget from the regional health agencies, and have incidental funds and the Recovery Funds, but they are linked to the project, they are not the basis of those budgets, i.e. they are project specific funds, independently managed, and most European projects when the project and funds end, no project is successfully put to use, which in my opinion is a waste of resources” (Interview). The financial costs of residents’ care and care services include the cost of ticket healthcare services in the public system, the full cost of individual access to private healthcare, and the cost of some Class A drugs. It is therefore recommended that the organizing committee of the Fund's projects consider the feasibility of the project and the execution of the project team, as well as post-implementation follow-up and feedback during the project evaluation phase, rather than just evaluating the brochure report.

From the environmental criteria, there is a lack of concern for sustainability, which highlights some contradictions between budget and ease of use, as mentioned in the interview, “because obviously a lot of green choices, I think also depend on budget. For example, recycled paper, now we buy it, but if we go to MEPA, the cost of recycled paper is even lower than non-recycled paper. However, when we have to scan a document, you don't see anything because it's almost brown... We must review the process to make it paperless” (Interview). The paperless office is currently also limited to the staff of the various departments of the community health board, and traditional paper is still used for patients' family doctor tickets, appointment tickets, test reports, diagnostic slips and treatment records.

From the older adults' criteria, as mentioned in the interview, “I am responsible for research and innovation, and I sweat it out. In that sense, it is clear that there is no chapter on the care of older adults, just as there is no chapter on the care of chronic diseases, Because we now have a lot of bottlenecks, i.e. the patient gets sick on a Friday night, calls the family doctor and can't find a doctor... then he decides to go to the emergency room where he has to wait 10 hours to be seen, after assessing that he needs to be hospitalized, he waits for an opening in internal healthcare, and once he is hospitalized, maybe he has to wait to be discharged, he has to get some sort of test report and then once he gets the report he has to wait to recover somewhere...” In the meantime, “it seems to me that there's a lot of talk about patient-centred care and then everyone is navigating by sight.” However, “in order to reduce waiting times for cardiac consultations, TO3 has agreed with ASO San Luigi di Orbassano to require 100 cardiac examinations per month in order to meet the health needs of cardiac patients and a network exists between regional health institutions to be able to respond to health needs. There is a network between the regional health institutions in order to be able to respond to health needs”. (Interview)



Turin offers a revolutionary organizational model in the response to emergencies, but the model is still in its experimental phase, and time will tell whether it can be practically applied on a large scale in emergency situations. Currently, in the TO3 community, there are no specific interventions focusing on older adults care and chronic disease care, while long waiting times, which fragment the treatment process, combined with delays due to lack of communication of effective and timely information, seem to be only at an unregulated stage with regard to the concept of patient-centred care, and it is noteworthy that the Italian population is ageing with a level of 24.84% (I.Stat, 2022). The prominence of the ageing population symbolizes the change in the population structure, and the care of the older adult in the community and at home faces more challenges (Lu, 2022) and the characteristics of care for the older adults and the characteristics of chronic diseases differ from those of other age groups. Ageing increases the risk of suffering from chronic non-communicable diseases (Barajas, 2021), and the health status tends to deteriorate among those with chronic non-communicable diseases, which

translates into increases in the use of healthcare services, associated costs and mortality (Barajas, 2021; WHO, 2015). Chronic conditions, especially multiple sclerosis, parkinsonism, memory problems, and stroke, are associated with the substantial time of formal and informal care in middle-aged and older women and men (Zhang, 2022).

5 Conclusion and future work

This research is conducted within the framework of systemic design through a literature review, semi-structured interviews, and the use of community care cross-scale model and stakeholder map design tools in order to understand complex community care systems holistically from multiple perspectives and to determine the gap in the current research that is the issue of inclusivity and response to digital care in emergencies has not been adequately addressed and to identify four key criteria for decision-making interventions on the sustainability of environmental innovations in the transformation of community healthcare, including social, economic, environmental, and older adults, and the above holistic synthesis found that the high degree of organizational autonomy in Italian regional healthcare management has its advantages and disadvantages, with more flexibility in developing and implementing innovative projects and a more localized state of governance, but with less capacity for interinstitutional coordination and cooperation, thus creating barriers to interinstitutional and interregional data sharing, which can easily lead to silos of data and information, and to a failure to make timely and appropriate strategies in response to emergencies. The practical implications are more patients, fewer doctors and longer waiting times for older adults, a problem that will be accentuated in emergencies, where more sick older adults may lose their lives while waiting indefinitely.

There are some limitations to this research, the number of interviewees and the fact that the research only looked at a single community and did not make cross-sectional comparisons with other communities, so future work will suggest cross-sectional comparisons across multiple communities as well as multiple countries. Digital healthcare using the same data cloud and developing paperless healthcare with multiple digital ports for users is therefore a future trend, among the key areas for future development are digital healthcare for seniors in the community, how communities are transitioning from traditional to digital healthcare models, and how older adults should use the new healthcare models, but the economic budget and data privacy, and ethical issues of digital healthcare need to be addressed.

Referencing

- WHO. (2016). Framework on Integrated, People-Centred Health Services. World Health Organization. https://apps.who.int/gb/ebwha/pdf_files/WHA69/A69_39-en.pdf?ua=1&ua=1
- Patrício, L., Sangiorgi, D., Mahr, D., Čaić, M., Kalantari, S., & Sundar, S. (2020), "Leveraging service design for healthcare transformation: toward people-centered, integrated, and technology-enabled healthcare systems", *Journal of Service Management*, 31(5), 889-909. <https://doi.org/10.1108/JOSM-11-2019-0332>
- Danaher, T.S., & Gallan, A.S. (2016), "Service research in health care: positively impacting lives", *Journal of Service Research*, 19(4), 433-437. <https://doi.org/10.1177/109467051666634>
- Capano G. (2020). Policy design and state capacity in the COVID-19 emergency in Italy: if you are not prepared for the (un)expected, you can be only what you already are. *Policy and Society*, 39(3), 326–344. <https://doi.org/10.1080/14494035.2020.1783790>
- Salute umana e sicurezza. (2023) Salute umana e sicurezza (Inspire) ISO 19115: Salute. Istituto Superiore di Sanità COVID-19 Situazione Italia [Data set]. <https://opendatamds.maps.arcgis.com/apps/dashboards/0f1c9a02467b45a7b4ca12d8ba296596>

- Paolini A. (2021). Covid, in Italia il più alto numero di morti tra gli anziani. Peggio di noi solo la Bulgaria. La Repubblica. https://www.repubblica.it/cronaca/2021/06/10/news/covid_in_italia_il_piu_alto_numero_di_morti_tra_gli_anziani_peggio_di_noi_solo_la_bulgaria-305115487/
- Riccardo F., Andrianou X., Bella A., Manso D. M., & et al. (2020). COVID-19 integrated surveillance system. Istituto Superiore di Sanità. <https://www.epicentro.iss.it/en/coronavirus/sars-cov-2-integrated-surveillance>
- Florentini G., Lippi B., M., & Ugolini C. (2008). Health systems and health reforms in Europe: The case of Italy. *Intereconomics-Review of European Economic Policy*, 43(4), 205–212. <https://doi.org/10.1007/s10272-008-0253-z>
- SS.S Relazioni Esterne ASL Città di Torino(2022). Uni triennio per le emergenze e al servizio della comunità. <https://www.aslcittaditorino.it/wp-content/uploads/2022/12/Un-triennio-per-le-emergenza.pdf>
- Mammana L., Milani C., Bordin P., Paglione L., & Salvia C. (2020). Health System Response during the European Refugee Crisis: Policy and Practice Analysis in Four Italian Regions. *Int J Environ Res Public Health*, 17(15),5458. <https://doi.org/10.3390/ijerph17155458>
- Ingleby D. (2015). The Refugee Crisis: A Challenge to Health Systems. *Proceedings of the Flucht und Migration Herausforderungen für Gesundheitsversorgung und-Forschung*, Berlin, Germany.
- Rittel W. J. H., & Webber M.M. (1973). Dilemmas in a General Theory of Planning. *Policy Sciences*,4(1973), 155-169, <https://doi.org/10.1007/BF01405730>
- Peter H. J. (2014). Systemic Design Principles for Complex Social Systems. In Metcalf, G. (eds) *Social Systems and Design. Translational Systems Sciences*, 1, 91–128, Springer, Tokyo. https://doi.org/10.1007/978-4-431-54478-4_4
- Peter H. J. (2020). Systemic Design: Design for Complex Social and Sociotechnical Systems. In Metcalf. G (Eds.), *Handbook of Systems Sciences. Volume 1 of the Translational Systems Science Series*, Springer Verlag. https://doi.org/10.1007/978-981-13-0370-8_60-1
- Iliescu W. R. (2022). Digital Technologies Can Help Older Persons Maintain Healthy, Productive Lives. *World Telecommunication and Information Society Day in United Nations Chronicle*. <https://www.un.org/en/un-chronicle/digital-technologies-can-help-older-persons-maintain-healthy-productive-lives>
- Mace A R., Mattos K M., & Vranceanu M.A. (2022). Older adults can use technology: why healthcare professionals must overcome ageism in digital health. *Transl Behav Med.*;12(12):1102-1105. <https://doi.org/10.1093/tbm/ibac070>
- Cuffaro L., Di Lorenzo F., Bonavita S., Tedeschi G., Leocani L., & Lavorgna L. (2020). Dementia care and COVID-19 pandemic: a necessary digital revolution. *Neurol Sci*, 41(8),1977–1979. <https://doi.org/10.1007/s10072-020-04512-4>
- Ienca, M., Schneble, C., Kressig, R.W., & et al. (2021). Digital health interventions for healthy ageing: a qualitative user evaluation and ethical assessment. *BMC Geriatr* 21, 412. <https://doi.org/10.1186/s12877-021-02338-z>
- Sevaldson B. (2022). Designing Complexity: The Methodology and Practice of Systems Oriented Design. *Common Ground Research Networks*. <https://doi.org/10.18848/978-1-86335-262-8/CGP>
- Jones H. P. (2013). Design for Care: Innovating Healthcare Experience. Rosenfeld Media, LLC. <https://doi.org/10.1080/24735132.2017.1295541>
- Pereno A., & Eriksson D. (2020). A multi-stakeholder perspective on sustainable healthcare: From 2030 onwards. *Futures*, 122 (2020),102605. <https://doi.org/10.1016/j.futures.2020.102605>
- Battistoni C., Nohra G. C., & Barbero S. (2019).A Systemic Design Method to Approach Future Complex Scenarios and Research Towards Sustainability: A Holistic Diagnosis Tool. *Sustainability*, 11(16),4458. <https://doi.org/10.3390/su11164458>
- Barbero. S., & Pallaro, A. (2017). Systemic design for sustainable healthcare. *The Design Journal*, 20(0), 2473-2485. <https://doi.org/10.1080/14606925.2017.1352762>
- Park J. (2017). An Introduction to Complexity Theory: What it is, what it replaces, and why it's important. Medium. <https://medium.com/@junp01/an-introduction-to-complexity-theory-3c20695725f8>
- Zimmerman, B., Lindberg, C., & Plsek, P. (2001). A Complexity Science Primer. In *Edgware: Insights from Complexity Science for Health Care Leaders*. Irving, Tex.: VHA Inc.
- Schneider, M., & Somers, M. (2006). Organizations as complex adaptive systems: Implications of Complexity Theory for leadership research. *The Leadership Quarterly*, 17(4), 351–365. <https://doi.org/10.1016/j.leaqua.2006.04.006>

- Uhl-Bien, M., Marion, R., & McKelvey, B. (2007). Complexity Leadership Theory: Shifting leadership from the industrial age to the knowledge era. *The Leadership Quarterly*, 18(4), 298–318.
<https://doi.org/10.1016/j.leaqua.2007.04.002>
- Bistagnino, L. (2011). *Systemic Design. In Design the Production and Environmental Sustainability*, 2nd ed. Slow Food: Bra.
- Giraldo N. C., Pereno A. & Barbero S. (2020). Systemic Design for Policy-Making: Towards the Next Circular Regions. *Sustainability*, 12(11), 4494. <https://doi.org/10.3390/su12114494>
- Maturana, H. R., Varela, F. J. (1972). *Autopoiesis and cognition: the realization of the living*. Boston studies in the philosophy and history of science (1st ed.). Dordrecht: Reidel.
https://monoskop.org/images/3/35/Maturana_Humberto_Varela_Francisco_Autopoiesis_and_Cognition_The_Realization_of_the_Living.pdf
- Norman, D. (2023). *Design for a Better World: How to create a meaningful, sustainable, and humanity-centered future*. The MIT Press. <https://mitpress.mit.edu/9780262047951/design-for-a-better-world/>
- Xie D., & Li X. (n.d.). A new view on China's digital health care: Launching innovative biopharma in China. Deloitte insights. Deloitte University EMEA CVBA.
https://www2.deloitte.com/content/dam/insights/us/articles/r722480_new-view-on-chinas-digital-health-care/DI_A-new-view-on-Chinas-digital-health-care.pdf
- Sidey-Gibbons M.A. J. & Sidey-Gibbons J.C. (2019). Machine learning in medicine: a practical introduction. *BMC Med Res Methodol*, 19(64). <https://doi.org/10.1186/s12874-019-0681-4>
- Shailaja K., Seetharamulu B., Jabbar M. A. (2018). Machine Learning in Healthcare: A Review. 2018 Second International Conference on Electronics, Communication and Aerospace Technology (ICECA), 910-914.
<https://doi.org/10.1109/ICECA.2018.8474918>
- Berros, N., El Mendili, F., Filaly, Y., & Idrissi E.B.E.Y. (2023). Enhancing Digital Health Services with Big Data Analytics. *Big Data and Cognitive Computing*, 7(2), 64. <https://doi.org/10.3390/bdcc7020064>
- Stickdorn, M., & Schneider, J. (2010). *This Is Service Design Thinking: Basics, Tools, Cases*. Amsterdam: BIS Publishers. <https://www.wiley.com/en-us/This+is+Service+Design+Thinking%3A+Basics%2C+Tools%2C+Cases-p-9781118156308>
- Morelli N., & Tollestrup C. (2007). New Representation Techniques for Designing in a Systemic Perspective. *Design Inquiries*, Nordes 07 Conference.
https://vbn.aau.dk/ws/portalfiles/portal/12648391/representation_techniques_for_design_in_a_systemic_perspective
- Lu W., Barbero S. Pereno A. (2022). Systemic Design For Elderly Healthcare: Analysis of the current responses in China, Italy and Japan. *Proceedings of Relating Systems Thinking and Design (RSD11) Symposium*.
<https://rsdsymposium.org/proceedings-of-rsd11-2022-symposium/>
- Strumenti e pratica del design. (2022). *Mappare gli stakeholder in pratica*. Maria Cristina Lavazza.
<https://www.mclavazza.it/mappare-gli-stakeholder-in-pratica/>
- I.Stat. (2023). *Indicatori demografici*. [Data set]. <http://dati.istat.it/Index.aspx?QueryId=18462>
- Barajas-Nava A L., Garduño-Espinosa J., Dorantes M M. J., Medina-Campos R., & García-Peña M C. (2021). Models of comprehensive care for older persons with chronic diseases: a systematic review with a focus on effectiveness. *BMJ Open*, 12(8). <https://doi.org/10.1136/bmjopen-2021-059606>
- Zhang W., & Sun H. (2020). Formal and informal care received by middle-aged and older adults with chronic conditions in Canada: CLSA data. *PLoS ONE*, 15(7), e0235774.
<https://doi.org/10.1371/journal.pone.0235774>
- Media review. (2023). Istat. Oltre 4 milioni di italiani rinunciano a curarsi per liste d'attesa e costi. Le difficoltà d'accesso sono la prima ragione più dei motivi economici. Cresce la spesa sanitaria pagata dai cittadini. *SIVeMP Veneto*. <https://www.sivempveneto.it/istat-oltre-4-milioni-di-italiani-rinunciano-a-curarsi-per-liste-dattesa-e-costi-le-difficolta-daccesso-sono-la-prima-ragione-piu-dei-motivi-economici-cresce-la-spesa-sanitaria-pa/>

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