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The implementation of design methodologies for supporting shared decision making in healthcare services: A systematic review.

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ABSTRACT

Objectives: This systematic review examines how design methodologies support Shared Decision Making (SDM), identifies the most suitable for future use, explores types of methodologies used, challenges faced, and the impact on patients, clinicians, and care pathways.
Methods: Studies were searched on Medline, Web of Science, Scopus and grey literature (Google Scholar, CORDIS) up to July 2024, following PRISMA guidelines.
Results: were analysed to identify patient involvement, design strategies, SDM solutions, and their impact on care paths, professionals, and patients.
Results: Out of 2499 studies and 39 grey literature projects identified, 22 studies (reported in 35 publications) were selected, primarily from the USA and Europe (2015 onward). User-Centered Design predominated, involving health professionals more than patients. IPDAS standards were common. Evaluations showed improved patient experience and SDM role, with a potential increase in healthcare professionals' workload.
Conclusion: Although design methodologies are used in SDM implementation, improvement is needed. Service Design can enhance implementation by analysing the entire SDM process, while co-creative approaches develop patient-focused solutions that integrate smoothly into health professionals' workflows.
Practical implications: Introducing SDM in healthcare is complex, but design methodologies can help by analysing stakeholder needs, providing a broader care path view, and facilitating SDM implementation.

1. Introduction

Patient-centred care (PCC) is a respectful widespread goal in healthcare [1–3] focused on patients' preferences and needs, ensuring that patients' values guide the entire care process to improve their experience and satisfaction [4]. This framework has evolved into person-centred care (PeCC), from achieving a functional life (PCC) to achieve a meaningful life (PeCC) [5]. PeCC is a more holistic framework in which all stakeholders are active agents in all aspects of care [6,7]. Understanding what matters most to people and what represents "good PeCC" is complex [8]. The Picker Institute has developed a list of eight key dimensions that constitute patients' most valued experiences and aspects (Picker Principles of PeCC). These include access to care, smooth transitions and continuity of care, involvement in decision making, and others such as emotional support or the physical environment [9].

Shared Decision Making (SDM) is a PeCC process that considers patients' values and preferences, involving health professionals, patients, and caregivers in discussing treatment options, tests, and supportive care [10,11]. The main goal is to select the most appropriate option based on medical evidence and patients' preferences and views. Partnering with patients is crucial when multiple treatment options have varying side effects [12]. Patients involved in SDM leads to better

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adherence to treatment choices [13], higher satisfaction [11], reduced depression related to illness or treatment side effects [14], and improved care experiences [15]. To improve SDM implementation, decision aids are frequently introduced [16], which can be classified into two types: Patient Decision Aids (PtDAs), used alone by the patients (although they can send information to health professionals about their preferences, needs and health status), and Encounter Decision Aids (EDA), used in clinical encounters [17–19]. Due to the variety of these tools, two standards are used to ensure their quality: the Ottawa Decision Support Framework (ODSF) and the International Patients Decisions Aid Standards (IPDAS) [20]. The main difference is that ODSF considers perspectives of clinicians and patients regarding their decisions throughout the entire process, whereas IPDAS focus on improving PtDAs' quality [21,22].

Despite SDM's positive outcomes, implementation is challenging due to issues like communication problems between patients and clinicians, leading to misunderstandings and reduced patient autonomy [18,23,24]. Decision making often occurs throughout the entire care path. Viewing SDM moments as isolated events within clinical encounters, rather than as a complex process, may contribute to the lack of widespread SDM adoption [25–27]. Furthermore, there is evidence that patients and other stakeholders may be insufficiently involved in the extraction of needs, preferences and problems during the aids development and SDM process [28,29], which may affect the adoption and implementation of the SDM in healthcare.

Considering these gaps, design methodologies can assist in the implementation of SDM by adopting a more comprehensive and integrated approach considering the entire process and all relevant stakeholders. Design methodologies help put the users at the center of the decision-making process, improving the experiences of all stakeholders. They are characterized as synthetic, participatory, and iterative methodologies, allowing end users to take part and directly influence the whole design process to 'creatively create' new solutions, and outcomes of the process [30,31]. Methodologies can do this by analysing processes, contexts, and stakeholder needs and preferences. Design can lead to innovative interventions such as new care processes, implemented to improve user experiences and satisfaction [32,33]. In this regard, PeCC and design methodologies are aligned in their focus on user experience and satisfaction.

Design methodologies can be structured in a variety of ways [34], but a prominent and widely used structure is the Framework for Innovation [35] (a recent revision of the 2004 Double Diamond model). It provides a simple summary that helps to understand the key characteristics and phases of the design process (Fig. 1). The framework describes a design process that encourages a commitment to innovation from a people-centered and collaborative perspective. At the heart of the framework is the double diamond, consisting of the following four phases: Discover and Define (in a challenge-oriented diamond), and Develop and Deliver (in an outcome-oriented diamond):

- Discover: Divergent step where designers focus on gaining a broad understanding of problems by engaging with users and stakeholders. The goal is to understand the service context and user experiences.
- Define: Convergent step where all user experience elements found in the previous phase are classified and the main problems to be solved in the next steps are selected.
- Develop: Divergent step in which designers co-design different solutions to the main problems. These solutions are iteratively tested and improved to select the most effective ones, together with users.
- Deliver: Convergent step towards final solutions, which are now prototyped and tested to ensure their usefulness, usability, and impact on improving user experience and satisfaction.

There can be many iterations between the two final phases, and on occasion, there can even be iterations with the first phase. If tests and prototypes reveal unforeseen issues with the initial challenge. The

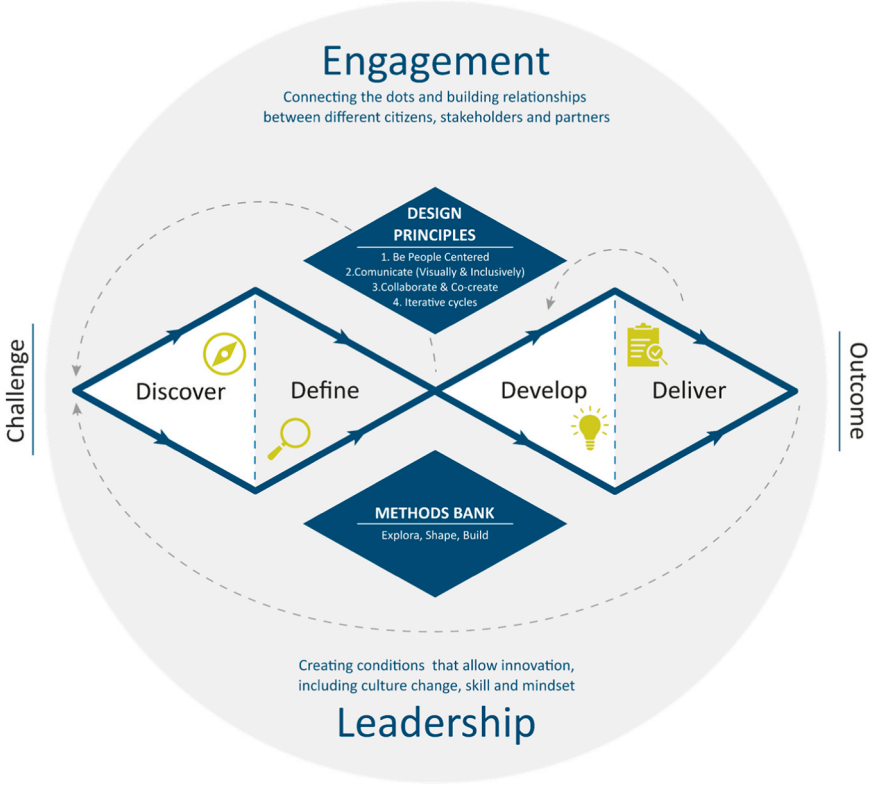

Fig. 1. Innovation Framework.
(adapted from Design Council, Framework for Innovation, Design Council (2023) [35]

objective of this final phase is to create a well-integrated solution.

The Innovation Framework can help to understand design processes for SDM. It is comprised of two subdisciplines of design: User-Centered Design (UCD) and Service Design (SD). UCD focuses on the main user experience and problems and is mainly used to design interfaces and products [36]. SD methodology is a specific methodology for the improvement and (re)design of services [37,38]. It focuses on touchpoints, agents, and processes to enhance service experiences and process optimisation [39]. In the SDM field, UCD could help improve aid designs while SD would help implement the whole process in the medical service. Both methodologies engage users actively in design [40,41] and production [42,43], providing an overview of the process to identify key touchpoints and issues. This is crucial for enhancing adoption and patient satisfaction with SDM [33,44], viewed as a service [45]. Design methodologies, especially SD, have techniques to extract user experience elements during the discovery phase.

As Fig. 2 shows, outcomes of design exploration (discovery phase) can have different levels of analysis depth. Problems are analysed by designers to create *learnings* (basic level), which are grouped (according to the challenge, and their impact on both the processes and user's experience) into *themes* (middle level). In turn, *themes* can be grouped into *insights* (highest level), i.e., the main challenges that designers must address in the following phases [46]. Consequently, the information extracted from the analysis converges in the *insights* [47]. In the example of Fig. 2, taken from M. Carrisa Abigail Roxas et al. [48], *learnings* are specific problems grouped into *themes* to propose *insights* as design challenges for the development phase.

As stated, user involvement is a key aspect of design methodologies, particularly in the search of problems (discovery) and solutions (development), but also in the final implementation (delivery). Three distinct approaches can be identified, each with a different level of engagement. Co-creation refers to users' active involvement throughout the entire process. Co-design is a collaboration between users and designers to create solutions. Co-production involves users in the implementation of previously defined solutions [49]. These approaches can be employed solely as methodology or can support SD or UCD methodologies [42]. Additionally, collaborative approaches can improve the development and implementation of SDM processes in healthcare by better identifying user problems and tailoring solutions to their needs.

This systematic literature review assesses if design methodologies can help to solve the problems detected in the implementation of SDM processes (Fig. 3). It aims to analyse how design methodologies have been used to support Shared Decision Making (SDM) and which one (SD or UCD) is better suited to support SDM in the future. The review analyses if design methodologies analysed the whole design process, following the Innovation Framework phases (from discovery to delivery), focused on the involvement of different stakeholders during the design phases, the problems faced, and characteristics of designed solutions and their impact on patient and healthcare professionals and healthcare processes. The following questions were addressed:

1. When, where and by whom were design methodologies applied in implementing or improving SDM processes?
2. What types of design methodologies were applied in studies to implement or improve SDM and how were patients and healthcare professionals involved?
3. What types of problems were discovered and how were they grouped and analysed?
4. What types of solutions were created during the definition and developing phases to enhance or implement SDM?
5. What was the impact of the solutions to support SDM on the care paths process, health professionals, and patients?

2. Methods

2.1. Study design

A systematic literature review was conducted for this study. The PRISMA guideline was applied to ensure clear and transparent processes and outcomes [50].

2.2. Search strategies

This literature review used the databases Web of Science (WoS), SCOPUS and MedLine. Search terms were included as a combination of keywords (WoS and SCOPUS) and Mesh-terms (MedLine). They were related to Patient/Person-Centered Care, Shared Decision Making and design methodologies. Due to the diversity of design methodologies, we included 'design' as a keyword as it referred to all of them, as it emerged from the preliminary analysis. Those combinations of terms provided the main *themes* of the review ('design' and 'SDM') and with the inclusion of patient participation, we aimed to ensure that patients were involved and were the center of the design/process. Furthermore, the 'SDM' and 'design' terms had to be mentioned in the abstract, title or keywords (Mesh-terms in MedLine) as the most important terms of the review, whereas 'PCC'/'PeCC' could be cited in any part of the article. In addition to PCC/PeCC, we also included 'co-design' as a search term, as this may imply patient- or person-centredness. We also included the terms 'co-creation' and 'co-production'. Although these terms have slightly different meanings and histories, we found that they were used interchangeably in the literature.

The search terms (Table 1) were constructed with the help of a librarian who helped with all the different terms and synonyms, advanced search, and wildcards ("?", "$", "*") used in the databases. The same terms and procedures were used for the grey literature search in Google Scholar and CORDIS (database of EU research and innovation projects). The last search was carried out in July 2023.

2.3. Eligibility criteria

As explained in Fig. 3, studies were accepted for the review if: design

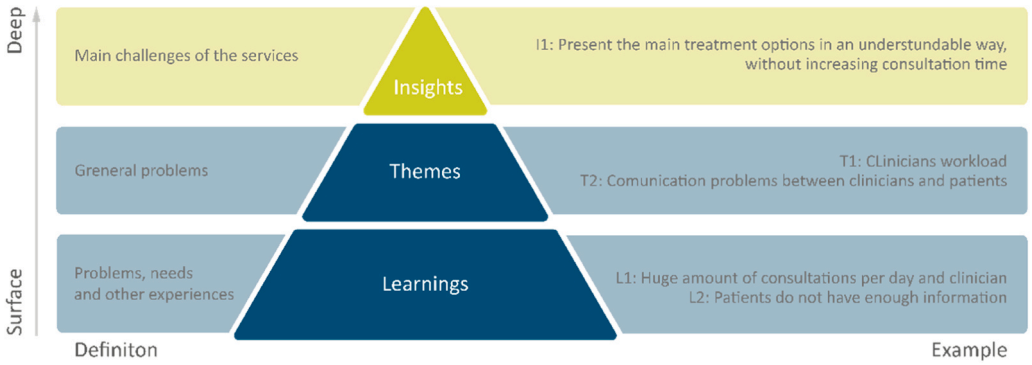

Fig. 2. Relation between *Learnings, Themes* and *Insights* from the discovery phase. Example is taken from M. Carrisa Abigail Roxas et al. [48].

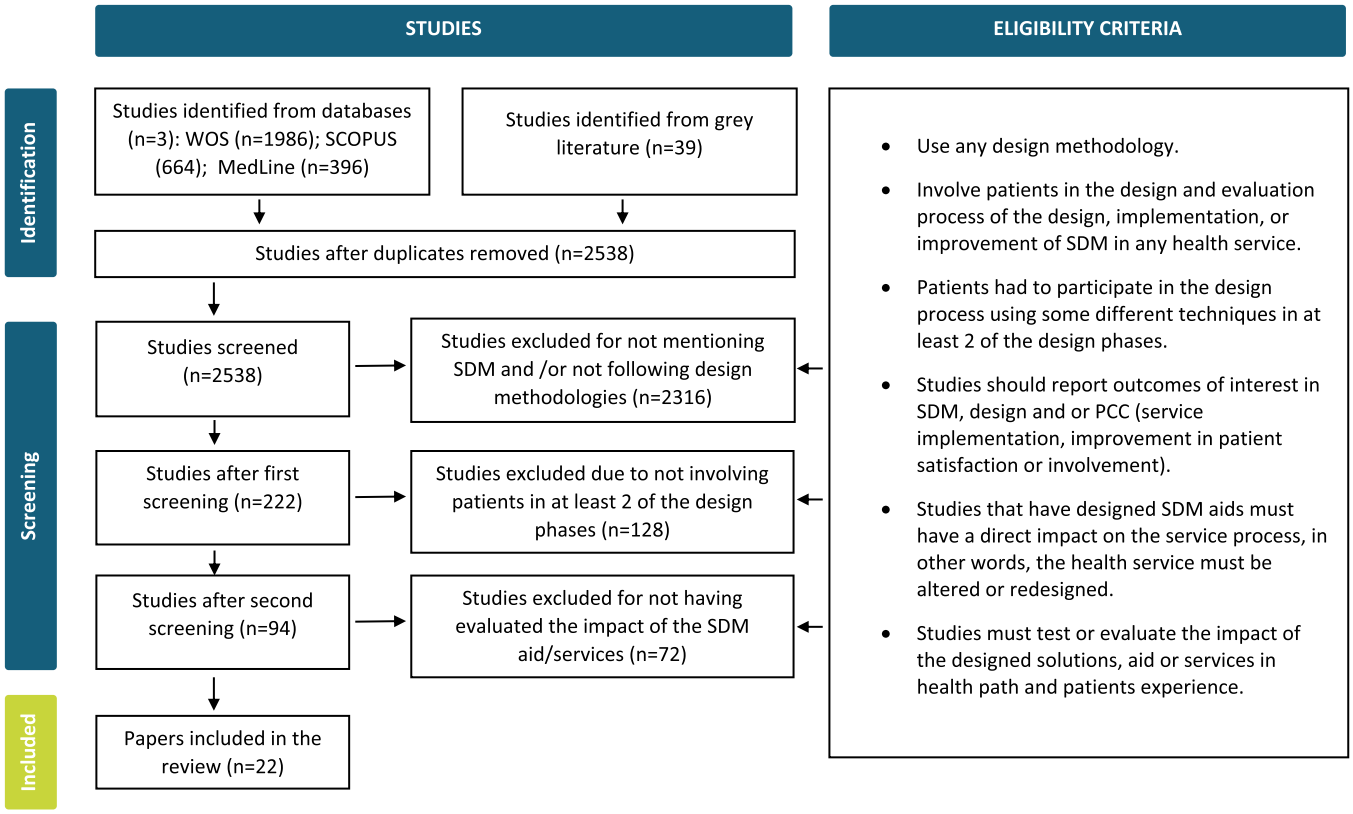

Fig. 3. Systematic literature review process based on the PRISMA flow diagram.

Table 1
Search terms in the scientific databases.

PeCC AND	SDM AND	Design methodologies
Patient center* care OR	Shar* decision$making OR	Co$creation OR
Patient* participation OR	Shar* decision* OR	Co$design OR
Patient* preference* OR	Shar* medical decision making	Co$production OR
Patient* experience* OR		design*
Person center* care		

$=Zero or one character.
* = Any group of characters including no character.

methodology was used; Patients were involved and had a continuous active role in the design process, in at least one phase of each innovation framework's diamonds; In order to understand the impact of methodologies and to complete the whole design process, the solutions had to report practical (not theoretical) outcomes in design, SDM, or PeCC; SDM aids or processes were intended to have a direct impact on the care path (solutions to be used alone by the patients without any modification on the processes or any other stakeholder were excluded as they do not fit with the SDM and PeCC principles).

Studies were not screened by publication date, status or language. Publications from any healthcare setting could be selected without restrictions on patients' age or gender. We excluded protocol papers, reviews, meta-analyses, letters, and editorials, because they are theoretical, not empirical. Studies described in more than one publication could be included in the review if they met all the criteria.

2.4. Study identification

YS (PhD student and designer) screened the titles and abstracts of the studies and categorised them as rejected, doubtful, and selected. JSP (design researcher with experience in healthcare projects) validated the rejected and selected groups, while studies in doubt were reclassified by consensus. Both authors performed a full-text screening of the studies focusing on methodology and outcomes, checking for patient involvement in the design process and use of design methods. Both authors carried out a final third screening to select studies that reported design, SDM, or PeCC outcomes from field trials or evaluation of solutions. Each author analysed half of the studies and both reviewed any that raised doubts about their inclusion. The remaining co-authors (two design researchers and two SDM researchers) reviewed the search and screening criteria, as well as the interpretation of the results from the perspective of their field. Non-selected papers from the final screening and reasons for exclusion can be found in Supplementary Material. Bias assessment of the selected studies was carried out by consensus of YS and JSP, following the JBI checklist for qualitative research [51] (see Supplementary Material).

2.5. Data extraction

The information from the selected studies was grouped into three topics, one relating to general characteristics of the studies and two describing the main topics of this review: Design methodologies and phases; SDM process and final designed aids and services.

- Study characteristics: Authors, title, publication date, study design, objective, country, type of health service, the Picker Dimensions (e.g. caregiver involvement, psychological aspects)
- Design approach: Design methodology followed, level of patient involvement, design phases, participation of design professionals, and outcomes (*insights*, *themes*, evaluation outcomes…).
- Features of SDM solutions: type of SDM aid used (PtDA or EDA), typology or context of SDM support (web-based, paper-based, board game…), aid's functionalities.

3. Results

This section presents the results obtained according to the proposed research questions. The analysis of the selected studies was done by research question, as explained above.

3.1. Study selection

The initial search yielded 3046 papers, and after removing duplicates 2538 studies, of which 39 from grey literature projects, were finally analysed. Studies in English, French, and Spanish were found. French articles had English abstracts, and Spanish articles were reviewed by YS as a native speaker, but none met the inclusion criteria.

After the title and abstract analysis, 222 were selected for full-text analysis. Papers were excluded if they mentioned patient participation in care process analysis or redesign but did not actively involve patients. In the final screening, we focused on outcomes from evaluations and their impact on healthcare processes and patient experiences, with their absence being the primary reason for rejection. This resulted in 22 studies being included in the review, with a total of 35 publications (Fig. 3).

Based on the risk of bias assessment presented in Supplementary Material, most studies (29/35) indicate some level of potential bias, particularly in the representation of data and participants' perspectives. Additionally, the influence and backgrounds of researchers are not consistently outlined, which is crucial in qualitative analyses.

3.2. When, where and by whom were design methodologies applied in implementing or improving SDM processes?

Selected studies were published in 2015 or later, with a significant increase in publications over the years (Fig. 4). We identified 13 different healthcare domains the most important of which was emergency care, especially paediatric emergency care. The second most relevant group was primary care, particularly elderly care as a subgroup. The studies were conducted in different geographical locations, with the USA (8), the Netherlands (3), Canada (3) and Philippines (2) having the most studies. Table 2 provides this information along with a summary of the SDM objective of the study.

Design researchers and /or companies were involved in half of the studies. Their involvement in the studies varied widely, from studies that were led by design researchers to limited participation, such as graphical improvement of prototype designs.

3.3. What types of design methodologies were applied in studies to implement or improve SDM and how were patients and healthcare professionals involved?

In terms of design methodologies, UCD was the most commonly used with 13 studies, two of which were described as human-centred design (HCD) {ID: 17, 21}. SD approach was used in only two {ID: 16, 18}. As expected, the terms co-design, co-creation, and co-production were used interchangeably to describe various forms of user involvement, such as patients, clinicians, or other stakeholders. Only one study primarily used co-design as the main design methodology {ID: 11}, while the others used these techniques to support different design methodologies during the development phase. Additionally, only six studies mentioned any of these approaches {ID: 10, 11, 13, 16, 18, 21}. There were no methodological and method differences between studies that mentioned UCD and co-design as their methodology. In contrast, studies that followed SD used specific techniques (i.e. journey mapping, blueprint, auto-ethnographic analysis) that distinguished them from the other design methods.

Patient and clinician involvement varied across studies. While participation rates were similar (71 and 78 phases, respectively), their roles in the design processes differed. Patients provided input on their service experiences rather than co-creation, while health professionals actively participated in nearly all phases, especially in the definition and development stages. In the studies analysed in this review, the most followed SDM standard was IPDAS, in 13 of the 22 studies. In almost all, it was used as a guide to design aids, and some used it as an evaluation checklist. The ODSF was employed in three studies as a complement to IPDAS {ID: 9, 10, 15}. .

3.4. What types of problems were discovered and how were they grouped and analysed?

Studies identified and extracted *learnings* from the user's journey through the processes, however only 14 grouped these into *themes* or *insights*. As can be seen in Table 4, these are the studies that identified the widest range of problems related to Picker Dimensions.

All the studies detected gaps in "Involvement in decisions, respect for preferences" and "Clear information, communication and support for self-care". Less than half of the studies extracted *learnings* about the "Involvement and support for family and carers". Of these ten studies, half were care paths for children, teenagers, or elderly people, for whom it is often mandatory to have a care supervisor. Although "Emotional support" *learnings* were detected in 11 studies, only four of them had developed specific solutions {ID:1, 4, 16, 18}.

This section highlights the differences between SD and UCD. The 13

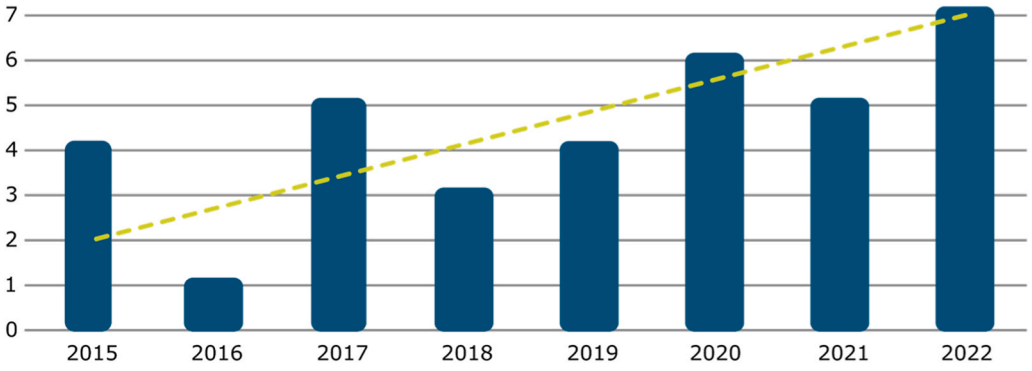

Fig. 4. Number of selected papers grouped by publication year.

Table 2
Summary of selected studies.

ID	Authors & Publication year	Reference	Country	Type of care	Objective	Did designers participate?
1	Eiring, Ø. et al. 2015 Eiring, Ø. et al. 2017	[52,53]	Norway	Psychiatry	Improve patients' understanding of bipolar treatments. The aid is designed to be used in clinical encounters by patients.	Yes
2	Melnick, E.R. et al. 2015 Melnick, E.R. et al. 2015 Melnick, E.R. et al. 2017 Singh, N. et al. 2017	[54–57]	Canada	Emergency Care	Determine the necessity of computed tomography in concussion and brain injury cases and improve patient-clinician conversation.	Yes
3	Tinetti, M. et al. 2016 Naik, A.D. et al. 2018	[58,59]	USA	Primary care (elderly care)	Identification of patient priorities with a facilitator to be discussed in the following clinical encounter.	Yes
4	Ehrler, F. et al. 2017 Rochat, J. et al. 2022	[60,61]	Switzerland	Emergency care (paediatric)	Support the patients' journey and worries during the use of Paediatric Emergency Department. Empowering to reach decisions and improve communication between parents and clinicians. Optimize the PED resources and reduce the waiting time by sharing information with the hospital via the app.	No
5	Rudin, R. et al. 2017	[62]	USA	Asthma care	Engage patients in their asthma control and give more updated information to the clinicians to improve treatment control and clinical discussions.	Yes (only to develop the interface)
6	Probst, M.A. et al. 2018 Probst, M.A. et al. 2020	[63,64]	USA	Emergency care	Promote shared decision-making for stable, alert patients who present to the emergency department (ED) with syncope.	Yes
7	Zaini, S. et al. 2018 Abousheishaa A.A. et al. 2021	[65,66]	Malaysia	Psychiatry	Enhance patient-clinician discussions during SDM moments for patients who require antidepressant therapy or transition to a different antidepressant.	No
8	Andersen, S. et al. 2019	[67]	Denmark	Neurology	Improve consultation discussions for decision making about to take or not spine surgery treatment.	Yes
9	Macalalad-Josue, A. A. et al. 2019	[68]	Philippines	Diabetes	Help clinicians to explain to patients the different treatment options for diabetes and their advantages and disadvantages.	No
10	Poitras, M.E. et al. 2019 Poitras, M.E. et al.2020	[69,70]	Canada	Primary care (multimorbidity)	Empower patients with complex needs and multimorbidity assess their preferences and make decisions on their Case Management. Improve the discussions between patients and clinicians	No
11	Porat, T. et al. 2019	[71]	UK	Cardiovascular care	Identify stroke patients' priorities and worries and improve SDM discussions.	No
12	Abigail Roxas, M.C. et al. 2020	[48]	Philippines	Primary care (osteoporosis)	Improve medical encounters, helping clinicians to explain the different treatment options for osteoporosis.	No
13	Backman, C et al. 2020	[72]	Canada	Primary care (elderly care)	Managing the needs of geriatric rehabilitation patients and clinicians. Improve the patient-health professionals' communication.	No*
14	Koopman, R. et al. 2020 Wegier, P. et al. 2021 Cohen, D et al. 2022	[73–75]	USA	Cardiovascular care	Support SDM discussions between patients and clinicians through blood pressure track and visualization tool.	No
15	Schoenfeld, E. et. al. 2020	[76]	USA	Emergency care	Determine the necessity of computer tomography, considering Ureterolithiasis patients and clinicians perspectives in Emergency Department	Yes
16	Singer, I. et al. 2020 Singer, I. et al. 2022	[77,78]	Netherlands	Speech and language therapy	Increase the parental involvement in speech therapy and help to visualize the goals and achievements of their children.	Yes
17	Anderson Jana, L. et al. 2021	[79]	USA	Emergency care (paediatric)	Improve parents-clinicians conversation about treatment for their children with acute otitis media.	Yes
18	Griffoen, I. et al. 2021 Stiggelbout, A. et al. 2022	[45,80]	Netherlands	Oncology	Improve patients, relatives and clinicians' care path journey and personalise it considering the preferences of each patient. Increase the communication between patients/others and clinicians.	Yes
19	Krishnamoorthi, R. et al. 2021	[81]	USA	Gastroenterology	Improve the SDM process in Barret's Oesophagus treatment, reducing the clinical conflicts and improving patients' knowledge and involvement	Yes
20	Vincent, Y. et al. 2021	[82]	France	Gynaecology	Facilitate the decision making between patients and clinicians about whether treat or not urinary infections with antibiotics	Yes (graphic designer participated in the prototype layout)
21	Taxter, A. et al. 2022	[83]	USA	Paediatric care	Involve and engage patients and their families to identify the most important aspects. Improve patients-family- physicians discussions.	No
22	Verkerk, E. et al. 2022	[84]	Netherlands	Sexual and Reproductive health	Help couples rank the most important themes to discuss in the clinical encounters and some open questions to talk about some other themes or topics.	No

As some studies contained more than 2 papers, IDs were used to facilitate the text reading.
* =The involvement of designers was initially unclear, but the study's authors clarified when asked.

Table 3
Methodologies used in the studies.

ID	Design methodologies			Involvement during the design process		SDM methodologies	
	User-Centered Design	Service Design	Co-design	Patients	Healthcare-professionals	IPDAS	ODSF
1			?	1 3 4	1 2 3 4	✓	
2	✓		?	1 2 3 4	1 2 3 4	✓	
3	✓			1 2 4	1 2 3 4		
4	✓			1 3 4	2		
5	✓		?	2 3 4	2 3 4		
6			?	1 3 4	1 3 4	✓	
7	?			1 3 4	1 2 3 4	✓	
8	?			1 3 4	1 2 4	✓	
9			?	1 2 3 4	1 2 3 4	✓	✓
10	✓		✓***	1 2 3 4	1 2 3 4	✓	✓
11			✓	1 2 3 4	1 2 3 4	✓	
12			?	1 3 4	1 3 4	✓	
13	✓		✓***	1 3 4	1 3 4		
14	✓		?	1 3 4	1 3 4		
15	✓			1 3 4	1 3 4	✓	✓
16		✓**	✓***	1 4	1 2 3 4		
17	✓*			1 3 4	1 2 3 4	✓	
18		✓	✓***	1 2 4	1 2 3 4		
19	✓			1 3 4	1 2 3 4	✓	
20	?		?	1 2 3 4	1 2 3 4	✓	
21	✓*		✓***	1 2 3 4	1 2 3 4		
22	✓		?	1 3 4	2 3 4		

Co-design column includes co-creation and co-production terms.
?= Studies used UCD, co-design, co-creation methods, however, did not mention the methodology.
1 =Discovery phase, 2 =Definition phase, 3 =Development phase, 4 = Deliver phase.
* = Studies mentioned Human Centered Design as their methodology, which is similar but more holistic than UCD [85].
** =Study mentioned Double Diamond framework and have a service perspective.
*** =Used as part of SD or UCD.

UCD studies show great variation in the dimensions identified, while the two SD studies were among the most comprehensive. SD studies {ID:16, 18} extracted *themes* and *insights* and were two of the top five studies with the highest number of dimensions detected. Notably, ID18 and ID20 studies were the only ones that detected problems in physical spaces.

Studies involving designers differed significantly from those that did not. Non-designer studies primarily used interviews and focus groups to identify problems, whereas designer-involved studies employed techniques like process mapping, encounter observations, or autoethnographic analysis for a more detailed exploration.

3.5. What types of solutions were created during the definition and developing phases to enhance or implement SDM?

All analysed studies designed a decision aid to improve or introduce SDM into the health processes. They partially or completely redesigned the care path process. Only two of them used the aids as complementary material and not as the main objective of the project {ID: 4, 18}. Most of the aids (14), were EDAs (Table 5) designed for use in clinical encounters, two were PtDAs and five were a mix of both. Fourteen aids were designed as a web-based platform or app, linked to the Electronic Medical Record, and used by the professionals with an app or website accessible by the patients. Seven studies designed paper-based aids (four loose-leaf cards and a double-sided A4) {ID: 6, 8, 9, 12, 15, 20} and one a board game {ID: 16}.

Different aids had various functions to improve Shared Decision Making (SDM) in health services. For the analysis of this review, the functions were grouped into five different functionalities to be able to compare the different studies and solutions. (see Table 5). Eighteen were designed to improve SDM between clinicians, patients, and caregivers, of which seven supported the elicitation of patients' preferences and goals. Most aids focused on the encounter, and only a few aids were designed to guide patients through the process {ID: 4, 10, 18} or to track their treatment {ID: 1, 5, 14, 22}. Two of the studies reported specific materials to summarise the clinical visit and the decision to be made, which patients or their caregivers could review after the encounter {ID: 4, 15}. Others could be of similar use to the patients, however, the authors did not specifically mention this in their studies.

The five functionalities of the aids were directly related to SDM objectives (see Table 5). For example, improving communication and tracking and visualising patients' treatments might support patient-physician communication. Eliciting the patient's goals and needs helps to involve and empower the patient during treatment discussions and to provide more personalised care. Finally, guiding patients through the process and providing summaries of discussions can enhance autonomy and reduce fear. However, these functions were underutilized, as most aids focused only on the encounter, neglecting previous and subsequent steps.

3.6. What was the impact of the solutions to support SDM on the care paths process, health professionals, and patients?

The majority of the studies were focused on improving clinical encounters (a specific point in the process), as shown in Table 6. Only a few studies reported impacts on other stages of care paths, such as the pre-encounter steps (i.e. entering the hospital, complementary tests, navigating through the hospital areas or preparing for the encounter) {ID: 3, 4, 18}, or the post-encounter steps (i.e. tracking patient treatments). In addition, only two studies were designed to improve both pre- and post-visit stages, taking a broader perspective of the whole care path. {ID: 4, 18}.

Studies analysed the impact of their solutions by assessing the changes in the SDM process and patient satisfaction with their experience. Two studies evaluated resource utilization. One of them reported a reduction {ID: 2}, while the other found no significant difference despite expecting a possible reduction {ID: 6}. Of the three studies that analysed the encounters' duration, two detected an increase in time, one of which – in emergency care- nearly doubled the time {ID: 6, 12}. Andersen et al. [67] {ID: 17} found that healthcare professionals' workload prevented

Table 4
Learnings, themes and insight classification on the Picker Dimensions.

ID	Involvement in decisions, respect for preferences	Clear information, communication, and support for self-care	Fast access to reliable healthcare	Emotional support, empathy and respect	Involvement and support for family and carers	Continuity of care and smooth transitions	Effective treatment by trusted professionals	Attention to physical and environmental needs
1 TI	✓	✓	✓	✓*	✓	✓		
2 TI	✓	✓		✓	✓		✓	
3 TI	✓	✓		✓		✓	✓	
4 TI	✓	✓	✓	✓*	✓	✓	✓	
5 TI	✓	✓	✓			✓	✓	
6	✓	✓	✓	✓				
7 TI	✓	✓		✓			✓	
8	✓	✓		✓				
9	✓	✓	✓		✓		✓	
10	✓	✓	✓	✓				
11 TI	✓	✓	✓					
12	✓	✓	✓				✓	
13	✓	✓	✓					
14 TI	✓	✓	✓		✓		✓	
15	✓	✓	✓			✓	✓	
16 TI	✓	✓	✓	✓*	✓	✓		
17	✓	✓					✓	
18 TI	✓	✓		✓*	✓	✓		✓
19	✓	✓	✓					
20	✓	✓	✓	✓	✓	✓	✓	✓
21 TI	✓	✓	✓	✓	✓	✓	✓	
22 TI	✓	✓			✓	✓		

TI = The study have grouped *learnings* into *themes* or *insights*.
* =Design a specific solution for emotional support.

the introduction of a designed aid into the care path. None of the studies assessed the satisfaction of healthcare professionals with the process, their role or the tools. Almost all studies changed clinical encounters, but only seven of them helped clinicians explain the different treatments (side effects, procedures, etc.) or visualise the data provided by the patients.

Fourteen studies reported positive impacts on patient involvement in SDM, treatment choice conformity, patient knowledge, and incorporating preferences. Three additional studies demonstrated improvements in other areas of SDM, such as patient satisfaction with the care pathway. Two showed positive impacts {ID: 4, 7}, while the third found no significant difference between current and redesigned paths {ID: 6}.

The types of evaluation used in the studies also varied widely, the main ones being usability testing or acceptability assessment. Only a few studies have conducted more exhaustive analyses such as parallel randomised controlled trials or follow-up surveys {ID: 2, 3, 6, 13, 14}, which can bias the results of this section. Other studies conducted field observation to assess aid's impacts {ID: 2, 7, 8, 9, 19, 22}. Interestingly, field observations reported more information about the impact on the workload and role of patients and health professionals than the other methods.

4. Discussion and conclusions

4.1. Discussion

This systematic review analysed the use of design methodologies in healthcare to support SDM. It considered all design phases, methods and patient involvement in generating solutions to improve SDM. This section discusses the findings on SDM and the Innovation Framework phases.

The search was not limited by publication date, yet only articles from 2015 onward were found, suggesting a growing interest in design methodologies to implement SDM. Furthermore, the range of healthcare processes using these methods may indicate their increasing importance in implementing SDM. According to the existing literature, countries from which more than one study was included are also the ones that have a longer history implementing SDM and PeCC in healthcare systems, care paths, and encounters [85–88]. Among those, there are two studies from the Philippines (in collaboration with Mayo Clinic) and one from Malaysia while the rest are from Europe or the USA. This may be either because SDM and design are not widespread in other regions, or same type of studies are not indexed or published in journals included in Medline, SCOPUS or Web of Science.

Nearly half of the studies using IPDAS did not explicitly mention a design methodology, though they seemed to follow design processes and involve patients. Notably, IPDAS recommends Dimensions for creating and implementing SDM aids, which implies that even without explicit mention, researchers may implicitly adhere to a design methodology. For those without design expertise, using IPDAS can ensure a basic level of stakeholder involvement in developing and implementing solutions or aids.

The selected studies analysed patients' and care path problems during the discovery phase. However, a few extracted relevant insights from learnings and themes. While all studies identified elements related to "clear information, communication, and support for self-care" and

Table 5
Type of aids and their objectives.

ID	PtDa or EDA	Type of SDM Tools used	Intended functionalities of the aid				
			Guide the patient through the process	Summary of the clinic visit	Improve communication	Extract/ manage the goals, preferences and needs	Track & Visualize patients' treatment
1	PtDA/ EDA	Web-based			✓	✓	✓
2	PtDA/ EDA	Web-based			✓	✓	
3	EDA/ Guide	Process with some complementary documents			✓	✓	
4	PtDA	Web-based app	✓	✓			
5	PtDA/ EDA	Web-based					✓
6	EDA	Paper-based			✓		
7	EDA	Web-based			✓	✓	
8	EDA	Paper-based			✓		
9	EDA	Paper-based		?	✓		
10	PtDA	Web/paper-based	✓		✓		
11	EDA	Web-based			✓	✓	
12	EDA	Paper-based		?	✓		
13	PtDA/ EDA	Web-based		?	✓	✓	
14	EDA	Web-based			✓		✓
15	PtDA/ EDA	Paper-based		✓	✓		
16	EDA	Board game			✓	✓	
17	EDA	Web-based		?	✓		
18	PtDA/ EDA	Process with Web-based complementary material	✓		✓		
19	EDA	Web-based			✓		
20	EDA	Paper-based		?	✓		
21	EDA	Web-based		?	✓	✓	
22	EDA	Web- based*			✓		✓

?= Possible use by the patients but not mentioned in the study.
* = patients can complete a paper-form and then transcribe it.

Table 6
Studies measured impact on the care paths and health professionals' work.

ID	Care path impact and changes in the process				Impact on healthcare professionals' work and SDM role			
	Pre-encounter	Encounter	Post-encounter	Resources utilization	Coordination or administrative issues	Explain options / visualizing the data	Increase (↑) / decrease (↓) encounter length	More control over the process
1		✓	✓			✓		
2		✓		✓		✓		
3	✓							
4*	✓	✓	✓		✓			
5*		✓	✓			✓		
6		✓		✓			↑	
7		✓					Same duration	✓
8		✓	✓		Reticent when reviewing the patient data			
9		✓				✓		
10*		✓				✓		
11*		✓						
12		✓					↑	
13		✓						✓
14		✓	✓			✓		
15*		✓				✓		
16*		✓						
17*		✓						
18*	✓	✓	✓					
19		✓						
20*		✓						
21		✓						
22		✓						

* =These studies did not make a specific evaluation test.

Table 7
Studies measured impact on patients' experiences, satisfaction, knowledge, engagement and empowerment.

ID	Impact on patients experience and their SDM role					
	Involvement in SDM / patient-clinicians discussions	Engagement/comfort with treatment choice	Satisfaction with the care path	Patient knowledge	More control over the process	Detect aims, objectives and preferences
1	✓	✓				
2	✓	✓	✓	✓		✓
3	✓					✓
4*			✓			
5*		✓				
6		✓	-	-		
7	✓	✓	✓	✓		
8						
9	✓			✓		
10*	✓	✓		✓	✓	
11*	✓					
12	✓	✓				
13					✓	
14		✓				
15*	✓		✓	✓		✓
16*	✓					✓
17*						
18*						
19	✓	✓		✓		
20*	✓					
22						✓
21	✓					

* =These studies did not make a specific evaluation test.

"involvement in decisions, respect for preferences," which are key objectives of SDM [2], only four of the 11 studies addressing emotional or psychological issues incorporated solutions to improve patients' emotional well-being. Caregiver involvement was considered only when caregivers played a significant role due to patients' age or psychological condition, such as in paediatrics or elderly care. This imbalance may be due to an intentional and focused search for SDM and PeCC principles. However, as Cinccida et al. (2023) [89] and Mazzocco et al. (2019) [90] noted, family involvement and emotional support for patients are also vital for improving SDM. Thus, the SDM field should embrace all Picker Dimensions, not just those related to communication and patient preferences.

Regarding the define and development phase, many studies used the terms co-production, co-creation, and co-design interchangeably. However, co-creation often excluded patients' experiences and perspectives, involving only clinicians instead of equal participation from all stakeholders as expected in co-creation [91]. Typically, researchers collaborated with health professionals to generate ideas, while patients were only involved in problem detection and testing, or improvement cycles. As a result, the full potential of design approaches and user involvement was not realized.

There are limited studies that evaluate patient satisfaction during the delivery phase, which is important for interpreting impact evaluations. More research is needed on stakeholder feedback and patient satisfaction with aids for clearer conclusions. While there was a positive impact on patient experience and satisfaction, the slight or sometimes negative impact on health professionals' workflow raised concerns. Despite greater clinician involvement in the design process, some studies reported increased workload, likely due to lacking consideration of the entire care path including the workflow of all professionals and/or professional-patient touchpoints. Improving workflow can be useful for adopting changes, as noted by Grol et al. [92]. Clinicians often seemed to struggle to explain treatment options, underscoring the need for graphical tools that could enhance clinical discussions and satisfaction [93]. However, only five solutions addressed this issue, which may be insufficient to have firm results.

One major problem with keywords was related to design methodologies and the different ways that the same methodologies could be named. In terms of limitations, choosing the combination of search elements and keywords was challenging due to the many synonyms used for the same terms, particularly for design methodologies. We are aware that they might be biased due to this large number of synonyms. After reading some of the studies we realised that researchers used many synonyms for design methodologies, and we decided to include "design" as a search term.

Less than two-thirds of the studies conducted evaluations beyond usability testing or acceptability assessment, which may bias conclusions due to a lack of concrete evaluation data or methods. Additionally, half of the selected studies were published fewer than three years ago, leading us to reject many that were incomplete or not yet implemented in healthcare. This suggests that future reviews may uncover more relevant studies as more complete data becomes available.

4.2. Conclusion

SD and UCD methodologies are quite similar and can have the same phases, but SD is much broader in terms of analysing the whole process and stakeholders' needs. According to the literature, it might detect more valuable *insights* and information than UCD or other design methodologies [36,94]. This is reflected in the finding that the studies that applied SD as the main methodology detected many problems related to the Picker Dimensions in the analysis of services, ranking among the top five with the highest number of dimensions detected. Nevertheless, the SD methodology was used only in two studies, and most used UCD instead. This is probably because almost all the studies designed aids for a specific moment, instead of looking at the whole SDM

process. However, comparing two studies versus 13 does not allow us to draw a robust conclusion on which of these two methodologies is more suitable for implementing SDM in clinical practice.

As noted in the introduction, SDM should be seen as a continuous process, not as isolated moments [95,96]. This implies that there is a need to broaden the approach and not only introduce new aids to support SDM at specific moments without changing the care path itself. Only two studies designed an aid that helps patients and their caregivers in the whole care path, by not only introducing changes in touchpoints but also improving health professionals' processes and workflow.

4.3. Practical implications

In conclusion, we found that design methodologies are not used to their full potential to support SDM in healthcare processes. We suggest that patients and caregivers should be more involved during the design process following co-creation approaches, not only in the beginning and end, to improve their experience and satisfaction. Solutions should not negatively impact health professionals' workload or experience; understanding their workflow and potential issues is crucial in terms of preventing potential problems and improving their workload.

All stakeholders must be satisfied with the solutions for long-term use and a holistic experience. Designs should account for the entire care path, not only SDM moments, to ensure usability and consistency. This will ensure the usability of solutions and promote consistency throughout the process for all. In theory, and with weak confirmation in only two reviewed studies, utilizing SD methodology could address these gaps by considering patients' and health professionals' processes and workload, potentially improving professionals' job satisfaction.

Rigorous evaluations, including pre- and post-assessments, are needed to measure changes in patient and professional satisfaction, communication, consultation length, care processes, and resource use.

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CRediT authorship contribution statement

Jorge Sierra-Pérez: Writing – review & editing, Supervision, Funding acquisition, Conceptualization. **Judith A.C. Rietjens:** Writing – review & editing, Project administration, Investigation, Funding acquisition. **Canan Akoglu:** Writing – review & editing, Investigation. **Anne M. Stiggelbout:** Writing – review & editing, Project administration, Investigation, Funding acquisition. **Dirk Snelders:** Writing – review & editing, Investigation. **Yeray Sañudo:** Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Data curation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.pec.2024.108551.

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