Health Policy and Planning, 2025, czaf001
DOI: https://doi.org/10.1093/heapol/czaf001
Advance Access Publication date: 17 January 2025
Review

OXFORD

How has the concept of health system software been used in health policy and systems research? A scoping review

Nicola Burger[1] **and Lucy Gilson**[2,3,*]

[1]Genesis Analytics, 50 6th Street, Hyde Park, Johannesburg 2196, South Africa
[2]Division of Health Policy and Systems, University of Cape Town, Falmouth Road, Observatory, Cape Town 7925, South Africa
[3]Department of Global Health and Development, London School of Hygiene and Tropical Medicine, Keppel Street, London WC1E 7HT, UK
*Corresponding author. Division of Health Policy and Systems, School of Public Health and Family Medicine, University of Cape Town, Falmouth Road, Observatory, Cape Town 7925, South Africa. E-mail: lucy.gilson@uct.ac.za

Accepted 9 January 2025

Abstract

Understanding health systems as comprising interacting elements of hardware and software acknowledges health systems as complex adaptive systems (CASs). Hardware represents the concrete components of systems, whereas software represents the elements that influence actions and underpin relationships, such as processes, values, and norms. As a specific call for research on health system software was made in 2011, we conducted a qualitative scoping review considering how and for what purpose the concept has been used since then. Our overall purpose was to synthesize current knowledge and generate lessons about how to deepen research on, and understanding of, health system software. The review consisted of two phases: first, for the period 2011–23, all papers that explicitly used the concept of health system software were identified and mapped; second, drawing on a subset of papers from Phase 1, we explored how the concept was purposively used within research. The databases PubMed, Scopus, EBSCOhost, Web of Science, and Google Scholar were systematically searched using a strategy developed by a skilled librarian. In Phase 1, data were extracted from 98 papers. Our analysis revealed that a third of the papers used the software concept rather superficially; a third used it to conceptualize the importance of selected software elements; and a third used it in examining a specific health system experience, such as preparedness or resilience. In Phase 2, our analysis confirmed that researchers have found value in proactively using the software concept within studies, demonstrating two patterns of use. However, a limited understanding of how to investigate interactions among hardware and software elements was also revealed. Future health policy and systems research should purposively investigate hardware–software interactions in order to gain a greater understanding of the complex, adaptive nature of health systems, understand their operations, and institutionalize thinking that considers health systems as CASs.

Keywords: health system software; health system hardware; health policy and systems research; complex adaptive health system

Key messages

- Exploring research on health system software alongside hardware advances our understanding of health systems as complex adaptive systems (CASs) and responds to the 2011 call for research in this area.
- Proactive use of the health system software concept demonstrates value in both coding frameworks and targeted investigations of hardware–software interactions.
- Limited exploration of hardware–software interactions highlights the need for future research to deepen understanding and institutionalize CAS thinking in health systems.
- Health policy and systems research should focus on practical guidance for working with health system software to enable actionable insights for system actors.

Introduction

Health systems seek to promote and improve population health through curative, preventive, and health promotion services, as well as by impacting on social empowerment and intersectoral action (Gilson et al. 2007, Gilson 2013). They are also critical in health emergency preparedness (Palagyi et al. 2019). There are various ways of conceptualizing health systems. A systems thinking approach suggests that they should be understood as complex adaptive systems (CASs), in which the system is characterized, in part, by the relationships and interactions between their various components (Adam and de Savigny 2012). Recognition of these dynamic interactions is critical in understanding how health systems work and what influences how they impact on health system performance goals.

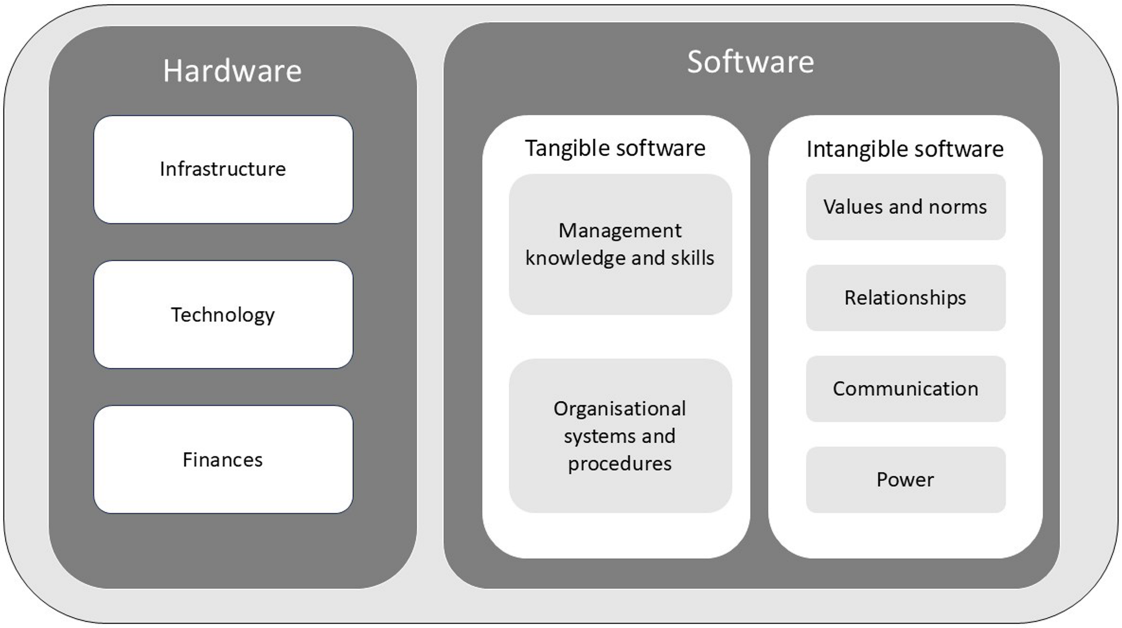

Figure 1. Hardware–software conceptualization of health systems [adapted from Elloker et al. (2012)].

One conceptualization of health systems that takes such interactions into account recognizes that health systems are comprised of interacting hardware and software elements, asserting that system capacity relies on these complex interactions (Elloker et al. 2012). The hardware represents the visible, infrastructural, and concrete components of the system, while the software represents the factors that guide actions and underpin relationships, such as ideas, interests, relationships and power, values, and norms (Sheikh et al. 2011). Elloker et al. (2012) further suggest that software can be distinguished between tangible forms, such as formal processes, knowledge and skills, and intangible forms, such as values, norms, and more (Fig. 1).

Health policy and systems research (HPSR) has acknowledged that this hardware–software conceptualization of health systems offers useful insights (Blaauw et al. 2003, Sheikh et al. 2011, Elloker et al. 2012). However, the research conducted has largely neglected the software components, tending to focus more on health system hardware. Sheikh et al. (2011) suggest that this is likely related to the tendency to focus on short-term operational needs such as specific health interventions or hardware investments, such as in buildings and equipment within health system development, often driven by donor interests in observing measurable returns on investment.

Focussing on the concrete and mechanical components (hardware) of a health system might also be due to the dominance of a positivist paradigm within the wider health research world. From this perspective, health systems are seen as 'vehicles for technological solutions rather than being grounded in political and social contexts with underlying power structures, interests, and interdependencies' (Sheikh et al. 2011, p. 4). The lack of conceptual clarity about what constitutes 'software' may itself also explain why the concept has been neglected (Sheikh et al. 2011).

In 2010, the First Global Symposium on Health Systems Research was held in Montreux, Switzerland. The symposium's objectives included developing a global agenda within the field of HPSR to work towards universal health coverage. In response, following the symposium, three papers (Bennett et al. 2011, Gilson et al. 2011, Sheikh et al. 2011) were published that aimed to examine the challenges facing the field of HPSR and identify what was needed to support health system development and strengthening, especially in low- and middle-income countries (LMICs). The three articles highlighted that research needed to be conducted on the social dimension of health systems and called for theoretical development to understand the complex social contexts within which such systems exist (Bennett et al. 2011, Gilson et al. 2011, Sheikh et al. 2011). More specifically, there was a call for theoretical development of health system software to deepen the understanding of the concept and, in doing so, develop the foundations of HPSR. Focusing on health system software is crucial as it shapes the underlying social dynamics and behaviours that impact health systems. Understanding the interactions among these elements allows researchers to identify and address the less visible, yet influential, factors that enhance or hinder health system performance, contributing to more holistic and sustainable health system strengthening.

Since this call was made in 2011, no review has yet taken stock of what research on health system software has been conducted. Taking stock creates a synthesis of a topic and deepens understanding. It is suggested that 'to take stock and analyze evolving landscapes' of various health system activities supports and better informs 'further advancements in the field' (Shakarishvili et al. 2012, p. 1).

A review of health system software can, specifically, help researchers consider the real-world value of this concept. It might, for example, be useful for understanding policy processes, given that these are nonlinear, and continuously influenced by actors (Walt 1994). A review can also assist in offering conceptual clarity, and both sets of insights can provide support for future HPSR.

Overall, this study aimed to review and take stock of how the concept of health system software has been used since the call for more research about it was made by Sheikh et al. (2011). It also sought to provide insights on how to strengthen consideration of the concept within future HPSR. The overall research question of the review is: how and for what purpose has the concept of health system software been used in HPSR since 2011?

Materials and methods

This review answered the research question in two phases. The first phase consisted of a systematic scoping review of HPSR around the concept of health system software. The second phase involved a detailed synthesis of a subset of the identified papers to explore, specifically, how the software concept was used to inform research. These two phases are described separately.

Phase 1: scoping review

The Arksey and O'Malley framework for conducting scoping reviews was applied (Arksey and O'Malley 2005). This method was chosen because such reviews are useful to examine the range and nature of research activity on a topic by aiming to synthesize all relevant literature to create an overview of the topic: a purpose of this research. The framework consists of five steps: identifying the research question, identifying the relevant literature, paper selection, data extraction, and data analysis. The research question has been discussed. The next four steps are described below.

Search strategy

The literature searches were conducted in February 2024. PubMed, Scopus, EBSCOhost, and Web of Science were systematically searched using various text forms of the health system software concept (Table 1). Google Scholar was also used as a supplementary database. These methodological steps were guided by a specialist librarian, based at the Faculty of Health Sciences, University of Cape Town (UCT). Database searches were further refined and limited according to the tools available in the respective databases. Within the Scopus and Web of Science searches, various subject areas were excluded, such as engineering, computer science, physics and astronomy, materials science and robotics, and so forth (see Supplementary material). The search was limited to English articles because translation of non-English articles was beyond the scope of this study. Additionally, the search was limited to publications from 2011 onwards.

Paper selection

Following the completion of the searches, the papers were exported to Rayyan for further screening. Rayyan is a systematic review tool that allows researchers to include and exclude papers based on the specified criteria, as well as allowing initial screening of abstracts and tracking the reasons for excluding papers (Ouzzani et al. 2016). The abstracts of articles were screened, and papers were included or excluded based on the criteria listed in Table 2. If it was not obvious what conceptualization of the term 'software' was being used within the paper, the full text was retrieved and the use of the term was investigated before deciding whether or not to include it. If full-text articles were not available freely through Google Scholar or UCT's online library, the first authors were contacted, and access to these publications was requested.

Table 1. Search strategy (Source: author)

Query	Criteria
Concept search	('health systems software' OR 'health system software' OR 'intangible software' OR 'software of a health system' OR 'software of health systems') NOT ('computer software' OR 'computational software' OR 'information software' OR 'informational software' OR 'digital software' OR 'mobile software' OR 'mobile health software' OR 'mobile health application' OR 'mobile health apps')
Filter	2011–23
Filter	English

Table 2. Inclusion and exclusion criteria (Source: author)

Inclusion criteria	Exclusion criteria
• Published papers • Relevant grey literature such as theses or dissertations	• Use term 'software' differently from our conceptualization, e.g. computer software and information software • Non-English papers

Data extraction and analysis

The year of publication, the type of paper, and the country/context of focus were extracted for all selected papers. For empirical papers, the particular section where the software concept is used was also considered, e.g. whether it was used in the methodology section, results section, and so forth. Furthermore, during data extraction, the way the software concept was used was categorized according to three predetermined themes: (i) acknowledgement of concept importance; (ii) using the concept to explain software elements; and (iii) using the concept to examine a health system experience in depth. These three themes were derived from a preliminary investigation of health system software literature. Depending on a paper's categorization according to these themes, additional data were extracted. Such data included the software elements described, if categorized as Theme 2 (using concept to explain software elements); and which health system experience as well as how the software concept was used in its examination, if categorized as Theme 3 (using concept to explore a health system experience).

These extracted data were recorded in a preprepared template (included as Supplementary material). The use of this template supported a transparent research process by distinguishing the actual data and our interpretations of those data, avoiding potential bias and enhancing research rigour (Arksey and O'Malley 2005).

Simple numerical analyses were conducted on extracted data to provide descriptive characteristics of the literature. Data pertaining to the three predetermined themes were also further analysed to inform a numerical and narrative description of how the concept has been used.

Phase 2: deeper exploration of how the software concept is used within empirical research

The overall purpose of this research was to gain insights into how the software concept has been used within HPSR since 2011. Following initial scoping of the broad use of the concept (Phase 1), the second phase of work sought to answer the research question in more detail by examining papers reporting research projects which used the hardware–software concept to influence/guide their study's design. We sought to understand how this conceptualization of health systems had informed research studies to contribute to deepening the 'theoretical foundations of the field', as called for by Sheikh et al. (2011). We specifically sought to derive understanding about the value of considering software, the research approaches used in its investigation, and whether or not hardware–software interactions were considered in the reported research. Elloker et al. (2012) argue that a specific intention of the conceptualization is to acknowledge and explore the interactions between the hardware and software elements.

Paper selection

The subset of papers categorized in Phase 1 as Theme 3: 'using the concept to examine health system experience' was used as a pool of papers for further consideration in Phase 2. From this pool, we then selected only those papers that used the hardware–software conceptualization to inform the design decisions made within the study reported in the paper (excluding those papers that only used the concept within the background, rationale, or discussion sections).

Data extraction

In addition to bibliographic information, four categories of data were derived from the papers selected for Phase 2 of this review (included as Supplementary material). First, an interpretation was made about how the software concept was used within the reported study, e.g. whether used to inform data collection or as a framework to guide data analysis. Secondly, the authors' judgement of the overall conclusion about the value of investigating software was recorded. Thirdly, we made an interpretation around whether and how the studies investigated the interactions between hardware and software. Lastly, we recorded which other health system experience was considered in the paper. To ensure the reliability of data extraction, the extracted data were reviewed for consistency and accuracy by both researchers, with any discrepancies or interpretive differences discussed collaboratively to achieve consensus. This approach helped to maintain a rigorous and reproducible analysis.

Data analysis

The extracted data were thematically analysed, following the Braun and Clarke (2006) six-step process. These steps included familiarization with the data, coding the data, searching for themes, reviewing the themes, defining the themes, and writing the report. Applying these steps, the analysis considered how the hardware–software conceptualization of health systems, as already described in the introduction, informed study designs, what authors considered as the value of investigating software, and how the interactions among hardware and software were investigated.

Results

The database and supplementary Google Scholar searches yielded a total of 299 articles in the first phase of the research. Rayyan identified 96 duplicates that were subsequently removed. In total, 82 articles used the term 'software' in ways that did not align with our conceptualization and were therefore excluded. One paper used the concept of health system software in its reference list only, in relation to a paper already included in the review, and therefore this paper was excluded. Two papers were not published in English and were also subsequently excluded. Finally, 112 articles were included in the review. The flowchart presented in Fig. 2 summarizes the selection of papers.

As shown in Fig. 3, there has been a recent increase in the number of publications which explicitly speak to the specific concept of 'health system software'. Of all the publications, 86% included in this review were published in the latter half of the 13-year period considered.

As Fig. 4 shows, a high proportion of included papers reported empirical studies (45%). A smaller portion were literature reviews (21%) and there were also a few commentaries (12%). The other included papers took the form of working papers, or book chapters, for example.

Many papers investigated specific contexts and settings. Half (50%) investigated an African country or region, while a quarter (24%) looked at LMICs in general or at a country outside the African continent that was classified by the World Bank as an LMIC, such as Pakistan or India. Almost 75% of the papers purposively referred to an LMIC context.

Use of the software concept

Using predetermined themes, the papers were classified as using the concept in three distinct ways, although some reported an approach that did not fit into any of these themes.

Acknowledgement of the concept's importance

Most papers (38%) used the concept simply to acknowledge the recognized importance of health system software within HPSR or public health debates. This point was often presented in the background discussion or introduction of the paper. For example, in a paper that discussed social accountability within the health system in Zambia (Schaaf et al. 2017), the software concept was used in the paper's introduction when highlighting the importance of norms in health systems

> … focus on norms echoes increasing acknowledgement of the import of health systems "software," such as norms, values and power in shaping health service delivery. (Schaaf et al. 2017, p. 848)

This extract reflects the many papers which briefly referred to health system software. Another example of using the concept to validate the core issue addressed by the paper is:

> … global health advocates and researchers call for attention to informality, such as the crucial role that health systems "software" … play in shaping services. (Joshi et al. 2022, p. 2)

Although these papers acknowledged the concept, it was not actively used in shaping the specific concepts of enquiry

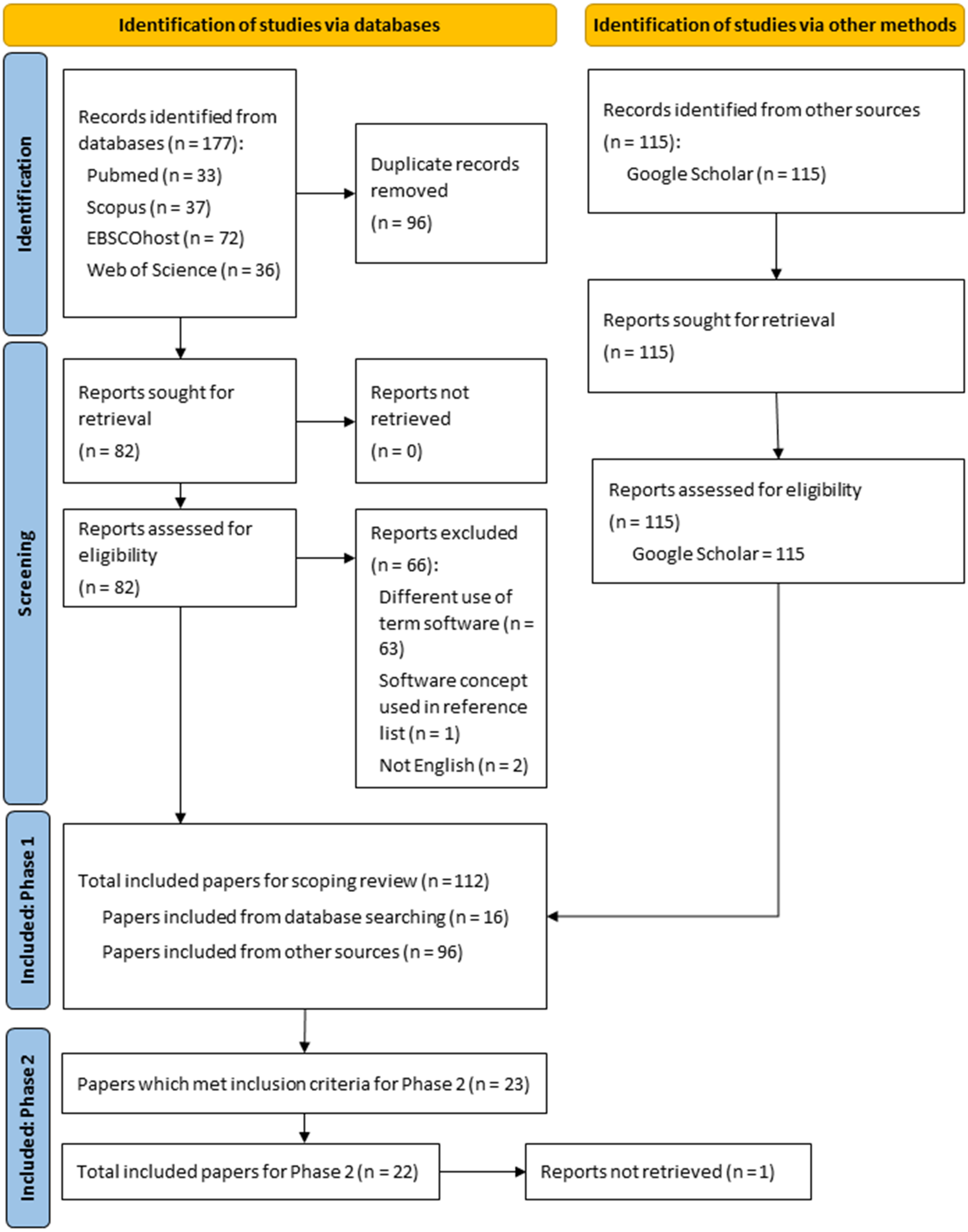

Figure 2. Flowchart of paper selection (Source: author).

within the research discussed, nor directly examined in that research. Many papers used the concept once or twice only.

Use of the concept to describe specific software elements

A quarter of the papers (27%) used the concept to justify looking at a particular phenomenon, defining that phenomenon as a software element. The elements that were investigated by these papers provide us with detailed examples of the overall scope of what is currently regarded as health system software, as summarized in Table 3. The table also categorizes these elements as either tangible or intangible software, using the distinctions established by Elloker et al. (2012, p. 162), as well as creating subgroups within each set to further synthesize the various elements which the papers identified as 'software'.

One paper suggested that 'governance' had both tangible features, such as committees, guidelines, and protocols, and intangible features, such as power relations, social hierarchies, collegiality, and normative practices, within the governance structure (Arakelyan et al. 2022). It is presented in both

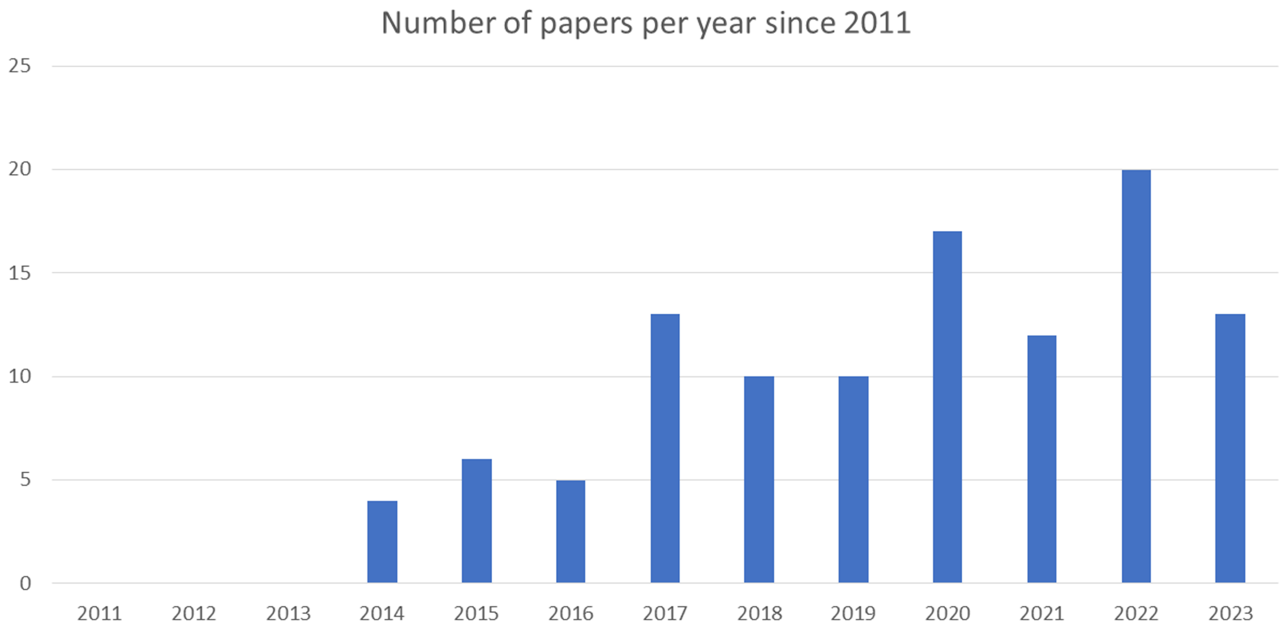

Figure 3. Number of included papers sorted by publication year since 2011 (Source: author).

columns of Table 3. This contrasts with the notion within the World Health Organization's building blocks framework, which views governance largely as hardware, 'organizational structures and legislation for example' (Sheikh et al. 2011, p. 2).

One paper unusually defined 'levels of maternal education' as software (Davis et al. 2023), highlighting the wider contextual features that impact on health and health systems.

Use of the concept to examine health system experiences

The concept of software was also used in a third (36%) of the included studies to investigate a range of health system experiences. In these papers, the overarching hardware–software conceptualization of health systems was often reported as purposively informing the research design, rather than, as in the first two themes, being used only to comment on its importance or to rationalize looking at another concept. The various experiences which were explored in these papers included heath system preparedness, resilience, governance, responsiveness, accessibility, implementation, and performance (Fig. 5). The last column in Fig. 5 represents multiple other experiences, such as judicialization of access to medicines, detection of tuberculosis (TB) and COVID-19, as well as organizational change, integration, social innovation, adaptive capacity, priority setting, and the financing of health systems.

In many papers, software elements were used to investigate what was influencing the health system experience of focus. Some papers used the concept as a framework to inform the data analysis, as discussed further in presenting the findings of Phase 2 of this review.

While some papers examined both hardware and software, some sought only to investigate software elements that impacted or influenced the health system experience of focus, thereby excluding hardware. For example, a protocol for empirical research presented its aim as follows:

> … to explore how, why, for whom and in what circumstances, features of health systems 'software' (e.g. values, norms, relationships) between health workers of all cadres caring for neonates in Kenyan hospitals, influence quality of care being targeted by improvement efforts. (Wanyama et al. 2022, p. 6)

Other papers again primarily used the software concept as a discussion point to elaborate further on findings about what may have influenced the health system experience examined. In the discussion section of one such paper, the authors explained that 'to accomplish health system preparedness for any infectious disease outbreak, one should consider the uniqueness of software components of the health system that hold the hardware together' (Tshitenge and Nthitu 2022, p. 5). Such papers did not, then, use the software concept to inform the study design but rather to analyse their findings in relation to a specific health system experience.

Other uses of the software concept

A few of the selected papers (12%) used the concept in ways that do not clearly fit into one of the three predetermined themes. Some papers again used the concept primarily as a discussion point, while referring to health systems in a broad sense.

Some review papers identified the concept during data analysis. For example, in presenting their results, Vargas-Peláez et al. (2017) discussed how hardware and software are needed 'in order to recognize the complexity of the health systems' (p. 172).

One commentary discussed the practical realities of trying to 'rewire' the intangible software within a health system (Ramani et al. 2022). This was the only paper included in the review that specifically focussed on how to reform software in order to improve health system performance; it offers useful advice for health system managers.

Table 3. Summary of software elements described in included papers (Source: author)

Tangible software	Intangible software
Governance, leadership, and management structures and processes	Health worker behaviours and practices
Formal rules within governance structure (George et al. 2019)	Provider behaviour (professionalism) (Hamon et al. 2022)
Governance of public policy during COVID-19 (Moussallem et al. 2022)	Bad attitudes of health workers (Topp et al. 2017)
Committees, guidelines, and protocols (Arakelyan et al. 2022)	Staff motivation (Barasa et al. 2018; Boydell et al. 2017; Nyikuri et al. 2017)
Distribution of power and process of decision-making within governance structure (Barasa et al. 2018)	Staff commitment (Barasa et al. 2018)
Governance processes (Karamagi et al. 2023)	Informal payments (Boydell et al. 2017)
Information and financial management systems (Karamagi et al. 2023)	Performing out: manipulation or inflation of data to create a false impression of meeting performance targets (Das et al. 2022)
Formal processes	Governance and leadership
Adequate planning (Mwamba et al. 2018)	Inclusive decision-making as a process (Reddy et al. 2022)
Audit style performance accountability processes (Das et al. 2022)	Governance as a force binding or repelling actors, relationships, and resources (George et al. 2019)
Recommendations from health-care providers (Davies et al. 2023)	Informal rules within governance structure (George et al. 2019)
	Leadership practices such as creating a clear and shared vision (Reddy et al. 2022; Barasa et al. 2018)
Managerial processes	Behavioural drivers
Role of human resource management (Boydell et al. 2017)	Incentives within the service delivery system (Boydell et al. 2017)
Management capability to anticipate and cope with shocks (Gooding et al. 2020)	Beliefs (Serge et al. 2023)
Management practices of: operations, performance monitoring, targets, people, and autonomy to make these decisions (Powell-Jackson et al. 2019)	Communication (Reddy et al. 2022)
Management (Nabyonga-Orem 2023)	Emotions (van Niekerk 2022)
Organizational and management resources (Agostini et al. 2023)	Ideas (Kok et al. 2017)
	Interests (Kok et al. 2017; Serge et al. 2023)
	Values (Hernández 2014; Kok et al. 2017; Whyle and Olivier 2020; Nabyonga-Orem and Asamani 2023; Karamagi et al. 2023; Serge et al. 2023; Whyle 2023)
	Norms (Kok et al. 2017; Nabyonga-Orem and Asamani 2023; Karamagi et al. 2023; Tesfa et al. 2023)
	Political and social contexts (Hirose et al. 2015)
	Underlying level of education (Davies et al. 2023)
Supportive systems	Cultures
Health information systems (Serge et al. 2023)	Culture of performing out within facilities (Das et al. 2022)
Financial management systems (Serge et al. 2023)	Organizational culture (Mphaphuli 2017; Topp et al. 2017; Barasa et al. 2018; Mbau and Gilson 2018; Bozorgmehr et al. 2020; Gooding et al. 2020; Walmisley et al. 2022; Karamagi et al. 2023; Serge et al. 2023; Tesfa et al. 2023)
	Institutional logics which are broader belief systems: e.g. a national identity logic and a development logic within a country (van Niekerk 2022)
	Power, trust, and relationships
	Power relations and social hierarchies (Arakelyan et al. 2022)
	Power dynamics (Hirose et al. 2015; Kok et al. 2017; Topp et al. 2017; Karamagi et al. 2023)
	Interpersonal trust, institutional trust, trust in colleagues, trust in supervisor, and trust in employer (Topp and Chipukuma 2016)
	Intra- and inter-professional relationships (Tesfa et al. 2023)
	Trust in government among people (Moussallem et al. 2022)
	Trust between researchers and managers (Nyikuri et al. 2017)
	Trusting relationships (Kok et al. 2017; Davies et al. 2023)
	Trust in providers (Hamon et al. 2022)
	Patients trust in medicines and health services (Aivalli et al. 2018)
	Relationships (Hernández 2014; Kok et al. 2017; Reddy et al. 2022; Wanyama et al. 2022; Karamagi et al. 2023; Serge et al. 2023)
	Peer networks (Reddy et al. 2022; Wanyama et al. 2022; Karamagi et al. 2023)
	Social ties (Whyle and Olivier 2020; Wanyama et al. 2022)
	Shared experiences (van Niekerk 2022)
	Community relationships (Gooding et al. 2020)
	Emotional support through peer networks (Reddy et al. 2022)
	Skills and abilities
	Team socio-cognitive skills (nontechnical human skills) (Wanyama et al. 2022)
	Everyday innovation (shifting of resource flows, social routines, and cultural values to address a systemic health challenge) (van Niekerk 2022)
	Population's ability to self-care, self-help, and self-responsibility with regard to health (Mathpati et al. 2020)

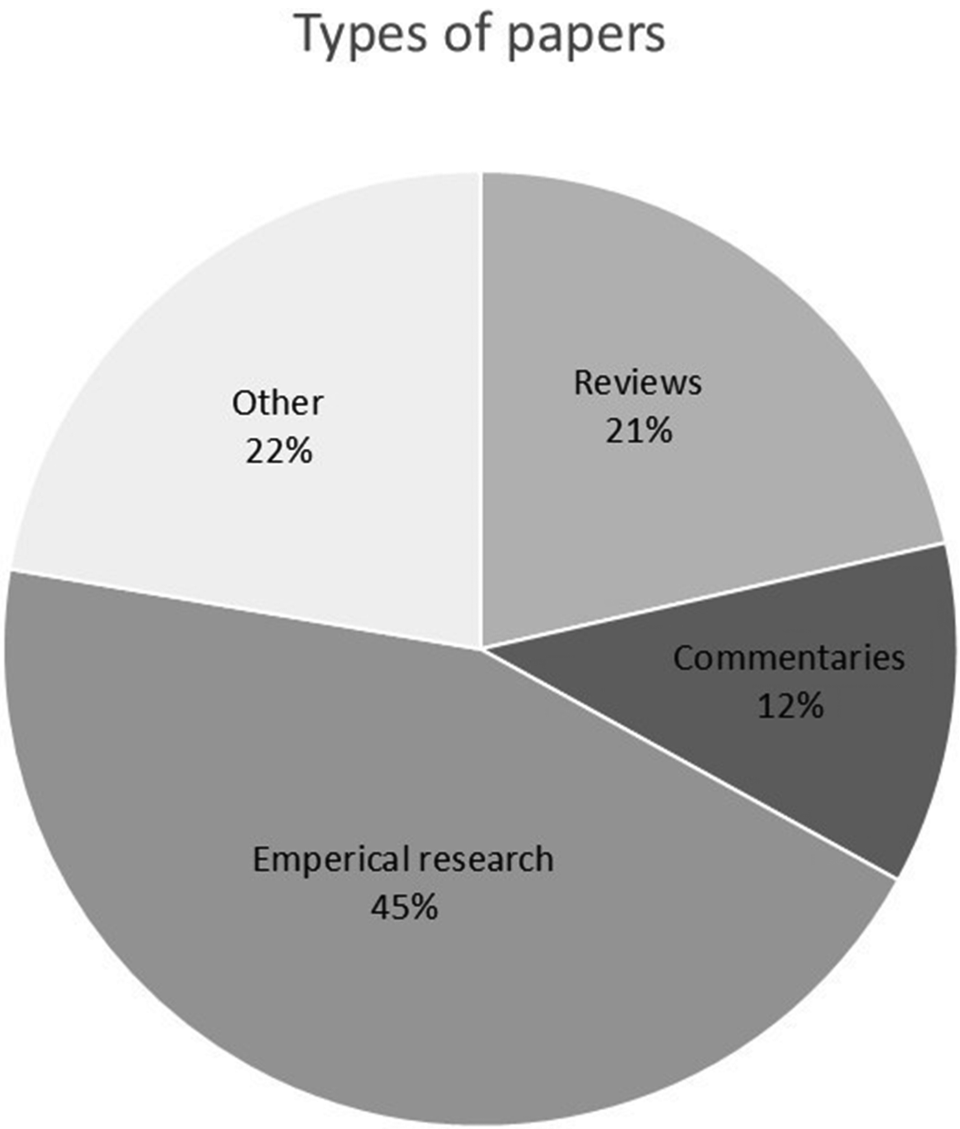

Figure 4. Pie chart showing the types of publications of selected papers (Source: author).

Exploration of papers that used the concept actively to inform the research

Nineteen papers met the criteria for the second phase of this review. The full text for one of these papers was not available and was subsequently excluded (Fig. 2). As noted earlier, this phase of the review aimed to investigate research that used the hardware–software concept to guide the design of the research. It was undertaken to deepen theoretical foundations of the field, as called for by Sheikh et al. (2011). A summary of this phase can be found below Figure 6.

Use of the concept within research studies

Thematic analysis of these papers revealed two patterns in how the overarching hardware–software conceptualization has been used within research. First, it is used as a coding framework in analysis; secondly, it is used to predetermine which hardware and software elements should be further investigated within a context rather than inductively analysing a range of elements.

Using conceptualization to code influences

In total, 14 of the papers selected in Phase 2 used the software conceptualization to frame/code influences on health system experiences such as preparedness, resilience, an issue within a particular setting, or the implementation of a programme, such as a specific disease programme in a given country. This was useful, as an established concept was used to analyse the research findings. Table 4 presents all the papers that used the concept in this way, also showing which experiences and country/context were considered, and a few of these are discussed further to demonstrate this use.

Zwama et al. (2021), a scoping review, mapped the influences on TB programme implementation in LMICs and used the hardware–software conceptualization in data analysis to code these influences, including interactions among hardware and software. The authors conclude that particular attention needs to be paid towards health system software (particularly workplace values and established practices, staff agency, TB risk perceptions, and staff attitudes), given its importance in

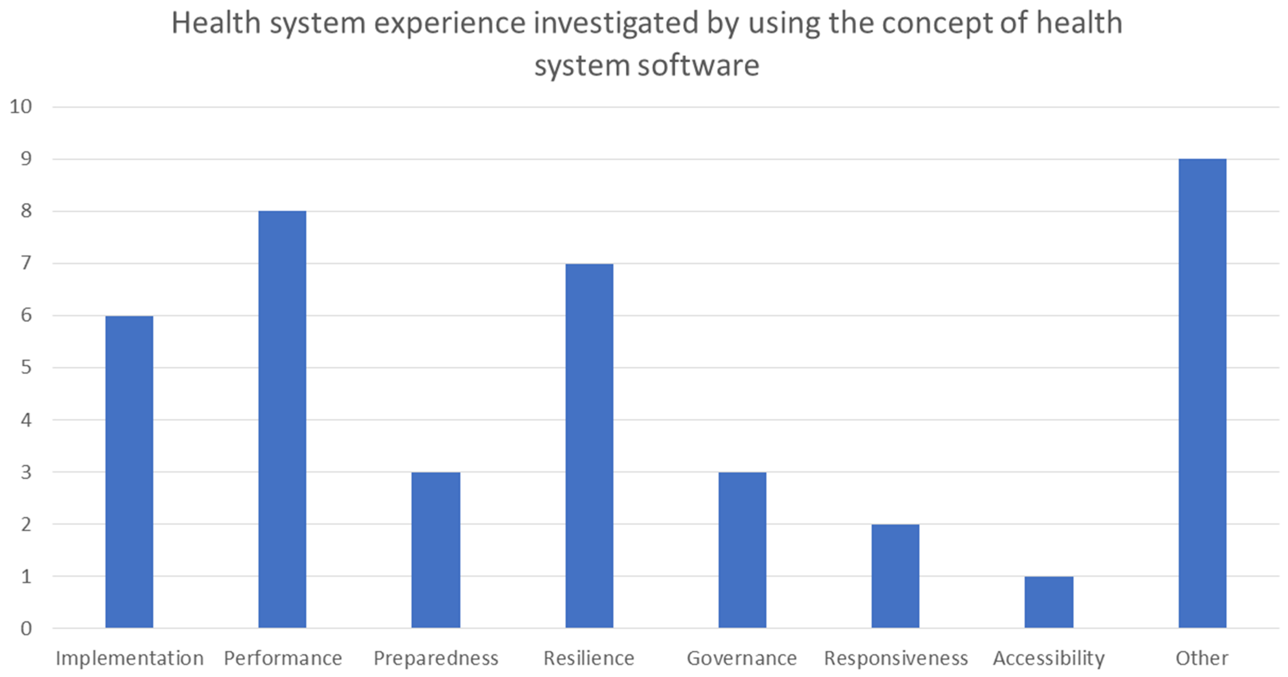

Figure 5. Use of the software concept to investigate other health system experiences (Source: author).

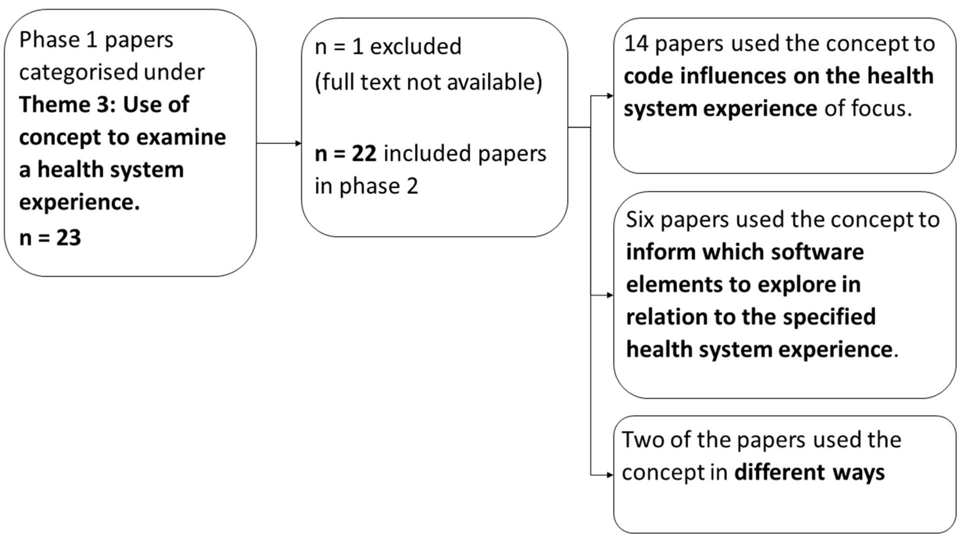

Figure 6. Summary of Phase 2 analysis.

the implementation of TB infection, prevention, and control (IPC).

Mwamba et al. (2018), similarly, sought to identify, through empirical research, what was influencing patients who decided to disengage from antiretroviral therapy (ART) in Zambia, categorizing these influences as either hardware or software. They concluded that 'health system "hardware" (resourcing) and "software" (clinic operating practices – including work norms and patterns and HCW [health-care workers] attitudes) often interacted and amalgamated to influence patients' decisions to engage or disengage in care' (p. 8). Again, the value of actively considering software, hardware, and their interactions in the analysis lies in deepening understanding of health system experiences.

McLennan et al. (2023) used the conceptualization to evaluate various components of the Fijian health system during the COVID-19 pandemic. While reporting their findings, they categorized components as tangible systems hardware, tangible systems software, or intangible systems software. They justified their approach by identifying a gap in the Pacific region's literature on identifying software influences and drew on Elloker's et al. (2012) work to emphasize the importance of software in health system resilience. They highlighted the intangible resources that helped the Fijian health system cope with the COVID-19 pandemic: adaptive practices of health workers, collective labour, and the sacrifice of people within the system, which were all categorized in the software bucket of 'communal cultural values'.

Table 4. Papers using the concept to categorize influences on various other areas of health system experiences (Source: author)

Paper	Health system experiences considered in relation to software	Country/context
Topp et al. (2015)	Mechanisms of accountability	Zambia
Topp and Chipukuma (2016)	Trusting relationships	Zambia
Mwamba et al. (2018)	Problem of patients' decisions to disengage from ART	Zambia
Palagyi et al. (2019)	Emerging infectious disease preparedness	LMIC
Mayhew et al. (2020)	Integration of HIV and sexual and reproductive health services	LMIC
Kagwanja et al. (2020)	Everyday resilience	Kenya
Zwama et al. (2021)	Implementation of TB-IPC programmes	LMIC
Myburgh et al. (2021)	Accessibility to ART	South Africa
Arakelyan et al. (2022)	Implementation of TB-IPC measures	South Africa
Das et al. (2022)	Problem of performing out (manipulation or inflation of data to create a false impression of meeting performance targets)	India
Chilala et al. (2024)	TB and delayed detection	Zambia
Edelman et al. (2024)	Governance of COVID-19 surveillance and response systems	Australia
McLennan et al. (2023)	Responsiveness of Fiji health system to the COVID-19 pandemic	Fiji
Karamagi et al. (2023)	Health system financing	Africa

Finally, Kagwanja et al. (2020) investigated empirically the everyday stressors experienced within the Kenyan health system through an analysis of its everyday resilience. These authors specifically used the hardware–software conceptualization to frame the stressors as either hardware (resource and infrastructure challenges) or software (low motivation among staff, political interference with managerial responsibilities, unclear roles, and reduced autonomy), as well as to consider ways of responding to them. They judged that the hardware–software conceptualization 'was useful to demonstrate different types of strategies and the role of organizational capacities in nurturing (or building) everyday resilience' (p.532). In other words, it enabled a deeper understanding of the nature of everyday resilience.

Table 5. Papers using the concept to suggest elements to undergo further investigation (Source: author)

Paper	Phenomenon	Country/context
Schneider et al. (2014)	Implementation of primary health-care reform	South Africa
Topp et al. (2019)	Implementation of HIV UTT services in correction facilities	South Africa and Zambia
Moussallem et al. (2022)	COVID-19 preparedness	Lebanon
Reddy et al. (2022)	Provider behaviour and experience of maternity care/respectful maternity care	LMICs
Wanyama et al. (2022)	Quality of care	Kenya
Zawolo et al. (2022)	CHW performance	Liberia

Using suggestions from other research to inform which software elements to explore

Six of the papers selected for Phase 2 used the conceptualization to inform which specific hardware and software elements should be investigated in relation to the health system experience of focus. These papers used the findings from previous research to inform the elements examined in their own study (Table 5).

Topp et al. (2019) aimed to examine the feasibility of universal test and treat (UTT) services within correctional facilities in South Africa and Zambia. This study drew on the previous work (Proctor et al. 2011) that suggested a range of hardware and software factors associated with UTT feasibility. The factors investigated were 'willingness of … [health system actors] to participate; the perceived appropriateness and convenience of the intervention; availability of appropriate resourcing; and logistical systems required to support the intervention' (p. 191). These authors confirmed that these factors played an important role in the feasibility and sustainability of UTT services in correctional facilities.

Moussallem et al. (2022) sought to investigate what was impacting on Lebanon's preparedness for the COVID-19 pandemic. They investigated various hardware and software elements, namely, surveillance, infrastructure, medical supplies, workforce, communication mechanisms, trust, and governance. Their rationale for investigating these factors was that the interconnectedness of these factors had been identified in an earlier review paper (Palagyi et al. 2019) as enabling LMICs to achieve and maintain such preparedness.

Zawolo et al. (2022) used the concept to frame which hardware and software factors should be investigated in relation to community health worker (CHW) motivation and support in Liberia. This study used a framework previously developed by Kok et al. (2017) (and discussed further) to investigate CHW utilization, management, and performance. The issues raised in the CHW framework specifically informed which software elements were considered.

However, it was not necessarily clear exactly how different software and hardware elements were used within these studies (Topp et al. 2019, Moussallem et al. 2022, Zawolo et al. 2022), other than by being chosen as elements to investigate.

One study provided more clarity on how the software concept informed its methods. Schneider et al. (2014) report that the concept of software informed the interviews and checklists used to collect data within a programme evaluation of primary health-care outreach teams in South Africa. The authors state that the 'software' of implementation consisted of 'actor knowledge and ownership of the policy, and changing roles and relationships' (Schneider et al. 2014, p. 4) but did not clarify the source of this judgement.

Reddy et al. (2022) and Wanyama et al. (2022), meanwhile, used the concept to examine which software factors impact on, respectively, quality of care in neonate Kenyan hospitals, and provider behaviour and experience of maternity care in LMICs. However, it was not specified who argued that these elements were worth looking at in relation to these experiences.

Other uses of software conceptualization

Two papers used the concept quite differently from other papers selected for Phase 2 review. One reported on the experience of supporting leadership development through on-the-job training (Nzinga et al. 2021). Within this training, health managers were taught about complex health systems, including the notions of hardware and software and, in terms of software, values, belief systems, and relationships.

Nzinga et al. (2021) found that the health managers showed enthusiasm towards the software concept, as evidenced in their reports on the value of the complex health system training course. The managers showed interest in viewing health systems as made up of hardware and software factors. Managers also reported that appealing to the values of nurses (software) helped them 'reassure and motivate some nurses to continue providing care' (Nzinga et al. 2021, p. 1030) during nursing strikes.

The second paper used the conceptualization in developing a framework derived from a systematic review of literature that incorporates hardware and software factors as influences on CHW performance (Kok et al. 2017). This framework was itself used by Zawolo et al. 2022 in their study. Presented in Fig. 7, the framework places CHW performance at its centre, where hardware and software are suggested to be 'influencing factors' (p. 2). The black arrows demonstrate the interactions among the hardware and software.

Interactions between hardware and software

Of the 18 papers selected for further analysis in the second phase, 5 intentionally outlined and investigated interactions between hardware and software. This relatively low number was somewhat surprising, seeing as such interactions are a fundamental feature of this conceptualization (Elloker et al. 2012). The papers that did not explore interactions merely described influences over the selected health system experience as either hardware or software. These papers often commented that interactions were important to look at but did not actually look at them.

The papers that discuss hardware–software interactions did so in various ways. One paper describes how interactions among hardware and software elements influenced patient disengagement from HIV care in Zambia (Mwamba et al. 2018), but it did not identify the nature of these interactions. Although noting that hardware and software interacted to influence patients' decisions, the exact nature of the interaction, such as which element was influencing which other element and in which direction, was not made clear. For example, was a lack of resourcing (in terms of clinic location, infrastructure, and drugs) compelling health workers to exercise their discretionary workplace power (such as changing clinic opening hours and rationing drugs), ultimately driving patients to disengage from care? Or were health workers using their discretionary power to make decisions that impacted on hardware components, causing patients to disengage from care?

Kagwanja et al. (2020), similarly, only alluded to interactions between hardware and software but did not examine them in detail. For example, they stated that in Kenya 'HR [human resource] management issues (tangible software) coupled with resource constraints (hardware) created dissatisfaction among HCWs leading to frequent HCW strikes' (Kagwanja et al. 2020, p. 527).

Das et al. (2022) and Topp et al. (2015), however, directly explored interactions among elements, more fully describing them in their studies' findings. In their study, Das et al. (2022) report the overall impact such interactions had on 'performing out' (i.e. the manipulation or inflation of data to create a false impression of meeting performance targets) in two Indian health facilities. They judge that 'the mechanisms through which ELAs [expected levels of achievement] are managed, monitored and reported evoke formal and informal power' (p. 4) and this power caused workers to be submissive and targets of exploitation. Furthermore, these authors suggest that

> … using a CAS framing, we demonstrate how these individual behaviours emerge from the dynamic interaction between underlying system elements of chronically deficient hardware, audit-style performance accountability approaches (tangible software), and an organisational culture that validates 'performing out' (intangible software). (Das et al. 2022, p. 9)

Topp et al. (2015) also describe hardware and software interactions in a study that explored what was impacting on accountability mechanisms in Zambian primary health centres.

> Structural human resource shortages (a hardware factor) … contributed to a high burden of work and pressure to complete tasks quickly, which compounded in some cases by a lack of capacity, contributed to data-entry errors, shortcuts or shirking of these duties altogether. (Topp et al. 2015, p. 10)

These human resource shortages (hardware), therefore, caused health workers to describe 'the time pressure they experienced' (p. 10) (software) and how it negatively impacted on health workers' clinical and administrative performance. This had consequences for their personal performance reviews (accountability system). Topp et al. (2015) further state that

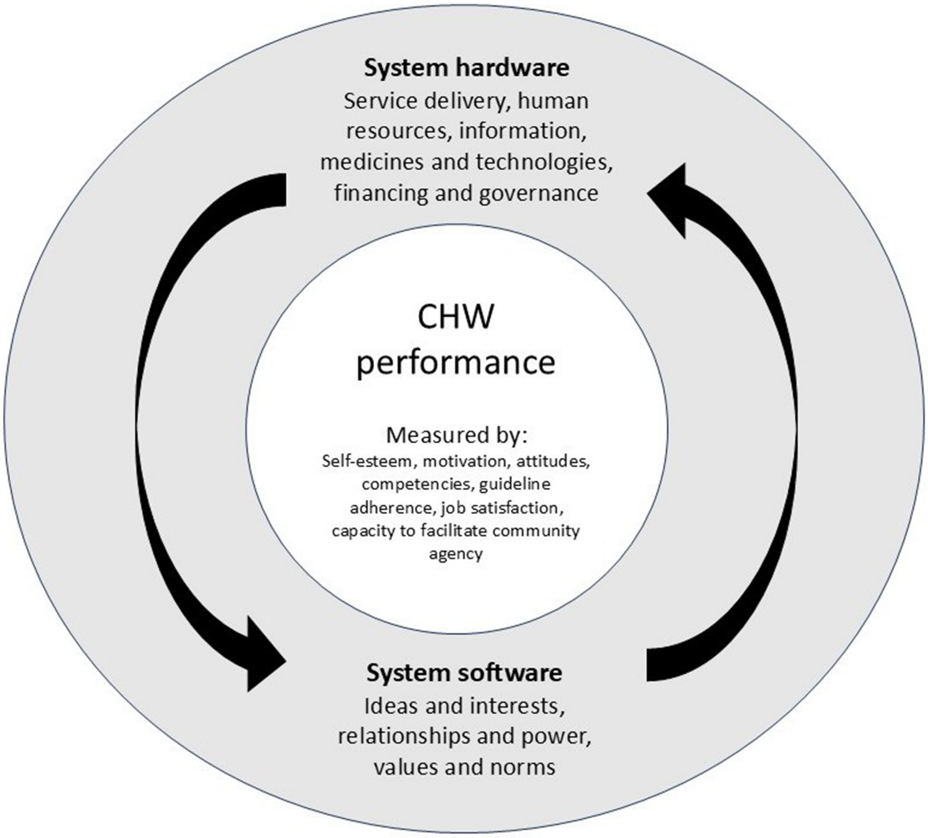

Figure 7. Summarized CHW performance framework [adapted from Kok et al. (2017)].

> The findings confirm the relevance of the Sheikh et al.'s (2011) hardware-software model and demonstrates how the original framework may be adapted to achieve greater analytical and explanatory power by examining first, the way hardware-software interactions act positively or negatively on particular mechanisms of accountability, and though these, health system performance. (Topp et al. 2015, p. 498)

Finally, Arakelyan et al. (2022) use the hardware–software conceptualization to categorize the various influences on TB-IPC measures in South Africa, explicitly investigating the interactions among influences (the influences categorized as tangible and less tangible). These authors created a concept map to demonstrate the complex interactions visually (Fig. 8—an adapted version of the authors' figure), explaining that such a map is useful to 'indicate what dynamics must be considered when studying the implementation of TB-IPC, or indeed IPC practice more generally' (Arakelyan et al. 2022, p. 17).

Reviews

Five of the papers selected for Phase 2 were reviews. These aimed to map the influences on various health system experiences, coding the influences as either hardware or software. The papers considered TB-IPC programmes (Zwama et al. 2021), integration of sexual and reproductive health services with HIV services (Mayhew et al. 2020), expanding ART access (Myburgh et al. 2021), respectful maternity care (Reddy et al. 2022), and emerging infectious disease preparedness (Palagyi et al. 2019). They demonstrate that the hardware–software conceptualization is a useful way to understand the scope of influences on a range of health system programmes and experiences.

Discussion

The scoping review revealed an increase in the use of the term 'health system software' over the last 12 years, suggesting that such research has picked up momentum. However, it also reveals that only in a few studies has the concept been used actively to inform the research undertaken, implying, for the most part, a somewhat superficial application. This is evidenced by the high number of studies categorized in the review as 'using the concept to acknowledge its importance'.

This scoping review sought primarily to inform future HPSR, by mapping how the concept of health system software has been used since 2011. Figure 9 summarizes the insights of relevance to researchers. The figure also provides some insights for other health system actors around the hardware–software conceptualization.

The papers reviewed were mostly drawn from LMIC contexts, reflecting the general focus on LMICs within the field of HPSR, as emphasized by Sheikh et al. (2011) and Bennett et al. (2011). Nonetheless, as Sheikh et al. (2011) suggested that the hardware–software conceptualization had value in high-income settings, researchers in such countries should not, therefore, shy away from using it.

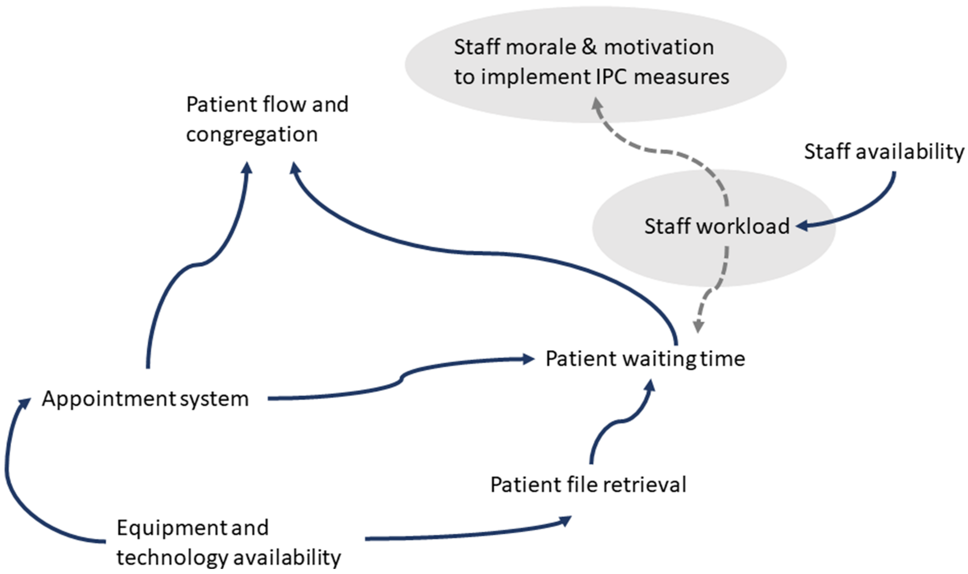

Figure 8. Key interactions between health systems hardware and software components across the hierarchy of TB-IPC controls. (Notes: solid arrows show interactions between health system hardware components. Dashed grey arrows show interactions between health systems software and hardware components. Software elements are in grey.) [Source: adapted from Arakelyan et al. (2022)].

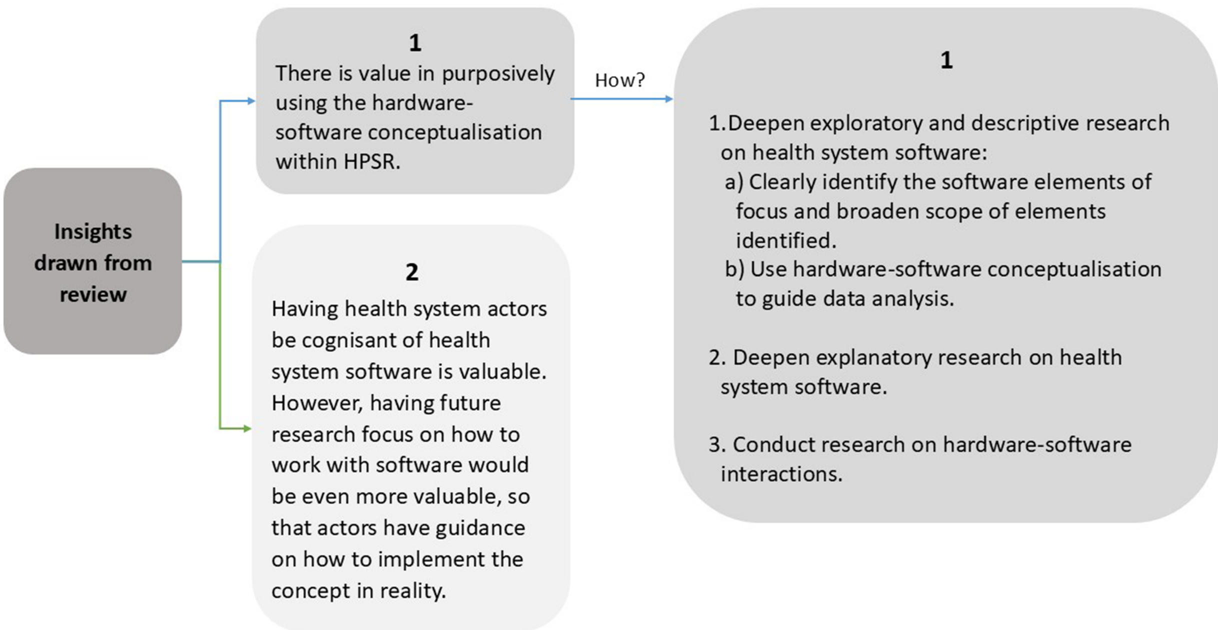

Figure 9. The insights drawn from this review (as summarized in this figure) can be grouped into two: insights for researchers (boxes 1) and insights for other health system actors (box 2) (Source: author).

Value of looking at hardware, software, and their interactions

Established health policy and systems researchers have already proposed that viewing health systems as CAS is important and that hardware–software interactions are part of their complexity (Blaauw et al. 2003, Sheikh et al. 2011, Elloker et al. 2012). These components have dynamic relationships and unpredictable influences on one another (Sheikh et al. 2011). Identifying and reviewing papers that have applied the hardware–software conceptualization in considering how software and its interactions with hardware impact on health system experiences offers further evidence of its value.

The experiences considered in these papers are summarized in Fig. 5, Table 4, and Table 5. They suggest that the hardware–software conceptualization has relevance across the macro, meso, and micro levels of the health system. They also highlight its value in understanding health programme experiences (e.g. TB and HIV/AIDS), as well as wider system experiences important in themselves (such as accountability, preparedness, and policy implementation), some of which also have links to overall system performance (e.g. CHW programme performance and quality of care). Some of these experiences are, moreover, reflected in what Bertone et al. (2022) have recently called 'health system process goals' (e.g.

learning and resilience), as opposed to overall health system performance goals. This current review suggests, then, that the hardware–software conceptualization could offer value in future health system evaluations considering process goals—evaluations judged by Bertone et al. (2022) as important in generating new ideas about health systems strengthening.

However, as this review has shown, existing research on health system software and hardware–software interactions remains limited. More research is needed to deepen understanding, and this research must be strengthened by more explicitly and purposively engaging with the hardware–software conceptualization. This synthesis highlights three relevant approaches.

Deepen exploratory and descriptive research on health system software

Given the still limited body of relevant research (Sheikh et al. 2011, Gilson 2013), more exploratory and descriptive work would be useful—offering further insights into forms of software and their interactions with hardware. Two steps to deepen such work are to preidentify which features of software to examine, and to ensure full coding of all data collected using the overall conceptualization in analysis.

Clearly identify the software dimensions of focus.

Sheikh et al. (2011) and Elloker et al. (2012) somewhat brief and surface-level descriptions of what software constitutes are summarized earlier. The concepts they identify, such as ideas, interests, values, norms, power, tangible, and intangible software, are broad, and somewhat open-ended categories that are not in themselves well defined.

In this review, we have identified the various software elements that have been investigated empirically, providing examples of the forms of software examined in real-world experiences. We also developed subcategories of both tangible and intangible software, as seen in Table 3, offering some conceptual clarity about health system software that can be used as a starting point for future research.

However, it is worth pointing out that some software elements have been neglected within empirical inquiry. Blaauw et al. (2003) describe research conducted in the beginning of the 2000s which investigated histories (Froestad 2002, as cited in Blaauw et al. 2003) and national political discourse (Schneider and Fassin 2002), identifying such issues as software. However, such factors, along with issues such as gender, cultural competencies, attitude of risk-averseness, authority, and hierarchy are not well represented in the literature since 2011. This may point to a limited understanding of what software constitutes, or limited inquiry, and suggests that future research should seek to explore such factors as well as deepening inquiry around the software elements identified in Table 3.

Use hardware–software conceptualization to guide data analysis.

The review revealed that many of the included studies coded health system elements as either hardware or software as part of data analysis (outlined in Table 4). Topp et al. (2015), Mwamba et al. (2018), Kagwanja et al. (2020), Arakelyan et al. (2022), and Das et al. (2022) all discuss that the hardware–software conceptualization was useful to characterize the various influences on the health system experiences they examined.

Using frameworks during qualitative data analysis is important in enhancing rigour because it separates the interpretations of the researchers from the experiences of the participants (Ritchie et al. 2013). The credibility of findings is enhanced as interpretation and the findings are clearly distinguished. Furthermore, using frameworks within analysis helps justify the decisions made within qualitative research and enhances rigour (Kegler et al. 2019).

Finally, by categorizing health system elements as either hardware or software, further conceptual clarity about the specific elements of both categories is developed (and this could, e.g., add to Table 3). Researchers should, therefore, consider using the hardware–software conceptualization as a coding framework to explore and analyse influences on various aspects of health system experience, as was done within the papers outlined in Table 4.

Deepen explanatory research about health system software

A stronger understanding of the influence of health system software in health systems could be developed by conducting more explanatory research that explicitly sets out to explain how and why software impacts on system experiences (Sheikh et al. 2011, Gilson 2013). Within such work, a more purposive or deductive inquiry approach would be useful in tracing complex interactions.

For example, the second phase of the review identified two literature reviews, one of which generated a specific framework, which were then purposively used in subsequent empirical research. Palagyi et al. (2019) identified what hardware and software elements influence health system preparedness for emerging infectious diseases and their synthesis was then to guide their empirical inquiry in Lebanon by Moussallem et al. (2022). Similarly, Kok et al. (2017) developed a model of the interacting influences over CHW performance from literature synthesis that was subsequently used by Zawolo et al. (2022) to inform their research.

Reviews can, then, be a step towards purposefully using the software concept to inform future research. They synthesize the evidence on a particular topic (Arksey and O'Malley 2005) and allow for rich interpretations of phenomena (Flemming and Noyes 2021). Reviews could, e.g. reveal which software factors are worth looking at in relation to specific health system experiences, so that researchers can purposively investigate these factors.

However, three papers that used the hardware–software conceptualization more deductively (Schneider et al. 2014, Reddy et al. 2022, Wanyama et al. 2022) did not clarify on what prior work they were based. This may undermine the claims these authors make. We therefore encourage researchers to, in future, make clear on which prior work they base their own research.

Additionally, researchers conducting primary empirical research could design data collection tools that iteratively elicit insights on software elements, allowing new insights to emerge throughout analysis.

Conduct research about the interactions among hardware–software

The second phase of the review revealed that only three papers explicitly investigated interactions among the identified hardware and software elements (Topp et al. 2015, Arakelyan et al. 2022, Das et al. 2022).

Blaauw et al. (2003), one of the first papers to introduce these concepts, theorized varying perspectives of health systems. The mechanistic perspective views health systems as made up of clearly defined and separate components. Ironically, the lack of investigation into the interactions of the hardware and software elements assumes a rather mechanistic view of these elements, as they are presented as isolated and independent from each other. Adam and de Savigny (2012) also argue that focusing on isolated components limits our ability to conceptualize a health system as a CAS. They suggest that understanding the interacting components is critical in understanding the operations of any health system.

Elloker et al. (2012) and Sheikh et al. (2011) also specifically highlight that interactions among hardware and software elements are an important feature of the conceptualization. Although some papers included in this review did explicitly examine interactions [within policy implementation (Arakelyan et al. 2022) and an accountability experience (Topp et al. 2015)], some only presented a surface-level assessment (Kagwanja et al. 2020; Mwamba et al. 2018), and most did not examine interactions at all.

However, Arakelyan et al. (2022) provide an unusual and strong example of how to depict and examine these interactions in their case within the implementation of TB-IPC programmes. For example, staff workload (software) impacted on the patient file retrieval system (hardware), and this, in turn, impacted on patient waiting time. This would ultimately influence patient flow and congregation within the TB-IPC programme (Arakelyan et al. 2022).

Their diagrammatic depiction of interactions (Fig. 8) acts as a useful example of the research approach called for by Adam and de Savigny (2012) 'dynamic and holistic approaches that appreciate the multifaceted and interconnected relationships among health system components' (p. iv). Future HPSR should seek to both understand and represent these relationships, as Arakelyan et al. (2022) have done. This would add to the knowledge of how to think of health systems as CAS and, as Adam and de Savigny (2012) argue, would aid in institutionalizing this way of thinking.

Value of system software in policy and practice

Adam and de Savigny (2012) discuss how the characteristics of CAS include the 'views, interests and power of its different actors' (p. iv). Therefore, as components of complex health systems, actors are themselves interacting with other components. Health system actors are also conscious beings, and in this lies another opportunity for applying the concept of health system software outside research. If health system managers are cognizant of the underlying software driving behaviours, this not only would increase their awareness of these software influences but also, as argued by Ramani et al. (2022), would offer ideas about strategies that they could use in rewiring organizational software to influence their staff's behaviours and actions. Being aware of the concept of software allows managers to better understand that health systems are CAS and to navigate their dynamics.

Walker and Gilson (2004), a study not included in this review, provide an example of when it might be useful to understand software within a particular context. They studied nurses' perceptions of the implementation of a free care policy in South Africa. One finding of their study was that nurses felt overlooked in the development of the policy process, and these feelings of isolation (software) were found to be barriers to the policy's implementation. As the authors conclude, if managers and policymakers had incorporated the nurses into the policy process and made them feel more included, more positive perceptions and attitudes towards the policy may have resulted and led to more successful policy implementation.

Another study included in this review also found that health managers showed interest in the software concept (Nzinga et al. 2021). A health system course increased managers' recognition that software is important, while other interventions improved their self-awareness and overall communication practices. A systematic review supports this idea, by emphasizing that the quality of health care could improve through health workers being more self-aware about hierarchical power dynamics (Kearns et al. 2021). These authors point out that these dynamics 'inhibit team communication and speaking up behaviours, which impacts team effectiveness and patient safety' (p. 1).

Furthermore, a study conducted in 2003 in a Canadian medical school also supports this idea, by emphasizing that doctors need to learn how to be self-aware of their power relations:

> … what would help them [doctors] be better physicians is getting in touch with their own biases … the work of helping patients become whole again, requires of the physician's own self-awareness: "When they are not brought to the level of consciousness, physicians' personal attitudes, biases, fears, emotional reflexes, psychological defences, and moods can interfere with their abilities to arrive at an accurate diagnosis, prescribe appropriate treatment, and promote healing" …. (Beagan 2003, p. 613)

Beagan's research argues that health practitioners need to understand the underlying power systems, which influence their own behaviours. These power systems are intangible software features that influence the social roles people have in a society and how they interact with each other.

Nzinga et al. (2021) conclude that including health systems software in training courses health managers and practitioners could change the way they work and so directly impact on the software of the health system.

Study limitations

A search strategy was created with the help of an expert UCT Faculty of Health Sciences librarian. Although this contributed to the robustness of the scoping review, it is possible that not all relevant papers were identified. This could have been due to the tight focus on the term 'health system software' rather than, e.g., searching for papers using terms for the wide array of software elements. This means that studies which have relevance to health system software, but do not specifically use the varying forms of the term 'health system software' which we indicate in the search strategy, were not included in this review. However, this tight focus was appropriate as the aim was to review how the specific term 'health system software' has been used. Furthermore, our search strategy did not involve seeking recommendations from colleagues, which may have contributed to gaps in the literature included in this review.

This review is also limited by only including English publications. There may also be bias as only one reviewer undertook the data extraction and analysis for this review, although a second researcher aided in ensuring rigour by reviewing the extracted data and analyses.

Conclusion

The field of HPSR acknowledges that understanding health system software can aid in understanding how health systems work in reality. However, this review has revealed that since 2011, when first called for, limited research has directly considered the software concept, and very few papers have used the concept purposively to support empirical research. Various insights were drawn from the review. First, the hardware–software conceptualization offers value as a framework within HPSR. Furthermore, future research can build on the existing work that has actively used the software concept. Clarity and practical guidance on how to investigate interactions between hardware and software elements is, however, needed as there may be uncertainty about how to conduct such research. Lastly, health system actors other than researchers can benefit from being aware of health system software. We therefore encourage future research to make use of this concept and so strengthen HPSR by considering health systems as CASs.

Acknowledgements

We would like to thank all the staff in the Faculty of Health Sciences at the UCT who helped us develop various components of this review from search strategies to reviewing final versions of the manuscript.

Supplementary data

Supplementary data is available at *Health Policy and Planning* online.

Author contributions

Nicola Burger: Conceptualization (Lead); Data curation; Formal Analysis; Methodology; Visualization; Writing—original draft; Writing—review & editing (Lead)
Lucy Gilson: Supervision; Conceptualization (Supporting); Validation; Writing—review & editing (Supporting)

Reflexivity statement

In conducting this qualitative review, we acknowledge the influence of our backgrounds, experiences, and biases on the research process. As health policy and systems researchers, our perspectives and theoretical inclinations might have shaped the data collection, interpretation, and overall analysis of the study. However, we conducted regular discussions with each other in order to share critical feedback and challenge each other's assumptions.

Ethical approval

As this was a review of published literature, it did not need ethical approval, and therefore the review does not have registration information.

Conflict of interest

Although the corresponding/coauthor, Lucy Gilson, is co-Chief Editor of the *Health Policy and Planning* journal, she had no involvement with the peer review process for this article.

Funding

None declared.

Data availability

This review was originally conducted as part of a dissertation, as partial fulfilment of a Master of Public Health degree. Therefore, the full, original thesis (including its protocol) is submitted to the UCT, where all theses are publicly available on the university's Open Access resource site.

References

Adam T, de Savigny D. Systems thinking for strengthening health systems in LMICs: need for a paradigm shift. *Health Policy Plann* 2012;**27**:iv1–iv3.
Agostini L, Onofrio R, Piccolo C *et al*. A management perspective on resilience in healthcare: a framework and avenues for future research. *BMC Health Serv Res* 2023;**23**:774.
Aivalli PK, Elias MA, Pati MK *et al*. Perceptions of the quality of generic medicines: implications for trust in public services within the local health system in Tumkur, India. *BMJ Global Health* 2018;**2**:e000644.
Arakelyan S, MacGregor H, Voce AS *et al*. Beyond checklists: using clinic ethnography to assess the enabling environment for tuberculosis infection prevention control in South Africa. *PLoS Global Public Health* 2022;**2**:e0000964.
Arksey H, O'Malley L. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;**8**:19–32.
Barasa E, Mbau R, Gilson L. What is resilience and how can it be nurtured? A systematic review of empirical literature on organizational resilience. *Int J Health Policy Manag* 2018;**7**:491–503.
Beagan BL. Teaching social and cultural awareness to medical students: "It's all very nice to talk about it in theory, but ultimately it makes no difference". *Acad Med* 2003;**78**:605–14.
Bennett S, Agyepong IA, Sheikh K *et al*. Building the field of health policy and systems research: an agenda for action. *PLoS Med* 2011;**8**:e1001081.
Bertone MP, Palmer N, Kruja K *et al*. How do we design and evaluate health system strengthening? Collaborative development of a set of health system process goals. *Int J Health Plann Manag* 2022;**38**:1–10.
Blaauw D, Gilson L, Penn-Kekana L *et al*. Organizational relationships and the 'software' of health sector reform. Background paper prepared for the Disease Control Priorities Project, Capacity Strengthening and Management Reform. Centre for Health Policy, 2003.
Boydell V, Fox J, Shaw S. Transparency and accountability strategies & reproductive health delivery systems. Learning Exchange

Report 1, Accountability Research Center, 2017. https://accountabilityresearch.org/wp-content/uploads/2018/05/LER1_SEPT17-V-May-7-2018.pdf.

Bozorgmehr K, Biddle L, Razum O *et al*. Health policy and systems responses to forced migration: an introduction. In: Bozorgmehr K, Roberts B and Razum O *et al*. (eds), *Health Policy and Systems Responses to Forced Migration*. Cham: Springer, 2020; 1–14.

Braun V, Clarke V. Using thematic analysis in psychology. *Qual Res Psychol* 2006;**3**:77–101.

Chilala SB, Silumbwe A, Zulu JM *et al*. Individual, community and health systems factors influencing time to notification of tuberculosis: situating software and hardware bottlenecks in local health systems. *BMC Health Serv Res* 2024;**24**.

Das P, Newton-Lewis T, Khalil K *et al*. How performance targets can ingrain a culture of 'performing out': an ethnography of two Indian primary healthcare facilities. *Soc Sci Med* 2022;**300**:114489.

Davies B, Olivier J, Amponsah-Dacosta E. Health systems determinants of delivery and uptake of maternal vaccines in low- and middle-income countries: a qualitative systematic review. *Vaccines* 2023;**11**:869.

Edelman A, Allen T, Devine S *et al*. "Hospitals respond to demand. Public health needs to respond to risk": health system lessons from a case study of northern Queensland's COVID-19 surveillance and response. *BMC Health Serv Res* 2024;**24**:104.

Elloker S, Olckers P, Gilson L *et al*. Crises, routines and innovations: the complexities and possibilities of sub-district management. *South Afr Health Rev* 2012;**2012**:161–73.

Flemming K, Noyes J. Qualitative evidence synthesis: where are we at? *Int J Qual Methods* 2021;**20**:1–13.

Froestad J. Unpublished results. Interest, knowledge and identity. The potential for building administrative systems based on trust in the health sector. Some lessons from the Western Cape province, South Africa. 2002.

George A, LeFevre AE, Jacobs T *et al*. Lenses and levels: the why, what and how of measuring health system drivers of women's, children's and adolescents' health with a governance focus. *BMJ Global Health* 2019;**4**:i143–53.

Gilson L. *Health Policy and System Research: A Methodology Reader: The Abridged Version*. Geneva, Switzerland: World Health Organization, 2013.

Gilson L, Doherty J, Lowenson R *et al*. Challenging inequity through health systems. Final report. Knowledge Network on Health Systems, 2007.

Gilson L, Hanson K, Sheikh K *et al*. Building the field of health policy and systems research: social science matters. *PLoS Med* 2011;**8**:1–6.

Gooding K, Harb J, Binci M *et al*. Evaluation of the Second-Generation Health Extension Programme's impact on health post capacity to prevent, prepare for and respond to shocks in selected areas of Ethiopia. Oxford Policy Management, 2020.

Hamon JK, Hoyt J, Krishnaratne S *et al*. Perceptions of quality and the integrated delivery of family planning with childhood immunization services in Kenya and Uganda. *PLoS One* 2022;**17**:e0269690.

Hernández A. Enabling the performance of nurses in rural Guatemala: the role of relationships. Doctoral Dissertation, Umeå universitet, 2014.

Hirose A, Hall S, Memon Z. Bridging evidence, policy, and practice to strengthen health systems for improved maternal and newborn health in Pakistan. *Health Res Policy Syst* 2015;**13**:1–7.

Joshi A, Schaaf M, Zayed D. The use of legal empowerment to improve access to quality health services: a scoping review. *Int J Equity Health* 2022;**21**:1–22.

Kagwanja N, Waithaka D, Nzinga J *et al*. Shocks, stress and everyday health system resilience: experiences from the Kenyan coast. *Health Policy Plann* 2020;**35**:522–35.

Karamagi HC, Njuguna D, Kidane SN *et al*. Financing health system elements in Africa: a scoping review. *PLoS One* 2023;**18**:e0291371.

Kearns E, Khurshid Z, Anjara S *et al*. P92 Power dynamics in healthcare teams—a barrier to team effectiveness and patient safety: a systematic review. *BJS Open* 2021;**5**:zrab032.091.

Kegler MC, Raskind IG, Comeau DL *et al*. Study design and use of inquiry frameworks in qualitative research published in health education & behavior. *Health Educ Behav* 2019;**46**:24–31.

Kok MC, Broerse JEW, Theobald S *et al*. Performance of community health workers: situating their intermediary position within complex adaptive health systems. *Hum Resour Health* 2017;**15**:59.

Mathpati MM, Payyappallimana U, Shankar D *et al*. 'Population self-reliance in health' and COVID-19: the need for a 4th tier in the health system. *J Ayurveda Integr Med* 2020;**13**:100354.

Mayhew SH, Warren CE, Ndwiga C *et al*. Health systems software factors and their effect on the integration of sexual and reproductive health and HIV services. *Lancet HIV* 2020;**7**:e711–20.

Mbau R, Gilson L. Influence of organisational culture on the implementation of health sector reforms in low- and middle-income countries: a qualitative interpretive review. *Global Health Action* 2018;**11**:1462579.

McLennan S, Movono A, Thomas-Maude J *et al*. "Nobody should talk about it": Fijian health system resilience and the COVID-19 pandemic. IDS Working Paper Series, Institute of Development Studies, Massey University, 2023.

Moussallem M, Zein-El-Din A, Hamra R *et al*. Evaluating the governance and preparedness of the Lebanese health system for the COVID-19 pandemic: a qualitative study. *BMJ Open* 2022;**12**:e058622.

Mphaphuli EB. Exploring the introduction of a complex intervention in primary health care facilities in the Western Cape: a single site exploratory case study of the C^2AIR^2. Club challenge. Masters Dissertation, University of Cape Town, 2017.

Mwamba C, Sharma A, Mukamba N *et al*. 'They care rudely!': resourcing and relational health system factors that influence retention in care for people living with HIV in Zambia. *BMJ Global Health* 2018;**3**:e001007.

Myburgh H, Reynolds L, Hoddinott G *et al*. Implementing 'universal' access to antiretroviral treatment in South Africa: a scoping review on research priorities. *Health Policy Plann* 2021;**36**: 923–38.

Nabyonga-Orem J, Asamani JA. Evolution of health sector strategic planning in Tanzania: what have we learnt and how can we improve? *Int J Health Plann Manag* 2023;**38**:662–78.

Nyikuri M, Tsofa B, Okoth P *et al*. "We are toothless and hanging, but optimistic": sub county managers' experiences of rapid devolution in coastal Kenya. *Int J Equity Health* 2017;**16**:113.

Nzinga J, Boga M, Kagwanja N *et al*. An innovative leadership development initiative to support building everyday resilience in health systems. *Health Policy Plann* 2021;**36**:1023–35.

Ouzzani M, Hammady H, Fedorowicz Z *et al*. Rayyan—a web and mobile app for systematic reviews. *Syst Rev* 2016;**5**:1–10.

Palagyi A, Marais BJ, Abimbola S *et al*. Health system preparedness for emerging infectious diseases: a synthesis of the literature. *Global Public Health* 2019;**14**:1847–68.

Powell-Jackson T, Purohit B, Saxena D *et al*. Measuring management practices in India's district public health bureaucracy. *Soc Sci Med* 2019;**220**:292–300.

Proctor E, Silmere H, Raghavan R *et al*. Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda. *Adm Policy Ment Health* 2011;**38**:65–76.

Ramani S, Parashar R, Roy N *et al*. How to work with intangible software in public health systems: some experiences from India. *Health Res Policy Syst* 2022;**20**:52.

Reddy B, Thomas S, Karachiwala B *et al*. A scoping review of the impact of organisational factors on providers and related interventions in LMICs: implications for respectful maternity care. *PLoS Global Public Health* 2022;**2**:e0001134.

Ritchie J, Lewis J, Nicholls CM *et al*. *Qualitative Research Practice: A Guide for Social Science Students and Researchers*. London: Sage, 2013.

Schaaf M, Topp SM, Ngulube M. From favours to entitlements: community voice and action and health service quality in Zambia. *Health Policy Plann* 2017;**32**:847–59.

Schneider H, English R, Tabana H *et al*. Whole-system change: case study of factors facilitating early implementation of a primary health care reform in a South African province. *BMC Health Serv Res* 2014;**14**:1–11.
Schneider H, Fassin D. Denial and defiance: a socio-political analysis of AIDS in South Africa. *AIDS* 2002;**16**:S45–51.
Serge B, Ebongue M, Ursull Alexandra ST *et al*. Focus, priorities, and challenges of National Health Observatories (NHOs) in Africa. 2023. http://dx.doi.org/10.2139/ssrn.4661902 (16 November 2024, date last accessed).
Shakarishvili G, Emrey B, and Atun R. Investing in health systems strengthening: taking stock of the evolving global landscape. *Global Health* 2012;**5**:1.
Sheikh K, Gilson L, Agyepong IA *et al*. Building the field of health policy and systems research: framing the questions. *PLoS Med* 2011;**8**:e1001073.
Tesfa A, Nakidde C, Akter K *et al*., QCN Evaluation Group. Individual, organizational and system circumstances, and the functioning of a multi-country implementation-focused network for maternal, newborn and child health: Bangladesh, Ethiopia, Malawi, and Uganda. *PLOS Global Public Health* 2023;**3**:e0002115.
Topp SM, Chetty-Makkan C, MI, Smith HJ *et al*. "It's not like taking chocolates": factors influencing the feasibility and sustainability of universal test and treat in correctional health systems in Zambia and South Africa. *Global Health* 2019;**7**:189–202.
Topp SM, Chipukuma JM. How did rapid scale-up of HIV services impact on workplace and interpersonal trust in Zambian primary health centres: a case-based health systems analysis. *BMJ Global Health* 2016;**1**:e000179.
Topp SM, Chipukuma JM, Hanefeld J. Understanding the dynamic interactions driving Zambian health centre performance: a case-based health systems analysis. *Health Policy Plann* 2015;**30**:485–99.
Topp S, Mwamba C, Beres L *et al*. Understanding patient decisions to transfer or disengage from HIV care and treatment in Zambia. *BMJ Global Health* 2017;**2**.
Tshitenge ST, Nthitu JM. COVID-19 frontline primary health care professionals' perspectives on health system preparedness and response to the pandemic in the Mahalapye Health District, Botswana. *African J Primary Health Care Family Med* 2022;**14**:3166.
van Niekerk L. The adoption and institutionalisation of social innovation in the Malawian health system: the influence of software factors. Doctoral Dissertation, London School of Hygiene & Tropical Medicine, 2022.
Vargas-Peláez CM, Soares L, Rover MRM *et al*. Towards a theoretical model on medicines as a health need. *Soc Sci Med* 2017;**178**:167–74.
Walker L, Gilson L. 'We are bitter but we are satisfied': nurses as street-level bureaucrats in South Africa. *Soc Sci Med* 2004;**59**: 1251–61.
Walmisley U, Lehmann U, Lembani M. 'You need to keep on looking to see how to improve it.' Lessons from a learning initiative in primary healthcare facilities in Cape Town, Southern Africa. *South Afr J Public Health* 2022;**5**:51–9.
Walt G. *Health Policy: An Introduction to Process and Power*. Johannesburg: Witwatersrand University Press, 1994.
Wanyama CW, Blacklock C, English M *et al*. Protocol for the Pathways Study: a realist evaluation of staff social ties and communication in the delivery of neonatal care in Kenya. *BMJ Open* 2022;**13**:e066150.
Whyle E. Health systems and social values: the case of the South African health system. Dissertation. University of Cape Town, Faculty of Health Sciences, Department of Public Health and Family Medicine, 2023.
Whyle E, Olivier J. Social values and health systems in health policy and systems research: a mixed-method systematic review and evidence map. *Health Policy Plann* 2020;**35**:735–51.
Zawolo G, Nyaaba GN, Nallo G *et al*. Transition and change: opportunities and challenges of CHW policy reform for community health systems and vertical disease programmes in Liberia. *Res Sq* 2022:1–27.
Zwama G, Diaconu K, Voce AS *et al*. Health system influences on the implementation of tuberculosis infection prevention and control at health facilities in low-income and middle-income countries: a scoping review. *BMJ Global Health* 2021;**6**: e004735.

Health Policy and Planning, 2025, 00, 1–18, DOI: https://doi.org/10.1093/heapol/czaf001, Advance Access Publication date: 17 January 2025, Review