








BMJ Open How can the healthcare system deliver sustainable performance? A scoping review

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To cite: Zurynski Y, Herkes-Deane J, Holt J, *et al.* How can the healthcare system deliver sustainable performance? A scoping review. *BMJ Open* 2022;**12**:e059207. doi:10.1136/bmjopen-2021-059207

► Prepublication history and additional supplemental material for this paper are available online. To view these files, please visit the journal online (<http://dx.doi.org/10.1136/bmjopen-2021-059207>).

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Received 16 November 2021
Accepted 14 January 2022



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ABSTRACT

Background Increasing health costs, demand and patient multimorbidity challenge the sustainability of healthcare systems. These challenges persist and have been amplified by the global pandemic.

Objectives We aimed to develop an understanding of how the sustainable performance of healthcare systems (SPHS) has been conceptualised, defined and measured.

Design Scoping review of peer-reviewed articles and editorials published from database inception to February 2021.

Data sources PubMed and Ovid Medline, and snowballing techniques.

Eligibility criteria We included articles that discussed key focus concepts of SPHS: (1) definitions, (2) measurement, (3) identified challenges, (4) identified solutions for improvement and (5) scaling successful solutions to maintain SPHS.

Data extraction and synthesis After title/abstract screening, full-text articles were reviewed, and relevant information extracted and synthesised under the five focus concepts.

Results Of 142 included articles, 38 (27%) provided a definition of SPHS. Definitions were based mainly on financial sustainability, however, SPHS was also more broadly conceptualised and included acceptability to patients and workforce, resilience through adaptation, and rapid absorption of evidence and innovations. Measures of SPHS were also predominantly financial, but recent articles proposed composite measures that accounted for financial, social and health outcomes. Challenges to achieving SPHS included the increasingly complex patient populations, limited integration because of entrenched fragmented systems and siloed professional groups, and the ongoing translational gaps in evidence-to-practice and policy-to-practice. Improvement strategies for SPHS included developing appropriate workplace cultures, direct community and consumer involvement, and adoption of evidence-based practice and technologies. There was also a strong identified need for long-term monitoring and evaluations to support adaptation of healthcare systems and to anticipate changing needs where possible.

Conclusions To implement lasting change and to respond to new challenges, we need context-relevant definitions and frameworks, and robust, flexible, and feasible measures to support the long-term sustainability and performance of healthcare systems.

STRENGTHS AND LIMITATIONS OF THIS STUDY

- ⇒ This scoping review addresses a knowledge gap by providing a comprehensive synthesis of the literature including definitions, measurement, challenges, solutions for improvement and scaling up successful solutions to maintain sustainable performance of healthcare systems (SPHS).
- ⇒ The review methodology was guided by the Preferred Reporting Items for Systematic review and Meta-Analysis extension for Scoping Reviews statement, and we searched multiple databases and used complementary snowballing techniques to increase comprehensiveness.
- ⇒ The use of the Hawker and Authority Accuracy Coverage Objectivity Date Significance quality appraisal tools provided an assessment of the quality of literature on the SPHS.
- ⇒ Our review is limited in scope to countries with health systems of relevance to Australia, and this limits the generalisability of our results to low-income or middle-income countries.

BACKGROUND

Globally, healthcare spending is tracking above and beyond economic growth.¹ Challenges facing healthcare systems include an ageing population and subsequent rise of chronic diseases and multimorbidity^{2,3} and increasingly expensive new medical technologies.^{3,4} It is estimated that approximately 30% of care delivered by healthcare systems is low-value, attributable mainly to administrative overheads, bureaucracy, overdiagnosis, over-treatment or other factors.⁵ Systems lacking coordination and integration across clinical disciplines and healthcare sectors also result in wasteful spending through both care duplication and omission of needed care.⁶ If healthcare spending follows current trajectories, governments suggest that healthcare systems will begin to become unaffordable.³ This leads us to the question: ‘what is the current thinking about interventions and



initiatives to make healthcare systems more sustainable?'. Understanding how healthcare system sustainability is conceptualised underpins the implementation and evaluation of system-wide interventions that aim to improve performance. Although literature about the sustainability of individual innovations and improvement programmes is growing,⁷ the broad question of whole-of-system sustainability is rarely studied.

Sustainability itself has remained an ambiguous topic in the literature. Sustainability suggests that healthcare systems should be built to last, and able to adapt and endure, ensuring that resources are expended efficiently and responsibly to maintain or improve individual and population health and well-being.⁸ To be sustainable, a healthcare system must adequately deliver across financial, social and environmental concerns.⁴ This triple bottom-line is difficult to achieve consistently over time. For example, sustainable health services may need additional short-term investments to be financially beneficial in the long term.¹

The healthcare system is defined as one that delivers care to those who need it across many different settings. It includes key components: capacity—including physical, capital and human assets; organisational structure, both formal and informal; finances—including mechanisms for funding allocations, ownership and solvency; patients or clients and their characteristics and needs; and care processes and infrastructure.⁹

Healthcare system sustainability is difficult to measure in practice and requires ongoing long-term monitoring and evaluation of appropriate indicators. One potential way to conceptualise and operationalise sustainability is an assessment of the sustainable performance of healthcare systems (SPHS). Although past reviews have

addressed the sustainability of improvement programmes and policies in the healthcare system,^{7 10 11} they did not specifically address how SPHS is conceptualised in the medical literature. As a response, this study was designed using a systems science lens to fill this gap in knowledge by reviewing publications that report on or discuss the SPHS.

OBJECTIVES

This scoping review of health and medical literature aims to develop an understanding of how SPHS has been conceptualised, defined, and measured, and to scope the identified challenges and potential solutions to achieving and maintaining SPHS.

METHODS

Study design

In keeping with scoping review methodology,¹² our inclusion criteria were broad, and our search was comprehensive to capture the state of knowledge about SPHS. We included literature reviews, primary empirical articles (including qualitative, quantitative and mixed-methods studies), case studies, opinion pieces and editorials published in English from database inception to February 2021. To be included, studies had to report on, or discuss in detail, aspects of healthcare systems sustainability, resilience or performance improvement, and could cover improvements in cost-effectiveness, affordability, safety, quality, equity or access, while creating or realising value (table 1). Only articles that addressed the research objectives and provided insights into current knowledge of sustainability in healthcare delivery systems were

Table 1 Inclusion and exclusion criteria

Inclusion criteria*	Exclusion criteria
<ol style="list-style-type: none"> 1. Definition(s) of healthcare systems performance sustainability. 2. Measurement of SPHS. 3. Discussion and identification of the challenges involved in SPHS. 4. Discussion or identification of ways in which to improve SPHS. 5. Discussion of sustaining and scaling change in SPHS. 	<ol style="list-style-type: none"> 1. Pertaining to sustainability relating to: <ol style="list-style-type: none"> a. Disaster management, pandemic or other emergency preparedness. b. Foreign aid or foreign investment. c. Workplace health and safety. d. Environmental sustainability. 2. Of no relevance to the Australian context: <ol style="list-style-type: none"> a. Low-income countries. b. Healthcare systems in conflict zones. c. Specific to a country's political situation. 3. Does not otherwise deal with sustainability of 'healthcare systems' (eg, concerned with diagnosis or management of a single disease or programme or improvements in a single healthcare setting). 4. Focuses on broad population healthcare initiatives rather than healthcare delivery systems (eg, vaccination programmes). 5. Does not otherwise address the objectives of this review. 6. High risk of bias or low quality.
<p>*To be eligible for inclusion, articles needed to demonstrate one or more of the inclusion criteria. SPHS, sustainable performance of healthcare systems.</p>	

included. Articles on environmental sustainability; those investigating discrete improvement programmes implemented in specific healthcare settings including studies on specific diseases or programmes (eg, studies on vaccination programmes for a specific disease); and studies with a specific focus on COVID-19 were out of scope, as we applied a system-wide lens rather than a disease-specific focus (table 1).

Information sources

In consultation with an experienced university medical librarian, we developed a search strategy using key words and MeSH terms and conducted an advanced search of PubMed and Ovid Medline (online supplemental file 1). Additional relevant articles were identified by hand searching reference lists of included articles (snowballing).

Study selection

Guided by the Preferred Reporting Items for Systematic review and Meta-Analysis extension for Scoping Reviews (PRISMA-ScR) statement,^{13 14} and the methodological framework for scoping reviews,¹² screening of the article titles and abstracts was conducted by four reviewers (JHolt, JHerkes, GD and EM) using the predetermined inclusion and exclusion criteria (table 1). Reviewers screened a 5% sample of the titles and abstracts while applying the inclusion and exclusion criteria and the team then met to discuss any discrepancies, before screening continued. The full-text review was then conducted by a second reviewer team (JHerkes, YZ, GD, IM and GL) in consultation with JHolt and EM. Discrepancies were resolved in team meetings in consultation with JB as arbitrator.

Quality assessment of individual studies

To understand the scope of the quality of included articles, Hawker *et al*'s Quality Assessment Tool was applied as it enables quality assessment among many different article types including quantitative, qualitative or mixed-methods empirical research studies or literature reviews.¹⁵ The Quality Assessment Tool contains nine categories (abstract and title; introduction and aims; method and data; sampling; data analysis; ethics and bias; results; transferability or generalisability; and implications and usefulness) and a total quality score can be calculated (maximum score=36), where higher scores denote higher quality.¹⁵⁻¹⁷ For quality assessment of opinion or commentary pieces, the Authority Accuracy Coverage Objectivity Date Significance (AACODS) checklist was used.^{12 17}

Data extraction

Characteristics of included articles, year of publication, country of origin and article type were tabulated. A purpose-designed Excel spreadsheet was used to extract relevant details from each article. The Excel spreadsheet was piloted by three reviewers on five articles and adjusted as needed.

Patient and public involvement

No patients or public were involved.

RESULTS

Study selection

Of 5675 articles identified in the database searches, 2404 were duplicates, leaving 3271 articles. Undertaking independent title and abstract screening of 5% of articles, two reviewers achieved an acceptable level of agreement ($\kappa=0.6$).¹⁸ A further 2750 articles were excluded, leaving 521 articles for full-text review. A substantial level of agreement was achieved on review of 5% of full-text articles undertaken independently by four reviewers JHerkes, YZ, GD and IM; ($\kappa=0.7$).¹⁸ After full-text review, 136 articles were included. Eighty-three additional articles were identified from snowballing, and six met the inclusion criteria, for a total of 142 articles included for data extraction (figure 1). See online supplemental file 2 for further details.

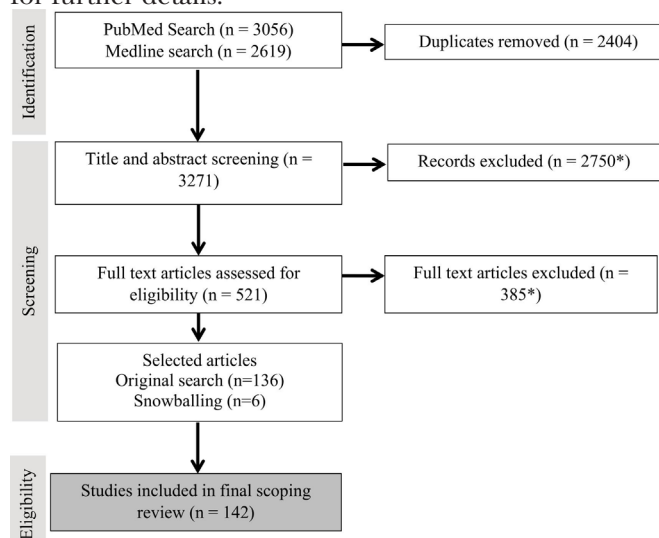


Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram summarising the review and reasons for article exclusion. *Full text articles and snowballed articles excluded for the following reasons. Note that some articles were excluded for multiple reasons. Reasons for article exclusion are below.

Reason	Excluded at title/abstract screening (N)	Excluded at full text review (N)
Disaster or emergency	199	3
Foreign aid, equity or community healthcare	598	20
Occupational health and safety	69	2
Environmental sustainability	89	5
Not relevant to Australia, for example, low-resource setting	730	82
Not about systems, for example, single disease or programme	1291	109



Reason	Excluded at title/abstract screening (N)	Excluded at full text review (N)
Preventative, for example, regarding vaccination or nutrition	277	18
Not relating to healthcare delivery, for example, regarding animal care or food safety	46	0
Regarding physiology/ pharmacology	44	0
Does not in another way define, measure, identify challenges, opportunities for improvement or scale up of sustainability in the healthcare system	398	166
Other, for example, article not written in English, full text not available	4	95

Study characteristics

Of the included articles, 18 were review articles (either systematic or narrative), 82 were editorial or opinion pieces, 37 were primary empirical studies and 5 were a brief narrative review combined with an empirical study (classified as empirical for simplicity). Empirical studies used a wide variety of data collection techniques and included qualitative analysis of interviews,¹⁹ survey results,^{20 21} analysis of hospital data records^{22 23} and economic analysis.^{24–28} The included articles described studies that covered various geographic locations, most commonly Canada (n=22), the USA (n=22), Australia (n=23, including two which involved Australia and New Zealand), the UK (n=6), the Netherlands (n=2) and one each from the following countries: Austria, Italy, Northern

Ireland, Malaysia, Malta, New Zealand, Oman, the Philippines, Portugal, Scotland and Spain. The remainder of studies referred to geographical regions such as the European Union, or to multiple nations, for example one included the USA, the UK and Australia²⁹ and another included Australia, Ireland, Austria and Denmark.³⁰

The data extraction sheet included the citation, study aims, study design, themes addressed and additional relevant information about SPHS. Details of the 142 included articles are summarised in online supplemental file 2. Of the 142, most identified challenges (n=94, 66%) and proposed ways to improve SPHS (n=89, 62%) while fewer discussed measuring SPHS (n=48, 34%), or sustaining and scaling change (n=47, 33%) and fewer still provided any definition of SPHS (n=38, 27%).

Quality of included studies

Forty-three empirical studies scored 25–34 points on the Hawker's Quality Assessment Tool,¹⁵ and 29 were of high quality, 13 moderate quality and 1 borderline low quality.¹⁶ None were excluded due to low quality (online supplemental file 3). The quality of editorial and opinion pieces (n=99) was analysed according to the AACODS criteria, and 72 articles ranked 'yes' for all criteria indicating high quality (online supplemental file 3).

Defining SPHS

Definitions of SPHS were provided by 38 publications including 25 opinion pieces, 7 review articles and 6 empirical studies (table 2). The definitions fell into three broad groupings: (1) fiscal sustainability, (2) human resource sustainability and acceptance of change by stakeholders and (3) system adaptability and improvement (table 2). Definitions focused on continual improvement,²⁹ and

Table 2 Definitions of sustainable performance of healthcare systems

Definition	Exemplar quotes	Relevant references		
		Empirical articles	Editorials or opinion pieces	Reviews
Fiscal sustainability	'The WHO considers fiscal sustainability as a requirement, rather than an objective, of health financing policy. Sustainability of healthcare financing therefore cannot be interpreted as a reduction of healthcare costs, but rather as a predictable growth or control of health expenditures'. ²⁴	35 36 64 127	24 32–34 37 39 56	40 41 104 127 128
Human resource sustainability and acceptability to stakeholders	'It has been increasingly recognised that getting HR policy and management "right" has to be at the core of any sustainable solution to health system performance'. ^{32 129} 'A sustainable health system also has acceptability to key constituents, including patients and health professionals'. ³³	64	32–34 38 56 67 83 90 129–132	31 104
Adaptability and improvement over time to create a future-focused intervention	'A sustainable health system ... [has] adaptability, because health and health care needs are not static (i.e., a health system must respond adaptively to new diseases, changing demographics, scientific discoveries, and dynamic technologies in order to remain viable)'. ³³ 'Ensuring that sufficient resources are available over the long term to provide timely access to quality services that address Canadians' evolving health needs'. ¹³³	36 43	4 33 39 42 56 67 78 83 89 98 108 131–135	31 49 88 104 128

Table 3 Summary of established and novel frameworks suggested for measuring SPHS

Established framework name	Rationale for use
Organisational Change Model (OCM)	To measure the success of sustained organisational change, according to faculty member survey respondents ⁵¹
Analysis of hospital records (eg, payroll records)	Measuring staff turnover, workforce supply and financial sustainability ^{22 26}
Evaluation of health networks	To evaluate the effectiveness and sustainability of health networks ¹³⁶
Novel framework name	Rationale for development
Q* Scale	To measure performance at the hospital level ⁵⁰
Dynamic Sustainability Framework (DSF)	To investigate the fit between the intervention, the practice setting, and the ecological system ³⁹ To improve measurement of SPHS beyond patient outcomes only ⁴⁰
Resilience Indicator	To highlight the systemic relevance of primary care network systems to quantify healthcare resilience ⁵⁴
eMergy (embodied energy) Sustainability Index	To address the lack of qualitative indicators for sustainability ⁴⁹
Future Health Index (FHI)	To identify preparedness of countries to build sustainable health systems ⁵⁵
Health Care Sustainability Framework (HCSF)	To measure the relationships between political and fiscal sustainability of an intervention ⁵²
Responsible Innovations for Health (RIH) Framework	To identify interventions that suitably address five domains (population health, healthcare system, economic, organisational, environmental) ⁵³
Research Lifecycle Framework	To enhance the impact of the Learning Health System by operationalising research innovations into clinical practice ⁴⁵
Value Of Diagnostic Information (VODI) Framework	To outline the multidimensional benefits and potential of healthcare diagnostics ¹¹⁴

*SPHS, sustainable performance of healthcare systems.

embeddedness of changes into the healthcare system in the long term.^{31–33}

Several articles defined SPHS in terms of fiscal sustainability.^{24 32–37} Examples included discussions of sustainability of rural primary care services in the face of ongoing policy change to reimbursement and practice incentives,³⁶ adoption of new funding models to ensure availability of medicines²⁴ and hospital capital investments to improve patient access to care.³⁵ Articles also discussed the importance of balancing financial interests with social and ecological interests.³⁸ Several papers conceptualised SPHS as the continuation of programmes after the cessation of external program-specific funding.^{39–41}

Four articles^{42–45} discussed SPHS through the lens of a learning healthcare system, a system in which ‘science, informatics, incentives, and culture are aligned for continuous improvement and innovation’.⁴⁶ These articles focused predominantly on using data and evidence to support system adaptability and improvement over time.

Measuring SPHS

The measurement of SPHS was addressed through theoretical discussions across the 24 editorials and 7 review articles, and by proposing, developing or applying frameworks or indicators in 17 empirical studies (table 3). These frameworks and indicators were heterogeneous and included financial, social and healthcare outcomes⁴⁷ with some articles highlighting the limitations of widely used financial metrics.^{34 48} Although heterogeneous,⁴⁰ measures were undertaken at three broad outcome levels: (1) individual (eg, continued health benefits for patients

or healthcare providers); (2) organisational (eg, continuation of innovations, hospital-level fiscal improvements) or (3) community (eg, continued use of programmes, services or healthcare interventions).

A variety of new SPHS measures were proposed, developed, modified or tested in research environments^{20 22 45 49–51} to address current deficits in available measures (table 3). For example, the Q*Scale was designed to combine data on caseload, patient satisfaction and physician aptitude, such that changes in hospital performance could be more effectively monitored.⁵⁰ In contrast, the Dynamic Sustainability Framework seeks to investigate the fit between the intervention, practice settings, contexts and cultures, healthcare policies, and the broader ecology within which healthcare systems operate, including sociopolitical systems.³⁹ Similarly, the Healthcare Sustainability Framework (HCSF) and the Responsible Innovations for Health framework, recognise the importance of accounting for the needs and trends of the population, workforce and financial constraints.^{52 53} Alternative models utilising a scoring system (eg, using the Resilience Indicator) were based on data-driven simulation modelling,⁵⁴ or theoretical composite indicators of the value of healthcare systems.^{54 55}

Identified challenges to SPHS

Ninety-four articles, including 60 editorials, 22 empirical studies and 12 reviews, identified challenges to SPHS across three main themes: (1) increasingly complex patient populations; (2) ongoing gaps between evidence, policy and practice and (3) concerns of system fragmentation



and need for integration for a more streamlined adoption and sustainment of interventions.

Increasingly complex patient populations,^{3 23 54 56–63} including patients with multi-morbidity^{21 54 58 59 61 64–66} and greater demand for effective aged care, under already strained healthcare budgets^{3 27 56 67–73} were frequently discussed. The increasing demands and expectations of patients for healthcare of the highest quality challenges healthcare systems to meet this demand.^{4 21 58 59 61 74 75}

The gaps between evidence, policy and practice^{40 76 77} continue to threaten SPHS as does limited investment in building workforce capacity and stakeholder involvement.^{30 43} The challenge of increasing public scrutiny and the need to balance financial, environmental and social sustainability were also recognised.^{28 38 78–80}

The fragmented nature of healthcare systems including power imbalances among the health professions, and resistance to changes in the scope of practice was reported to limit team approaches to care.^{81 82} Siloed care delivery models can become misaligned with the complexity of the healthcare system and the complexity of patient needs.^{52 83–85} Other publications reported lack of collaboration between public and private hospitals^{72 86} and widening gaps in care quality in rural/remote regions due to limited resources.^{23 36 72 87} Poor integration of primary care with the broader healthcare system was also seen as challenging SPHS.^{60 88}

Opportunities for improvement of SPHS

To address the challenges posed requires more than a one-time simple ‘fix’. Continued adaptation in response to local contexts, and ongoing monitoring and evaluation are required to support the sustainment of effective solutions and to anticipate future needs and solutions.⁵¹ Twelve review articles, 19 empirical articles and 56 editorials discussed opportunities to improve SPHS.

Greater strategic investment in the system,^{34 48 69 70 89} including funding novel interventions,^{26 40 80 90 91} and capacity building programmes for staff^{30 92} were advocated. Workplace culture in healthcare was identified as an important factor for SPHS. The importance of physician well-being was highlighted,^{44 76 93 94} and was strongly linked with organisational culture.¹⁷ The importance of mentorship, teaching and leadership were also highlighted as enablers of organisational improvements.^{19 43 75 76} Building healthcare system cultures that support medical graduates was viewed as crucial.^{38 94–96} Promoting incentives for generalist doctors to practice rurally was thought to address the current geographical gap in access to healthcare.^{44 87 95–97}

The promotion of desired attitudes, values and ideals of healthcare organisations was also recognised for achieving SPHS. Specifically, the value of patient-centred care and evidence-based medicine,^{30 44 58 63 65 97–99} and collaboration between and within healthcare facilities and disciplines was highlighted as important for SPHS.^{42 64 86 99–102} Support by management that values the workforce, uses robust data-driven hospital management systems, and

accessible, shared electronic medical record systems was also acknowledged as vital.^{74 103}

The importance of political stability and bridging the jurisdictional-federal divide in federated healthcare systems (such as in the USA, Canada and Australia) was important for effective unified healthcare system functioning.^{24 69 70 104–106} It is not only organisational culture in healthcare,¹⁰⁷ but the broader organisation, governance and regulation of the healthcare system that are important for SPHS.^{108–110}

Community involvement is an important factor that bolsters capacity to implement and sustain change.¹⁰³ Empowering patients to care for their own health, and building confidence among caregivers to deliver some aspects of care, reduces burden on the healthcare system.⁵⁸ Community involvement via Community Based Participatory Research bolstered equity and improved outcomes of care¹¹¹ and responding to recommendations from citizen panels also improved SPHS.^{73 102 112}

As technology advances, so does the ability to harness it to promote the sustainability of healthcare systems.³³ For example, point-of-care electronic prompts were used in one study of hospital surgical wards to decrease rates of hospital-acquired infections.¹¹³ Embedding artificial intelligence and big data analytics hold promise to support efficient and effective service delivery to improve SPHS.⁸³ Other studies have suggested greater adoption of telemedicine to reduce travel time and costs⁴ as complementary support to patients,⁹¹ to improve diagnostics,¹¹⁴ and as a platform to promote prevention of illness,²³ as contributing to SPHS.

Sustaining and scaling change in SPHS

Forty-seven articles addressed this theme, including 9 reviews, 11 empirical articles and 27 editorials. As interventions are often implemented with limited and/or short-term (2–3 years) evaluation plans, demonstrating SPHS is often elusive.⁴⁰ Robust evaluations using relevant SPHS indicators embedded alongside implementation, from the outset, to support adaptations and decisions about ongoing investments were advocated.^{104 115} One article proposed that federal funding agencies should perceive funding implementations of health innovations as ongoing strategic investments rather than time-limited projects.⁴²

The importance of accepting changes or adaptations to proposed interventions were also highlighted.^{116 117} For example, Greenhalgh *et al*¹¹⁷ reported on a 3-year case study follow-up of a healthcare system transformation and found that adaptations of the intervention to local contexts was important for sustainment of the intervention.

A recurring sentiment in the articles reviewed was the importance of support for the continuation of interventions from leaders and stakeholders.^{57 98 103 107 118 119} Leaders and managers have a clear role in supporting staff throughout the processes of reforms and changes, by providing opportunities for codesign, education

including e-learning, and building peer networks^{89 120} while creating open communication to involve front-line staff in planning and implementation.^{103 121} For example, one article suggested that pharmacists should be involved in developing hospital discharge procedures to improve medication safety and adherence.¹²² In more recent articles, policy-makers and political leaders are highlighted as important change agents, as long as they work in concert with front-line health staff.^{104 119 123}

Transparent healthcare policies and algorithms for equitable distribution of healthcare funds were advocated, and particularly prioritised by rural areas.^{36 48} Beyond the government, communities and multi-sectorial partners,⁵⁶ collaborations among hospitals, medical schools and physicians were also highlighted as vital for SPHS.⁴⁷

Although publications in our review predominantly urged for the sustainability of innovations, recent literature also highlights the need for discontinuation or redesign of programmes that have become ineffective or irrelevant over time.^{4 39 117} This is important to achieve sustainability as it ensures that value is maintained in the healthcare system.¹²⁴

DISCUSSION

Definitions of SPHS were rarely offered, with only 27% of included articles providing any definition of SPHS while referring to the concept of SPHS. When definitions were provided, they mainly centred on financial and workforce sustainability, and a variety of concepts related to adaptability, improvement and innovation for the future. The lack of definitions and variability in definitions creates significant limitations for the interpretation of the current body of literature on SPHS. As a first step to address this limitation, we would urge authors discussing SPHS to provide a definition that is relevant to their context. Furthermore, there were interesting contrasts in the boundaries adopted to describe the 'healthcare system' in the included papers which has also been identified by others.¹²⁵ For example, some studies measured SPHS at a single hospital level,⁵⁰ whereas others addressed it at a national system level,¹²⁶ making comparisons across studies difficult. In the future, as evidence about SPHS develops it may be possible to create nuanced measures, definitions, and approaches to SPHS as applied to different healthcare system levels and contexts.

The long-standing approach to measure SPHS in terms of financial outcomes is increasingly becoming more sophisticated through the development of newer more nuanced frameworks and indicators that account for health and societal benefits while factoring in the complex and dynamic nature of healthcare systems. Although new frameworks and measures, for example, the Future Health Index,⁵⁵ the Q*Scale⁵⁰ and the Resilience Indicator⁵⁴ have been proposed, the evidence for the practical application of such frameworks and measures in the real world was limited.

The most common opportunities for improving SPHS related to building supportive and functional workplace and organisational cultures that promote collaboration, transparency, patient-centredness and community participation. The adoption of technological advances including greater use of linked up information technology platforms to provide intelligence about aspects of SPHS were also discussed in the literature.^{4 23 33 91 113} Importantly, policy and political stability over time was also recognised as a supportive factor for SPHS, especially when implementing innovations and interventions that require longer-term horizons to demonstrate their impacts on SPHS.^{24 40 69 70 77 104–106} This aligns with findings from a recent systematic review that specifically focused on the sustainability of health improvement programmes.⁴⁴

The increasing adoption of pragmatic implementation trials in healthcare research is an important advance to support effectiveness testing in real-life situations rather than in contrived randomised controlled trials that are difficult to implement at scale in real-world settings to meet the needs of changing populations.^{46 121}

Table 4 provides a summary of the current evidence about SPHS under five headings: defining sustainability; measuring it; associated challenges of realising sustainable performance; identifying opportunities for improvement and creating, sustaining and scaling SPHS. This provides an important starting point for future research in the field.

Strengths and limitations

Methodological strengths of the current review include the use of the PRISMA-ScR statement to guide the review, including searching multiple databases and using snowballing techniques to increase comprehensiveness. Although formal quality appraisal is not recommended for scoping reviews, we felt it was important to also understand the scope of the quality of articles being published in addition to understanding their content and findings about SPHS.

As described earlier, the heterogenous nature of the current literature and limited use of definitions and frameworks made synthesis challenging. Our choice to limit the current review to studies reporting on SPHS in high-income countries further limits generalisability to other settings including in low-income and middle-income countries (LMICs).

Future research directions

This article summarises the current scope of the literature on SPHS and provides an important starting point for future research. Although new SPHS measures and frameworks that include factors other than financial inputs and outputs have been proposed, their usefulness needs to be evaluated in the real-world healthcare ecosystem in the future. Taking a broad system-wide lens, our focus was on the SPHS in healthcare delivery settings and did not specifically consider individual programmes for specific diseases, conditions or settings. In addition, the role of

**Table 4** Summary of key findings under the five SPHS focus areas analysed in this review

Criteria	Explanation	Key points from included articles
Defining sustainability	What do we mean by SPHS?	<ul style="list-style-type: none"> ▶ SPHS is difficult to define^{29 31–33} ▶ Sustainability is most often framed in terms of fiscal/financial or economic sustainability^{4 24 32–37 49} ▶ Sustaining a system intervention post implementation and initial funding period^{39–41}
Measuring	How do we measure SPHS?	<ul style="list-style-type: none"> ▶ Issue of system boundaries—at which level should we measure sustainability? (eg, at the individual hospital or healthcare system level)^{50 126} ▶ Heterogeneous outcome data collection techniques (eg, individual, organisation and community level)^{34 40 47 48} ▶ Wide variety of new methods and indicators suggested (see table 3)^{20 22 49–51 53}
Associated challenges	What challenges are associated with SPHS?	<ul style="list-style-type: none"> ▶ Complex patient population (eg, ageing, comorbidities and chronic illnesses)^{3 4 21 27 56–59 65 66 68–72 74} ▶ The chasm between evidence and practice and policy and practice^{26 28 34 40 48 69 70 76–80 89–92} ▶ Fragmentation and gaps (eg, power imbalances between healthcare personnel, rural vs urban services, fragmentation between public and private hospitals)^{36 51 52 72 81 82 84 86}
Opportunities for improvement	What helps improve SPHS?	<ul style="list-style-type: none"> ▶ Workplace culture (eg, mentorship, leadership, support for health professionals)^{17 19 76 87 93 95 96} ▶ Organisational culture (eg, promoting collaborative attitudes, transparency, patient-centred care and political stability)^{24 58 65 69 70 74 86 100 103 105 106} ▶ Consumer and community involvement to align the system with needs (eg, patient reported measures, in research, focus groups and consumer panels)^{58 103 111 112} ▶ Implementing technological advances (eg, e-health)^{4 23 33 91 113}
Sustaining and scaling	What initiatives for have been used to improve and maintain to SPHS (or value)?	<ul style="list-style-type: none"> ▶ Setting up interventions for sustainability (eg, extended initial funding periods, ongoing evaluation feedback loops, using pragmatic trial designs)^{40 80 113 137} ▶ Support from all stakeholders^{56 57 89 103 118 120–122} ▶ Developing cross-sectoral, interdisciplinary relationships and collaborations^{36 47 48 58} ▶ Ability of intervention to adapt and flex depending on the context of implementation¹¹⁷

SPHS, sustainable performance of healthcare systems.

preventative care and broader public health prevention measures such as vaccination programmes, should be a focus for future research. Research on the specific effect of the COVID-19 pandemic on SPHS is warranted to inform future responses to similar broad-ranging global threats to SPHS.^{113 115} Understanding the scope of SPHS in LMICs is important for the future development of SPHS and future research is needed to summarise current knowledge, interventions, programmes and measures of SPHS in these settings.

CONCLUSION

There is broad agreement that the sustainability of healthcare systems and their performance levels are increasingly being challenged. Our review confirms that the concept of SPHS is important and is frequently discussed in the health and medical literature. The field of SPHS is expanding with recent publications defining SPHS in terms other than the traditional financial measures. This places more emphasis on acceptability of the system to patients, healthcare providers and other stakeholders,

adaptation and resilience, and sufficient nimbleness to absorb new evidence and innovations to support continuous improvements.

It is unlikely that we will, nor should we, settle on a single definition of SPHS. We would favour definitions that are robust but flexible to ensure their utility in the many and varied healthcare system contexts, however, authors and editors should strive to ensure that a definition is provided in any discussions of SPHS. We need sophisticated yet practical indicators of SPHS that capture sustainability beyond the traditional financial measures. Such measures have been proposed in the research literature, but their utility needs to be tested in real-world settings. The current literature suggests that SPHS is improved by strengthening workplace cultures, continuous workforce development, direct health consumer and community involvement, and swift adoption and embedding of new evidence and technologies that are proven to have an advantage over current practice.

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Acknowledgements We gratefully acknowledge Kelly Nguyen for administrative and logistical support.

Contributors JB conceptualised the study and led the team's work. EM, JHerkes, JHolt and YZ developed the search strategy. EM, JHerkes, JHolt, GL, GD and YZ conducted the abstract review, and JHerkes, GD, GL, IM and YZ full-text review and data extraction, with JB acting as arbitrator when needed. JHerkes, IM and GD conducted the quality assessment. YZ and JHerkes drafted the manuscript with input from GD and NKH, and all authors contributed their comments and approved of the final version of the manuscript. JB is the guarantor for this study.

Funding This work was supported by the NHMRC Partnership Centre for Health System Sustainability (Grant ID 9100002) and NHMRC Investigator Grant APP1176620.

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.

Patient consent for publication Not applicable.

Ethics approval This study does not involve human participants.

Provenance and peer review Not commissioned; externally peer reviewed.

Data availability statement All data relevant to the study are included in the article or uploaded as supplementary information.

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REFERENCES

- OECD. *Fiscal sustainability of health systems: bridging health and finance perspectives*. Paris, France: OECD Publishing, 2015.
- GBD 2015 DALYs and HALE Collaborators. Global, regional, and national disability-adjusted life-years (DALYs) for 315 diseases and injuries and healthy life expectancy (HALE), 1990-2015: a systematic analysis for the global burden of disease study 2015. *Lancet* 2016;388:1603-58.
- Amalberti R, Nicklin W, Braithwaite J. Preparing National health systems to cope with the impending tsunami of ageing and its associated complexities: towards more sustainable health care. *Int J Qual Health Care* 2016;28:412-4.
- Coiera E, Hovenga EJS. Building a sustainable health system. *Yearb Med Inform* 2007;11-18.
- Fisher ES, Bynum JP, Skinner JS. Slowing the growth of health care costs--lessons from regional variation. *N Engl J Med* 2009;360:849-52.
- Zhi M, Ding EL, Theisen-Toupal J, et al. The landscape of inappropriate laboratory testing: a 15-year meta-analysis. *PLoS One* 2013;8:e78962-e.
- Braithwaite J, Ludlow K, Testa L, et al. Built to last? the sustainability of healthcare system improvements, programmes and interventions: a systematic integrative review. *BMJ Open* 2020;10:e036453.
- Australian Institute of Health Innovation. Purpose, NHMRC Partnership Centre for Health System Sustainability, 2017. Available: <https://www.healthsystemsustainability.com.au/about-us-2/purpose-of-nhmrc-partnership-centres/>
- Piña IL, Cohen PD, Larson DB, et al. A framework for describing health care delivery organizations and systems. *Am J Public Health* 2015;105:670-9.
- Lennox L, Maher L, Reed J. Navigating the sustainability landscape: a systematic review of sustainability approaches in healthcare. *Implement Sci* 2018;13:27.
- Stirman SW, Kimberly J, Cook N, et al. The sustainability of new programs and innovations: a review of the empirical literature and recommendations for future research. *Implement Sci* 2012;7:17.
- Arksey H, O'Malley L, O'Malley LO. Scoping studies: towards a methodological framework. *Int J Soc Res Methodol* 2005;8:19-32.
- Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med* 2009;6:e1000097.
- Shamseer L, Moher D, Clarke M, et al. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015: elaboration and explanation. *BMJ* 2015;349:g7647.
- Hawker S, Payne S, Kerr C, et al. Appraising the evidence: reviewing disparate data systematically. *Qual Health Res* 2002;12:1284-99.
- Lorenc T, Pettigrew M, Whitehead M. Appendix 5: quality assessment for the systematic review of qualitative evidence. In: Research PH, ed. *Crime, fear of crime and mental health: synthesis of theory and systematic reviews of interventions and qualitative evidence*. 2.2. Southampton, United Kingdom: NIHR Journals Library, 2014.
- Braithwaite J, Herkes J, Ludlow K, et al. Association between organisational and workplace cultures, and patient outcomes: systematic review. *BMJ Open* 2017;7:e017708.
- Landis JR, Koch GG. The measurement of observer agreement for categorical data. *Biometrics* 1977;33:159-74.
- Stockdale SE, Zuchowski J, Rubenstein LV, et al. Fostering evidence-based quality improvement for patient-centered medical homes: initiating local quality councils to transform primary care. *Health Care Manage Rev* 2018;43:168-80.
- Lizarondo L, Turnbull C, Kroon T, et al. Allied health: integral to transforming health. *Aust Health Rev* 2016;40:194-204.
- Robertson J, Walkom EJ, Henry DA. Health systems and sustainability: doctors and consumers differ on threats and solutions. *PLoS One* 2011;6:e19222.
- Fox LA, Walsh KE, Schainker EG. The creation of a pediatric hospital medicine dashboard: performance assessment for improvement. *Hosp Pediatr* 2016;6:412-9.
- Pencheon D. Developing a sustainable health and care system: lessons for research and policy. *J Health Serv Res Policy* 2013;18:193-4.
- Inotai A, Petrova G, Vitezić D, et al. Benefits of investment into modern medicines in Central-Eastern European countries. *Expert Rev Pharm Out* 2014;14:71-9.
- Sepehri A. Does autonomization of public hospitals and exposure to market pressure complement or debilitate social health insurance systems? Evidence from a low-income country. *Int J Health Serv* 2014;44:73-92.
- Zhao Y, Russell DJ, Guthridge S, et al. Long-Term trends in supply and sustainability of the health workforce in remote Aboriginal communities in the Northern Territory of Australia. *BMC Health Serv Res* 2017;17:836.
- Sonnenreich P, Geisler L. Covering the cost of the cure: from hepatitis C to cancer, new therapies are straining a system plagued by inefficiency. *P T* 2016;41:565-89.
- Stuart B, D'Onofrio CN, Boatman S, et al. Choices: promoting early access to end-of-life care through home-based transition management. *J Palliat Med* 2003;6:671-83.
- Rees GH. Organisational readiness and lean thinking implementation: findings from three emergency department case studies in New Zealand. *Health Serv Manage Res* 2014;27:1-9.
- Ammentorp J, Bigi S, Silverman J, et al. Upscaling communication skills training - lessons learned from international initiatives. *Patient Educ Couns* 2021;104:352-9.
- Braithwaite J, Marks D, Taylor N. Harnessing implementation science to improve care quality and patient safety: a systematic review of targeted literature. *Int J Qual Health Care* 2014;26:321-9.
- Shigayeva A, Coker RJ. Communicable disease control programmes and health systems: an analytical approach to sustainability. *Health Policy Plan* 2015;30:368-85.

- 33 Fineberg HV. Shattuck Lecture. A successful and sustainable health system--how to get there from here. *N Engl J Med* 2012;366:1020-7.
- 34 Sepelri A, Chernomas R. Is the Canadian health care system fiscally sustainable? *Int J Health Serv* 2004;34:229-43.
- 35 Kerr R, Hendrie DV. Is capital investment in Australian hospitals effectively funding patient access to efficient public hospital care? *Aust Health Rev* 2018;42:501.
- 36 Buykx P, Humphreys JS, Tham R, et al. How do small rural primary health care services sustain themselves in a constantly changing health system environment? *BMC Health Serv Res* 2012;12:81.
- 37 Cashin A. The challenge of nurse innovation in the Australian context of universal health care. *Collegian* 2015;22:319-24.
- 38 Buttigieg SC. Innovation strategies and health system guiding principles to address equity and sustainability in responsible innovation in health; comment on "What Health System Challenges Should Responsible Innovation in Health Address? Insights From an International Scoping Review". *Int J Health Policy Manag* 2019;8:570-2.
- 39 Chambers DA, Glasgow RE, Stange KC. The dynamic sustainability framework: addressing the paradox of sustainment amid ongoing change. *Implement Sci* 2013;8:117.
- 40 Scheirer MA. Is sustainability possible? A review and commentary on empirical studies of program sustainability. *Am J Eval* 2005;26:320-47.
- 41 Gruen RL, Elliott JH, Nolan ML, et al. Sustainability science: an integrated approach for health-programme planning. *Lancet* 2008;372:1579-89.
- 42 Embi PJ, Richesson R, Tenenbaum J, et al. Reimagining the research-practice relationship: policy recommendations for informatics-enabled evidence-generation across the US health system. *JAMIA Open* 2019;2:2-9.
- 43 Enticott J, Braaf S, Johnson A, et al. Leaders' perspectives on learning health systems: a qualitative study. *BMC Health Serv Res* 2020;20:1087.
- 44 Clancy C. Creating world-class care and service for our Nation's finest: How Veterans Health Administration Diffusion of Excellence Initiative is innovating and transforming Veterans Affairs health care. *Permanente Journal* 2019;23.
- 45 Kilbourne AM, Braganza MZ, Bowersox NW. Research lifecycle to increase the substantial real-world impact of research: accelerating innovations to application. *Med Care* 2019;57 Suppl:S206-12.
- 46 Smith M, Saunders R, et al, Committee on the Learning Health Care System in A, Institute of M. *Best care at lower cost: the path to continuously learning health care in America*. Washington (DC): National Academies Press (US), 2013.
- 47 Kepros JP, Opreanu RC. A new model for health care delivery. *BMC Health Serv Res* 2009;9:57.
- 48 Dhalla I. Canada's health care system and the sustainability paradox. *Can Med Assoc J* 2007;177:51-3.
- 49 Garde S, Hullin CM, Chen R, et al. Towards sustainability of health information systems: how can we define, measure and achieve it? *Stud Health Technol Inform* 2007;129:1179-83.
- 50 Solon O, Woo K, Quimbo SA, et al. A novel method for measuring health care system performance: experience from QIDS in the Philippines. *Health Policy Plan* 2009;24:167-74.
- 51 Molfenter T, Gustafson D, Kilo C, et al. Prospective evaluation of a Bayesian model to predict organizational change. *Health Care Manage Rev* 2005;30:270-9.
- 52 Birch S, Murphy GT, MacKenzie A, et al. In place of fear: aligning health care planning with system objectives to achieve financial sustainability. *J Health Serv Res Policy* 2015;20:109-14.
- 53 Pacifico Silva H, Lehoux P, Miller FA, et al. Introducing responsible innovation in health: a policy-oriented framework. *Health Res Policy Syst* 2018;16:90.
- 54 Lo Sardo DR, Thurner S, Sorger J, et al. Quantification of the resilience of primary care networks by stress testing the health care system. *Proc Natl Acad Sci U S A* 2019;116:23930-5.
- 55 Shen H, Sui Y, Fu Y. Using social choice theory and acceptability analysis to measure the value of health systems. *PLoS One* 2020;15:e0235531.
- 56 Crisp N. What would a sustainable health and care system look like? *BMJ* 2017;358:j3895.
- 57 Shaw J, Wong I, Griffin B, et al. Principles for health system capacity planning: insights for healthcare leaders. *Healthc Q* 2017;19:17-22.
- 58 Scott IA. Is modern medicine at risk of losing the plot? *Med J Aust* 2006;185:213-6.
- 59 Robertson TM, Lofgren RP. Where population health misses the mark: breaking the 80/20 rule. *Acad Med* 2015;90:277-8.
- 60 Pisco L, Pinto LF. From Alma-Ata to Astana: the path of primary health care in Portugal, 1978-2018 and the genesis of family medicine. *Cien Saude Colet* 2020;25:1197-204.
- 61 Jessup RL, O'Connor DA, Putrik P, et al. Alternative service models for delivery of healthcare services in high-income countries: a scoping review of systematic reviews. *BMJ Open* 2019;9:e024385.
- 62 Rudnicka E, Napierała P, Podfigurna A, et al. The World Health Organization (WHO) approach to healthy ageing. *Maturitas* 2020;139:6-11.
- 63 Quaglio G, Figueras J, Mantoan D, et al. An overview of future EU health systems. An insight into governance, primary care, data collection and citizens' participation. *J Public Health* 2018;40:891-8.
- 64 Pereno A, Eriksson D. A multi-stakeholder perspective on sustainable healthcare: from 2030 onwards. *Futures* 2020;122:102605.
- 65 Knutson DJ. The role of strategic alliances in ensuring health care quality: a health care system perspective. *Clin Ther* 1997;19:1572-8.
- 66 Delgado P. Meeting the challenge of chronic conditions in a sustainable manner: building on the AHC learning. *Healthc Pap* 2016;15 Spec No:90-5.
- 67 Costa-Font J, Levaggi R. Innovation, aging, and health care: Unraveling "silver" from "red" herrings? *Health Econ* 2020;29 Suppl 1:3-7.
- 68 Veillard J, Denny K. Transformation through clinical and social integration: meeting the needs of high users of healthcare. *Healthc Pap* 2014;14:4-7.
- 69 Stoelwinder JU. Final report of the National Health and Hospitals Reform Commission: will we get the health care governance reform we need? *Med J Aust* 2009;191:387-8.
- 70 Stoelwinder JU, Paolucci F. Sustaining Medicare through consumer choice of health funds: lessons from the Netherlands. *Med J Aust* 2009;191:30-2.
- 71 Magnan S, Fisher E, Kindig D, et al. Achieving accountability for health and health care. *Minn Med* 2012;95:37-9.
- 72 Armstrong BK, Gillespie JA, Leeder SR, et al. Challenges in health and health care for Australia. *Med J Aust* 2007;187:485-9.
- 73 Ganann R, Peacock S, Garnett A, et al. Capacity development among academic trainees in community-based primary health care research: the aging, community and health research unit experience. *Prim Health Care Res Dev* 2019;20:e139.
- 74 Al Dhawi AA, West DJ, Spinelli RJ, et al. The challenge of sustaining health care in Oman. *Health Care Manag* 2007;26:19-30.
- 75 Thistlethwaite JE, Dunston R, Yassine T. The times are changing: workforce planning, new health-care models and the need for interprofessional education in Australia. *J Interprof Care* 2019;33:361-8.
- 76 Dunn PM, Arnetz BB, Christensen JF, et al. Meeting the imperative to improve physician well-being: assessment of an innovative program. *J Gen Intern Med* 2007;22:1544-52.
- 77 Woodward GL, Iverson A, Harvey R, et al. Implementation of an agency to improve chronic kidney disease care in Ontario: lessons learned by the Ontario renal network. *Healthc Q* 2015;17 Spec No:44-7.
- 78 Mackenzie J. The old care paradigm is dead, long live the new sustainable care paradigm: how can GP commissioning consortia meet the demand challenges of 21st century healthcare? *London J Prim Care* 2011;4:65-9.
- 79 Pencheon D. Making health care more sustainable: the case of the English NHS. *Public Health* 2015;129:1335-43.
- 80 Lewis S. Can a learning-disabled nation learn healthcare lessons from abroad? *Healthc Policy* 2007;3:19-28.
- 81 Edwards N, Rowan M, Marck P, et al. Understanding whole systems change in health care: the case of nurse practitioners in Canada. *Policy Polit Nurs Pract* 2011;12:4-17.
- 82 Lozano I, Rondán J, Vegas JM, et al. Sustainability of the health system: beyond cost-effectiveness analyses. *Rev Esp Cardiol* 2016;69:880-1.
- 83 Vainieri M, Noto G, Ferre F, et al. A performance management system in healthcare for all seasons? *Int J Environ Res Public Health* 2020;17. doi:10.3390/ijerph17155590. [Epub ahead of print: 03 08 2020].
- 84 Farmanova E, Kirvan C, Verma J, et al. Triple aim in Canada: developing capacity to lead to better health, care and cost. *Int J Qual Health Care* 2016;28:830-7.
- 85 Iskrov G, Stefanov R, Ferrelli RM. Health systems for rare diseases: financial sustainability. *Ann Ist Super Sanita* 2019;55:270-5.
- 86 Buttigieg SC, Schuetz M, Bezzina F. Value chains of public and private health-care services in a small EU island state: a SWOT analysis. *Front Public Health* 2016;4:201.

- 87 Atmore C. The role of medical generalism in the New Zealand health system into the future. *N Z Med J* 2015;128:50–5.
- 88 Barbazza E, Kringos D, Kruse I, *et al.* Creating performance intelligence for primary health care strengthening in Europe. *BMC Health Serv Res* 2019;19:1006.
- 89 Thompson RE. Sustainability as the lynch pin of public policy and industry initiatives. *Physician Exec* 1998;24:52–5.
- 90 Buchan JM, Naccarella L, Brooks PM. Is health workforce sustainability in Australia and New Zealand a realistic policy goal? *Aust Health Rev* 2011;35:152–5.
- 91 McGorry PD, Hamilton MP. Stepwise expansion of evidence-based care is needed for mental health reform. *Med J Aust* 2016;204:351–3.
- 92 Ehrlich C, Kendall E. Integrating collaborative place-based health promotion coalitions into existing health system structures: the experience from one Australian health coalition. *Int J Integr Care* 2015;15:e047.
- 93 Levine S, O'Mahony S, Baron A, *et al.* Training the workforce: description of a longitudinal interdisciplinary education and mentoring program in palliative care. *J Pain Symptom Manage* 2017;53:728–37.
- 94 Lega F, Prenestini A, Spurgeon P. Is management essential to improving the performance and sustainability of health care systems and organizations? A systematic review and a roadmap for future studies. *Value in Health* 2013;16:S46–51.
- 95 Wakerman J, Humphreys JS. Sustainable workforce and sustainable health systems for rural and remote Australia. *Med J Aust* 2013;199:S14–17.
- 96 Wakerman J, Humphreys JS. Sustainable primary health care services in rural and remote areas: innovation and evidence. *Aust J Rural Health* 2011;19:118–24.
- 97 Lehoux P, Roncarolo F, Silva HP, *et al.* What health system challenges should responsible innovation in health address? Insights from an international scoping review. *Int J Health Policy Manag* 2019;8:63–75.
- 98 Marcotte LM, Moriates C, Wolfson DB, *et al.* Professionalism as the bedrock of high-value care. *Acad Med* 2020;95:864–7.
- 99 Braithwaite J, Vincent C, Nicklin W, *et al.* Coping with more people with more illness. Part 2: new generation of standards for enabling healthcare system transformation and sustainability. *Int J Qual Health Care* 2019;31:159–63.
- 100 Tsisis P. Chronic disease management and the home-care alternative in Ontario, Canada. *Health Serv Manage Res* 2009;22:136–9.
- 101 Niraula S. Strategizing health technology assessment for containment of cancer drug costs in a universal health care system: case of the pan-Canadian oncology drug review. *Cancer* 2019;125:3100–3.
- 102 Bentley C, Peacock S, Abelson J, *et al.* Addressing the affordability of cancer drugs: using deliberative public engagement to inform health policy. *Health Res Policy Syst* 2019;17:17:17.
- 103 Rosser M. Advancing health system integration through supply chain improvement. *Hcq* 2006;9:4:62–6.
- 104 Derakhshani N, Doshmangir L, Ahmadi A, *et al.* Monitoring process barriers and enablers towards universal health coverage within the sustainable development goals: a systematic review and content analysis. *Clinicoecon Outcomes Res* 2020;12:459–72.
- 105 Guyon Ak'ingabe, Hancock T, Kirk M, *et al.* The weakening of public health: a threat to population health and health care system sustainability. *Can J Public Health* 2017;108:e1–6.
- 106 Bessler JS, Ellies M. Values and value-a vision for the Australian health care system. *Aust Health Rev* 1995;18:6–17.
- 107 Ferrelli RM, Fantini B, Taruscio D. Health systems sustainability for rare diseases. Preface. *Ann Ist Super Sanita* 2019;55:249–50.
- 108 Walsh K. Strengthening primary care: the role of e-learning. *Educ Prim Care* 2019;30:267–9.
- 109 Bogaert P, van Oers H, Van Oyen H, *et al.* Towards a sustainable EU health information system infrastructure: a consensus driven approach. *Health Policy* 2018;122:1340–7.
- 110 Fridell M, Edwin S, von Schreeb J, *et al.* Health system resilience: what are we talking about? A scoping review mapping characteristics and keywords. *Int J Health Policy Manag* 2020;9:6–16.
- 111 Casale CR, Clancy CM. Commentary: not about us without us. *Academic Medicine* 2009;84:1333–5.
- 112 Nagle L, Pitts B. Citizen perspectives on the future of healthcare. *Healthc Q* 2012;15:40–5.
- 113 Schwann NM, Bretz KA, Eid S, *et al.* Point-of-care electronic prompts: an effective means of increasing compliance, demonstrating quality, and improving outcome. *Anesth Analg* 2011;113:869–76.
- 114 Wurcel V, Cicchetti A, Garrison L, *et al.* The value of diagnostic information in personalised healthcare: a comprehensive concept to facilitate bringing this technology into healthcare systems. *Public Health Genomics* 2019;22:8–15.
- 115 Huynh AK, Hamilton AB, Farmer MM, *et al.* A pragmatic approach to guide implementation evaluation research: strategy mapping for complex interventions. *Front Public Health* 2018;6.
- 116 Kilbourne AM, Braganza MZ, Bowersox NW, *et al.* Research lifecycle to increase the substantial real-world impact of research: accelerating innovations to application. *Med Care* 2019;57 Suppl 10 Suppl 3:S206–12.
- 117 Greenhalgh T, Macfarlane F, Barton-Sweeney C, *et al.* "If we build it, will it stay?" A case study of the sustainability of whole-system change in London. *Milbank Q* 2012;90:516–47.
- 118 McVeigh J, MacLachlan M, Gilmore B, *et al.* Promoting good policy for leadership and governance of health related rehabilitation: a realist synthesis. *Global Health* 2016;12:49.
- 119 De Santis M. Integrated care for healthcare sustainability for patients living with rare diseases. *Ann Ist Super Sanita* 2019;55:276–82.
- 120 McIntosh E, Nagelkerk J, Vonderheid SC, *et al.* Financially viable nurse-managed centers. *Nurse Pract* 2003;28:40–51.
- 121 Wutzke S, Benton M, Verma R. Towards the implementation of large scale innovations in complex health care systems: views of managers and frontline personnel. *BMC Res Notes* 2016;9:327.
- 122 Burgess LH, Cohen MR, Denham CR. A new leadership role for pharmacists: a prescription for change. *J Patient Saf* 2010;6:31–7.
- 123 Hanney S, Kanya L, Pokhrel S. *WHO Health Evidence Network Synthesis Reports. What is the evidence on policies, interventions and tools for establishing and/or strengthening National health research systems and their effectiveness?* Copenhagen: WHO Regional Office for Europe, 2020.
- 124 Braithwaite J, Glasziou P, Westbrook J. The three numbers you need to know about healthcare: the 60-30-10 challenge. *BMC Med* 2020;18.
- 125 Braithwaite J, Churrua K, Long JC, *et al.* When complexity science meets implementation science: a theoretical and empirical analysis of systems change. *BMC Med* 2018;16:63.
- 126 Bramesfeld A, Amaddeo F, Caldas-de-Almeida JosÁ©, *et al.* Monitoring mental healthcare on a system level: country profiles and status from EU countries. *Health Policy* 2016;120:706–17.
- 127 Braithwaite J, Zurynski Y, Ludlow K, *et al.* Towards sustainable healthcare system performance in the 21st century in high-income countries: a protocol for a systematic review of the grey literature. *BMJ Open* 2019;9:e025892.
- 128 Abimbola S, Baatiema L, Bigdeli M. The impacts of decentralization on health system equity, efficiency and resilience: a realist synthesis of the evidence. *Health Policy Plan* 2019;34:605–17.
- 129 Buchan J. What difference does ("good") HRM make? *Hum Resour Health* 2004;2:6.
- 130 Hovenga EJS. Impact of data governance on a nation's healthcare system building blocks. *Stud Health Technol Inform* 2013;193:24–66.
- 131 Editorial. *Healthc Q* 2020;22:1–2.
- 132 Craig N, Robinson M. Towards a preventative approach to improving health and reducing health inequalities: a view from Scotland. *Public Health* 2019;169:195–200.
- 133 Rosenberg-Yunger ZRS, Daar AS, Singer PA, *et al.* Healthcare sustainability and the challenges of innovation to biopharmaceuticals in Canada. *Health Policy* 2008;87:359–68.
- 134 Barasa EW, Cloete K, Gilson L. From bouncing back, to nurturing emergence: reframing the concept of resilience in health systems strengthening. *Health Policy Plan* 2017;32:iii91–4.
- 135 Lehoux P, Williams-Jones B, Miller F, *et al.* What leads to better health care innovation? arguments for an integrated policy-oriented research agenda. *J Health Serv Res Policy* 2008;13:251–4.
- 136 Cunningham FC, Ranmuthugala G, Westbrook JI, *et al.* Tackling the wicked problem of health networks: the design of an evaluation framework. *BMJ Open* 2019;9:e024231.
- 137 Tricco AC, Ashoor HM, Cardoso R, *et al.* Sustainability of knowledge translation interventions in healthcare decision-making: a scoping review. *Implementation Sci* 2015;11:55.