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Innovative models of healthcare delivery: an umbrella review of reviews

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ABSTRACT

Objective To undertake a synthesis of evidence-based research for seven innovative models of care to inform the development of new hospitals.

Design Umbrella review.

Setting Interventions delivered inside and outside of acute care settings.

Participants Children and adults with one or more identified acute or chronic health conditions.

Data sources PsycINFO, Ovid MEDLINE and CINAHL.

Primary and secondary outcome measures Clinical indicators and mortality, healthcare utilisation, quality of life, self-management and self-care and patient knowledge.

Results A total of 66 reviews were included, synthesising evidence from 1272 primary studies across the 7 models of care. Virtual care was the most common model studied, addressed by 47 (73%) of the reviews. Common outcomes evaluated across reviews were clinical indicators and mortality, healthcare utilisation, self-care and self-management, patient knowledge, quality of life and cost-effectiveness. The findings indicate that the innovative models of healthcare we identified in this review may be effective in managing patients with a range of acute and chronic conditions. Most of the included reviews reported evidence of comparable or improved care.

Conclusions A consideration of local infrastructure and individual patient characteristics, such as health literacy, may be critical in determining the suitability of models of care for patients and their implementation in local health systems.

Trial registration number 10.17605/OSF.IO/PS6ZU.

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This review presents a broad array of evidence for the implementation of seven innovative models of care in managing several acute and chronic health conditions.
⇒ The search string and strategy was developed in consultation with a local health district and a research librarian to reflect current high prevalence conditions typically found in developed countries.
⇒ We assessed evidence of blended or hybrid model delivery, as well as model to model comparisons.
⇒ Evidence for the digital hospital model of care was limited due to the focus on review articles. As a result, cutting-edge developments that have currently evaded systematic review may not have been adequately captured.
⇒ Umbrella reviews present an overview of evidence, but do not permit in-depth discussion of primary studies. Individual systematic reviews may provide more detail on the outcomes of specific interventions within models of care.

INTRODUCTION

The increasing demands of ageing populations and burgeoning rates of chronic illness have necessitated substantial changes in the delivery of acute care.[1 2] In response to these growing demands and challenges, hospitals and governments internationally have adopted innovative approaches to care delivery. These include prioritising consumer engagement,[1] adopting cost-effective care alternatives that are positioned outside of conventional hospital settings,[3] and making investments in digitised care services.[4] For example, some hospitals have integrated emerging technologies (eg, artificial intelligence, robotics, big data analytics) into hospital workflows to provide more streamlined care to consumers.[5–7] The COVID-19 pandemic accelerated the rollout of many of these innovative ways of delivering healthcare, termed models of care, including the adoption of telehealth and other virtual care methods.[8–10] However, while these methods show promise, innovations in healthcare delivery have been adopted in an ad-hoc

manner, without adequately addressing the potential for larger-scale, systematic changes in the care delivery.[11–13]

Models of care describe alternative methods of healthcare delivery that differ in setting, type of care, provider, population or the patient experience.[14] Applied models of care are often captured under broader categories of delivery, such as integrated care, outpatient care and telehealth. This review builds on the findings from a rapid review of grey literature that identified seven innovative models of care: consumer-focused care; ambulatory care and diagnostic hospitals; digital hospitals; hospital in the home (HITH); integrated care; virtual care; and specialist hospitals and population-specific care units.[15] See online supplemental file for definitions of models.

AIMS

The aim of this review is to evaluate the evidence-base regarding the efficacy of seven innovative models of care compared with usual care, in treating identified priority acute and chronic conditions. Results can inform the adoption of models for treating these conditions internationally.

METHODS

The protocol for this umbrella review is registered on the Centre for Open Science protocol register (OSF; registration number 10.17605/OSF.IO/PS6ZU); methodology was developed in accordance with the Joanna Briggs Institute Methodology for JBI Umbrella Reviews.[16] We used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[17]

Patient and public involvement

There was no direct involvement of patients or members of the public in designing or conducting this review.

Inclusion criteria

We included systematic reviews, meta-analyses, scoping reviews, integrated reviews and meta-ethnographies in the peer-reviewed literature that evaluated outcomes of innovative models of care compared with usual care in treating a number of acute and chronic conditions. Priority conditions were selected based on selected high impact conditions with consideration of a balance between chronic and acute conditions, covering various body systems. The publication date range was limited to 5 years to capture the most recent evidence. See table 1 for inclusion criteria.

Table 1 Academic literature search strategy

	Inclusion criteria
Publication date	2016–2022
Language	English
Document type	Peer-reviewed reviews
Population	Humans
Model of care	Describes one of the following seven innovative models of care: consumer-focused care; ambulatory care and diagnostic hospitals; digital hospitals; hospital in the home; integrated care; telehealth and virtual care; specialised hospitals and population-specific hospital care units
Priority condition	Describes one of the priority acute or chronic conditions/services: Acute: cardiac arrest, chest pain, myocardial infarction, fractures, knee replacement, hip replacement, joint replacement, abdominal pain, pelvic pain, gastrointestinal pain, pneumonia, postnatal depression Chronic: congestive heart failure, dialysis, kidney disease, end-stage kidney disease, abnormal gait, bone disease, osteoporosis, asthma, chronic obstructive pulmonary disease

Data sources and search strategy

The search was designed in consultation with a research librarian and conducted across three databases: PsycINFO, Ovid MEDLINE and CINAHL. Online supplemental table 1 presents the search string for CINAHL used in the academic search.

The screening of the reviews was undertaken in two steps: title/abstract screen and full-text screen. At both stages, all articles were independently screened by blinded pairs of reviewers on Rayyan (https://www.rayyan.ai/), a web-based collaborative tool. A total of 16 reviewers were paired and each pair allocated 926 articles at the title/abstract stage (7412/8 pairs). One pair was assisted by a third reviewer as one reviewer was unable to complete the screening. Three reviewers independently conducted an interrater reliability assessment on 5% of the articles during full-text screening (κ=1, 95% CI 0.97 to 1.00, p<0.001). Prior to screening, a selection of 20 articles were pilot screened by all 17 reviewers for calibration purposes. The search was updated in January 2022 to identify suitable articles published within the 6 months following the initial search. See figure 1 for PRISMA flow diagram of initial and updated searches.

Critical appraisal

The risk of bias and quality of methodological results for the included reviews were evaluated using the Joanna Briggs Institute Critical Appraisal Checklist for Systematic Reviews.[18] This process was conducted in pairs and discrepancies were discussed to reduce the risk of interobserver bias.[18] See online supplemental table 2 for ratings of included reviews. Although several studies were marked N or NA, they were still considered to meet the criteria the team had set, so all articles were included in the synthesis.

Data collection and extraction

Data was extracted using a purpose-built Microsoft Excel data extraction sheet developed for the study and piloted before use. Reviews that did not meet criteria were

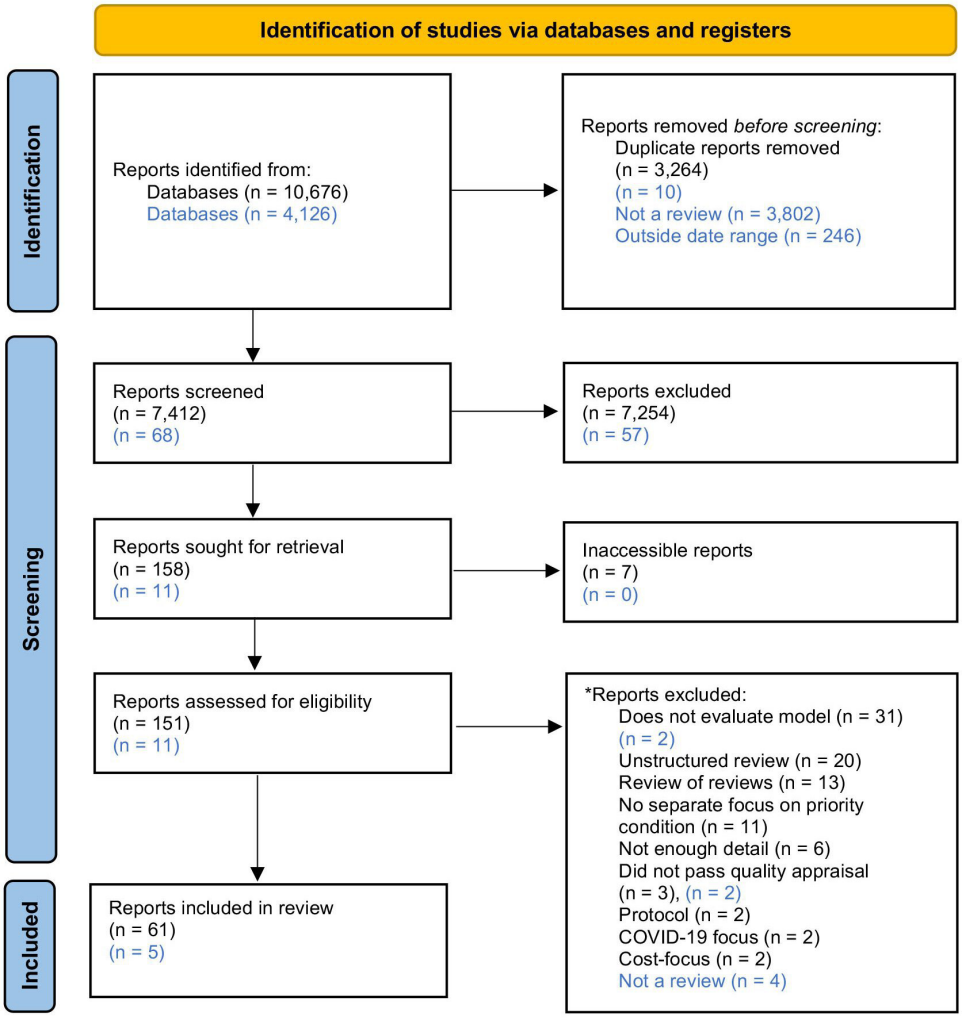

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram for initial and updated search. Black text: original search; blue text: updated search. *Some reports were excluded for multiple reasons.

excluded at the full-text review stage. Data were extracted during the full-text review stage and included details on the model of care, setting, providers, consumers, conditions/service specificities, broader applicability to other conditions and outcome measures (ie, clinical indicators, mortality, quality of life). Models of care were coded to capture blended models or comparisons between models within reviews. During extraction, separate spreadsheets were created to evaluate the evidence for each model.

RESULTS

Following the initial and updated screening, a total of 66 reviews published between 2016 and 2021 met the inclusion criteria. Sixty-one reviews were identified during the initial search, and a further five reviews identified during an updated search. Of these, most reviews were published in 2018 (n=17, 59%), followed by 2016 (n=13, 20%), 2017 (n=11, 17%), 2020 (n=8, 12%) and 2019 (n=6, 9%). Overall, 6 articles from the initial search and a further 5 articles from the updated search were published in 2021 (n=11). Overall, 54 reviews (82%) discussed a single model of care and 12 reviews (18%) evaluated multiple models of care (ie, comparing or blending models).

Overlap of evidence

A total of 1272 primary studies were captured within the 66 reviews. Of these, 523 studies were included in multiple reviews, representing a 41% overlap of primary evidence. The overlap was most frequently found for reviews that assessed evidence for singular conditions. For example, chronic kidney disease (CKD),[19–21] heart failure[22 23] and chronic obstructive pulmonary disease (COPD).[24–27]

Population

The included reviews assessed evidence for care across a diverse age range. Participants ranged between 6 and 93 years of age, varying by condition. For example, younger participants (<18) were more frequently represented within asthma reviews, while older participants (>65) were most frequently captured within fracture and COPD reviews.

Table 2 Definitions of included models of care

Model of care	Definition	Example
Consumer-focused care	During planning, delivery and evaluation, consumers, carers and families are placed at the centre of care.[84 85]	Individualised self-management support in early chronic kidney disease transition of the care plan.
Ambulatory care and diagnostic hospitals	Outpatient or non-admitted services, where patient care does not involve an overnight stay and usually involves diagnosis and treatment on the same day.[86]	Outpatient renal dialysis.
Hospital in the home	Patient care and consultation that are typically delivered in the hospital settings are delivered to patients in their own home.[87 88]	Early discharge hospital at home care for chronic obstructive airways disease managed by a community service.
Integrated care	Multidimensional needs of the patient are delivered in a coordinated manner by an interdisciplinary team or network of healthcare professionals.[89 90]	Orthogeriatric fracture service.
Virtual care	Patient care and consultation are delivered through telephone or video communication.[91]	Telehealth management in patients with heart failure.
Specialist hospitals and population-specific care units	Specialist hospitals provide selective care services for targeted patient groups. Population-specific care units are pathways within general hospitals dedicated to the treatment of specific conditions.[92 93]	Comprehensive cancer centres.

Models of care

The included reviews covered evidence for virtual care (n=47, 71%), integrated care (n=11, 17%), HITH (n=10, 15%), ambulatory care and diagnostic hospitals (n=10, 15%), specialist hospitals and population-specific care units (n=6, 9%) and consumer-focused care (n=3, 5%). No reviews were retained that evaluated the digital hospital model; evidence for this model was solely found in primary studies and thus excluded. See table 2 for definitions of models of care and figure 2 for the relationships among models across reviews.

Conditions and outcomes

The reviews presented evidence for the outcomes of models of care in treating and managing several health conditions. See table 3 for a summary of included conditions and outcomes. Additional details are presented descriptively for the top 4 outcomes, which were reported in 64 out of 66 (96.7%) reviews. See online supplemental table 3 for a summary of outcomes across models of care, and online supplemental table 4 for descriptions of included studies.

Clinical indicators and mortality

Virtual care

A total of 31 (47%) reviews assessed the impact of virtual care interventions on clinical indicators and mortality.[22 23 25–53] Of these, four reviews reported positive effects of virtual care on clinical indicators[47] and mortality[38 42 47 52] for patients with chronic heart failure. Two reviews presented mixed evidence on mortality[29] and clinical indicators,[29 32] while four reviews found no significant effect of virtual care interventions on clinical indicators[49] or mortality[23 30 32] for heart failure patients.

The effects of virtual care on clinical indicators and mortality among asthma patients were explored in seven reviews.[31 34 36 37 40 44 51] Of these, four reviews found mixed evidence for the impact of interactive digital interventions and remote check-ups on clinical indicators[31 36 51] and exacerbations.[44] Three reviews found no significant effect of interventions on asthma exacerbations.[34 37 40]

Four reviews evaluated the evidence for virtual care on clinical indicators and mortality for COPD.[25–28] One review found mixed evidence for the effect of mobile health applications on lung function,[26] while three reviews found no significant effect of telemonitoring-based interventions on mortality[25 27] and exercise capacity.[28]

The effects of eHealth and Information Technology (IT)-based interventions on proximal clinical indicators for CKD were assessed in two reviews.[35 46] Mixed evidence was found for the effects of interventions on clinical indicators, including blood pressure.[35 46] Similarly, mixed effects were found for the effect of tele-based interventions on myocardial infarction outcomes, with one review finding significant reductions in mortality,[39] and one review indicating no effect of intervention on cardiovascular disease-related mortality outcomes,[50] when compared with usual care.

Evidence for virtual interventions on multiple chronic conditions was evaluated in four reviews.[41 43 45 48] Two reviews found no significant effect of virtual care, including telerehabilitation, on functional outcomes,[48] mortality or adverse events such as COPD exacerbations.[43] However, two reviews found positive effects of clinical pharmacist telemedicine interventions[41] and virtual education[45] on pulmonary function and inhaler use,[45] and chronic disease management.[41]

Two reviews found a significant improvement in postpartum depression[33 53] and anxiety[53] scores among women who received telemedicine interventions, when

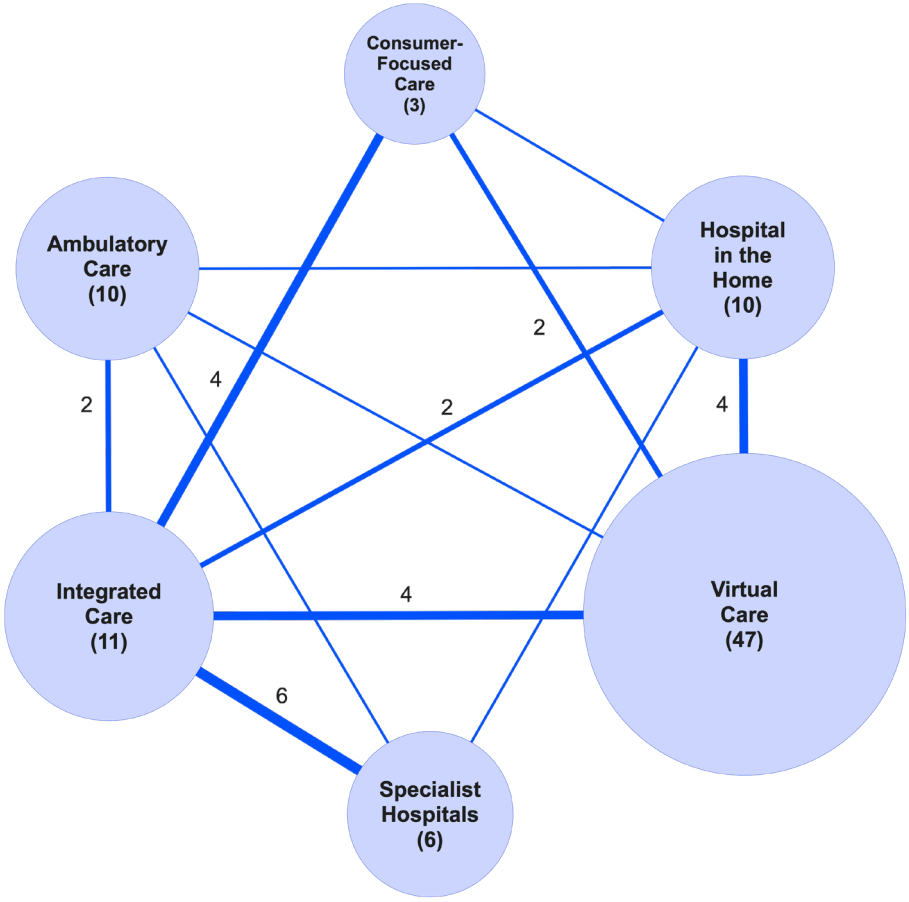

Figure 2 Relationships among models across reviews.

compared with usual care. This effect was most significant for telephone-based interventions.[33]

Ambulatory care and diagnostic hospitals

A total of 10 reviews (15%) investigated the effects of ambulatory care interventions on clinical indicators and mortality,[50 54–62] with 3 reviews demonstrating positive effects. One review found that total ankle arthroplasty patients reported five times fewer complications when performed in ambulatory settings in contrast with usual care.[54] Outpatient total hip arthroplasty (THA) was similarly associated with improvements in pain and functional outcomes.[59] Among patients with myocardial infarction, significant reductions in cardiovascular and all-cause mortality were recorded among patients receiving centre-based cardiac rehabilitation, when compared with usual care.[50]

Mixed-effects of ambulatory interventions on mortality and functional status were reported in two reviews.[57 58] For example, ambulatory management of chronic heart failure,[57] and nocturnal haemodialysis,[58] produced mixed effects on mortality. However, improved mortality rates were found among patients receiving haemodialysis in satellite clinics and community houses.[58] In addition, five reviews reported non-significant effects of ambulatory care on functional outcomes, when compared with usual care.[55 56 60–62]

Hospital in the home

The impact of HITH interventions on clinical indicators such as blood pressure, functional capacity and exercise duration was assessed in 8 reviews (12%).[23 27 49 50 58 63–65] Of these, seven reviews found no significant effect of HITH interventions on mortality, and one review found significant reductions in mortality among heart failure patients receiving nurse home visits, when compared with usual care.[23]

Integrated care

Eight reviews assessed the impact of integrated care interventions on clinical indicators and mortality.[21 23 25 62 66–69] Four reviews recorded positive effects of integrated care interventions on physical[62 68] and mental health outcomes,[68] mobility[66] and osteoporosis treatment[69] for hip fracture patients. Similarly, improvements in blood pressure,[21] heart rate and oxygen saturation[25] were reported for patients with CKD[21] and COPD[25]. No effects on mortality were found for patients with CKD[21] and COPD.[25] One review found mixed evidence for reductions in mortality among hip fracture patients.[62] One review found no effect

Table 3 Number of reviews assessing conditions and outcomes

	Type	Reviews, n, (%)
Condition	Heart failure	34 (52%)
	Chronic obstructive pulmonary disease	20 (30%)
	Asthma	13 (20%)
	Chronic kidney disease	13 (20%)
	Joint replacement	8 (12%)
	Fractures	7 (11%)
	Myocardial infarction	2 (3%)
	Postnatal depression	2 (3%)
	Chest pain	1 (2%)
Outcome	Clinical indicators and mortality	32 (48%)
	Healthcare utilisation	30 (45%)
	Quality of life	25 (38%)
	Self-management and self-care	21 (32%)
	Patient knowledge	8 (12%)
	Cost-effectiveness	7 (11%)
	Patient satisfaction	2 (3%)
	Feelings of belonging	1 (2%)
	User experience	1 (2%)
	Social support	1 (2%)
	Loneliness	1 (2%)
	Self-efficacy	1 (2%)
	Staff perspectives	1 (2%)

of multidisciplinary care on mortality among heart failure patients,[67] while another review found that nurse home visits and nurse case management significantly decreased all-cause mortality for heart failure patients.[23]

Specialist hospitals

The effect of specialist hospital care on clinical indicators and mortality were assessed in four reviews.[19 20 23 70] Of the three reviews that evaluated a blended integrated-specialist model for the treatment of CKD, two reviews found that multidisciplinary specialist care was associated with improved estimated glomerular filtration rate and reductions in mortality.[19 20] One review found that nurse-coordinated care produced improvements in blood pressure, markers of kidney function and reduced the risk of ischaemic stroke and cardiovascular death.[70] One review found significant decreases in all-cause mortality for heart failure patients receiving nurse case management.[23]

Consumer-focused care

One review assessed the impact of consumer-focused care on clinical indicators among patients with CKD, including mortality, blood pressure control and risk of kidney transplant.[21] Mixed evidence was reported for the effect of interventions on all-cause or cardiovascular mortality, when compared with usual care.[21] No significant difference in CKD outcomes or blood pressure control were observed between intervention patients and those receiving usual care.[21]

Healthcare utilisation

Virtual care

A total of 29 reviews (44%) recorded the impact of virtual care interventions on healthcare utilisation.[22 23 25–32 36 38–40 42–45 47 50 52 58 71–77] Of these, eight reviews reported positive effects of virtual care interventions such as health education and telemonitoring on healthcare utilisation, in managing fractures,[75] CKD,[58] myocardial infarction,[39] asthma,[44] COPD[25 26] and heart failure.[72 74]

A total of 10 reviews reported mixed evidence[22 29 31 32 40 43 47 71 73 77] and 11 studies (17%) found no significant effect of virtual care on healthcare utilisation.[23 27 28 30 36 38 42 45 50 52 76] Three reviews reported negative effects of virtual care, including increased non-emergency or outpatient clinic contacts and visits,[32 77] and some evidence of increased admissions for patients with COPD when compared with usual care.[76]

Hospital in the home

A total of 9 reviews (14%) assessed the impact of HITH interventions on readmission rates.[23 27 50 58 63–65 74 78] Of these, three reviews reported a significant reduction in COPD readmissions[27 64 65] and length of stay[65] following interventions, including early supported discharge and continuity of care.[27 64 65]

Positive effects of transitional care interventions[74] and nurse home visits[23] on all-cause[23 74] and heart failure-specific[74] readmission rates for patients with heart failure were found in two reviews. Similarly, in one review that assessed the impact of blended integrated, HITH and virtual care for heart failure patients, interventions that used home visits, telemedicine and telemonitoring demonstrated some positive effect on admission rates.[78] One review found that home dialysis and blended home dialysis with telemedicine produced superior outcomes for patients with CKD, when compared with centre-based and satellite clinic dialysis.[58]

Conversely, in two reviews that assessed the impact of home-based cardiac rehabilitation on readmission for cardiac conditions including myocardial infarction,[50 63] heart failure[63] and chest pain,[63] no significant effects of interventions were observed when compared with usual care.

Ambulatory care

A total of 8 reviews (12%) examined the impact of ambulatory care on healthcare utilisation.[50 54–59 61] Three reviews found significant reductions in hospitalisations and length of stay for patients receiving dialysis in alternate settings[58] and ambulatory THA.[56 59] One review found mixed evidence for a reduction in readmission rates, as well as emergency department (ED), physician and nurse visits among patients with heart failure who received ambulatory joint replacement.[57]

No evidence of reduced reoperation or readmission rates following ambulatory total joint replacement were found in two reviews, when compared with usual care.[54 61] Similarly, 2 reviews (2%) found no significant difference in readmissions between ambulatory interventions and other models of care, including tele-based, home-based or centre-based cardiac rehabilitation for myocardial infarction,[50] and outpatient versus home-based exercise therapy for total knee arthroplasty and THA.[55]

Integrated care

A total of 6 reviews (9%) assessed the effects of integrated care on readmission rates.[21 23 25 67 74 79] Four reviews found evidence of reduced all cause hospitalisations[67] and readmissions[23 74 79] and heart failure-specific hospitalisations[67] and readmissions[74] for heart failure patients. No effect of interventions on ED utilisation was found for heart failure.[74 79] One review found low-quality evidence for reduced all cause hospitalisation for CKD,[21] and one review found a significant reduction in ED visits for COPD following integrated telemonitoring.[25] No effect was reported for hospitalisations and length of stay.[25]

Specialist hospitals

The impact of blended integrated and specialist hospital interventions, including transitional care,[74] disease management clinics[23] and multidisciplinary specialist care, was assessed in 3 reviews (5%).[19] Two reviews reported evidence for reduced rates of all-cause readmissions[23 74] for heart failure and heart failure-specific readmissions.[74] One review found evidence of lower hospitalisation rates for end-stage kidney disease.[19]

Consumer-focused care

One review (2%) found evidence for reduced all-cause hospitalisation rates among patients with CKD receiving person-centred integrated care.[21]

Quality of life

Virtual care

A total of 21 reviews (32%) examined the impact of virtual care on patient quality of life.[24 25 27–29 32 34 36 37 40 43 45–49 52 72 80–82] Five reviews reported a positive effect of virtual care interventions, including telemedicine and videoconferencing on quality-of-life outcomes.[32 36 49 72 81]

In total, 5 reviews found no significant effect of interventions on quality of life,[27 37 43 47 80] and 11 reviews presented mixed evidence for the impact of interventions on quality of life.[24 25 28 29 34 40 45 46 48 52 82]

Hospital in the home

The effect of HITH interventions on quality of life were assessed in four reviews (6%).[27 49 60 63] One review found mixed effects of home-based care on quality of life for patients with COPD,[60] and three reviews found no significant difference in quality of life between interventions and other forms of care.[27 49 63]

Integrated care

A total of 4 reviews (6%) assessed the effect of integrated care on quality of life.[21 25 67 68] One review found a moderate improvement in quality of life for patients with fragility fractures,[68] one review found mixed effects on quality of life[25] and two reviews found no significant effect of interventions on quality of life.[21 25 67]

Ambulatory care

The impact of ambulatory care interventions on quality of life was assessed in 3 reviews (5%).[57 59 60] One review reported a moderate-to-large positive effect of THA on quality of life.[59] One review found mixed evidence of interventions on quality of life among heart failure[57] patients and one review found no significant difference in quality-of-life outcomes among patients with COPD[60] when interventions were delivered in outpatient or community settings.

Consumer-focused care

Overall, 2 reviews (3%) evaluated the effect of blended integrated and consumer-focused care on patient quality of life.[21 69] One review reported an improvement in quality of life, depression and anxiety scores among hip fracture patients,[69] and one review found no significant difference between patients with CKD receiving interventions,[21] compared with usual care.

Self-management and self-care

Virtual care

A total of 17 reviews (26%) assessed the impact of virtual care on consumer-management outcomes, including medication, diet and inhaler adherence.[26 29 31 32 34–37 40 41 44–47 51 72 83] Six reviews found evidence for a positive effect of virtual care interventions on self-management behaviours for chronic illnesses such as asthma, COPD and heart failure.[26 31 34 41 47 51] A total of 10 reviews found mixed evidence,[29 31 32 35 40 44–46 72 83] and 2 reviews (3%) recorded no effect of virtual care on self-management outcomes.[36 37]

Consumer-focused care

In total, 1 review (2%) assessed the impact of blended integrated and consumer-focused care interventions on self-management outcomes in hip fracture patients.[69] The review found mixed evidence for improvements in commitment to physical activity and osteoporosis treatment.[69]

Ambulatory care

The effect of ambulatory care on patient self-management of heart failure was assessed in 1 review (2%).[57] The review found a positive effect of ambulatory management on diet and medication adherence.[57]

Hospital in the home

In total, 1 review (2%) examined the effect of home-based models of cardiac rehabilitation on adherence to care.[63] The review found mixed evidence for HITH

rehabilitation on adherence to rehabilitation for patients with heart failure, myocardial infarction and chest pain, when compared with centre-based care.[63]

Integrated care

In total, 1 review (2%) examined the impact of pharmacist involvement in multidisciplinary management on consumer management of their care for patients with heart failure.[67] No significant improvements in patient management were observed following interventions.[67]

Patient knowledge

Virtual care

A total of 5 reviews (8%) assessed the impact of virtual care interventions on patient knowledge.[33 35 40 45 69] Three reviews found that virtual care interventions produced positive effects on knowledge for patients with osteoporosis,[69] CKD[35] and postnatal depression.[33] One review found mixed results for patients with asthma or heart failure,[45] and one found no significant difference among asthma patients when compared with usual care.[40]

Integrated care

The impact of integrated care interventions, including multidisciplinary educative sessions,[69] on patient knowledge was examined in 2 reviews (3%).[67 69] Among patients with osteoporosis[69] and heart failure,[67] knowledge of their disease significantly improved following the intervention.

Ambulatory care

In total, 1 review (2%)[57] found a significant improvement in disease-specific and nutritional knowledge among heart failure patients receiving ambulatory educational and self-management interventions.

DISCUSSION

This umbrella review of reviews presents an overview of evidence for innovative models of healthcare in and outside of hospital settings in treating and managing common acute and chronic conditions. Informed by a grey literature search,[15] seven models of care were identified in the academic literature. Evidence in support of the models of care was mixed; however, all models of care demonstrated positive or equivalent healthcare outcomes for patients in treating several conditions, when compared with usual care. Importantly, non-significant effects of interventions indicated that the outcomes did not substantially differ from those seen with usual care. That is, non-significant results demonstrate a comparable intervention, rather than an ineffective intervention in absolute terms. Models of care that demonstrate similar effects to usual care on outcomes, such as clinical indicators, mortality or readmission, may produce additional benefits such as patient knowledge, quality of life and reduced cost.[21 23 25 57] As a result, when implementing models of care in healthcare settings, a broader consideration of patient needs and health system factors may be critical when evaluating the suitability of models of care that produce similar outcomes to usual care.

Virtual care was the most frequently evaluated model in the literature, represented in 47 out of 66 included reviews. This may be partially attributable to recent innovations seen in response to the COVID-19 pandemic and resultant adaptations in healthcare delivery. For example, virtual care interventions were frequently blended or implemented in conjunction with other models, including HITH[50 58] and integrated care,[23 25 69] to increase the reach and timeliness of care in the community. Blended or hybrid models were similarly seen outside of the virtual care model, including specialist-integrated care,[19 20 70] consumer-focused-integrated care[21] and ambulatory–HITH care.[50] While blended interventions appeared to produce superior outcomes in some reviews,[21 25] it may be critical to examine whether they increase, decrease or shift resource requirements to other areas within the health system, for example, non-urgent visits, as well as nurse and General Practitioner (GP) contacts.[32 77]

Strengths and limitations

A noted strength of this study is that it presents a comprehensive overview of evidence for innovative models of care and was guided by a research librarian with expertise in search string development. However, given the scope of the literature, primary studies were omitted to capture the maximum amount of high-level evidence across diverse interventions and cohorts. As a result, cutting-edge developments that have evaded systematic review may not have been adequately captured. This limitation was most pertinent for the digital hospital model. Finally, the evidence provided by the reviews was sufficiently heterogeneous that data were unable to be pooled for statistical analyses.

Conclusions

This review identified seven innovative models of healthcare that may be effective in managing patients across a wide range of acute and chronic conditions. While most of the included reviews found evidence of comparable or improved care relative to usual practice, a consideration of local infrastructure, specific health system contexts and individual patient characteristics, such as health literacy, cultural background and age, may be critical in determining the suitability of models for patients. Structured approaches to identifying patient and provider expectations should be incorporated into planning and implementing innovative models of care into the hospitals of the future.

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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.

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REFERENCES

1 Department of Health. Systemic national challenges in health care: australian government. 2013. Available: https://www1.health.gov.au/internet/publications/publishing.nsf/Content/NPHC-Strategic-Framework~systemic
2 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.
3 Conley J, O'Brien CW, Leff BA, *et al*. Alternative strategies to inpatient hospitalization for acute medical conditions: a systematic review. *JAMA Intern Med* 2016;176:1693–702.
4 The Australian Digital Health Agency. Framework for action: how australia will deliver the benefits of digitally enabled health and care. 2020. Available: https://conversation.digitalhealth.gov.au/sites/default/files/framework_for_action_-_july_2018.pdf
5 The Mckell Institute. Positive disruption: healthcare, ageing & participation in the age of technology. 2015. Available: https://mckellinstitute.org.au/app/uploads/The-McKell-Institute-Positive-Disruption-September-2015.pdf
6 Penno E, Gauld R. Change, connectivity, and challenge: exploring the role of health technology in shaping health care for aging populations in asia pacific. *Health Syst Reform* 2017;3:224–35.
7 Zurynski Y, Smith CL, Vedovi A, *et al*. Mapping the learning health system: A scoping review of current evidence sydney: australian institute of health innovation; NHRMC partnership centre for health system sustainability. 2020. Available: https://research-management.mq.edu.au/ws/portalfiles/portal/134364432/Publisher_version_open_access_.pdf
8 Smith AC, Thomas E, Snoswell CL, *et al*. Telehealth for global emergencies: implications for coronavirus disease 2019 (COVID-19). *J Telemed Telecare* 2020;26:309–13.
9 Royal Adelaide. Hospital in the home patients triple at COVID height: government of south australia. central adelaide local health network. 2021. Available: https://www.rah.sa.gov.au/news/hospital-in-the-home-patients-triple-at-covid-height
10 Maka K, Loy G, Green A, *et al*. Strong governance, trusted leadership and clear communication: a descriptive narrative of an Australian public hospital response to COVID-19. *JSSM* 2021;14:291–304.
11 Calder R, Dunkin R. Australian health serices: too complex to navigate. A review of the national reviews of australia's health service arrangments: australian health policy collaboration. policy issues paper no/1. 2019. Available: https://www.vu.edu.au/sites/default/files/australian-health-services-too-complex-to-navigate-mitchell-institute.pdf
12 Herzlinger RE. Why innovation in health care is so hard. *Harv Bus Rev* 2006;84:58–66, Available: https://hbr.org/2006/05/why-innovation-in-health-care-is-so-hard
13 Wiltsey Stirman S, 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.
14 Agency for Clinical Innovation. *Understandingthe process to develop a model of care: an ACI framework*. Sydney: Agency for Clinical Innovation, 2013. Available: https://www.aci.health.nsw.gov.au/__data/assets/pdf_file/0009/181935/HS13-034_Framework-DevelopMoC_D7.pdf
15 Roberts N, Carrigan A, Clay-WIlliams R, *et al*. Innovative models of care for hospitals of the future: an integrative review of the grey and academic literature: prepared for the western sydney local health district and health infrastructure. 2021.
16 Aromataris E, Munn Z. Chapter 10: umbrella reviews. In: *JBI reviewer's manual*. 2020.
17 Moher D, Shamseer L, Clarke M, *et al*. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst Rev* 2015;4:1.
18 Aromataris E, Fernandez R, Godfrey CM, *et al*. Summarizing systematic reviews: methodological development, conduct and reporting of an umbrella review approach. *Int J Evid Based Healthc* 2015;13:132–40.
19 Shi Y, Xiong J, Chen Y, *et al*. The effectiveness of multidisciplinary care models for patients with chronic kidney disease: a systematic review and meta-analysis. *Int Urol Nephrol* 2018;50:301–12.
20 Hsu H-T, Chiang Y-C, Lai Y-H, *et al*. Effectiveness of multidisciplinary care for chronic kidney disease: a systematic review. *Worldviews Evid Based Nurs* 2021;18:33–41.
21 Valentijn PP, Pereira FA, Ruospo M, *et al*. Person-centered integrated care for chronic kidney disease: a systematic review and meta-analysis of randomized controlled trials. *Clin J Am Soc Nephrol* 2018;13:375–86.
22 Gonzalez Garcia M, Fatehi F, Bashi N, *et al*. A review of randomized controlled trials utilizing telemedicine for improving heart failure

readmission: can A realist approach bridge the translational divide? *Clin Med Insights Cardiol* 2019;13:1179546819861396.
23 Van Spall HGC, Rahman T, Mytton O, *et al*. Comparative effectiveness of transitional care services in patients discharged from the hospital with heart failure: a systematic review and network meta-analysis. *Eur J Heart Fail* 2017;19:1427–43.
24 Gregersen TL, Green A, Frausing E, *et al*. Do telemedical interventions improve quality of life in patients with COPD? A systematic review. *Int J Chron Obstruct Pulmon Dis* 2016;11:809–22.
25 Hong Y, Lee SH. Effectiveness of tele-monitoring by patient severity and intervention type in chronic obstructive pulmonary disease patients: a systematic review and meta-analysis. *Int J Nurs Stud* 2019;92:1–15.
26 Yang F, Wang Y, Yang C, *et al*. Mobile health applications in self-management of patients with chronic obstructive pulmonary disease: a systematic review and meta-analysis of their efficacy. *BMC Pulm Med* 2018;18:147.
27 Yang F, Xiong Z-F, Yang C, *et al*. Continuity of care to prevent readmissions for patients with chronic obstructive pulmonary disease: a systematic review and meta-analysis. *COPD* 2017;14:251–61.
28 Bonnevie T, Smondack P, Elkins M, *et al*. Advanced telehealth technology improves home-based exercise therapy for people with stable chronic obstructive pulmonary disease: a systematic review. *J Physiother* 2021;67:27–40.
29 Cajita MI, Gleason KT, Han H-R. A systematic review of mhealth-based heart failure interventions. *J Cardiovasc Nurs* 2016;31:E10–22.
30 Ding H, Chen SH, Edwards I, *et al*. Effects of different telemonitoring strategies on chronic heart failure care: systematic review and subgroup meta-analysis. *J Med Internet Res* 2020;22:e20032.
31 Farzandipour M, Nabovati E, Sharif R, *et al*. Patient self-management of asthma using mobile health applications: a systematic review of the functionalities and effects. *Appl Clin Inform* 2017;8:1068–81.
32 Hamilton SJ, Mills B, Birch EM, *et al*. Smartphones in the secondary prevention of cardiovascular disease: a systematic review. *BMC Cardiovasc Disord* 2018;18:25.
33 Hanach N, de Vries N, Radwan H, *et al*. The effectiveness of telemedicine interventions, delivered exclusively during the postnatal period, on postpartum depression in mothers without history or existing mental disorders: a systematic review and meta-analysis. *Midwifery* 2021;94:S0266-6138(20)30278-3.
34 Hui CY, Walton R, McKinstry B, *et al*. The use of mobile applications to support self-management for people with asthma: a systematic review of controlled studies to identify features associated with clinical effectiveness and adherence. *J Am Med Inform Assoc* 2017;24:619–32.
35 Jeddi FR, Nabovati E, Amirazodi S. Features and effects of information technology-based interventions to improve self-management in chronic kidney disease patients: a systematic review of the literature. *J Med Syst* 2017;41:1–13.
36 Kew KM, Cates CJ. Home telemonitoring and remote feedback between clinic visits for asthma. *Cochrane Database Syst Rev* 2016;2016:CD011714.
37 Kew KM, Cates CJ. Remote versus face-to-face check-ups for asthma. *Cochrane Database Syst Rev* 2016;4:CD011715.
38 Long G. Impact of home telemonitoring on 30-day hospital readmission rates for patients with heart failure: a systematic review. *MEDSURG Nurs* 2017;26:337–48.
39 Marcolino MS, Maia LM, Oliveira JAQ, *et al*. Impact of telemedicine interventions on mortality in patients with acute myocardial infarction: a systematic review and meta-analysis. *Heart* 2019;105:1479–86.
40 McLean G, Murray E, Band R, *et al*. Interactive digital interventions to promote self-management in adults with asthma: systematic review and meta-analysis. *BMC Pulm Med* 2016;16:83.
41 Niznik JD, He H, Kane-Gill SL. Impact of clinical pharmacist services delivered via telemedicine in the outpatient or ambulatory care setting: a systematic review. *Res Social Adm Pharm* 2018;14:707–17.
42 Pekmezaris R, Tortez L, Williams M, *et al*. Home telemonitoring in heart failure: a systematic review and meta-analysis. *Health Affairs* 2018;37:1983–9.
43 Posadzki P, Mastellos N, Ryan R, *et al*. Automated telephone communication systems for preventive healthcare and management of long-term conditions. *Cochrane Database Syst Rev* 2016;12:CD009921.
44 Ramsey RR, Plevinsky JM, Kollin SR, *et al*. Systematic review of digital interventions for pediatric asthma management. *J Allergy Clin Immunol Pract* 2020;8:1284–93.
45 Rush KL, Hatt L, Janke R, *et al*. The efficacy of telehealth delivered educational approaches for patients with chronic diseases: a systematic review. *Patient Educ Couns* 2018;101:1310–21.
46 Shen H, van der Kleij RMJJ, van der Boog PJM, *et al*. Electronic health self-management interventions for patients with chronic kidney disease: systematic review of quantitative and qualitative evidence. *J Med Internet Res* 2019;21:e12384.
47 Son YJ, Lee Y, Lee HJ. Effectiveness of mobile phone-based interventions for improving health outcomes in patients with chronic heart failure: a systematic review and meta-analysis. *Int J Environ Res Public Health* 2020;17:1749.
48 Velayati F, Ayatollahi H, Hemmat M. A systematic review of the effectiveness of telerehabilitation interventions for therapeutic purposes in the elderly. *Methods Inf Med* 2020;59:104–9.
49 Wu C, Li Y, Chen J. Hybrid versus traditional cardiac rehabilitation models: a systematic review and meta-analysis. *Kardiol Pol* 2018;76:1717–24.
50 Xia T-L, Huang F-Y, Peng Y, *et al*. Efficacy of different types of exercise-based cardiac rehabilitation on coronary heart disease: a network meta-analysis. *J Gen Intern Med* 2018;33:2201–9.
51 Yasmin F, Banu B, Zakir SM, *et al*. Positive influence of short message service and voice call interventions on adherence and health outcomes in case of chronic disease care: a systematic review. *BMC Med Inform Decis Mak* 2016;16:46.
52 Yun JE, Park J-E, Park H-Y, *et al*. Comparative effectiveness of telemonitoring versus usual care for heart failure: a systematic review and meta-analysis. *J Card Fail* 2018;24:19–28.
53 Zhao L, Chen J, Lan L, *et al*. Effectiveness of telehealth interventions for women with postpartum depression: systematic review and meta-analysis. *JMIR Mhealth Uhealth* 2021;9:e32544.
54 Albright RH, Rodela RJ, Nabili P, *et al*. Complication rates following total ankle arthroplasty in inpatient versus outpatient populations: a systematic review & meta-analysis. *J Foot Ankle Surg* 2021;60:61–6.
55 Florez-García M, García-Pérez F, Curbelo R, *et al*. Efficacy and safety of home-based exercises versus individualized supervised outpatient physical therapy programs after total knee arthroplasty: a systematic review and meta-analysis. *Knee Surg Sports Traumatol Arthrosc* 2017;25:3340–53.
56 Hoffmann JD, Kusnezov NA, Dunn JC, *et al*. The shift to same-day outpatient joint arthroplasty: a systematic review. *J Arthroplasty* 2018;33:1265–74.
57 Jensen L, Troster SM, Cai K, *et al*. Improving heart failure outcomes in ambulatory and community care: a scoping study. *Med Care Res Rev* 2017;74:551–81.
58 Ramar P, Ahmed AT, Wang Z, *et al*. Effects of different models of dialysis care on patient-important outcomes: a systematic review and meta-analysis. *Popul Health Manag* 2017;20:495–505.
59 Shapira J, Chen SL, Rosinsky PJ, *et al*. Outcomes of outpatient total hip arthroplasty: a systematic review. *Hip Int* 2021;31:4–11.
60 Wuytack F, Devane D, Stovold E, *et al*. Comparison of outpatient and home-based exercise training programmes for COPD: a systematic review and meta-analysis. *Respirology* 2018;23:272–83.
61 Xu J, Cao JY, Chaggar GS, *et al*. Comparison of outpatient versus inpatient total hip and knee arthroplasty: a systematic review and meta-analysis of complications. *J Orthop* 2020;17:38–43.
62 Handoll HH, Cameron ID, Mak JC, *et al*. Multidisciplinary rehabilitation for older people with hip fractures. *Cochrane Database Syst Rev* 2021;11:CD007125.
63 Anderson L, Sharp GA, Norton RJ, *et al*. Home-Based versus centre-based cardiac rehabilitation. *Cochrane Database Syst Rev* 2017;6:CD007130.
64 Echevarria C, Brewin K, Horobin H, *et al*. Early supported discharge/hospital at home for acute exacerbation of chronic obstructive pulmonary disease: a review and meta-analysis. *COPD* 2016;13:523–33.
65 Gonçalves-Bradley DC, Iliffe S, Doll HA, *et al*. Early discharge Hospital at home. *Cochrane Database Syst Rev* 2017;6:CD000356.
66 Nordström P, Thorngren K-G, Hommel A, *et al*. Effects of geriatric team rehabilitation after hip fracture: meta-analysis of randomized controlled trials. *J Am Med Dir Assoc* 2018;19:840–5.
67 Parajuli DR, Kourbelis C, Franzon J, *et al*. Effectiveness of the pharmacist-involved multidisciplinary management of heart failure to improve hospitalizations and mortality rates in 4630 patients: a systematic review and meta-analysis of randomized controlled trials. *J Card Fail* 2019;25:744–56.
68 Talevski J, Sanders KM, Duque G, *et al*. Effect of clinical care pathways on quality of life and physical function after fragility fracture: a meta-analysis. *J Am Med Dir Assoc* 2019;20:S1525-8610(19)30248-8:926..
69 Yadav L, Haldar A, Jasper U, *et al*. Utilising digital health technology to support patient-healthcare provider communication in fragility fracture recovery: systematic review and meta-analysis. *Int J Environ Res Public Health* 2019;16:4047.

70 Xu H, Mou L, Cai Z. A nurse-coordinated model of care versus usual care for chronic kidney disease: meta-analysis. *J Clin Nurs* 2017;26:1639–49.
71 Baroi S, McNamara RJ, McKenzie DK, *et al*. Advances in remote respiratory assessments for people with chronic obstructive pulmonary disease: a systematic review. *Telemedicine and E-Health* 2018;24:415–24.
72 Bauce K, Fahs DB, Batten J, *et al*. Videoconferencing for management of heart failure: an integrative review. *J Gerontol Nurs* 2018;44:45–52.
73 Jones L, Grech C. The patient experience of remote telemonitoring for heart failure in the rural setting: a literature review. *Contemp Nurse* 2016;52:230–43.
74 Li Y, Fu MR, Luo B, *et al*. The effectiveness of transitional care interventions on health care utilization in patients discharged from the hospital with heart failure: a systematic review and meta-analysis. *J Am Med Dir Assoc* 2021;22:621–9.
75 Murphy EP, Fenelon C, Murphy RP, *et al*. Are virtual fracture clinics during the COVID-19 pandemic a potential alternative for delivering fracture care? A systematic review. *Clin Orthop Relat Res* 2020;478:2610–21.
76 Taylor ML, Thomas EE, Snoswell CL, *et al*. Does remote patient monitoring reduce acute care use? A systematic review. *BMJ Open* 2021;11:e040232.
77 Auener SL, Remers TEP, van Dulmen SA, *et al*. The effect of noninvasive telemonitoring for chronic heart failure on health care utilization: systematic review. *J Med Internet Res* 2021;23:e26744.
78 Ledwin KM, Lorenz R. The impact of nurse-led community-based models of care on hospital admission rates in heart failure patients: an integrative review. *Heart Lung* 2021;50:685–92.
79 Shah B. Effectiveness of interprofessional care teams on reducing hospital readmissions in patients with heart failure: a systematic review. *MEDSURG Nurs* 2018;27:177–85.
80 Chongmelaxme B, Lee S, Dhippayom T, *et al*. The effects of telemedicine on asthma control and patients' quality of life in adults: a systematic review and meta-analysis. *J Allergy Clin Immunol Pract* 2019;7:S2213-2198(18)30450-1:199–216..
81 Knox L, Rahman RJ, Beedie C. Quality of life in patients receiving telemedicine enhanced chronic heart failure disease management: a meta-analysis. *J Telemed Telecare* 2017;23:639–49.
82 Snoswell CL, Rahja M, Lalor AF. A systematic review and meta-analysis of change in health-related quality of life for interactive telehealth interventions for patients with asthma. *Value Health* 2021;24:291–302.
83 Schulte MHJ, Aardoom JJ, Loheide-Niesmann L, *et al*. Effectiveness of ehealth interventions in improving medication adherence for patients with chronic obstructive pulmonary disease or asthma: systematic review. *J Med Internet Res* 2021;23:e29475.
84 Australian Commission on Safety and Quality in Health Care (ACSQHC). Person-centred care: ACSQHC. 2019. Available: https://www.safetyandquality.gov.au/our-work/partnering-consumers/person-centred-care
85 Consumers Health Forum of Australia (CHF). What is consumer-centred care? 2021. Available: https://chf.org.au/real-people-real-data-toolkit/real-people-real-data/what-consumer-centred-care
86 ACT. *Ambulatory care framework 2012*. Canberra, 2012.
87 Shepperd S, Iliffe S. Hospital at home versus in-patient hospital care. *Cochrane Database Syst Rev* 2005;3.
88 NSW. Hospital in the home (HITH). 2019. Available: https://www.health.nsw.gov.au/Performance/Pages/hith.aspx
89 Goodwin N. Understanding integrated care. *Int J Integr Care* 2016;16:6.
90 Agency for Clinical Innovation (ACI). NSW health integrated care. 2021. Available: https://www.aci.health.nsw.gov.au/nhn/health-professionals/tools-and-resources/nsw-health-integrated-care
91 Agency for Clinical Innovation, NSW Health. Telehealth. 2021. Available: https://aci.health.nsw.gov.au/make-it-happen/telehealth
92 Capkun V, Messner M, Rissbacher C. Service specialization and operational performance in hospitals. *International Journal of Operations & Production Management* 2012;32:468–95.
93 Guterman S. Specialty hospitals: a problem or a symptom? *Health Aff (Millwood)* 2006;25:95–105.