Collegian 30 (2023) 769–778

Contents lists available at ScienceDirect

Collegian

journal homepage: www.elsevier.com/locate/colegn

Evaluated nurse-led models of care implemented in regional, rural, and remote Australia: A scoping review

Hannah Beks [a,*], Suzanne Clayden [a,b], Anna Wong Shee [a,c], Marley J. Binder [a], Sophie O'Keeffe [d], Vincent L. Versace [a]

[a] Deakin Rural Health, School of Medicine, Warrnambool, Victoria, Australia
[b] Southwest Healthcare, Warrnambool, Victoria, Australia
[c] Grampians Health, Ballarat, Victoria, Australia
[d] School of Nursing & Midwifery, Deakin University, Warrnambool, Victoria, Australia

ARTICLE INFO

Article history:
Received 26 November 2022
Received in revised form 4 May 2023
Accepted 9 May 2023

Keywords:
Nurses
Models of care
Rural and remote health
Rural Health Services
Australia

ABSTRACT

Background: Nurse-led models of care are important for populations residing in regional, rural, and remote settings, who experience barriers to accessing health care. A previous review examining a subset of research undertaken in the Australian context through the Rural Health Multidisciplinary Training program identified a paucity of literature around nurse-led models of care implemented in these settings. Given the maldistribution of the medical workforce in non-metropolitan settings, scoping the broader literature for evidence around nurse-led models of care in these settings is imperative for informing the future directions of the nursing workforce.

Aim: To identify available literature for evaluated nurse-led modes of care implemented in regional, rural, and remote geographical settings of Australia.

Methods: A scoping review was undertaken using the Joanna Briggs Institutes' scoping review methodology. A protocol was developed in advance, which documented the objectives, inclusion criteria, and methods. The search involved a comprehensive review of peer-reviewed and grey literature published between 2010 and 2022, to map the evidence examining evaluated nurse-led models of care implemented in regional, rural, and remote settings of Australia. A descriptive approach aligning with the review question and objectives, was used to synthesise findings.

Findings: The search retrieved 1807 unique citations, of which 53 were included with an additional 4 studies identified through review of reference lists. In total, 57 studies examining 49 unique nurse-led models of care were included. Studies were heterogenous in the models of care implemented, settings, and research evaluation designs. Most models of care were implemented in the community-health setting. The majority of first authors were affiliated with a university, with the highest proportion based in a metropolitan setting. The benefits of implementing nurse-led models of care included improving hospital indicators, the prevention and management of chronic disease, healthcare access, and health outcomes. Barriers for implementation were widely cited and were attributed to the non-metropolitan setting of implementation and organisational factors. Specific barriers were also cited for the implementation of nurse practitioner (NP) models of care, such as the constraints of the Medicare Benefits Schedule and role ambiguity.

Discussion: Nurse-led models of care included in this review were diverse, implemented across the lifespan, mostly led by registered nurses rather than nurses who were also NPs or transitional NPs, and implemented in the community-health setting. The findings expand on the international literature around nurse-led models of care and identify the need for greater support around implementation and evaluation, particularly in non-metropolitan geographical settings.

Conclusion: A greater focus on the implementation and evaluation of nurse-led models of care, including NP-led models of care, in regional, rural, and remote settings of Australia, is required. This is important given the maldistribution of the health workforce and inequity experienced by populations residing in these

* Correspondence to: P.O. Box 423 Princes Highway, Warrnambool, Victoria 3280, Australia. Tel.: +61 3 5563 3039.
E-mail address: hannah.beks@deakin.edu.au (H. Beks).

https://doi.org/10.1016/j.colegn.2023.05.004

settings when accessing health services. Greater support is required for place-based evaluations of nurse-led models of care, which builds organisational capability and nursing workforce capacity for research.

Summary of relevance
Problem or Issue
The state of evidence around evaluated nurse-led models of care implemented in regional, rural, and remote settings of Australia is not known.
What is already known
Nurse-led models of care are important to meeting the increased demand for health care, particularly in settings that experience challenges around health service access such as rural and remote communities.
What this paper adds
This paper maps the literature around evaluated nurse-led models of care implemented in regional, rural, and remote settings of Australia, identifies geographical and knowledge gaps, and future directions for the nursing workforce and research.

1. Introduction

Growing the skills and capabilities of the nursing workforce is critical to enhancing healthcare systems internationally (World Health Organization, 2020). Developing and implementing nurse-led models of care are important to meeting the increasing demand for health care, particularly in settings that experience challenges around health service access such as rural and remote communities (World Health Organization, 2020). Although there are inconsistencies around the definitions of nurse-led models of care (Gonçalves, Mendes, Caldeira, & Nunes, 2021), 'models of care' have previously been defined as approaches to the delivery of health services within a healthcare setting that have been informed by evidence-based practice (Davidson, Halcomb, Hickman, Phillips, & Graham, 2006). In the nursing context, examples of evidence-based models of care led by registered nurses (RNs) practicing with higher levels of autonomy include a nurse-led chronic kidney disease clinic where a RN coordinates care pathways and collaborates with nephrologists (Coleman et al., 2017), and nurse practitioner (NP)-led wound care clinics (Carville et al., 2018). For the purpose of this review, nurse-led models of care include those led by RN (including advanced practice nurses (APNs)), and RNs with an additional Masters qualification and endorsement as an NP, and those working towards the same (transitional NP).

The uptake of nurse-led models of care in Australia has been slow in comparison to other high-income countries. A key example is the low uptake of NPs in Australia in comparison to the United States (4.4 NPs per 100,000 population in Australia, compared with 40.5 NPs per 100,000 in the United States) (Maier, Barnes, Aiken, & Busse, 2016). This is despite strong support from the nursing workforce for the implementation of nurse-led models of care (Baldwin et al., 1998; Harvey, 2011; Whitehead et al., 2019). Barriers to the implementation of nurse-led models of care such as APN and NP-led models of care, include a lack of consensus in role definitions and scope of practice (Newall, Twomey, & Lima, 2018). There is also a need for funding reforms, such as Medicare Benefits Schedule (MBS) item numbers for NPs and general-practice nurses, to support the sustainability of nurse-led models of care (Considine & Fielding, 2010). Further, there is a paucity of evidence from experimental research supporting the effectiveness of nurse-led models of care across different healthcare settings, including nurse-led cardiac rehabilitation programs (Mares, McNally, & Fernandez, 2018), nurse-led ear, nose, and throat models of care (Whiteford, White, & Stephenson, 2016), nurse-led care for type-two diabetes, and other chronic diseases in general practice (Morgan et al., 2013; Parker, Clifton, Shams, & Young, 2012). A scoping study of nurse-led services in Queensland, Australia, identified that only a small proportion (9.3%) of identified services were engaged in research to evaluate the service (Douglas, Schmalkuche, Nizette, Yates, & Bonner, 2018). Undertaking research and evaluation is key to advocating for a greater uptake of nurse-led models of care, particularly in regional, rural, and remote settings.

The implementation of nurse-led models of care in regional, rural, and remote settings has the potential to improve equitable access to health care for these communities — a need long established in the literature (Baldwin et al., 1998). Populations residing in rural and remote communities, even in high-income countries, encounter barriers to accessing healthcare services due to factors related to geographical proximity and availability of specialist services (Beks, Healey, & Schlicht, 2018; Brundisini et al., 2013; Versace et al., 2019). These issues, coupled with a maldistribution of the health workforce (e.g., medical doctor shortages (Cosgrave, Malatzky, & Gillespie, 2019)), highlight the potential for nurse-led models of care in these settings to address workforce gaps, particularly in the primary healthcare context (Jennings, Lowe, & Tori, 2021). A review of the literature by Maier and colleagues in 2016 reported that NPs safely provided up to 93% of primary care services that would otherwise be provided by a medical doctor (Maier et al., 2016).

The purpose of this review was to scope the literature for evaluated nurse-led models of care implemented in regional, rural, and remote healthcare settings in Australia. The review was limited to the Australian setting to provide consistency in definitions of regional, rural, and remote. A previous review of Australian research has identified variability in how rurality is defined (Beks et al., 2022). In the Australian health policy context, the Modified Monash Model (MMM) is the preferred geographical classification system to define regional, rural, and remote areas (Department of Health, 2022; Versace, Beks, & Charles, 2021). Other geographical classification systems, such as the Australian Bureau of Statistics' Australian Statistical Geographical Standard Remoteness Areas (Australian Bureau of Statistics, 2016), have also been used in research to define rurality (Beks et al., 2022). The MMM classification system includes seven categories: metropolitan (MM1), regional (MM2), large rural towns (MM3), medium rural towns (MM4), small rural towns (MM5), remote communities (MM6), and very remote communities (MM7) (Department of Health, 2022).

A previous review examining a subset of nurse-led peer-reviewed outputs from the Rural Health Multidisciplinary Training (RHMT) program (a national Australian program to address the maldistribution of the health workforce) (Australian Government, 2022), identified a paucity of evidence around nurse-led models of care implemented in the rural and remote context (Beks, Walsh, Binder, Jones, & Versace, 2021). However, the review did not involve a systematic review of the literature or search of grey literature. To search for other reviews examining this concept, an initial search was undertaken of Ovid MEDLINE, Cochrane Database of Systematic Reviews, Joanna Briggs Institute's (JBI) Evidence Synthesis, and PROSPERO for both existing and proposed reviews. A review protocol recently published proposed to examine nurse-led care for patients

Table 1
Inclusion and exclusion criteria.

	Inclusion	Exclusion
Population	Nurse (registered nurse (RN)), including APN, NP, transitional NP, and dual-registered midwives/ RN-led models of care.	Excludes student nurses, endorsed enroled/enroled nurses, personal care workers/assistant nurses, and registered midwives' models of care.
Concept	Studies evaluating nurse-led models of care, including, but not limited to, nurse-led clinics and nurse-led services.	Nurse-led models of care that have not been subject to any form of evaluation, including those described in opinion pieces.
Context	Implemented in Australian regional, rural, and remote healthcare settings as defined by a geographical classification (MM2–7 or ASGS-RA 2–5) or otherwise defined by authors and/or cross-checked by reviewers if location data were available. Models of care implemented in both metropolitan and regional, rural, or remote settings will be included. Healthcare settings will include, but are not limited to, hospitals, primary care clinics, and community-health organisations (including Aboriginal Community Controlled Health Organisations, schools), and hospitals (including outpatient clinics).	Models of care only implemented in major cties or metropolitan areas of Australia, as defined by a geographical classification (MM1 or ASGS-RA 1) or otherwise defined by the authors. International studies and studies not published in English.

APN — advanced practice nurses; NP — nurse practitioner; ASGS-RA — Australian Statistical Geographical Standard Remoteness Areas.

with multi-morbidity in hospital settings (Gonçalves et al., 2021), however, the protocol did not specifically focus on models of care implemented in regional, rural, and remote Australian healthcare settings.

The research question for this scoping review was:

What is the available evidence around evaluated nurse-led models of care implemented in regional, rural, and remote healthcare settings in Australia?

The review objectives were to

(1) Identify available evidence for evaluated nurse-led models of care implemented in regional, rural, and remote healthcare settings in Australia, including characteristics of nurse-led models of care,
(2) Identify geographical gaps in the implementation and evaluation of nurse-led models of care in regional, rural, and remote healthcare settings in Australia,
(3) Identify reported outcomes and mediators of implementation of evaluated nurse-led models of care implemented in regional, rural, and remote healthcare settings of Australia.

2. Materials and methods

This scoping review examined the literature for evaluated nurse-led models of care implemented in regional, rural, and remote healthcare settings in Australia. The JBI scoping review methodology was used (Peters et al., 2020a, 2020b). Using this methodology, search terms were developed using Population, Concept and Context (PCC) (Peters et al., 2020a, 2020b). The Preferred Reporting Items for Systematic Reviews and Meta-analysis extension for Scoping Reviews (PRISMA-ScR) (Kyoon-Achan et al., 2018) checklist was used to report against (Appendix I). The review question, objectives, inclusion/exclusion criteria, and search strategies were specified in advance and registered with Open Science Framework (doi: 10.17605/OSF.IO/ZXWYU).

2.1. Search strategy

The JBI three-step search process guided the development of the search strategy (Peters et al., 2020a, 2020b). This involved a preliminary search undertaken in Ovid MEDLINE and CINAHL using keywords. A tailored search strategy for each information source was then developed. A combination of Boolean operators, truncations, and medical subject headings or EMTREE headings were used to form search strings (Appendix II). A librarian with expertise in developing search strategies for databases reviewed the searches. Reference lists of included studies were reviewed for additional studies.

Databases searched included Ovid MEDLINE, CINAHL (EBSCOhost), APA PsycInfo (EBSCOhost), and Embase (Elsevier). An extensive search of the grey literature was undertaken in key information sources (Appendix II). Database searches were conducted on the 26 April 2022, and grey literature searches were undertaken between the 26 April and 8 June 2022.

2.2. Inclusion and exclusion criteria

Literature was screened according to the following PCC inclusion and exclusion criteria (also summarised in Table 1). Nurse-led models of care were defined as approaches to the delivery of health care that were informed by evidence-based practice and led by RNs practicing autonomously (including APNs), which included RNs with an additional Masters qualification and endorsement as an NP, and those working towards a Masters qualification and/or endorsement as an NP (transitional NP) (Davidson et al., 2006; Khair & Chaplin, 2017). These included nurse-led services and nurse-led clinics, and excluded registered midwife-led services and clinics as the scope of practice for midwives differs to that of RN. However, models of care, services, and clinics that were led by dual-RN midwives (e.g., maternal child health services) or by a RN in collaboration with a registered midwife, were included.

Like other scoping reviews undertaken in the Australian health context (Beks et al., 2019), evaluation was defined in this review as an assessment of whether a model of care met its objective(s) and was implemented as planned (Hudson, 2017). Models of care evaluated by any party to any level with evaluation methods and findings, were considered for inclusion. Study types considered for inclusion were pilot studies, feasibility studies, mixed-method studies, impact, outcome or process evaluations, experimental research (e.g., randomised controlled trials), observational studies (e.g., cohort studies), qualitative studies, economic studies, and evaluation reports. Opinion and discussion pieces were excluded. Systematic reviews containing relevant studies were included.

Literature published from 1 January 2010 was included in order to capture studies published after a greater focus on nurse-led models of care was supported by key Australian legislation (e.g., MBS subsidies for NPs (Health Legislation Amendment (Midwives and Nurse Practitioners) Act 2010)) (Department of Health, 2013), and to provide a contemporary synthesis of evaluation literature as per the objectives of the review. Studies not published in English were excluded due to resource constraints.

2.3. Study selection and data extraction

Citations were imported into Covidence (Veritas Health Innovation, Melbourne, Australia) for screening. Titles and abstracts were screened

independently by two reviewers, with conflicts resolved through discussion with a third reviewer. Full-text review and data extraction was then undertaken independently by two reviewers. For articles that did not meet the inclusion criteria at full-text review, a reason for exclusion was provided (Appendix III). Reference lists of included studies were screened for additional studies meeting the inclusion criteria. In the instance where citations were retrieved that had reviewers listed as a co-author, the reviewer was not involved in screening that citation. Data extraction was tabulated using the following headings: author, year, nurse-led model of care, setting (clinical practice area), state/territory (suburb), MMM category, evaluation/research aim, evaluation/research study design (data collection methods), participant sample (gender and age), findings, study limitations, and implications. Findings were synthesised using a descriptive approach that aligned with the review question and objectives (Peters et al., 2020a, 2020b). A critical appraisal of included studies was not undertaken as is conventional for scoping reviews and is a limitation of this review (Peters et al., 2015, 2020a, 2020b).

3. Results

The search retrieved 1807 unique citations, of which 166 full texts were assessed for eligibility. Of these, 53 were included with an additional four studies snowballed from a review of reference lists. In total, 57 studies (53 peer-reviewed journal articles (93%) and four evaluation reports (7%)) evaluating 49 models of nurse-led care were included (Fig. 1. PRISMA flow diagram). One study included five unique models of NP-led care (KPMG, 2019). The reasons for excluding studies are provided in Appendix III.

3.1. Characteristics of included studies

Included studies (n = 57) were heterogeneous in evaluation design and methods (Table 2 in Supplementary Material). The highest proportion of studies used a quantitative evaluation design (n = 24, 42%). Other study designs included cohort (n = 7); cross-sectional (n = 5); quasi-experimental (n = 5); randomised controlled trial (n = 4); feasibility or pilot study (n = 2); and one stepped-wedge non-randomised cluster trial. Fifteen studies used mixed-method evaluations, 14 used both quantitative and qualitative data, and one used both economic and qualitative data. There were 14 qualitative studies (eight interview studies, four case studies, one grounded theory study, and one focus group study). Four studies involved economic analyses (two cost–benefit, one cost-effectiveness, and one cost analysis).

Of the included studies, the majority reported a funding source for the evaluation of the model of care (n = 44, 77%). Of studies evaluating a NP-led model of care (n = 12), nearly all studies received funding for evaluation (n = 11, 92%). This was not the case for studies evaluating RN-led models of care (n = 40), where 70% of studies received evaluation funding (n = 28). All five studies that examined an NP and RN-led model of care reported funding for the evaluation.

The limitations of evaluation designs were cited by studies and included a lack of consistent data collection for a state-wide program with the potential to impair outcome measures (Adams, Hooker, & Taft, 2019), lack of generalisability of findings to other settings (Atkinson-Briggs, Jenkins, Keech, Ryan, & Brazionis, 2021; Barraclough, Longman, & Barclay, 2016; Coady, Warren, Bilkhu, & Ayton, 2019; Croese, Lawson, Singh, Brimstone, & Brunott, 2018; Dwyer et al., 2017; Hungerford, Prosser, Davey, & Clark, 2016; Huxtable, Millar, Love, Bell, & Whelan, 2018; Kelly, Garvey, & Biro, 2017; Lawton et al., 2017; Mossenson, Algie, Olding, Garton, & Reeve, 2012; Roberts, 2017), impact of COVID-19 on participant recruitment (Atkinson-Briggs, Jenkins, Ryan, & Brazionis, 2022), incomplete or variations in health service data (Bramble, Wong, Carroll, Schwebel, & Rossiter, 2021), lack of randomisation in experimental studies (Carrington & Stewart, 2015; Hakanson, Douglas, Robertson, & Lester, 2014; Hullick et al., 2021; Sawyer et al., 2014, 2019), lack of blinding to nurse-led model of care in a randomised controlled trial (Carrington & Zimmet, 2022), risk of bias in data collection methods (Coleman et al., 2017; Dutton et al., 2020; Lobo, Mascarenhas, Worthington, Bevan, & Mak, 2015; Wand et al., 2021a, 2021b, 2021c), low survey response rates (Croese et al., 2018), small participant sample (Currie, Nielsen, Ervin, & Koschel, 2016; Eley et al., 2013; Frohmader, Lin, & Chaboyer, 2015; Frohmader, Lin, & Chaboyer, 2018; Happell, Stanton, Platania-Phung, McKenna, & Scott, 2014; Happell, Stanton, Hoey, & Scott, 2015; Hegarty et al., 2013; Iles et al., 2014; Kirby, Moore, McCarron, Perkins, & Lyle, 2015a; Kirby et al., 2015b; Lawton et al., 2017; Roche, Gardner, & Jack, 2017; Sinclair et al., 2017; Zadoroznyj et al., 2013), and a lack of control group in an experimental study (Murfet, Allen, & Hingston, 2014).

3.2. Characteristics of included nurse-led models of care

Of the 49 models of care described, most were led by RNs (n = 30, 61%), followed by NPs (n = 16, 33%). A small proportion were led by an RN and an NP working together (n = 3, 6%). Studies described models of care implemented across a range of clinical settings with the majority implemented in the community-health setting (n = 36, 74%), which included outpatient hospital, home-based setting, and primary care organisations (e.g., general practice, women's health clinics, and Aboriginal Community Controlled Health Organisations) (Table 2). Of these 36 models of care, 25 were led by an RN (69%), 10 were led by an NP (28%), and one was led by a NP and RN working together (3%). Seven models of care were implemented in an inpatient hospital or an emergency department (ED) (three NP-led, three RN-led, and one NP- and RN-led). Three models of care were implemented in community non-health settings, such as homeless shelters or schools (one NP-led, one RN-led, and one NP- and RN-led), and three were implemented in residential aged care facilities (two NP-led and one RN-led) (Table 2).

Models of care provided a range of services for patients across the lifespan and at a heightened risk for illness (e.g., persons with chronic disease, deteriorating aged care residents, and Aboriginal and Torres Strait Islander Peoples). One study described a model of care implemented only for children attending school (Sanford, Saurman, Dennis, & Lyle, 2021), whereas another study described a model of care implemented in a primary care practice for young people (Hegarty et al., 2013). Over a quarter of studies (n = 16, 28%) described models of care implemented for chronic disease management (Table 3). Of the 10 models of care for chronic disease management (20% of all models of care included in this review), eight were RN-led and two were NP-led. Of the remaining models of care (n = 39), nine focused on the delivery of primary healthcare services, which included screening for communicable and non-communicable disease and health education (five NP-led, three RN-led, and one NP and RN-led); six on delivery of acute care services (three NP-led, three RN-led); five on care for older persons (three NP-led, two RN-led); four on maternal and child health services, all of which were RN-led; four on Aboriginal and Torres Strait Islander health care (one NP-led, three RN-led), two on post-discharge hospital care (one RN-led, one NP- and RN-led); two on oncology care, both RN-led; two on mental health care (one NP-led, one NP- and RN-led); one on cardiac rehabilitation, which was RN-led; and four (one NP-led, three RN-led) on care for other conditions (e.g., sexual dysfunction, diabetes in pregnancy, unwanted pregnancy, and incontinence).

3.3. Location of implementation and evaluation using the Modified Monash Model classification

Of models of care with information available reporting the state or territory of implementation (n = 43, 88% of all included models of care), 15 were implemented in Victoria, seven in Queensland, seven

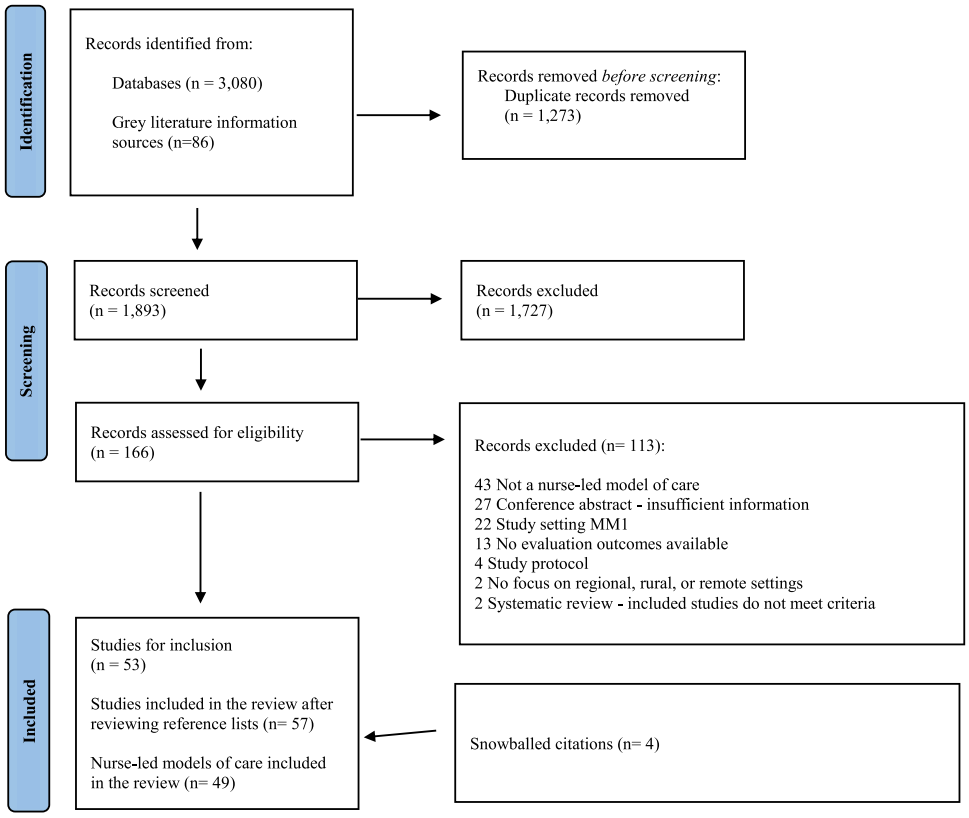

Fig. 1. PRISMA flow diagram.
From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ 2021;372:n71. doi: 10.1136/bmj.n7.

in New South Wales, five in Tasmania, five in Western Australia, one in the Northern Territory, and one in South Australia. One study was implemented Australia-wide, and one study was implemented in both Queensland and Victoria.

Thirty models of care were classified using the MMM categories (three models of care implemented state-wide, one model of care implemented Australia-wide, and 15 models of care with no location of implementation reported, were excluded). Six models of care

Table 3
Included studies by clinical area of focus.

Clinical area of focus	Studies examining RN-led model of care	Studies examining NP-led model of care	Studies examining a NP- and RN-led model of care
Maternal and child health	Adams et al. (2019), Huxtable et al. (2018), Sawyer et al. (2014, 2019), and Zadoroznyj et al. (2013)		
Chronic disease management	Carrington and Stewart (2015), Carrington and Zimmet (2022), Carrington et al. (2019), Coady et al. (2019), Coleman et al. (2017), Happell et al. (2014, 2015), Lobo et al. (2015), Roberts (2017), Iles et al. (2014), Eley et al. (2013), Young et al. (2016), and Kirby et al. (2015a, 2015b)	Craswell et al. (2018) and Stanley et al. (2015)	
Post-discharge hospital care	Croese et al. (2018)		Lawton et al. (2017)
Cardiac rehabilitation	Frohmader et al. (2018, 2015)		
Sexual dysfunction	Hakanson et al. (2014)		
Primary health care	Hegarty et al. (2013) and Sanford et al. (2021)	Hungerford et al. (2016), KPMG (2019), Elmer and Stirling (2013), and Kelly et al. (2017)	Bennett-Daly et al. (2021)
Oncology care	Monteross and Platt (2016) and Paynter et al. (2013)		
Incontinence	Wilson et al. (2015)		
Antenatal diabetes care		Murfet et al. (2014)	
Care of older persons	Sinclair et al. (2017) and Hullick et al. (2021)	KPMG (2019), Dwyer et al. (2017) and Ervin et al. (2019)	
Abortion services	Tomnay et al. (2018)		
Aboriginal and Torres Strait Islander health care	Atkinson-Briggs et al. (2021, 2022), Nguyen et al. (2018), KPMG (2019), and Dutton et al. (2020)		
Mental health		Barraclough et al. (2016)	Wand et al. (2021a, 2021b, 2021c)
Acute care	Bramble et al. (2021), Rossiter, Bramble, Matheson, Carroll & Phillips, (2019), Bramble, Wong, Rossiter, Carroll & Schwebel, (2019), Mossenson et al., 2012; and Currie et al. (2016)	Roche et al. (2017), Wilson et al. (2021) and KPMG (2019)	

RN — registered nurses; NP — nurse practitioner.

were implemented across two or more MM categories. Of the 24 models of care implemented within a single MM category, eight were implemented in MM2 — regional centres (three NP-led, four RN-led, and one NP- and RN-led), seven in MM3 — large rural towns (two NP-led, four RN-led, and one NP- and RN-led), three in MM4 — medium rural towns, all RN-led, three in MM6-remote communities (one NP-led, two RN-led), two in MM5 — small rural towns (one NP-led, one RN-led), and one in MM7 — very remote community, which was NP-led.

When examining first author institutional affiliation for included studies (a proxy for identifying the location of evaluation as used in a previous scoping review (Beks et al., 2019; Versace, Skinner, Bourke, Harvey, & Barnett, 2021) noting that the review included models of care implemented in MM2–MM7), most first authors were affiliated with a university (n = 42, 74%), which included seven studies where the author was affiliated with both a university and a health service. Eight studies were led by a first author from a health service, five studies were led by a first author from a research institute or other organisation, and two studies did not report a first author institutional affiliation. When categorising the geographical location of first authors using the MMM categories for studies with first author location available (n = 56), the highest proportion were located in a metropolitan setting (MM1: n = 26, 46%), followed by a large rural town (MM3: n = 13, 23%), regional centre (MM2: n = 11, 19%), and a medium rural town (MM4: n = 4, 7%). The first author of two studies was reported as being based in a metropolitan setting and a large rural town (MM1 and MM3). No first author locations were reported as being in a small rural town, remote community, or very remote community (MM5, MM6, or MM7).

3.4. Evaluation outcomes and mediators of implementation

Evidence supporting the implementation of nurse-led models of care was identified (Table 4). Most studies (n = 54) were able to identify at least one benefit from the implementation of a nurse-led model of care, which was supported by quantitative, qualitative, economic, or mixed-method data analysis and interpretation. These included improving hospital indicators (e.g., reducing length of stay, cost savings), improving chronic disease prevention and management (e.g., improvements in clinical indicators), addressing risk factors for chronic disease, improving healthcare access (e.g., access to timely care), and improving health outcomes (Table 4). One study identified no benefits or support for a nurse-led clinic delivering primary health care for youth in the general-practice setting and found the clinic was costly, poorly attended, and generally not supported (Hegarty et al., 2013). Another two studies examining one nurse-led model of care implemented state-wide, did not identify any additional benefits attributed to the intervention group when compared with the group receiving standard care (Sawyer et al., 2014, 2019).

Although the benefits were identified, not all studies provided evidence supporting program effectiveness or feasibility given the study designs used, or did not examine this as part of the evaluation. For example, a randomised controlled trial of a nurse-led model of care for managing cardiometabolic risk factors was unable to support effectiveness of the model in modifying risk parameters (Carrington & Zimmet, 2022). In this study, it was identified that improvements in blood pressure in the intervention group were not statistically significant when compared with the usual care group, and therefore had no enhanced clinical benefit (Carrington & Zimmet, 2022).

Enablers to implementation of nurse-led models of care were reported by studies and included having sufficient resourcing (e.g., MBS item numbers for supporting practice nurses in general practice (Iles et al., 2014)), having the support of the organisation and collaborative agreements with other organisations (Hungerford et al., 2016), being co-located with other services (e.g., non-government organisations) (Barraclough et al., 2016), and having a nurse with the appropriate skills, qualification, and expertise to implement the model of care (Wilson, Bellefeuille, D'Amore, & Mitchell, 2015). Those enablers specific to NP-led models of care included an understanding of the NP role and scope of practice at organisational, health professional, and patient level (Barraclough et al., 2016; Wilson, Hanson, Tori, & Perrin, 2021).

Barriers to the implementation of nurse-led models of care were widely cited by studies, and included issues attributed to the regional, rural, and remote setting of implementation such as the geographical distance between the nurse-led model of care and other services (Barraclough et al., 2016) and variation in implementation of a state-wide nurse-led model of care across rural and metropolitan services (Adams et al., 2019). Barriers at an organisational level included difficulties in raising the awareness of the nurse-led model of care in the implementation setting (Barraclough et al., 2016; Elmer & Stirling, 2013), a lack of resources to support the roles (Ervin, Reid, Moran, Opie, & Haines, 2019) and the need for ongoing resources (Wand et al., 2021b), a lack of support from other health professionals for nurse-led model of care (Hegarty et al., 2013; Lawton et al., 2017), misconceptions around scope of practice (Currie et al., 2016), and the costs of establishing nurse-led model of care within an organisation (Hegarty et al., 2013). The integration of the nurse-led model of care with external services and referral pathways was also identified as a challenge (Hegarty et al., 2013).

Barriers specific to NP-led models of care included having poor access to MBS item numbers for NPs to fund their role (Dwyer et al., 2017; Elmer & Stirling, 2013; Ervin et al., 2019; Hungerford et al., 2016; Kelly et al., 2017; Roche et al., 2017), the capacity of the service to support NP-led models of care particularly after hours (Wilson et al., 2021), and NP role ambiguity from the perspectives of other health professionals, including doctors (Ervin et al., 2019) and the public (Hungerford et al., 2016).

4. Discussion

This scoping review examined the peer-reviewed and grey literature for evaluated nurse-led models of care implemented in regional, rural, and remote settings of Australia. Included studies were heterogenous and examined nurse-led models of care that were diverse and implemented across the lifespan. Enablers and barriers to the implementation of nurse-led models of care were identified. Studies provided evidence of nurse-led models of care improving hospital indicators, chronic disease prevention and management, and healthcare access.

Review findings expand on international scholarly discussion (Khair & Chaplin, 2017) and research (Douglas et al., 2018; Gordon, Gray, Dainty, deLacy, & Seto, 2019; Mares et al., 2018) around the implementation of nurse-led models of care in a range of health and non-health settings, particularly in the community-health setting. A greater focus on the evaluation of nurse-led models of care in acute inpatient hospital settings (e.g., ED and inpatient facilities) and residential aged care settings, is required, particularly given the changing needs of an ageing population (World Health Organization, 2022), and maldistribution of the general practitioner workforce in non-metropolitan settings (Wilkinson & Symon, 2000), which has a flow on the effects to already-strained EDs and inpatient facilities (Chen & Tescher, 2010).

A strong focus on nurse-led models of care implemented for chronic disease prevention and management was also identified. This is not surprising given the burden of chronic disease in Australia, particularly for populations residing in rural areas with high socio-economic disadvantage (Australian Institute of Health and Welfare, 2022). Australian research has identified that socio-economic status is generally lower in rural and remote areas when

Table 4
Evidence supporting nurse-led models of care.

Key concepts	Key outcomes
Improving hospital indicators	• Reduced hospital length of stay attributed to nurse-led model of care (Bramble et al., 2019, 2021) • Cost savings for hospital and patients attributed to nurse-led model of care (Bramble et al., 2019, 2021; Croese et al., 2018; KPMG, 2019) • Nurse-led model of care more cost-effective than standard care models (Craswell, Dwyer, Rossi, Armstrong, & Akbar, 2018) • Patient satisfaction with hospital-based nurse-led models of care (Croese et al., 2018) • Reduced hospital admissions and ED visits (Hullick et al., 2021) • Reduced planned re-presentations to ED (Lawton et al., 2017) • Improved ED culture and practice (Wand et al., 2021a, 2021c)
Improving chronic disease prevention (primary and secondary) and management	• Increased rates of chronic disease screening in populations identified at risk (Atkinson-Briggs et al., 2021, 2022; Dutton et al., 2020) • Improvements in clinical indicators of chronic disease (Carrington & Stewart, 2015; Carrington, Wiley, & Zimmet, 2019; Carrington & Zimmet, 2022; Kirby et al., 2015a, 2015b; Roberts, 2017) • Enhanced continuity of care for persons living with chronic disease (Rossiter et al., 2019; Coady et al., 2019; Paynter, Foderc, Scuteri, Kerin-Ayres, & Tink, 2013) • Patient satisfaction and acceptance of nurse-led chronic disease management (Coleman et al., 2017; Eley et al., 2013) and prevention (Frohmader et al., 2015, 2018) • Support patients to implement lifestyle modifications and improve health behaviours (Happell et al., 2014) • Improved compliance to treatment for chronic disease management (Lobo et al., 2015) • Supporting early childhood development by addressing risk factors for chronic disease through parental education (Huxtable et al., 2018)
Improving healthcare access	• Integration of nurse-led model of care with other services in the community setting (Barraclough et al., 2016; Sanford et al., 2021) • Acceptability of nurse-led models of care from the perspectives of nurses, stakeholders, other service providers (Barraclough et al., 2016; Currie et al., 2016; Stanley, Worrall-Carter, Rahman, McEvedy, & Langham, 2015; Wilson et al., 2021), and patients (Bennett-Daly et al., 2021; Sinclair et al., 2017) • Improved accessibility to timely care (Coady et al., 2019; Currie et al., 2016; Dwyer et al., 2017; Ervin et al., 2019; Hungerford et al., 2016; Kelly et al., 2017; Wand et al., 2021a) • Improved accessibility to specialist care (Hakanson et al., 2014; Lobo et al., 2015; Monterosso & Platt, 2016) • Improve accessibility to primary healthcare services (Kelly et al., 2017; Mossenson et al., 2016; Sanford et al., 2021;Tomnay et al., 2018; Wilson et al., 2021; Zadoroznyj et al., 2013) • Acceptability of NP role from the perspectives of patients (Elmer & Stirling, 2013; Kelly et al., 2017; Roche et al., 2017) • Improved accessibility of health care to otherwise vulnerable and hard-to-reach populations (Nguyen et al., 2018; Stanley et al., 2015)
Improved health outcomes	• NP model of care reduced adverse neonatal outcomes (Murfet et al., 2014)

ED — emergency department; NP — nurse practitioner.

compared with metropolitan settings (Versace et al., 2021). Further research is required around nurse-led models of care targeting chronic disease, particularly given that the international evidence around nurse-led models of care for complex chronic conditions is limited in contrast to the growing prevalence of multi-morbidity (Gordon et al., 2019).

Geographical gaps in knowledge were also identified. The highest proportion of evaluated models of care implemented at a single site, were in regional centres (MM2) where approximately 9% of the Australian population resides (Versace et al., 2021). Geographical settings requiring a greater focus include medium rural towns, small rural towns, remote towns, and very remote towns (MM4–MM7) where a total of 13% of the Australian population resides (Versace et al., 2021). This review also identified that the majority of first authors were affiliated with a university, with the highest proportion based in a metropolitan setting. From the authorship list of included studies, it is difficult to ascertain the degree of collaboration between universities and health services.

The university affiliation of first authors is not surprising given the contribution of universities to research, and support to health services research, particularly in non-metropolitan settings of Australia (Beks et al., 2021; Gausia, Thompson, Lindeman, Brown, & Perkins, 2015). The development of research partnerships between universities and health services in non-metropolitan settings would likely facilitate greater evaluation activity around nurse-led models of care and build the capacity of researchers in non-metropolitan settings to lead this work (Alston & Versace, 2023). In the literature, there is a growing focus on targeted approaches to building research skills in nurses through research education (King et al., 2022), and the capacity of health services in non-metropolitan settings. An Australian example is the establishment of co-located research unit supported by a University Department of Rural Health (through the RHMT program), which supports health professionals to undertake research in their clinical area (Alston et al., 2022).

As part of this, building the capacity of health services and capability of nurses to evaluate is imperative to growing the evidence around nurse-led models of care in regional, rural, and remote settings of Australia (Beks et al., 2021; Douglas et al., 2018). There are many examples of evaluation frameworks frequently applied in health care, including the RE-AIM framework (which examines reach, effectiveness, adoption, implementation, and maintenance) (Glasgow et al., 2019), and the Donabedian framework (which assesses structure, process, and outcomes) (Gardner, Gardner, & O'Connell, 2014), that could be applied to evaluate nurse-led models of care. Further, cost-effectiveness evaluations are of value for building the evidence around nurse-led models of care (Gordon et al., 2019) and identifying priority settings (e.g., chronic disease management in community setting), particularly at a health service level where a business case is often required for supporting new models of care.

The benefits of implementing nurse-led models of care identified by this review resonate with those presented in the international literature (e.g., improved access to health care) (Bergengren et al., 2022; Woo, Lee, & Tam, 2017). Likewise, the barriers identified by this review have been discussed in other Australian research examining issues mediating RNs expanding their scope of practice (Birks, Davis, Smithson, & Lindsay, 2019). Specific barriers for the implementation of NP models of care, have also been identified in

other research, and support those identified by this review (e.g., role ambiguity) (Smith, McNeil, Mitchell, Boyle, & Ries, 2019). Addressing these barriers by supporting the nursing workforce in non-metropolitan settings to implement and evaluate models of care is critical to improving the delivery of health care for populations residing in these settings (Whitehead et al., 2019). An important part of this involves addressing variations in scope of practice within the nursing workforce, including definitions of advanced practice nursing (Birks et al., 2019; Parker & Hill, 2017), and working collaboratively with other health professionals (e.g., medical doctors and allied health professionals) to ensure necessary support and resourcing are in place.

4.1. Limitations

Although this scoping review provides a comprehensive search of the peer-reviewed and grey literature, there is the potential that evaluations have not been included due to publication bias (e.g., internal health service evaluations of nurse-led models of care that have not been published due to evaluation findings). Often, health service interventions and models of care can be evaluated, but evaluation findings are not publicly available. This review supports the need for funding and academic support for nurses to evaluate models of care, and to make evaluation findings publicly available in the form of peer-reviewed studies, which is imperative to building the international evidence base around nurse-led models of care. Further, a quality assessment of included studies was not undertaken, which is a limitation.

5. Conclusions

Greater support is required for the implementation and evaluation of nurse-led models of care in regional, rural, and remote settings of Australia. Building evidence around the outcomes of nurse-led models of care and impact on hospital and healthcare indicators is important given the maldistribution of the medical workforce in non-metropolitan settings. Academic partnerships with health services offer one such approach to supporting nurses in evaluating models of care. Place-based evaluations, which support the research capacity of health services, and research capability of nurses, are recommended to achieve this. Future research should focus on the strategies to support nurses and health services in regional, rural, and remote settings to implement and evaluate nurse-led models of care.

Authorship contribution statement

HB conceptualized the study. HB drafted the study design, search strategies, screened studies, extracted data, drafted findings, and the review. SC, MJB, VLV, and AWS provided input into the study design. SC, MJB, and AWS were involved in the screening of studies. SC was involved in the extraction of studies and drafting of findings. AWS and SO provided input into drafting the paper. All authors have read and approved the final paper.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

Ethical statement

As the review was of published peer-reviewed outputs, no ethical review was required.

Conflict of interest

The authors have no conflicts of interest to declare.

Acknowledgements

HB, SC, MJB, AWS, and VLV are supported by the Rural Health Multidisciplinary Training (RHMT) Program, funded by the Australian Government. We wish to thank Deakin University librarian, Louisa Sher, for reviewing the search strategies, and Dr Sally Lima (Bendigo Health and University of Melbourne) for contributing to the scoping review protocol.

Appendix A. Supporting information

Supplementary data associated with this article can be found in the online version at doi:10.1016/j.colegn.2023.05.004.

References

Adams, C., Hooker, L., & Taft, A. (2019). The enhanced maternal and child health nursing program in Victoria: a cross-sectional study of clinical practice. *Australian Journal of Primary Health, 25*, 281–287.

Alston, L. & Versace, V.L. (2023). *Place-based Research in Small Rural Hospitals: An Overlooked Opportunity for Action to Reduce Health Inequities in Australia?* The Lancet Regional Health Western Pacific. ⟨https://doi.org/10.1016/j.lanwpc.2022.100682⟩.

Alston, L., Field, M., Brew, F., Payne, W., Aras, D., & Versace, V. L. (2022). Addressing the lack of research in rural communities through building rural health service research: establishment of a research unit in Colac, a medium rural town. *Australian Journal of Rural Health, 30*, 536–539. https://doi.org/10.1111/ajr.12860

Atkinson-Briggs, S., Jenkins, A., Keech, A., Ryan, C., & Brazionis, L. (2021). Prevalence of diabetic retinopathy and reduced vision among indigenous Australians in the nurse-led iDEES study in a regional primary care clinic. *Internal Medicine Journal,* 1–8. https://doi.org/10.1111/imj.15625

Atkinson-Briggs, S., Jenkins, A., Ryan, C., & Brazionis, L. (2022). Mixed diabetic retinopathy screening coverage results in indigenous Australian primary care settings: a nurse-led model of integrated diabetes care. *Journal of Advanced Nursing, 78*, 3187–3196.

Australian Bureau of Statistics (2016). *Australian Statistical Geography Standard (ASGS) Remoteness Structure*. Australian Bureau of Statistics. ⟨https://www.abs.gov.au/websitedbs/D3310114.nsf/home/remoteness+structure⟩.

Australian Government (2022). *Rural Health Multidisciplinary Training (RHMT) program*. Available from: ⟨https://www.health.gov.au/initiatives-and-programs/rhmt⟩ [Accessed 14 June].

Australian Institute of Health and Welfare (AIHW) (2022). *Chronic Conditions and Multimorbidity*. ⟨https://www.aihw.gov.au/reports/australias-health/chronic-conditions-and-multimorbidity#Variation%20between%20population%20groups⟩.

Baldwin, K. A., Sisk, R. J., Watts, P., McCubbin, J., Brockschmidt, B., & Marion, L. N. (1998). Acceptance of nurse practitioners and physician assistants in meeting the perceived needs of rural communities. *Public Health Nursing, 15*, 389–397. https://doi.org/10.1111/j.1525-1446.1998.tb00365.x

Barraclough, F., Longman, J., & Barclay, L. (2016). Integration in a nurse practitioner-led mental health service in rural Australia. *Australian Journal of Rural Health, 24*, 144–150.

Beks, H., Binder, M. J., Kourbelis, C., Ewing, G., Charles, J., Paradies, Y., et al. (2019). Geographical analysis of evaluated chronic disease programs for Aboriginal and Torres Strait Islander people in the Australian primary health care setting: a systematic scoping review. *BMC Public Health, 19*, Article 1115. https://doi.org/10.1186/s12889-019-7463-0

Beks, H., Healey, C., & Schlicht, K. G. (2018). 'When you're it': a qualitative study exploring the rural nurse experience of managing acute mental health presentations. *Rural and Remote Health, 18*, Article 4616. https://doi.org/10.22605/rrh4616

Beks, H., Walsh, S., Alston, L., Jones, M., Smith, T., Maybery, D., et al. (2022). Approaches used to describe, measure, and analyze place of practice in dentistry, medical, nursing, and allied health rural graduate workforce research in Australia: a systematic scoping review. *International Journal of Environmental Research and Public Health, 19*, Article 1438. ⟨https://www.mdpi.com/1660-4601/19/3/1438⟩.

Beks, H., Walsh, S. M., Binder, M. J., Jones, M., & Versace, V. L. (2021). Contribution of nurse leaders to rural and remote health research in Australia: a non-systematic scoping review. *Collegian, 28*, 652–684. https://doi.org/10.1016/j.colegn.2021.10.005

Bennett-Daly, G., Unwin, M., Dinh, H., Dowlman, M., Harkness, L., Laidlaw, J., et al. (2021). Development and initial evaluation of a nurse-led healthcare clinic for homeless and at-risk populations in Tasmania, Australia: a collaborative initiative. *International Journal of Environmental Research and Public Health, 18*, 1–15. https://doi.org/10.3390/ijerph182312770

Bergengren, O., Kaihola, H., Borgefeldt, A.-C., Johansson, E., Garmo, H., & Bill-Axelson, A. (2022). Satisfaction with nurse-led follow-up in prostate cancer patients; a

nationwide population-based study. *European Urology Open Science, 38*, 25–31. https://doi.org/10.1016/j.euros.2022.01.009
Birks, M., Davis, J., Smithson, J., & Lindsay, D. (2019). Enablers and barriers to registered nurses expanding their scope of practice in Australia: a cross-sectional study. *Policy, Politics, & Nursing Practice, 20*, 145–152. https://doi.org/10.1177/1527154419864176
Bramble, M., Wong, A., Rossiter, R., Carroll, V., & Schwebel, D. (2019). *Exploring the Cost Effectiveness of the Specialist Parkinson's Disease Nurse Position in the Mid North Coast Local Health District of New South Wales*. ⟨https://researchoutput.csu.edu.au/ws/portalfiles/portal/33515513/Stage_2B_Report_Final_30.07.2019.pdf⟩.
Bramble, M., Wong, A., Carroll, V., Schwebel, D., & Rossiter, R. (2021). Using an economic evaluation approach to support specialist nursing services for people with Parkinson's in a regional community. *Journal of Advanced Nursing, 77*, 4722–4732.
Brundisini, F., Giacomini, M., DeJean, D., Vanstone, M., Winsor, S., & Smith, A. (2013). Chronic disease patients' experiences with accessing health care in rural and remote areas: a systematic review and qualitative meta-synthesis. *Ontario Health Technology Assessment Series, 13*, 1–33.
Carrington, M., & Stewart, S. (2015). Cardiovascular disease prevention via a nurse-facilitated intervention clinic in a regional setting: the Protecting Healthy Hearts Program. *European Journal of Cardiovascular Nursing, 14*, 352–361.
Carrington, M., Wiley, J., & Zimmet, P. (2019). Health and lifestyle modification for reducing severity of cardio-metabolic risk in individuals with metabolic syndrome: findings from the MODERN trial. *Heart, Lung and Circulation, 28*, S301–S302.
Carrington, M., & Zimmet, P. (2022). Nurse co-ordinated health and lifestyle modification for reducing multiple cardio-metabolic risk factors in regional adults: outcomes from the MODERN randomized controlled trial. *European Journal of Cardiovascular Nursing, 21*, 26–35.
Carville, K., Howse, L., Edmondson, M., Petkovska, G., Morey, P., Maguire, C., et al. (2018). Nurse practitioners and their use of low-frequency ultrasound debridement in the management of chronic wounds. *Wound Practice & Research: Journal of the Australian Wound Management Association, 26*, 122–126.
Chen, T. M., & Tescher, P. (2010). Emergency department demographics at a small Australian rural hospital. *Rural Remote Health, 10*, Article 1318.
Coady, V., Warren, N., Bilkhu, N., & Ayton, D. (2019). Preferences for rural specialist health care in the treatment of Parkinson's disease: exploring the role of community-based nursing specialists. *Australian Journal of Primary Health, 25*, 49–53.
Coleman, S., Havas, K., Ersham, S., Stone, C., Taylor, B., Graham, A., et al. (2017). Patient satisfaction with nurse-led chronic kidney disease clinics: a multicentre evaluation. *Journal of Renal Care, 43*, 11–20. https://doi.org/10.1111/jorc.12189
Considine, J., & Fielding, K. (2010). Sustainable workforce reform: case study of Victorian nurse practitioner roles. *Australian Health Review, 34*, 297–303. https://doi.org/10.1071/ah08727
Cosgrave, C., Malatzky, C., & Gillespie, J. (2019). Social determinants of rural health workforce retention: a scoping review. *International Journal of Environmental Research and Public Health, 16*, 1–19. https://doi.org/10.3390/ijerph16030314
Craswell, A., Dwyer, T., Rossi, D., Armstrong, C., & Akbar, D. (2018). Cost-effectiveness of nurse practitioner–led regional titration service for heart failure patients. *J Nurse Practitioners, 14*, 105–111.
Croese, A., Lawson, A., Singh, T., Brimstone, S., & Brunott, N. (2018). An evaluation of nurse-led post-operative telephone follow-up in a regional centre. *ANZ Journal of Surgery, 88*, 397–398.
Currie, F., Nielsen, G., Ervin, K., & Koschel, A. (2016). The value of rural isolated practice endorsed registered nurses in a small rural health service. *Research in Health Science, 1*, Article 58. https://doi.org/10.22158/rhs.v1n1p58
Davidson, P., Halcomb, E., Hickman, L., Phillips, J., & Graham, B. (2006). Beyond the rhetoric: what do we mean by a 'model of care'? *The Australian Journal of Advanced Nursing, 23*, 47–55.
Department of Health (2013). *Review of Australian Government Health Workforce Programs*. ⟨https://medicaldeans.org.au/md/2018/07/2013-April_Mason-Review.pdf⟩.
Department of Health (2022). *Modified Monash Model*. ⟨https://www.health.gov.au/health-topics/rural-health-workforce/classifications/mmm⟩.
Douglas, C., Schmalkuche, D., Nizette, D., Yates, P., & Bonner, A. (2018). Nurse-led services in Queensland: a scoping study. *Collegian, 25*, 363–370. https://doi.org/10.1016/j.colegn.2017.10.011
Dutton, T., Marjoram, J., Burgess, S., Montgomery, L., Vail, A., Callan, N., et al. (2020). Uptake and acceptability of human papillomavirus self-sampling in rural and remote aboriginal communities: evaluation of a nurse-led community engagement model. *BMC Health Services Research, 20*, Article 398.
Dwyer, T., Alison, A., Dolene, D., Darren, D., Craswell, A., Rossi, D., et al. (2017). Evaluation of an aged care nurse practitioner service: quality of care within a residential aged care facility hospital avoidance service. *BMC Health Services Research, 17*, 1–11.
Eley, D. S., Patterson, E., Young, J., Fahey, P. P., Del Mar, C. B., Hegney, D. G., et al. (2013). Outcomes and opportunities: a nurse-led model of chronic disease management in Australian general practice. *Australian Journal of Primary Health, 19*, 150–158. https://doi.org/10.1071/PY11164
Elmer, S. & Stirling, C. (2013). *Evaluation of the Nurse Practitioner Role at the Hobart Women's Health Centre*. ⟨https://www.womenshealthtas.org.au/sites/default/files/resources/evaluation-nurse-practitioner-role-hobart-womens-health-centre/nphwhcfinalreport.pdf⟩.
Ervin, K., Reid, C., Moran, A., Opie, C., & Haines, H. (2019). Implementation of an older person's nurse practitioner in rural aged care in Victoria, Australia: a qualitative study. *Human Resources for Health, 17*, Article 80.
Frohmader, T., Lin, F., & Chaboyer, W. (2018). Structures, processes and outcomes of the Aussie Heart Guide Program: a nurse mentor supported, home based cardiac rehabilitation program for rural patients with acute coronary syndrome. *Australian Critical Care, 31*, 93–100.
Frohmader, T. J., Lin, F., & Chaboyer, W. (2015). Patient perceptions of nurse mentors facilitating the Aussie Heart Guide: a home-based cardiac rehabilitation programme for rural patients. *Nursing Open, 3*, 41–50. https://doi.org/10.1002/nop2.34
Gardner, G., Gardner, A., & O'Connell, J. (2014). Using the Donabedian framework to examine the quality and safety of nursing service innovation. *Journal of Clinical Nursing, 23*, 145–155. https://doi.org/10.1111/jocn.12146 Epub 2013 Jul 3. PMID: 23834585.
Gausia, K., Thompson, S. C., Lindeman, M. A., Brown, L. J., & Perkins, D. (2015). Contribution of university departments of rural health to rural health research: an analysis of outputs. *Australian Journal of Rural Health, 23*, 101–106. https://doi.org/10.1111/ajr.12142
Glasgow, R., Harden, S. M., Gaglio, B., Rabin, B., Smith, M. L., Porter, G. C., et al. (2019). RE-AIM planning and evaluation framework: adapting to new science and practice with a 20-year review. *Frontiers in Public Health, 7*, 1–9. https://doi.org/10.3389/fpubh.2019.00064
Gonçalves, I., Mendes, D. A., Caldeira, S., & Nunes, E. (2021). Nurse-led care management models for patients with multimorbidity in hospital settings: a scoping review protocol. *JBI Evidence Synthesis, 19*, 1934–1940. https://doi.org/10.11124/jbies-20-00222
Gordon, K., Gray, C. S., Dainty, K. N., deLacy, J., & Seto, E. (2019). Nurse-led models of care for patients with complex chronic conditions: a scoping review. *Nursing Leadership, 32*, 57–76. https://doi.org/10.12927/cjnl.2019.25972
Hakanson, C., Douglas, C., Robertson, J., & Lester, L. (2014). Evaluation of a rural nurse-led clinic for female sexual dysfunction. *Australian Journal of Rural Health, 22*, 33–39.
Happell, B., Stanton, R., Hoey, W., & Scott, D. (2015). Reduced ambivalence to the role of the cardiometabolic health nurse following a 6-month trial. *Perspectives in Psychiatric Care, 51*, 80–85.
Happell, B., Stanton, R., Platania-Phung, C., McKenna, B., & Scott, D. (2014). The cardiometabolic health nurse: physical health behaviour outcomes from a randomised controlled trial. *Issues in Mental Health Nursing, 35*, 768–775.
Harvey, C. (2011). Legislative hegemony and nurse practitioner practice in rural and remote Australia. *Health Sociology Review, 20*, 269–280. https://doi.org/10.5172/hesr.2011.20.3.269
Hegarty, K., Parker, R., Newton, D., Forrest, L., Seymour, J., & Sanci, L. (2013). Feasibility and acceptability of nurse-led youth clinics in Australian general practice. *Australian Journal of Primary Health, 19*, 159–165.
Hudson, S. (2017). *Evaluating Indigenous Programs: A Toolkit for Change*. ⟨https://www.cis.org.au/wp-content/uploads/2017/06/rr28.pdf⟩.
Hullick, C., Hall, A., Conway, J., Hewitt, J., Darcy, L., Barker, R., et al. (2021). Reducing hospital transfers from aged care facilities: a large-scale stepped wedge evaluation. *Journal of the American Geriatrics Society, 69*, 201–209.
Hungerford, C., Prosser, B., Davey, R., & Clark, S. (2016). The Australian 'grey nomad' and aged care nurse practitioner models of practice: a case study analysis. *Rural Remote Health, 16*, Article 3647.
Huxtable, A., Millar, L., Love, P., Bell, C., & Whelan, J. (2018). Parental translation into practice of healthy eating and active play messages and the impact on childhood obesity: a mixed methods study. *Nutrients, 10*, Article 27.
Iles, R., Eley, D., Hegney, D., Patterson, E., Young, J., Del Mar, C., et al. (2014). Revenue effects of practice nurse-led care for chronic diseases. *Australian Health Review, 38*, 363–369.
Jennings, N., Lowe, G., & Tori, K. (2021). Nurse practitioner locums: a plausible solution for augmenting health care access for rural communities. *Australian Journal of Primary Health, 27*, 1–5. https://doi.org/10.1071/py20103
Kelly, J., Garvey, D., & Biro, M. A. (2017). Managing medical service delivery gaps in a socially disadvantaged rural community: a nurse practitioner led clinic. *Australian Journal of Advanced Nursing, 34*, 42–49.
Khair, K., & Chaplin, S. (2017). What is a nurse-led service? A discussion paper. *The Journal of Haemophilia Practice, 4*, 1–10. https://doi.org/10.17225/jhp00100
King, O., West, E., Lee, S., Glenister, K., Quilliam, C., Wong Shee, A., et al. (2022). Research education and training for nurses and allied health professionals: a systematic scoping review. *BMC Medical Education, 22*, Article 385. https://doi.org/10.1186/s12909-022-03406-7
Kirby, S., Moore, M., McCarron, T., Perkins, D., & Lyle, D. (2015a). Nurse-led diabetes management in remote locations. *Canadian Journal of Rural Medicine, 20*, 51–55.
Kirby, S., Moore, M., McGarron, T., Johnstone, P., Perkins, D., & Lyle, D. (2015b). People living in remote communities can have best-practice diabetes care. *Rural Remote Health, 15*, Article 3203.
KPMG (2019). *Cost Benefit Analysis of Nurse Practitioner Models of Care*. ⟨https://www.health.gov.au/sites/default/files/documents/2021/03/cost-benefit-analysis-of-nurse-practitioner-models-of-care.pdf⟩.
Kyoon-Achan, G., Lavoie, J., Avery Kinew, K., Phillips-Beck, W., Ibrahim, N., Katz, A., et al. (2018). Innovating for transformation in first nations health using community-based participatory research. *Qualitative Health Research, 28*, 1036–1049. https://doi.org/10.1177/1049732318756056
Lawton, J., Kinsman, L., Dalton, L., Walsh, F., Bryan, H., & Williams, S. (2017). Right service, right place: optimising utilisation of a community nursing service to reduce planned re-presentations to the emergency department. *BMJ Open Quality, 6*, 1–8.
Lobo, R., Mascarenhas, L., Worthington, D., Bevan, J., & Mak, D. (2015). Evaluation of the regional nurse-supported hepatitis C shared care program in Western Australia: a mixed methods study. *BMC Health Services Research, 15*, Article 399.

Maier, C. B., Barnes, H., Aiken, L. H., & Busse, R. (2016). Descriptive, cross-country analysis of the nurse practitioner workforce in six countries: size, growth, physician substitution potential. *BMJ Open, 6*, Article e011901. https://doi.org/10.1136/bmjopen-2016-011901

Mares, M. A., McNally, S., & Fernandez, R. S. (2018). Effectiveness of nurse-led cardiac rehabilitation programs following coronary artery bypass graft surgery: a systematic review. *JB Database of Systematic Reviews and Implementation Reports, 16*, 2304–2329. https://doi.org/10.11124/jbisrir-2017-003565

Monterosso, L., & Platt, V. (2016). The cancer nurse coordinator service in Western Australia: perspectives of specialist cancer nurse coordinators. *Australian Journal of Advanced Nursing, 34*, 16–26.

Morgan, M. A. J., Coates, M. J., Dunbar, J. A., Reddy, P., Schlicht, K., & Fuller, J. (2013). The TrueBlue model of collaborative care using practice nurses as case managers for depression alongside diabetes or heart disease: a randomised trial. *BMJ Open, 3*, Article e002171. https://doi.org/10.1136/bmjopen-2012-002171

Mossenson, A., Algie, K., Olding, M., Garton, L., & Reeve, C. (2012). 'Yes wee can' — a nurse-driven asymptomatic screening program for chlamydia and gonorrhoea in a remote emergency department. *Sexual Health, 9*, 194–195.

Murfet, G. O., Allen, P., & Hingston, T. J. (2014). Maternal and neonatal health outcomes following the implementation of an innovative model of nurse practitioner-led care for diabetes in pregnancy. *Journal of Advanced Nursing, 70*, 1150–1163.

Newall, F., Twomey, B., & Lima, S. (2018). Advanced practice nursing–promoting organisation clarity and connectedness: a mixed methods approach. *Collegian, 25*, 97–103. https://doi.org/10.1016/j.colegn.2017.04.003

Nguyen, H., Zarnowiecki, D., Segal, L., Gent, D., Silver, B., & Boffa, J. (2018). Feasibility of implementing infant home visiting in a Central Australian aboriginal community. *Prevention Science, 19*, 966–976.

Parker, D., Clifton, K., Shams, R., & Young, J. (2012). The effectiveness of nurse-led care in general practice on clinical outcomes in adults with type 2 diabetes. *JBI Library of Systematic Reviews, 10*, 2514–2558. https://doi.org/10.11124/jbisrir-2012-33

Parker, J. M., & Hill, M. N. (2017). A review of advanced practice nursing in the United States, Canada, Australia and Hong Kong Special Administrative Region (SAR), China. *International Journal of Nursing Sciences, 4*, 196–204. https://doi.org/10.1016/j.ijnss.2017.01.002

Paynter, H., Foderc, L., Scuteri, J., Kerin-Ayres, K., & Tink, K. (2013). Evaluation of the McGrath Foundation's Breast Cancer Nurses Initiative. *Australian Journal of Cancer Nursing, 14*, 4–9.

Peters, M. D. J., McInerney, P., Munn, Z., Tricco, A. C., & Khalil, H. (2020). Chapter 11: scoping reviews. In E. Aromataris, & Z. Munn (Eds.). *JBI Manual for Evidence Synthesis*. Adelaide, South Australia: JBI. https://doi.org/10.46658/JBIMES-20-12

Peters, M. D. J., Godfrey, C. M., Khalil, H., McInerney, P., Parker, D., & Soares, C. B. (2015). Guidance for conducting systematic scoping reviews. *JBI Evidence Implementation, 13*, 141–146. https://doi.org/10.1097/xeb.0000000000000050

Peters, M. D. J., Marnie, C. I., Tricco, A., Pollock, D., Munn, Z., Alexander, L., et al. (2020). Updated methodological guidance for the conduct of scoping reviews. *JBI Evidence Synthesis, 18*, 2119–2126. https://doi.org/10.11124/JBIES-20-00167

Roberts, D. P. (2017). Accessibility and outcomes from a rural diabetes nurse-educator led self-management program. *Australian Journal of Advanced Nursing, 34*, 26–33.

Roche, T., Gardner, G., & Jack, L. (2017). The effectiveness of emergency nurse practitioner service in the management of patients presenting to rural hospitals with chest pain: a multisite prospective longitudinal nested cohort study. *BMC Health Services Research, 17*, Article 445.

Rossiter, R., Bramble, M., Matheson, A., Carroll, V., & Phillips, R. (2019). *Evaluating the Impact of Two Specialist Parkinson's Disease Nurse Positions in Regional New South Wales, Australia: A Qualitative Descriptive Study*. ⟨https://researchoutput.csu.edu.au/ws/portalfiles/portal/29400873/Final_Report_Evaluating_the_impact_of_2_specialist_PD_nurse_positions_2019.pdf⟩.

Sanford, C., Saurman, E., Dennis, S., & Lyle, D. (2021). 'We're definitely that link': the role of school-based primary health care registered nurses in a rural community. *Australian Journal of Primary Health, 27*, 76–82.

Sawyer, M., Pfeiffer, S., Sawyer, A., Bowering, K., Jeffs, D., & Lynch, J. (2014). Effectiveness of nurse home visiting for families in rural South Australia. *Journal of Paediatrics and Child Health, 50*, 1013–1022.

Sawyer, A., Kaim, A., Mittinity, M., Jeffs, D., Lynch, J., & Sawyer, M. (2019). Effectiveness of a 2-year post-natal nurse home-visiting programme when children are aged 5 years: results from a natural experiment. *Journal of Paediatrics and Child Health, 55*, 1091–1098.

Sinclair, C., Auret, K., Evans, S., Williamson, F., Dormer, S., Wilkinson, A., et al. (2017). Advance care planning uptake among patients with severe lung disease: a randomised patient preference trial of a nurse-led, facilitated advance care planning intervention. *BMJ Open, 7*, 1–11.

Smith, T., McNeil, K., Mitchell, R., Boyle, B., & Ries, N. (2019). A study of macro-, meso- and micro-barriers and enablers affecting extended scopes of practice: the case of rural nurse practitioners in Australia. *BMC Nursing, 18*, Article 14. https://doi.org/10.1186/s12912-019-0337-z

Stanley, M., Worrall-Carter, L., Rahman, M., McEvedy, S., & Langham, R. (2015). Assessment of an established dialysis nurse practitioner model of care using mixed methods research. *Contemporary Nurse, 51*, 148–152.

Tomnay, J., Coelli, L., Davidson, A., Hulme-Chambers, A., Orr, C., & Hocking, J. (2018). Providing accessible medical abortion services in a Victorian rural community: a description and audit of service delivery and contraception follow up. *Sexual Reproductive Healthcare, 16*, 174–180.

Versace, V. L., Beks, H., & Charles, J. A. (2021). Towards consistent geographic reporting of Australian health research. *Medical Journal of Australia, 215*, 1. https://doi.org/10.5694/mja2.51344 1-1.

Versace, V. L., Coffee, N. T., Franzon, J., Turner, D., Lange, J., Taylor, D., et al. (2019). Comparison of general and cardiac care-specific indices of spatial access in Australia. *PLoS One, 14*, Article e0219959. https://doi.org/10.1371/journal.pone.0219959

Versace, V. L., Skinner, T. C., Bourke, L., Harvey, P., & Barnett, T. (2021). National analysis of the Modified Monash Model, population distribution and a socio-economic index to inform rural health workforce planning. *Australian Journal of Rural Health, 29*, 801–810. https://doi.org/10.1111/ajr.12805

Wand, T., Collett, G., Cutten, A., Buchanan-Hagen, S., Stack, A., & White, K. (2021a). Patient and staff experience with a new model of emergency department based mental health nursing care implemented in two rural settings. *International Emrgecny Nursing, 57*, 1–9.

Wand, T., Collett, G., Cutten, A., Stack, A., Dinh, M., Bein, K., et al. (2021b). Evaluating an emergency department-based mental health liaison nurse service: a multi-site translational research project. *Emergency Medicine Australasia, 33*, 74–81.

Wand, T., Collett, G., Keep, J., Cutten, A., Stack, A., & White, K. (2021c). Mental health nurses' experiences of working in the emergency department of two rural Australian settings. *Issues in Mental Health Nursing, 42*, 893–898.

Whiteford, C., White, S., & Stephenson, M. (2016). Effectiveness of nurse-led clinics on service delivery and clinical outcomes in adults with chronic ear, nose and throat complaints: a systematic review. *JBI Database of Systematic Reviews and Implementation Reports, 14*, 229–256. https://doi.org/10.11124/jbisrir-2016-2237

Whitehead, L., Quinn, R., Bryce, J., Christian, C., Fitzsimons, J., Gascard, D., et al. (2019). Improving health outcomes in rural and remote Australia: optimising the contribution of nurses. *Collegian, 26*, 407–414. https://doi.org/10.1016/j.colegn.2019.03.002

Wilkinson, D., & Symon, B. (2000). Inequitable distribution of general practitioners in Australia: estimating need through the Robin Hood Index. *Australian and New Zealand Journal of Public Health, 24*, 71–75. https://doi.org/10.1111/j.1467-842x.2000.tb00726.x

Wilson, E., Hanson, L., Tori, K., & Perrin, B. (2021). Nurse practitioner led model of after-hours emergency care in an Australian rural urgent care centre: health service stakeholder perceptions. *BMC Health Services Research, 21*, Article 819.

Wilson, M., Bellefeuille, L.-A., D'Amore, A., & Mitchell, E. K. (2015). Establishing a continence nurse-led pessary clinic as a new model of care for women in rural Victoria. *The Australian and New Zealand Continence Journal, 21*, 75–83.

Woo, B. F. Y., Lee, J. X. Y., & Tam, W. W. S. (2017). The impact of the advanced practice nursing role on quality of care, clinical outcomes, patient satisfaction, and cost in the emergency and critical care settings: a systematic review. *Human Resources for Health, 15*, Article 63. https://doi.org/10.1186/s12960-017-0237-9

World Health Organization (2020). *State of the World's Nursing 2020: Investing in Education, Jobs and Leadership*. ⟨https://www.who.int/publications/i/item/9789240003279⟩.

World Health Organization. (2022). *Ageing and health*. Geneva, Switzerland: World Health Organization. ⟨https://www.who.int/news-room/fact-sheets/detail/ageing-and-health⟩.

Young, J., Eley, D., Patterson, E., & Turner, C. (2016). A nurse-led model of chronic disease management in general practice: patients' perspectives. *Australian Family Physician, 45*, 912–916.

Zadoroznyj, M., Brodribb, W., Falconer, L., Pearce, L., Northam, C., & Kruske, S. (2013). A qualitative study of pharmacy nurse providers of community based post-birth care in Queensland, Australia. *BMC Pregnancy & Childbirth, 13*, Article 144.