



International practice settings, interventions and outcomes of nurse practitioners in geriatric care: A scoping review



Krista S. Chavez¹, Andrew A. Dwyer^{1,2}, Anne-Sylvie Ramelet^{*,2}

University of Lausanne and the Centre Hospitalier Universitaire Vaudois (CHUV), Institute of Higher Education and Research in Healthcare – IUFRS, Biopole 2, Route de la Corniche 10, 1010 Lausanne, Switzerland

ARTICLE INFO

Keywords:

Advanced practice nursing
Continuity of patient care
Diffusion of innovation
Geriatric nursing
Home care services
Long term care
Nurse practitioner
Primary care
Transitional care

ABSTRACT

Objectives: To identify and summarize the common clinical settings, interventions, and outcomes of nurse practitioner care specific to older people.

Design: Scoping review of the international published and grey literature.

Data sources: A structured literature search was conducted of CINAHL, EMBASE, MEDLINE, Google Scholar, and Cochrane Collaboration and Joanna Briggs Institute databases.

Review methods: Following the Arksey and O'Malley framework, randomized controlled and quasi-experimental studies of Masters-prepared nurse practitioners providing care for patients over 65 years were included. Studies were reviewed independently by two investigators. Data were extracted, collated by setting, summarized in tables and synthesized for analysis.

Results: In total, 56 primary research studies from four countries and 23 systematic reviews were identified. Primary studies were conducted in primary care (n = 13), home care (n = 14), long-term care (n = 10), acute/hospital care (n = 9), and transitional care (n = 10). Nurse practitioner interventions included substitutive as well as a supplementation NP role elements to meet specific unmet patient care needs. Studies examined six main outcome measures: service utilization (n = 41), cost (n = 24), length of stay (n = 14), health indices (n = 44), satisfaction (n = 14) and quality of life (n = 7). Cumulatively, nurse practitioners demonstrated enhanced results in 83/144 (58%) of outcomes compared to physician-only or usual care. The most commonly measured financial-related outcome was service utilization (n = 41) and benefits were frequently reported in home care (8/9, 89%) and long-term care (7/10, 70%) settings. Among patient and care-related outcomes health indices were most frequently measured (n = 44). Primary care most frequently reported improved health indices (11/13, 85%). Transitional care reported improved outcomes across all measures, except for service utilization.

Conclusions: This review demonstrates improved or non-inferiority results of nurse practitioner care in older people across settings. More well-designed, rigorous studies are needed particularly in relation to costs. The results of this review could be used for future systemic review of effectiveness of NP care specific to older people. Despite the demonstrated NP role value, barriers to implementing the nurse practitioner role persist internationally and more work is needed to develop and promote these roles.

What is already known about the topic?

- The nurse practitioner role continues to spread and develop internationally.
- Studies have demonstrated positive outcomes in patients receiving care from nurse practitioners.
- Nurse practitioners have been used extensively in geriatric care.

What this paper adds

- This review identified the studies that reported the impact of NP care in geriatric patients.
- NP care of geriatric patients was identified in five clinical settings, including primary care, home care, long-term care, acute care, and transitional care.
- NPs have consistently produced equivalent or better outcomes compared to physician care alone/usual care across the five identified settings.
- It highlights the outcomes sensitive to NP care in geriatric patients.

* Corresponding author at: Institute of Higher Education and Research in Healthcare – IUFRS, Biopole 2, Route de la Corniche 10, 1010 Lausanne, Switzerland.
E-mail addresses: chavezkrista14@gmail.com (K.S. Chavez), anne-sylvie.ramelet@unil.ch (A.-S. Ramelet).

¹ Authors were employed at the Institute of Higher Education and Research in Healthcare – IUFRS at the time of the study.

² Authors contributed equally to this work.

1. Introduction

The United Nations (UN) estimates that by 2045, one-third of the global population will be over 60 years of age and the number of people over 80 years of age will triple (United Nations, 2015). This demographic shift, as well as the growing rates of chronic disease and obesity-related illness, will strain health care systems internationally. Currently, the population of people over 60 years of age in Europe, is greater than in any other part of the world (United Nations, 2015). To meet the healthcare needs of aging patients, governments and international health care organizations endeavor to increase the number of practitioners to provide direct clinical care. However, many geriatric residency programs continue to have unfilled posts. Indeed, in the United States (US), 56% of geriatric fellowships were unfilled in 2015 (Golden et al., 2015). Moreover, the number of practicing generalist physicians (i.e. primary care) continues to decline globally (World Health Organization, 2015).

In Anglophone countries such as the US, Canada, Australia and the United Kingdom (UK) nurse practitioners (NPs) function as autonomous health care providers to improve access to care, reduce physician work and/or mitigate physician shortages (Martin-Misener et al., 2015). Indeed, a 1995 Canadian study found 46% of nurse practitioners were functioning in a substitutive role to address physician shortages (Dunn and Nicklin, 1995). Nurses in a substitute role function autonomously and provides the same care as physicians alone. In contrast, supplementation refers to situation where NPs “supplements or extends the care of the doctor by providing a new primary care service” (p. 3) (Laurant et al., 2007). The distinction of the types of care models has been reported as a crucial determinant for successful interprofessional collaboration and role clarification when implementing these roles into practice (Contandriopoulos et al., 2015). Nurse practitioners have successfully closed gaps in care related to provider shortages and have expanded access to care for vulnerable populations – including geriatric patients with complex chronic conditions (Donald et al., 2013; Kane et al., 2003). Additionally, NPs in certain settings function in collaborative roles wherein they bring an advanced practice nursing perspective as part of an interprofessional approach to care emphasizing case management, care coordination, disease prevention, and health promotion improving the quality of care (Newhouse et al., 2012; Stanik-Hutt et al., 2013).

A nurse practitioner is an advanced practice nursing role (Hamric et al., 2014). The NP has advanced training that today requires a Master’s degree in most countries. The advanced education focuses on developing expert knowledge and competencies in pathophysiology, pharmacology, and advanced physical assessment – also known as the “3 Ps”. The NP is trained to examine, diagnose, and treat patients throughout the lifespan (American Association of Nurse Practitioners, 2015). This role has been implemented, or is in development, in 27 of the 39 countries in Europe, USA, Canada, Australia and New Zealand, yet training requirements, legal protection of the title, professional licensure and certification vary significantly between countries (Maier and Aiken, 2016; Pulcini et al., 2010). While the International Council of Nurses has developed an internationally-accepted definition of the NP role and competencies (2014, Sastre-Fullana et al., 2014), there continues to be a notable lack of consensus on requirements for NP education and clinical training.

In light of the growing global public health needs resulting from the aging population, the mounting shortfall of healthcare providers and the documented effectiveness of nurse practitioner care, this scoping review aims to identify experimental and quasi-experimental studies and summarize the common clinical settings, interventions, and outcomes of nurse practitioner care for older people, especially. We envision this mapping of the literature will be of interest to educators, researchers, health administrators, and policy makers implicated in the development and implementation of novel nurse practitioner roles particularly in countries where the field is only now emerging.

2. Methods

This scoping review follows the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2015). We employed the five-stage Arksey and O’Malley framework for scoping reviews (Levac et al., 2010). Briefly, the sequential stages of the process are: i) identify the research question, ii) identify the relevant literature, iii) select the literature, iv) chart the data, and v) collate, summarize, and report results (Davis et al., 2009).

2.1. Identifying the research question(s)

This project was guided by the following inter-related queries:

- In what geriatric care settings have NPs been implemented and its rationale?
- What type of interventions has been employed in the various clinical settings?
- What NP sensitive outcomes have been reported in the literature?
- Based on the reported outcomes, are NP interventions effective for older people?

2.2. Identifying relevant literature

A two-tiered search strategy was used. First, CINAHL, EMBASE and MEDLINE databases were searched for relevant published articles. Hand-searching of reference lists on key papers and web-based search of the grey literature, such as Google Scholar and professional and government websites were performed with the same terms used for the published articles. Systematic reviews were retrieved from the Cochrane Library and the Joanna Briggs Institute EBP database. Second, references from the retrieved systematic reviews were screened to ensure that all relevant primary studies were included in this scoping review. Articles published in English, French, and German between January 1980 and March 2016 were retrieved. This extended time period was selected to enable identification of pertinent early interventions in geriatric NP care. Search terms and linked terms included: primary health care OR general practice OR private practice OR general practitioner OR primary nursing OR ambulatory care OR outpatient department OR emergency health services OR emergency healthcare OR ambulatory OR outpatient OR family AND nurse practitioner OR acute care nurse practitioner OR emergency nurse practitioner OR gerontologic nurse practitioner, OR adult nurse practitioner OR advanced practice nurse, OR clinical nurse specialist OR PCNP OR ANP AND aged OR elderly. This search yielded 1437 articles. The second-tier search involved examining the bibliographies of retrieved key articles to identify additional relevant studies and seminal articles from the literature; this process identified an additional 346 articles for a total of 1783 articles.

2.3. Selecting the literature (i.e. inclusion-exclusion criteria)

Articles included in this scoping review met specified inclusion criteria: i) randomized controlled or quasi-experimental design, ii) a patient population with an average (\pm SD) age of 65 years or older iii) an intervention delivered by a Masters-prepared nurse practitioner with a scope of practice in line with the definition below.

The definition of a nurse practitioner drew from the broad definition of the International Council of Nurses (2014); “A Nurse Practitioner/Advanced Practice Nurse is a registered nurse who has acquired the expert knowledge base, complex decision-making skills and clinical competencies for expanded practice, the characteristics of which are shaped by the context and/or country in which s/he is credentialed to practice. A Master’s degree is recommended for entry level” (2014). However, this consensus definition lacks precision regarding the day-to-day function and scope of practice of the nurse practitioner. Therefore, we created an operational



PRISMA 2009 Flow Diagram

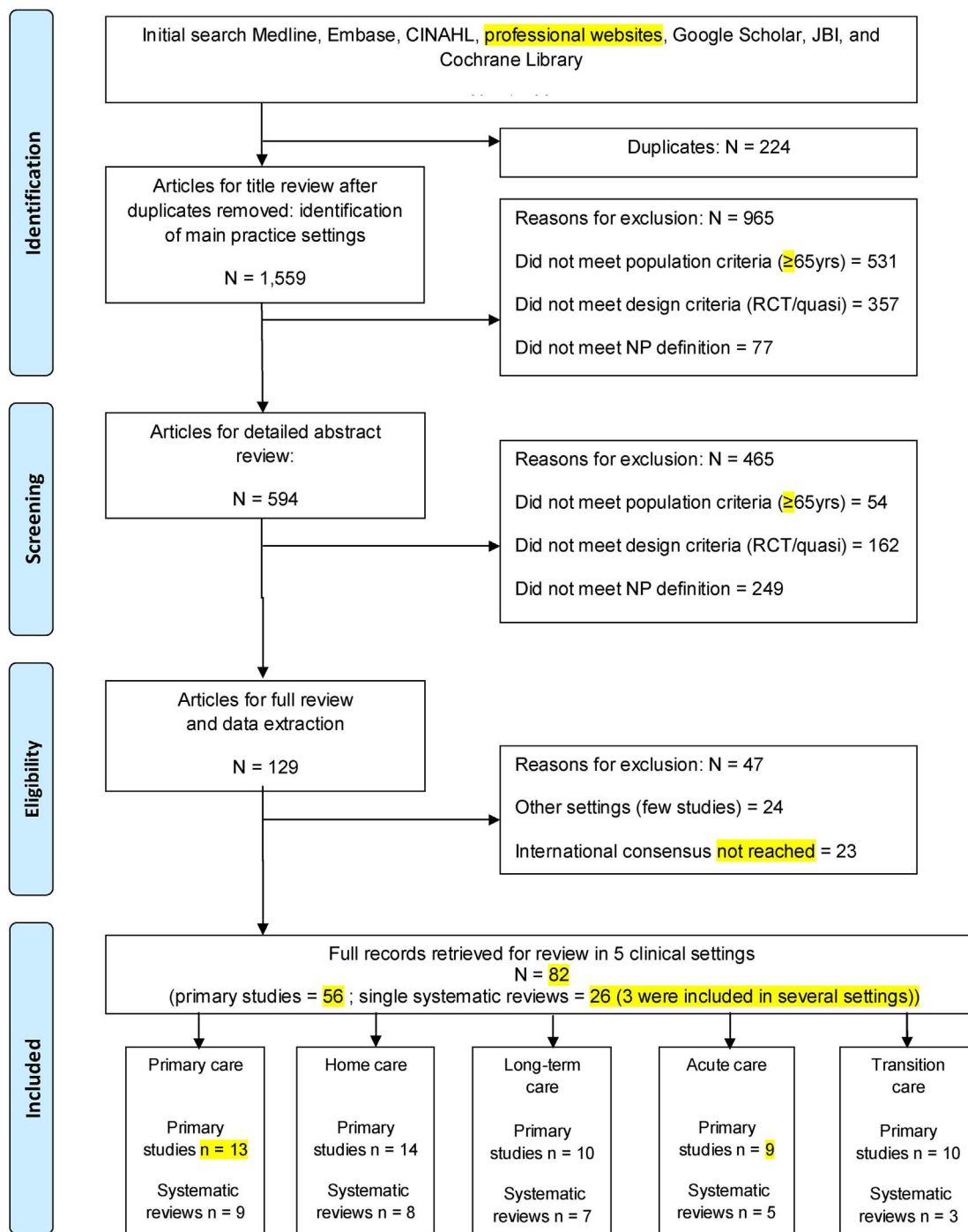


Fig. 1. Flow diagram of search strategy.

definition and vetted it with an international advisory panel of seven experts from Switzerland, Canada, USA, and Australia. The resulting definition used in this scoping review is:

An advanced practice nurse prepared in an NP-specific Masters program, who is authorized to independently assess patients, perform physical exams, order/interpret diagnostic tests, diagnose, make appropriate referrals and prescribe or adjust medications within their collaborative scope of practice.

Each study intervention was reviewed to verify it met this definition ensuring interoperable comparisons. Articles were subjected to general title and abstract screening based on the established inclusion criteria and sorted to determine the most frequently studied clinical settings. Studies with a population aged less than 65 years and studies with no comparison group were excluded.

Our search strategy identified a total of 1783 references (Fig. 1). After removing duplicates, a total of 1559 titles were reviewed by one

reviewer for relevance. In total 594 potentially relevant abstracts were moved to the screening phase and reviewed by two reviewers (KC, AD). Subsequently, the remaining 132 studies underwent full text review to determine eligibility by two independent investigators (KC, AD). At this phase, studies in the five most common clinical care settings underwent data extraction. The reviewers had conflicting opinions on 10/132 (8%) studies. Following in-depth discussion and a review by the advisory panel, consensus was reached to remove 23 studies from the analysis as the nurse practitioner intervention did not meet the role definition for this scoping review. The final 82 articles (56 primary studies, 26 systematic reviews) were included for detailed analysis and reported in the results of this review. The findings of the respective systematic reviews are compared and contrasted with the findings from this scoping review in the discussion section.

2.4. Charting the data

Following initial screening, two reviewers (KC, AD) extracted three specific components using a standardized form: i) key elements of the NP intervention, ii) the most frequently reported outcome measures used to assess NP care, and iii) data evaluating effectiveness of the intervention. Data were tabulated by care setting. Outcome measures were thematically grouped creating a “snapshot” to facilitate comparisons across clinical settings. A substitutive model of care was defined as those interventions wherein the NP functions autonomously and provides the same care that would have formerly been performed by physicians alone; in this model performance of both NP and physician are compared (Laurant et al., 2007; Martin-Misener et al., 2015). Supplementation model of care refers to situations where NPs supplement or extend the care provided by physicians by providing an innovative new care service (Laurant et al., 2007). Interventions delivered in the context of an interprofessional team were considered a supplementation model of care, wherein the aim of the NP role is to improve the quality of care provided to patients (Laurant et al., 2007; Martin-Misener et al., 2015).

2.5. Collating, summarizing, and reporting the literature

For each care setting, we provide a brief history of and rationale for the development of the NP role, a summary of the structural elements of the intervention as well as outcome measures and trend of effectiveness of the NP intervention. For each study, outcomes were summarized and reported as better, equivalent or worse than usual care or physician-only care. In cases where multiple outcome measures were evaluated within the same category, the outcome was reported using majority rule. For example, if a beneficial effect was observed in one of the health indices such as decreased glycated hemoglobin level (clinical outcome), yet were observed to be neutral in two other health outcomes, e.g. no change in total cholesterol or blood pressure – the health indices outcome for the study was reported as neutral.

3. Results

The 56 primary research studies were identified from four countries: Canada, Netherlands, Taiwan, and the United States. All of these countries have accredited Master’s level university NP programs. The primary studies clustered in five clinical settings i) primary care, ii) home care, iii) long-term care (i.e. nursing home), iv) acute (hospital) care, and v) transitional care which was separated from the acute care and home care settings due to the unique nature of the care provided across settings. The outcome measures assessing the impact of respective geriatric NP roles fell into two broad categories: financial-related outcomes and patient care-related outcomes (Box 1).

3.1. Geriatric primary care

In many countries, the NP is an emerging role responding to demographic changes and the increasing demand for coordinated chronic disease care (Carryer and Yarwood, 2015; Currie et al., 2013; DiCenso et al., 2007; Maier and Aiken, 2016). In the US, primary care was the original setting for NP role development and currently 86% of registered NPs work in this domain (American Academy of Nurse Practitioners, 2016). Notably, the UK’s National Health Service has utilized “specialty nurses” in primary care settings since the 1940’s. However, a number of studies from the UK were not included in this review, as the educational requirement identified as inclusion criteria was not met or was unclear.

In this review, thirteen primary studies from the US examined the substitutive (Hemani et al., 1999; Leveille et al., 1998) and supplementation NP role in primary care (Allen et al., 2002; Allen et al., 2002, 2001, 1995; Allen et al., 2002, 2001, 1995; Burns et al., 2000; Callahan et al., 2006; Engelhardt et al., 1996; Epstein et al., 1990; Ganz et al., 2010; Litaker et al., 2003; Paez and Allen, 2006; Reuben et al., 2013).

3.1.1. Intervention

Out of the 13 studies, the majority of them were randomized controlled trials (n = 9) and four used a quasi-experiment design. Five included primary care, where NP treats patients in the same manner as a physician and thus is largely a substitutive role. In this role, the NP mainly provided consultations to chronically ill patients that focused on chronic management as well as prevention, therapeutic adherence, patient education and health promotion. There are two predominate substitutive models of care in these studies. First, the NP evaluates and treats patients in the same manner as the physician collaborator providing full physical assessment, differential diagnosis and treatment of acute, routine, and chronic disease patients (Hemani et al., 1999; Leveille et al., 1998; Litaker et al., 2003). In the second model, the NP provides disease-specific interventions with in-depth physical examination and ongoing care by adjusting and personalizing the treatment plan for specific patient populations (e.g. coronary heart disease) (Allen et al., 2002; Paez and Allen, 2006). The remaining seven studies included NP interventions in high risk patients in supplement to medical care and to usual care as part of a geriatric assessment and management in an interdisciplinary team (see Table 1A).

3.1.2. Outcomes and effectiveness

Retrieved primary care studies (n = 13) demonstrate NP care is equal or superior in all measured outcomes except cost (Table 2) (Allen et al., 2002; Boulton et al., 2001; Burns et al., 1995, 2000; Callahan et al., 2006; Engelhardt et al., 1996; Epstein et al., 1990; Ganz et al., 2010; Hemani et al., 1999; Leveille et al., 1998; Litaker et al., 2003; Paez and Allen, 2006; Reuben et al., 2013). NPs have similar service utilization (7/8, 88%) (Boulton et al., 2001; Burns et al., 1995, 2000; Callahan et al., 2006; Engelhardt et al., 1996; Hemani et al., 1999) as physician colleagues. Among the four studies examining cost, two reported cost-neutral effects (Boulton et al., 2001; Paez and Allen, 2006), while the other two reported increased cost (Engelhardt et al., 1996; Litaker et al., 2003). Patient satisfaction was positive in 2/3 (67%) studies reporting this outcome (Engelhardt et al., 1996; Litaker et al., 2003). The NPs impact was frequently superior in terms of health indices for 11/13 (85%) studies. Several studies attribute the efficacy of NP care to the emphasis on coordinated patient-centered care including therapeutic education and patient engagement in self-management. Indeed, NP patient care was superior in terms of screening (n = 5) (Allen et al., 2002; Boulton et al., 2001; Callahan et al., 2006; Ganz et al., 2010; Reuben et al., 2013) and clinical outcomes (n = 5) (Allen et al., 2002; Burns et al., 1995; Epstein et al., 1990; Litaker et al., 2003; Paez and Allen, 2006) (Table 3).

A total of nine systematic reviews have been identified and included for further review, including seven that examined the effect of the

Box 1

Geriatric NP outcome measures and definitions.

Financial-Related Outcomes

- *Service utilization*: This includes hospital admissions, emergency room visits, planned/unplanned physician visits.
- *Cost*: Cost-related outcomes varied by setting and were most commonly reported as an indirect measure of service utilization, length of stay, and/or resource utilization.
- *Length of stay*: Refers to the length of stay in the facility during NP intervention.

Patient Care-Related Outcomes

- *Health indices*: These include a wide range of clinical parameters, measures of health status and quality indicators (see Table 2).
- *Quality of life*: As measured using validated instruments.
- *Satisfaction*: Refers to either patients, family members, and/or physicians and staff.

advanced nursing practice role in primary care only (Horrocks et al., 2002; Laurant et al., 2007; Martin-Misener et al., 2015; Martinez-Gonzalez et al., 2014a,b, 2015; Swan et al., 2015) and two in different settings, but including primary care (Newhouse et al., 2011; Stanik-Hutt et al., 2013). NPs provide equivalent or better care for high-use, high-cost, chronically ill geriatric patients (Horrocks et al., 2002; Laurant et al., 2007; Martin-Misener et al., 2015; Martinez-Gonzalez et al., 2014a,b, 2015; Stanik-Hutt et al., 2013; Swan et al., 2015). No primary studies included in these systematic reviews were missed by our initial search of the literature. Key findings of these reviews show NPs provide equivalent or better care for high-use, high-cost, chronically ill patients. However, all the reviews included studies with different population ages, such as children, older patients, as well as a mix of all ages.

3.2. Geriatric home care

NPs have been used in the home care setting since the 1970s in a substitutive and supplementation model to deliver episodic and acute care to homebound patients.

In this review, fourteen primary research studies were identified from Canada (Tung et al., 2012), the Netherlands (Looman et al., 2014), and the US (Alessi et al., 1997; Beck et al., 2009; Bula et al., 1999; Counsell et al., 2007, 2009; De Jonge et al., 2014; Krichbaum, 2007; Laurant et al., 2007; North et al., 2008; Ritchie et al., 2016; Stuck et al., 1995; Tinetti et al., 1994; Zimmer et al., 1985). The majority of them (n = 9) were randomized controlled trials and five used a quasi-experimental design (see Table 1B).

3.2.1. Intervention

In these studies, the NP provides timely on-site screening and a personalized approach to evaluation, diagnosis and treatment. The Comprehensive Geriatric Assessment (CGA) tool is a validated instrument used to identify previously undiagnosed health and safety problems (Alessi et al., 1997; Bula et al., 1999; Stuck et al., 1995). Interdisciplinary care team, including NPs, primary care physicians and geriatricians, social workers, and other health care providers have been tested in several studies (Counsell et al., 2007, 2009; De Jonge et al., 2014; Looman et al., 2014; North et al., 2008; Zimmer et al., 1985). In this type of supplementation model of care, NPs work closely alongside the other members of the team and perform CGA and develop and review individualized care plan with the primary care physicians (e.g. GRACE intervention) (Counsell et al., 2007).

3.2.2. Outcomes and effectiveness

Primary studies (n = 14) have compared NPs model of care in the home to usual care and report equal or superior results in all measured outcomes except cost (Table 2) (Alessi et al., 1997; Beck et al., 2009;

Bula et al., 1999; Counsell et al., 2007, 2009; De Jonge et al., 2014; Krichbaum, 2007; Looman et al., 2014; North et al., 2008; Ritchie et al., 2016; Stuck et al., 1995; Tinetti et al., 1994; Tung et al., 2012; Zimmer et al., 1985). Nurse practitioners were most frequently effective in decreasing service utilization (8/9, 89%) (Beck et al., 2009; Counsell et al., 2007; Laurant et al., 2007; North et al., 2008; Ritchie et al., 2016; Stuck et al., 1995; Tung et al., 2012; Zimmer et al., 1985). The NP interventions were deemed cost effective in 2/6 (33%) studies evaluating this outcome (De Jonge et al., 2014; North et al., 2008). Authors note the high acuity of geriatric patients as a challenge in cost containment regardless of the intervention. NP care was evaluated positively (58%) across a range of health indices in 7/12 studies (Table 3), most frequently improving prevention and screening (8/11 73%) (Alessi et al., 1997; Beck et al., 2009; Bula et al., 1999; Counsell et al., 2007; North et al., 2008; Ritchie et al., 2016; Stuck et al., 1995; Tinetti et al., 1994). The nurse practitioner's positive impact on these quality indicators is thought to prolong patient independence at home thus decreasing service utilization and improving quality of life.

Eight systematic reviews in home care settings have been identified and included for further review; five examined effect of specific interventions or program to maintain older people at home (Beswick et al., 2008; Bleich et al., 2015; Chang et al., 2004; Stuck et al., 2002; van Haastregt et al., 2000) and three reported the effectiveness of advanced nursing roles in the care of older people (Morilla-Herrera et al., 2016; Newhouse et al., 2011; Stanik-Hutt et al., 2013). No primary studies included in these systematic reviews were missed by our initial search of the literature. Key findings of these reviews show NP home care improved physical function and reduced falls and hospital admission.

3.3. Geriatric long-term care (nursing home)

NPs were introduced into long-term care settings in the US during the mid-1970s largely driven by the shortfall of physicians in rural nursing homes – and thus is mainly a substitutive model of care. New models of care emerged for long-term care, Optum CarePlus (formerly known as EverCare), where on-site NPs provide primary and acute care for residents, out of hours on call duty, and both formal and informal training to nursing home staff (Kane et al., 1989, 2003). Today, this model is extensively used in the US and has been piloted in Canada and the UK (Optum Inc., 2013; Roland et al., 2006).

In this review, ten primary quasi-experimental studies, from Canada (Klaasen et al., 2009; Lacny et al., 2016), and the US (Aigner et al., 2004; Buchanan et al., 1990; Burl et al., 1998; Garrard et al., 1990; Joseph and Boulton, 1998; Kane et al., 1989, 2003; Reuben et al., 1999) were included (Table 1C).

3.3.1. Intervention

The NP in long-term care typically has a broader scope of practice

Table 1A
Primary care: Characteristics of the included studies.

Refs.	Country of origin	Study population	Type of model of care	design [†]	Type of intervention	Comparator
Allen et al. (2002)	USA	Coronary heart disease patients with hypercholesterolemia	Supplementation	E	NP care Case management + 12-month follow-up in collaboration with primary provider and/or cardiologist	Physician care only
Boult et al. (2001)	USA	High risk patients for hospital admission	Supplementation	E	GEM* interdisciplinary clinic	Usual care (no GEM)
Burns et al. (1995)	USA	Outpatients following hospital discharge	Supplementation	E	GEM* interdisciplinary clinic	Usual care (no GEM)
Burns et al. (2000)	USA	Outpatients following hospital discharge	Supplementation	E	GEM* interdisciplinary clinic	Usual care (no GEM)
Callahan et al. (2006)	USA	Adults with Alzheimer disease	Supplementation	E	Primary care physician + NP care acting as the care manager	Primary care physician + augmented usual care
Engelhardt et al. (1996)	USA	Outpatients	Supplementation	E	GEM* interdisciplinary clinic	Usual care (no GEM)
Epstein et al. (1990)	USA	Outpatients	Supplementation	E	GEM* interdisciplinary clinic	Comparator 1: Second opinion internist Comparator 2: usual care (no assessment)
Ganz et al. (2010)	USA	High risk patients	Supplementation	QE	Collaborative care of specific complex conditions: ACOVE-3	Usual care
Hemani et al. (1999)	USA	Outpatients clinic	Substitutive	QE	NP consultation	Comparator 1: Medical resident Comparator 2: attending physicians
Leveille (2003)	USA	Chronic disease	Substitutive	E	NP Consultation	Usual care
Litaker et al. (2003)	USA	Chronic disease	Supplementation	QE	NP Consultation + Physician	Physician only
Paez and Allen (2006)	USA	Coronary heart disease patients with hypercholesterolemia	Supplementation	E	Case management + usual care	Usual care
Reuben et al. (2013)	USA	High risk patients	Supplementation	QE	Collaborative care of specific complex conditions: ACOVE	Physician only

Note. [†] E = Experimental, QE = Quasi-experimental, *GEM = Geriatric Evaluation & Management.

Table 2
Summary of financial and patient care related outcomes for geriatric nurse practitioner care by clinical setting.

Setting	financial-related outcomes				patient care-related outcomes																	
	service utilization (n = 41)				costs (n = 24)				length of stay (n = 14)			health indices ¹ (n = 44)				satisfaction (n = 14)		quality of life (n = 7)				
	+	=	-		+	=	-		+	=	-		+	=	-		+	=	-			
Primary care (n = 13)	1/7 (14%)	6/7 (86%)	0/7		0/4	2/4 (50%)	2/4 (50%)		-	-	-		11/13 (85%)	2/13 (15%)	0/13	2/3 (67%)	1/3 (33%)	2/3 (67%)	1/3 (33%)	2/3 (67%)	0/3	
Home care (n = 14)	8/9 (89%)	1/9 (11%)	0/9		2/6 (33%)	3/6 (50%)	1/6 (17%)		-	-	-		7/12 (58%)	5/12 (42%)	0/12	2/2	0/2	0/2	0/2	0/2	-	
Long-term care (n = 10)	7/10 (70%)	2/10 (20%)	1/10 (10%)		3/6 (50%)	2/6 (33%)	1/6 (17%)		-	-	-		2/4 (50%)	2/4 (50%)	0/4	2/3 (67%)	1/3 (33%)	2/3 (67%)	1/3 (33%)	0/3	-	
Acute care (n = 9)	3/5 (60%)	2/5 (40%)	0/5		2/4 (50%)	0/4	2/4 (50%)		3/9 (35%)	2/9 (20%)	0/9		4/6 (67%)	2/6 (33%)	0/6	0/2	1/2 (50%)	0/2	1/2 (50%)	0/2	-	
Transitional care (n = 10)	4/10 (40%)	6/10 (60%)	0/10		3/4 (75%)	1/4 (25%)	0/4		4/5 (80%)	1/5 (20%)	0/5		5/9 (55%)	4/9 (45%)	0/9	3/4 (75%)	1/4 (25%)	3/4 (75%)	1/4 (25%)	0/4	0/4 (0%)	
Totals (%)	23/41 (56%)	17/41 (42%)	1/41 (2%)		10/24 (42%)	8/24 (33%)	6/24 (25%)		8/14 (57%)	5/14 (36%)	2/14 (14%)		29/44 (66%)	15/44 (34%)	0/44 (0%)	9/14 (64%)	4/14 (29%)	9/14 (64%)	4/14 (29%)	1/14 (7%)	4/7 (57%)	3/7 (43%)

¹ health indices are detailed in Table 3.

Table 3
Most frequently reported health indices (outcomes) for nurse practitioner care by care setting.

Setting	functional status (n = 30)			symptom screening ² (n = 19)			mortality (n = 16)			clinical outcomes ³ (n = 13)			mental health ⁴ (n = 15)			falls ⁵ (n = 4)			medication review ⁶ (n = 4)			advanced directives (n = 4)			
	+	=	-	+	=	-	+	=	-	+	=	-	+	=	-	+	=	-	+	=	-	+	=	-	
	Primary care (n = 13)	4/12 (33%)	8/12 (67%)		4/5 (80%)	1/5 (20%)	1/4 (25%)	3/4 (75%)	1/4 (25%)	0/5	5/5 (100%)	0/5	5/10 (50%)	5/10 (50%)	2/2	0/2	1/1	0	0	0	0	0	0	0	0
Home care (n = 14)	3/7 (43%)	4/7 (57%)		8/11 (73%)	3/11 (27%)	0/11	3/3	0/11	-	-	-	2/4 (50%)	2/4 (50%)	1/1	0/1	0/1	-	-	-	-	-	-	-	-	0/2
Long-term care (n = 10)	1/3 (33%)	2/3 (67%)		1/1	0/1	0/1	1/1	0/1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0/1
Acute care (n = 9)	0/2	2/2		-	-	1/3 (33%)	2/3 (67%)	0/3	1/3 (33%)	2/3 (67%)	0/3	-	-	-	-	-	-	-	-	-	-	-	-	-	0/1
Transitional care (n = 10)	2/6 (33%)	4/6 (67%)		1/2 (50%)	1/2 (50%)	0/2	3/4 (75%)	0/4	2/5 (40%)	3/5 (60%)	0/5	1/1	0/1	0/1	1/1	0/1	0/2	0/2	1/1	1/1	0/2	0/2	0/2	-	-
Totals (%)	20/30 (67%)	10/30 (33%)		14/19 (74%)	5/19 (26%)	3/15 (20%)	12/15 (80%)	3/15 (20%)	8/13 (62%)	5/13 (38%)	2/13 (15%)	7/15 (47%)	7/15 (47%)	3/4 (75%)	1/4 (25%)	4/4 (100%)	0/4 (0%)	0/4 (0%)	4/4 (100%)	4/4 (100%)	0/4 (0%)	4/4 (100%)	0/4 (0%)	0/4 (0%)	0/4 (0%)

¹ "functional status" includes activities of daily living (ADLs) and Karnofsky score.

² "symptom screening" includes assessment for depression, cognition/dementia, urinary incontinence, and preventive care (i.e. influenza vaccine, eye exams, podiatry).

³ "clinical outcomes" include peak flow, blood pressure, glycated hemoglobin (HbA1c), lipid profile, and ejection fraction.

⁴ "mental health" includes measures of depression, cognition and mental status i.e. Center for Epidemiologic Studies Depression Scale (CES-D), Geriatric Depression Scale (GDS), Cornell Scale for Depression and Dementia (CSDD), mini mental status exam (MMSE).

⁵ "falls" includes measuring frequency and assessing risk for falls using validated tools/instruments.

⁶ "medication review" includes reviews of current medication and decreased number of medications used (polypharmacy).

Table 1B
Home care: Characteristics of the included studies.

Refs.	Country of origin	Study population	Type of model of care	Design*	Type of intervention	Comparator
Alessi et al. (1997)†	USA	Outpatients > 75 y	Substitutive	E (exp. arm)	Annual in home CGA and quarterly home visit by NP	Physician care
Beck et al. (2009)	USA	Outpatients	Supplementation	QE	NP care Urgent visits and additional home visits between physicians visit	Usual care
Bula et al. (1999)†	USA	Outpatients > 75 y	Substitutive	E	Annual in home CGA and quarterly home visit by NP	Physician care
Counsell et al. (2007)‡	USA	Outpatients > 65 y	Supplementation	E	Interdisciplinary team: NP care + Geriatric team + Primary care physician + Social Worker	Geriatric team + Primary care physician + Social Worker
Counsell et al. (2009)‡	USA	Outpatients > 65 y	Supplementation	E	Interdisciplinary team: NP care + Geriatric team + Primary care physician + Social Worker	Geriatric team + Primary care physician + Social Worker
De Jonge et al. (2014)	USA	Elderly chronically ill outpatients	Supplementation	QE	Interdisciplinary team: physician + NP + Mental health staff (admission and long term care)	Usual care
Krichbaum (2007)	USA	Elders with hip fracture outpatients	Hybrid	E	NP post-acute care coordinator 6-month follow-up	Physician care
Looman et al. (2014)	The Netherlands	Frail elders outpatients	Substitutive	QE	Integrated model of care, including supplementary NP care of high risk patients	Usual care
North et al. (2008)	USA	Elders outpatients	Substitutive	QE	NP-led home-based interdisciplinary primary care prevention program	Physician care
Ritchie et al. (2016)	USA	High risk outpatients > 65 y	Supplementation	QE	NP/social team Acute problems and plan care with families (e.g. advanced directives)	Physician care
Stuck et al. (1995) †	USA	Outpatients > 75 y	Substitutive	E	Annual in home CGA and quarterly home visit by NP	Physician care
Tinetti et al. (1994)	USA	Outpatients > 70 y	Supplementation	E	Assessment of risks by NP	Physician care *
Tung et al. (2012)	Canada	Homebound patients	Substitutive	E	NP consultations (assessment and treatment upon referral)	Medical care
Zimmer et al. (1985)	USA	Homebound chronically or terminally ill elderly	Supplementation	E	Interdisciplinary team, including NP nursing and medical care as needed.	No interdisciplinary team

Note. † these studies reported different results of one 3-year randomized trial of preventive in-home CGA (Comprehensive geriatric assessment); ‡ these studies reported results of a RCT of a home-based management program; * E = Experimental, QE = Quasi-experimental.

Table 1C
Long term care: Characteristics of the included studies.

Refs.	Country of origin	Study population	Type of model of care	Design [†]	Type of intervention	Comparator
Aigner et al. (2004)	USA	Nursing home residents	Substitutive	QE (chart review)	Acute visits by NP	Physician usual care
Buchanan et al. (1990)	USA	Nursing home residents	Substitutive	QE	NP care (no details)	Physician usual care
Burl et al. (1998)	USA	Nursing home residents	Substitutive	QE	NP care (admission and coordination of care)	Physician usual care
Garrard et al. (1990)	USA	Nursing home residents	Substitutive	QE	NP care (no details)	Physician usual care
Joseph and Boulton (1998)	USA	Nursing home residents	Supplementation	QE	New admission and long-term care NP care alongside physician (initial visit and review of medication) + NP alone (prevention, chronic care and monthly visit)	Physician care Acute care and monthly visit
Kane et al. (1989)	USA	Nursing home residents	Substitutive	QE	NP care (admission and long term care)	Physician usual care
Kane et al. (2003)	USA	EverCare nursing home residents	Substitutive	QE	EverCare: NPs work autonomously (1–2 visits/week) + out of hours oncall + training of nursing home staff	Physician usual care
Klaassen et al. (2009)	Canada	Nursing home residents	Substitutive	QE	NP primary care	Physician usual care
Lacny et al. (2016)	Canada	Nursing home residents	Substitutive	QE	NP primary care	Physician usual care
Reuben et al. (1999)	USA	Health Maintenance Organizations Nursing home residents	Supplementation	QE	NP care Acute problems and plan care with families (e.g. advanced directives)	Physician usual care

Note. [†] E = Experimental, QE = Quasi-experimental.

compared to other settings. The competencies needed for this role range from the substitutive role of providing acute/chronic advanced assessment and adjusting treatment regimens, to the supplementation role of care coordination, coaching, prevention, educating and advocacy for patients, families and staff. The majority of studies (n = 8) included a substitutive model of care, in which the NP is employed by a physician or healthcare group to rotate between multiple sites providing intermittent and ongoing care spanning a broad spectrum of care needs or is employed full-time by the facility providing direct patient assessment, initiation of treatment, care coordination, and serving a management role (see Table 1C).

3.3.2. Outcomes and Effectiveness

Primary studies (n = 10) (Aigner et al., 2004; Buchanan et al., 1990; Burl et al., 1998; Garrard et al., 1990; Joseph and Boulton, 1998; Kane et al., 1989, 2003; Klaassen et al., 2009; Lacny et al., 2016; Reuben et al., 1999) compared facilities with an NP involved in the team to care in facilities without an NP. Studies reported better or equal outcomes compared to physician care alone for all outcomes, except for cost (Table 2). The role was most effective in reducing service utilization (7/10, 70%) (Buchanan et al., 1990; Burl et al., 1998; Garrard et al., 1990; Joseph and Boulton, 1998; Kane et al., 2003; Klaassen et al., 2009; Reuben et al., 1999).

Seven systematic reviews in home care settings have been identified and included for further review. Two examined the effect of specific interventions to reduce hospital admission (Graverholt et al., 2014) and to improve End of life care in nursing home patients (Hall et al., 2011). Five reported the effectiveness of advanced nursing roles in the care of nursing homes residents (Christian and Baker, 2009; Donald et al., 2013; Morilla-Herrera et al., 2016; Newhouse et al., 2011; Stanik-Hutt et al., 2013). No primary studies included in these systematic reviews were missed by our initial search of the literature. Key findings of these reviews show NP long-term care favored continuity of care, reduced hospital admission, improved satisfaction and comfort, yet the quality of the studies included were low.

3.4. Geriatric acute care (hospital-based)

Historically, the NP in hospital-based acute care setting is a supplementation model that was adopted in response to regulations limiting the number of resident physician work hours (Delamaire, 2010; Howie-Esquivel and Fontaine, 2006; Kilpatrick et al., 2015).

Nine primary studies from the US were included for review, including eight quasi-experimental (Arbaje et al., 2010; Dahle et al., 1998; David et al., 2015; Iannuzzi et al., 2015; Lambing et al., 2004; Meyer and Miers, 2005; Miller, 1997; Robles et al., 2011) and one were randomized controlled trails (Reuben et al., 1995) (Table 1D).

3.4.1. Intervention

All primary studies (n = 9) examined care provided by teams with supplementation NP care compared to usual care. The supplementation model of care employs the NP as part of an inpatient interdisciplinary team (e.g. the Geri-FITT model). Notably, the structure and composition of such teams vary widely. The NP co-manages disease-specific hospitalised patients alongside the physician or specialist (e.g. cardiovascular surgeon) and coordinate care (Dahle et al., 1998; David et al., 2015; Meyer and Miers, 2005). For general medicine or surgical patients, the NP collaborates within a team of physicians, social workers, case managers and other allied health professionals to address the unique needs of older complex patients and mitigate iatrogenic complications (Arbaje et al., 2010; Lambing et al., 2004; Reuben et al., 1995) or in collaboration with the medical team (Iannuzzi et al., 2015; Miller, 1997; Robles et al., 2011).

3.4.2. Outcomes and effectiveness

The efficacy in the acute care setting is not as striking as other care

Table 1D
Transitional care: Characteristics of the included studies.

Refs.	Country of origin	Study population	Type of model of care	Design [†]	Type of intervention	Comparator
Cowan et al. (2006)	USA	Acutely ill hospitalised patients	Supplementation	QE	Case management by NP Hospital to Home 30-day follow-up with additional visits	Usual care
Enguidanos et al. (2012)	USA	High risk patients	Supplementation	E	BNPT case management Hospital to Home	Usual care
Huang and Liang (2005)	Taiwan	Outpatients following hospital discharge	Supplementation	E	Individualised discharge plan by NP: self-care management, fall prevention, patient education, and coordination of care and resources required	Usual care by registered nurses
Kauh et al. (2005)	USA	Patients in geriatric rehabilitation clinic	Supplementation	QE	Geriatric rehabilitation intervention by an NP + Geriatrician Hospital to Home 12-month follow-up	Usual care
Kotowycz et al. (2010)	Canada	Low risk STEMI patients	Supplementation	E	Early discharge plan by NP Hospital to discharge	Usual care by treating physician and nursing team
Naylor et al. (1999)	USA	High risk patients	Supplementation	E	Discharge plan by NP Hospital to home	usual care
Naylor et al. (2004)	USA	Heart failure hospitalised patients	Supplementation	E	Training program by multidisciplinary team + discharge plan by NP + additional 3-month follow-up	discharge plan by treating physician and RN
Ornstein et al. (2011)	USA	Hospitalised home-bound patients	Supplementation	QE	Discharge plan by NP Visit 3 Wks post-discharge and every 6–8 Wks as needed	Pre-intervention
Rawl et al. (1998)	USA	Inpatients	Supplementation	E	Hospital to Home 4-month Follow-up program by NP, including general and rehabilitation education	Usual care with no follow-up
Takahashi et al. (2013)	USA	Inpatients	Supplementation	QE	Interdisciplinary Care transition program (NP, case manager, primary physician, consulting geriatrician) Hospital to Home 30-day follow-up	Usual care

Note. * Brief Nurse Practitioner Transition; [†] E = Experimental, QE = Quasi-experimental.

settings with the exception being cost where 60% (3/5) studies reported cost improvement with the NP (Dahle et al., 1998; Meyer and Miers, 2005). Overall in the acute care setting, the outcomes are either improved or equal to the comparison group, except for cost (Table 2) (Arbaje et al., 2010; Dahle et al., 1998; David et al., 2015; Iannuzzi et al., 2015; Lambing et al., 2004; Meyer and Miers, 2005; Miller, 1997; Reuben et al., 1995; Robles et al., 2011). Five studies examined service utilization with beneficial effects in 60% (3/5) and neutral effects in 40% (4/7) (Dahle et al., 1998; David et al., 2015; Lambing et al., 2004; Meyer and Miers, 2005; Robles et al., 2011). Length of stay was the most commonly reported outcome, in all of the studies with mixed results. The NP improved length of stay in 45% (4/9) of studies (Dahle et al., 1998; Meyer and Miers, 2005; Miller, 1997), produced equal outcomes in 35% (3/9) of the studies (Arbaje et al., 2010; David et al., 2015; Robles et al., 2011), and increased length of stay in 20% (2/9). In terms of health indices, mortality data was reported in three studies all of which found NP care was better or equivalent to physician care alone (Table 3) (Iannuzzi et al., 2015; Lambing et al., 2004; Reuben et al., 1995).

Five systematic reviews in acute care hospital settings have been identified and included for further review. Four examined the effect of specific preventive interventions, including geriatric evaluation and management, but not specifically with NP care (GEM) (Bachmann et al., 2010; Bakker et al., 2011; Deschodt et al., 2013; Van Craen et al., 2010) and one reported the effectiveness of advanced nursing roles in the acute care settings (Kilpatrick et al., 2015). No primary studies included in these systematic reviews were missed by our initial search of the literature. Key findings of these reviews show that inpatients geriatric consultations reduce mortality at 6 and 8 months postdischarge, but no impact on other patients' health outcomes.

3.5. Geriatric transitional care

By definition, transitional care is not a setting but a set of actions. According to the American Geriatrics Society, transitional care is designed to “ensure coordination and continuity of healthcare as patients transfer between different locations or different care levels within the same location” (Coleman et al., 2003). In 1981, Dorothy Brooten and colleagues developed the “Quality Cost Model of advanced practice nursing transitional care” with the aim of improving outcomes for high-risk high-cost patients (preterm neonates) (Brooten et al., 1988, 1986, 2002). The transitional care NP engages the patient and family during the acute illness phase (i.e. during hospitalization) to coordinate care and discharge planning and evaluate specific patient needs. The NP then follows the patient post-discharge to: i) provide substitutive on-site assessments and diagnostic evaluation, ii) adapt treatment plans based on evolving patient needs, iii) coach patients and caregivers, and iv) provide ongoing coordination and communication with the inter-professional care team (Brooten et al., 1988). In the late 1980s, Mary Naylor and colleagues successfully adapted the Quality Cost Model to hospitalised elderly patients (Naylor, 2000).

In this review, ten primary research studies from Canada (Kotowycz et al., 2010), Taiwan (Huang and Liang, 2005) and the US (Cowan et al., 2006; Enguidanos et al., 2012; Kauh et al., 2005; Naylor et al., 1999, 2004; Ornstein et al., 2011; Rawl et al., 1998; Takahashi et al., 2013) were identified for transitional care. Six were randomized controlled trials and the remaining (n = 4) used quasi-experimental designs (Table 1E).

3.5.1. Intervention

The model of care used in the included studies comprises interventions by advanced practice nurses to facilitate early discharge and provide ongoing follow-up care to decrease unplanned service utilization, length of stay, cost and improve patient-related outcomes, such as

Table 1E. Acute care: Characteristics of the included studies.

Refs.	Country of origin	Study population	Type of model of care	Design [†]	Type of intervention	Comparator
Arbaje et al. (2010)	USA	Hospitalised medical patients > 70 years	Supplementation	QE	Geri-FITT interdisciplinary care team: GNP + geriatrician	Usual care (no team)
Dahle et al. (1998)	USA	Uncomplicated Heart failure hospitalised patients	Supplementation	QE	From Day 1 and on to day 1 or 2 post-discharge NP care + discharge plan	Physician care only
David et al. (2015)	USA	Older patients admitted in emergency for cardiology procedures	Supplementation	QE	Plan of care reviewed by NP + physician daily NP + Physician team Permanent staff NP presence	Physician only team Presence 1 to 3 Weeks at a time
Iannuzzi et al. (2015)	USA	Inpatients admitted under "observation" status	Supplementation	QE	Middle level NP care	Resident team
Lambing et al. (2004)	USA	Geriatric general medicine inpatients	Supplementation	QE	NP care alongside physician (initial visit and review of medication) + NP alone (prevention, chronic care and monthly visit)	Physician care
Meyer and Miers (2005)	USA	Postoperative cardiovascular (CV) patients	Supplementation	QE	NP collaborative care with CV surgeons (admission and long term care)	CV surgeon only
Miller (1997)	USA	Geriatric general medicine inpatients	Supplementation	QE	NP care	Physician care only
Reuben et al. (1995)	USA	Geriatric inpatients	Supplementation	E	Interdisciplinary team: NP + social worker + geriatrician (CGA + follow-up)	Usual care
Robles et al. (2011)	USA	Surgical patients	Supplementation	QE	NP care Assessment, discharge plan and follow-up consultations	Physician care only

Note. [†] E = Experimental, QE = Quasi-experimental.

satisfaction, quality of life, and health indices. It is mainly a supplementation model as the care by NPs introduces additional visits and patient education during a longer follow-up period either as part of an interdisciplinary team or of individual NP care (see Table 1E).

3.5.2. Outcomes and effectiveness

Primary studies (n = 10) compared NPs providing transitional care to usual care (Cowan et al., 2006; Enguidanos et al., 2012; Huang and Liang, 2005; Kauh et al., 2005; Kotowycz et al., 2010; Naylor et al., 1999, 2004; Ornstein et al., 2011; Rawl et al., 1998; Takahashi et al., 2013). Notably, transitional care by an NP was better than usual care by the physicians alone in 5/6 outcome measures – a result not seen in any other clinical setting (Table 2). The NP was equally effective in improving financial-related outcomes as they were for patient and care-related outcomes. Most often reported was service utilization (10/10) studies and was improved in 4/10 (40%) studies (Huang and Liang, 2005; Kauh et al., 2005; Naylor et al., 1999, 2004). NP care was superior for length of stay (4/5, 80%), cost (3/4, 75%), quality of life (3/4, 75%) and satisfaction (3/4, 75%) compared to physician care alone (Cowan et al., 2006; Enguidanos et al., 2012; Huang and Liang, 2005; Kauh et al., 2005; Naylor et al., 1999, 2004; Ornstein et al., 2011; Rawl et al., 1998; Takahashi et al., 2013). Care by an NP was found to be equivalent or superior to physician colleagues alone in all of the measured health indices (Table 3).

Three systematic reviews were included for this setting. Two reported outcomes of transitional care by NPs specifically (Donald et al., 2015; Morilla-Herrera et al., 2016) and one in general (Allen et al., 2014). No primary studies were missed by our search. Key findings show that supplementation NP care has positive effect on the reduction of hospital readmissions in complex care patients (Allen et al., 2014; Donald et al., 2015; Morilla-Herrera et al., 2016), yet the cost benefit of NP in transitional care is inconclusive (Donald et al., 2015).

4. Discussion

To the best of our knowledge, this scoping review is the first highlighting the studies that reported the impact of NP care in geriatric patients only. Indeed the 26 systematic reviews included in this scoping paper were two folds: 1) some reported the impact of models of care or interventions that were not necessarily performed by NPs; 2) other reported the effect or effectiveness of NP care that did not focus on older people only.

Our results show that nurse practitioners have consistently produced equivalent or better outcomes compared to physician care alone/ usual care across the five identified geriatric settings, namely primary care, home care, long term care, acute care, and transitional care. A mix of substitutive and supplementation model of care was used in primary care, home care, and long-term care settings. Transitional and acute care included supplementation model of care provided by NPs. In this latter model, NP care included a combination of specific care that would have formally been performed by physicians and additional care, such as follow-up visits and training. Notably, in substitutive NP roles effectiveness is evaluated by non-inferiority. In contrast, in a complementary role effectiveness is demonstrated by superior outcomes when compared to standard physician only care models, except for cost that is expected to increase due to additional resources (Donald et al., 2015; Martin-Misener et al., 2015).

In our review, superior outcomes, except for cost, were observed with NP care in more than half of studies across the five settings. Service utilization, length of stay, health indices, satisfaction and quality of life each reported greater than 50% positive outcomes. The nurse-developed transitional care model was a stand-out for both financial- and patient-related outcomes – a finding consistent with two systematic reviews in this setting (Allen et al., 2014; Donald et al., 2015). This suggests that appropriately trained nurse practitioners with a foundation in nursing science and advanced clinical practice

including the “3 Ps” (pathophysiology, pharmacology, physical exam) can function in a substitutive and supplementation role delivering effective integrated care across various settings.

Considering the financial-related outcome measures, our analysis indicates that NP care reduces service utilization in 23/41 (56%) studies. Notably, this positive impact was most frequent in the home care setting and may reflect enhanced access to care, maintained functional status and in-home safety assessment. The NP intervention was beneficial for cost in 10/24 (42%) studies across all settings. Only a minority of studies (6/24, 25%) reported increased costs related to additional referrals and diagnostic testing for chronically ill patients (Beck et al., 2009; Buchanan et al., 1990; Engelhardt et al., 1996; Iannuzzi et al., 2015; Lambing et al., 2004; Litaker et al., 2003). These results are congruent with the cost-effectiveness systematic reviews, reporting inconclusive evidence regarding cost effectiveness of NP in transitional care (Donald et al., 2015), acute care (Kilpatrick et al., 2015) and in primary care (Martin-Misener et al., 2015).

Regarding patient-related outcomes, a notable finding was the proportion of studies reporting enhanced health indices by NP care, including functional status, symptom screening, medication review, advanced directives, and other specific clinical outcomes. This is perhaps not surprising as these draw on nursing's foundation of preventive care, health promotion and patient advocacy. Importantly, NP care is highly accepted as satisfaction with NP care was higher than usual care in nearly two-thirds of studies (9/14, 64%).

The systematic reviews examining nurse practitioner care in specific care settings are in line with our aggregate findings – yet many authors have noted the need for additional high-quality, rigorous studies of NP interventions with geriatric patients. Several systematic reviews of the **home care** setting (n = 5) (Beswick et al., 2008; Chang et al., 2004; Morilla-Herrera et al., 2016; Stuck et al., 2002; van Haastregt et al., 2000) highlight the complexity of delivering multidisciplinary care yet note that NPs contribute to positive outcomes – in particular, diminishing service utilization (Beswick et al., 2008; Morilla-Herrera et al., 2016; Newhouse et al., 2011; Stuck et al., 2002). This is congruent with our results in this setting.

Benefits for decreased service utilization were also identified in systematic reviews of **long-term care** settings (n = 5) (Arendts and Howard, 2010; Bakerjian, 2008; Christian and Baker, 2009; Donald et al., 2013; Graverholt et al., 2014). Long-term care facilities are complex environments that benefit from the addition of geriatric NPs with expanded competencies (Bakerjian, 2008; Christian and Baker, 2009; Donald et al., 2013; Graverholt et al., 2014; Hamby and Christian, 2015; Lovink et al., 2015; Morilla-Herrera et al., 2016). The Optum CarePlus model has been extensively evaluated in research studies. The researchers have consistently proven that an appropriately trained on-site NP who evaluates and treats changes in resident health status decreases unnecessary hospitalizations and unplanned transfers thereby improving overall care in the facility (Abdallah et al., 2005; Buchanan et al., 1990; Garrard et al., 1990; Kane et al., 2004, 1989, 2003).

In **acute care**, as all primary studies used a supplementation model of care, outcomes reflect the impact of the inpatient geriatric consult teams as a whole and not NP care independently. However, the clinical data suggest that NP care is an acceptable alternative for the shortfall in resident-covered in-patient hours (Dahle et al., 1998; Meyer and Miers, 2005). The systematic reviews evaluating the acute care NP role in a geriatric inter-professional team (Bachmann et al., 2010; Bakker et al., 2011; Deschodt et al., 2013; Kilpatrick et al., 2015, 2010) highlight an important caveat as strict methodological designs are not well-suited to evaluate complex interventions such as the NP within dynamic and changing settings like acute care (Bakker et al., 2011; Deschodt et al., 2013; Van Craen et al., 2010).

This scoping review has several limitations as it focuses exclusively on geriatric care and thus is not directly transferable to other patient populations. Additionally, several systematic reviews evaluating the

quality of studies have concluded that there are a limited number of high quality randomized controlled trials (Donald et al., 2013; Graverholt et al., 2014; Morilla-Herrera et al., 2016; Newhouse et al., 2011). While there is a long history of effective NP role implementation in Anglophone countries, many publications were excluded from this review as they were neither randomized controlled nor quasi-experimental studies. It is worthwhile to note, that this scoping review aimed to broadly summarize the type of interventions performed by NPs and their impact on financial- and patient-related outcomes, and not to report the effectiveness of interventions as we would do in a formal systematic review of effect. Further, an additional limitation, inherent to scoping review methodology, is that no quality assessment was performed of the included studies. We adapted the ICN definition of nurse practitioner which represents a widely-accepted consensus (International Council of Nurses, 2002). However, given the range of NP roles currently in place, this 2002 definition appeared not specific enough to delineate between the different roles of advanced nursing practice and is perhaps in need of updating. Other professional titles such as “specialist nurse” or “nurse clinician” are often used without further explanation thereby making it difficult or impossible to clarify the education and professional autonomy of the role. As such, some studies examining legitimate NP roles may have been excluded for that reason. This may have been the case for a number of studies from the UK as educational requirements and title are not clearly delineated by the National Health System. An important consideration is that study outcomes are frequently based on interventions delivered by a limited number of NPs – indeed this may be a single provider in some instances. Therefore, such evaluations may reflect the quality of a particular individual delivering the intervention rather than a formal evaluation of the NP role (or the intervention) in a particular care setting.

We included studies from four countries where the NP role is recognized and regulated, but international comparisons are challenging. The differences in health systems, financing, governance, title protection and culture pose significant challenges for implementing NP roles (Bryant-Lukosius et al., 2004; DiCenso et al., 2010a,b; Franks, 2014; Rigolosi and Salmond, 2014; Sangster-Gormley et al., 2011; ter Maten-Speksnijder et al., 2014). Some of the major barriers frequently reported include developing professional competencies, establishing a certification process, obtaining legal recognition of the role and reimbursement as well as NP acceptance by various stakeholders (Bryant-Lukosius et al., 2004; Bryant-Lukosius and Dicenso, 2004; DiCenso et al., 2010a,b; Sangster-Gormley et al., 2013, 2011; ter Maten-Speksnijder et al., 2014). Many studies commented on the importance of specific NP competencies including inter-professional collaboration, care coordination, coaching and advanced clinical assessment skills as cornerstones of success (Bryant-Lukosius et al., 2004; Bryant-Lukosius and Dicenso, 2004; DiCenso et al., 2010a,b). Interestingly, many of these competencies can be mapped onto the “A, B, C goals” (Box 2) identified as priorities to meet the current health challenges of the aging population. For example, inter-professional care coordination ensures timely and appropriate access to the full range of healthcare (i.e. “A”: access to care). Patient coaching and education is integral for self-management and patient/family engagement (i.e. “B”: building self-management). Advanced clinical assessment skills of the NP enable rapid identification of changes in health/mental status, timely diagnosis and initiation of treatment to avoid unplanned visits and hospitalization (i.e. “C”: cost containment). In a substitutive model, NPs can expand access and ameliorate overburdened geriatric physicians. However, these “A, B, C goals” are not solely specific to nurse practitioners. Indeed, the NP role has overlapping competencies with other advanced practice roles, notably the clinical nurse specialist (Donald et al., 2010). Therefore, it would appear improving the care for geriatric patients across clinical settings may not be best achieved by implementing a single, specific nursing role (i.e., NP). Rather, greater change could be exacted by encouraging nurses to practice at their optimal level of training and competency – as recommended by the Institute of

Box 2

The “A, B, C goals” for geriatric nurse practitioner care.

“A” Access to continuous and integrated high-quality care

NPs expand access to care and can play an important role in ongoing integrated care

“B” Building self-management skills to maintain function and independence

NPs have competencies in patient education, guidance, and coaching. Their strong focus on patient centered care and health promotion are important for helping patients develop self-management skills enabling patients to stay at home.

“C” Cost containment

NPs contribute to decreased service utilization and length of stay and thereby enhance key financial-related outcomes

Medicine (Institute of Medicine, 2010).

This scoping review was intended to highlight the NP-related literature specific to older people in various clinical settings. Our results may help guide stakeholders in identifying priority areas for impacting geriatric care based on the published and grey literature. The confluence of an aging global population and the rise in chronic diseases create the so-called “gray tsunami” that is challenging health systems internationally (Barusch, 2013). NPs are one potential “disruptive” solution. The notion of disruptive innovation was coined by Clayton Christensen to describe innovations that “enable a larger population of less-skilled, less-wealthy, people to do things in a more convenient, lower-cost setting which historically could only be done by specialists in a less-convenient settings” (Christensen, 2007, 2015; Hwang and Christensen, 2008). Recently an expert commission has proposed four main areas of focus for disruptive innovation in healthcare: i) developing new models of person-centered community-based health delivery, ii) emphasizing person-oriented approaches that take into account complexity (i.e. culturally relevant, multiple morbidities), iii) educating the health workforce and transferring of skills (i.e. task shifting), and iv) using new technologies (2016, Expert Panel on effective ways of investing in Health (EXPH), 29 February 2016). Nurse practitioners in a substitutive or in a supplementation role can play an important part in each of these priority areas. There is a need for all nurses to help transform healthcare in the 21st century to meet the needs of an aging population. Unfortunately, the diffusion of innovation in healthcare is challenged by a number of translational roadblocks that limit the implementation of discoveries into clinical practice (Crowley et al., 2004). As such, despite decades of evidence, there is a lag in public understanding and acceptance of NP roles. Therefore, academics, nursing leaders and clinical champions alike must continue to educate, promote and validate advanced practice nursing roles to overcome these barriers.

Acknowledgments

We express deep gratitude to our advisory panel and the invaluable contributions of Professor Denise Bryant-Lukosius of McMaster University. This work was supported by a grant from the Leenards Foundation (<http://www.leenards.ch/>).

References

- Abdallah, L., Fawcett, J., Kane, R., Dick, K., Chen, J., 2005. Development and psychometric testing of the EverCare nurse practitioner role and activity scale (ENPRAS). *J. Am. Acad. Nurse Pract.* 17 (1), 21–26.
- Aigner, M.J., Drew, S., Phipps, J., 2004. A comparative study of nursing home resident outcomes between care provided by nurse practitioners/physicians versus physicians only. *J. Am. Med. Dir. Assoc.* 5 (1), 16–23.
- Alessi, C.A., Stuck, A.E., Aronow, H.U., Yuhus, K.E., Bula, C.J., Madison, R., Gold, M., Segal-Gidan, F., Fanello, R., Rubenstein, L.Z., Beck, J.C., 1997. The process of care in preventive in-home comprehensive geriatric assessment. *J. Am. Geriatr. Soc.* 45 (9), 1044–1050.
- Allen, J.K., Blumenthal, R.S., Margolis, S., Young, D.R., Miller 3rd, E.R., Kelly, K., 2002. Nurse case management of hypercholesterolemia in patients with coronary heart disease: results of a randomized clinical trial. *Am. Heart J.* 144 (4), 678–686.
- Allen, J., Hutchinson, A.M., Brown, R., Livingston, P.M., 2014. Quality care outcomes

- following transitional care interventions for older people from hospital to home: a systematic review. *BMC Health Serv. Res.* 14, 346.
- American Academy of Nurse Practitioners, 2016. NP Fact Sheet. <https://www.aanp.org/all-about-nps/np-fact-sheet> (Accessed 06 June 2016).
- American Association of Nurse Practitioners, What is an NP. <https://www.aanp.org/all-about-nps/what-is-an-np> (Accessed 05.03.15).
- Arbaje, A.I., Maron, D.D., Yu, Q., Wendel, V.I., Tanner, E., Boulton, C., Eubank, K.J., Durso, S.C., 2010. The geriatric floating interdisciplinary transition team. *J. Am. Geriatr. Soc.* 58 (2), 364–370.
- Arendts, G., Howard, K., 2010. The interface between residential aged care and the emergency department: a systematic review. *Age Ageing* 39 (3), 306–312.
- Bachmann, S., Finger, C., Huss, A., Egger, M., Stuck, A.E., Clough-Gorr, K.M., 2010. Inpatient rehabilitation specifically designed for geriatric patients: systematic review and meta-analysis of randomised controlled trials. *BMJ* 340, c1718.
- Bakerjian, D., 2008. Care of nursing home residents by advanced practice nurses. A review of the literature. *Res. Gerontol. Nurs.* 1 (3), 177–185.
- Bakker, F.C., Robben, S.H., Olde Rikkert, M.G., 2011. Effects of hospital-wide interventions to improve care for frail older inpatients: a systematic review. *BMJ Qual. Saf.* 20 (8), 680–691.
- Barusch, A.S., 2013. The aging tsunami: time for a new metaphor? *J. Gerontol. Soc. Work* 56 (3), 181–184.
- Beck, R.A., Arizmendi, A., Purnell, C., Fultz, B.A., Callahan, C.M., 2009. House calls for seniors: building and sustaining a model of care for homebound seniors. *J. Am. Geriatr. Soc.* 57 (6), 1103–1109.
- Beswick, A.D., Rees, K., Dieppe, P., Ayis, S., Goberman-Hill, R., Horwood, J., Ebrahim, S., 2008. Complex interventions to improve physical function and maintain independent living in elderly people: a systematic review and meta-analysis. *Lancet* 371 (9614), 725–735.
- Bleich, S.N., Sherrod, C., Chiang, A., Boyd, C., Wolff, J., Chang, E., Salzberg, C., Anderson, K., Leff, B., Anderson, G., 2015. Systematic review of programs treating high-need and high-cost people with multiple chronic diseases or disabilities in the United States, 2008–2014. *Prev. Chronic Dis.* 12, E197.
- Boulton, C., Boulton, L.B., Morishita, L., Dowd, B., Kane, R.L., Urdangarin, C.F., 2001. A randomized clinical trial of outpatient geriatric evaluation and management. *J. Am. Geriatr. Soc.* 49 (4), 351–359.
- Brooten, D., Kumar, S., Brown, L.P., Butts, P., Finkler, S.A., Bakewell-Sachs, S., Gibbons, A., Delivoria-Papadopoulos, M., 1986. A randomized clinical trial of early hospital discharge and home follow-up of very-low-birth-weight infants. *N. Engl. J. Med.* 315 (15), 934–939.
- Brooten, D., Brown, L.P., Munro, B.H., York, R., Cohen, S.M., Roncoli, M., Hollingsworth, A., 1988. Early discharge and specialist transitional care. *Image J. Nurs. Sch.* 20 (2), 64–68.
- Brooten, D., Naylor, M.D., York, R., Brown, L.P., Munro, B.H., Hollingsworth, A.O., Cohen, S.M., Finkler, S., Deatrick, J., Youngblut, J.M., 2002. Lessons learned from testing the quality cost model of advanced practice nursing (APN) transitional care. *J. Nurs. Scholarship* 34 (4), 369–375.
- Bryant-Lukosius, D., Dicenso, A., 2004. A framework for the introduction and evaluation of advanced practice nursing roles. *J. Adv. Nurs.* 48 (5), 530–540.
- Bryant-Lukosius, D., Dicenso, A., Browne, G., Pinelli, J., 2004. Advanced practice nursing roles: development, implementation and evaluation. *J. Adv. Nurs.* 48 (5), 519–529.
- Buchanan, J.L., Bell, R.M., Arnold, S.B., Witsberger, C., Kane, R.L., Garrard, J., 1990. Assessing cost effects of nursing-home-based geriatric nurse practitioners. *Health Care Financ. Rev.* 11 (3), 67–78.
- Bula, C.J., Berod, A.C., Stuck, A.E., Alessi, C.A., Aronow, H.U., Santos-Eggimann, B., Rubenstein, L.Z., Beck, J.C., 1999. Effectiveness of preventive in-home geriatric assessment in well functioning, community-dwelling older people: secondary analysis of a randomized trial. *J. Am. Geriatr. Soc.* 47 (4), 389–395.
- Burl, J.B., Bonner, A., Rao, M., Khan, A.M., 1998. Geriatric nurse practitioners in long-term care: demonstration of effectiveness in managed care. *J. Am. Geriatr. Soc.* 46 (4), 506–510.
- Burns, R., Nichols, L.O., Graney, M.J., Cloar, F.T., 1995. Impact of continued geriatric outpatient management on health outcomes of older veterans. *Arch. Intern. Med.* 155 (12), 1313–1318.
- Burns, R., Nichols, L.O., Martindale-Adams, J., Graney, M.J., 2000. Interdisciplinary geriatric primary care evaluation and management: two-year outcomes. *J. Am. Geriatr. Soc.* 48 (1), 8–13.
- Callahan, C.M., Boustani, M.A., Unverzagt, F.W., Austrom, M.G., Damush, T.M., Perkins, A.J., Fultz, B.A., Hui, S.L., Counsell, S.R., Hendrie, H.C., 2006. Effectiveness of collaborative care for older adults with Alzheimer disease in primary care: a randomized controlled trial. *JAMA* 295 (18), 2148–2157.

- Carrier, J., Yarwood, J., 2015. The nurse practitioner role: solution or servant in improving primary health care service delivery. *Collegian* 22 (2), 169–174.
- Chang, J.T., Morton, S.C., Rubenstein, L.Z., Mojica, W.A., Maglione, M., Suttrop, M.J., Roth, E.A., Shekelle, P.G., 2004. Interventions for the prevention of falls in older adults: systematic review and meta-analysis of randomised clinical trials. *BMJ* 328 (7411), 680.
- Christensen, C.M., 2007. Disruptive innovation: can health care learn from other industries? A conversation with Clayton M. Christensen. Interview by Mark D. Smith. *Health Aff. (Millwood)* 26 (3), w288–295.
- Christensen, D., 2015. Advanced practice nurses evolve healthcare solutions. *ONS Connect* 30 (1), 26–30.
- Christian, R., Baker, K., 2009. Effectiveness of Nurse Practitioners in nursing homes: a systematic review. *JBHI Database Syst. Rev. Implement Rep.* 7 (30), 1333–1352.
- Coleman, E.A., Boulton, C., American Geriatrics Society Health Care Systems, C., 2003. Improving the quality of transitional care for persons with complex care needs. *J. Am. Geriatr. Soc.* 51 (4), 556–557.
- Contandriopoulos, D., Brousselle, A., Dubois, C.-A., Perroux, M., Beaulieu, M.-D., Brault, I., Kilpatrick, K., D'Amour, D., Sansgter-Gormley, E., 2015. A process-based framework to guide nurse practitioners integration into primary healthcare teams: results from a logic analysis. *BMC Health Serv. Res.* 15, 78.
- Counsell, S.R., Callahan, C.M., Clark, D.O., Tu, W., Buttar, A.B., Stump, T.E., Ricketts, G.D., 2007. Geriatric care management for low-income seniors: a randomized controlled trial. *JAMA* 298 (22), 2623–2633.
- Counsell, S.R., Callahan, C.M., Tu, W., Stump, T.E., Arling, G.W., 2009. Cost analysis of the geriatric resources for assessment and care of elders care management intervention. *J. Am. Geriatr. Soc.* 57 (8), 1420–1426.
- Cowan, M.J., Shapiro, M., Hays, R.D., Affi, A., Vazirani, S., Ward, C.R., Ettner, S.L., 2006. The effect of a multidisciplinary hospitalist/physician and advanced practice nurse collaboration on hospital costs. *J. Nurs. Adm.* 36 (2), 79–85.
- Crowley Jr., W.F., Sherwood, L., Salber, P., Scheinberg, D., Slavkin, H., Tilson, H., Reece, E.A., Catanese, V., Johnson, S.B., Dobs, A., Genel, M., Korn, A., Reame, N., Bonow, R., Grebb, J., Rimoin, D., 2004. Clinical research in the United States at a crossroads: proposal for a novel public-private partnership to establish a national clinical research enterprise. *JAMA* 291 (9), 1120–1126.
- Currie, J., Chiarella, M., Buckley, T., 2013. An investigation of the international literature on nurse practitioner private practice models. *Int. Nurs. Rev.* 60 (4), 435–447.
- Dahle, K.L., Smith, J.S., Ingersoll, G.L., Wilson, J.R., 1998. Impact of a nurse practitioner on the cost of managing inpatients with heart failure. *Am. J. Cardiol.* 82 (5), 686–688 (A688).
- David, D., Britting, L., Dalton, J., 2015. Cardiac acute care nurse practitioner and 30-day readmission. *J. Cardiovasc. Nurs.* 30 (3), 248–255.
- Davis, K., Drey, N., Gould, D., 2009. What are scoping studies? A review of the nursing literature. *Int. J. Nurs. Stud.* 46 (10), 1386–1400.
- De Jonge, K.E., Jamshed, N., Gilden, D., Kubisiak, J., Bruce, S.R., Taler, G., 2014. Effects of home-based primary care on Medicare costs in high-risk elders. *J. Am. Geriatr. Soc.* 62 (10), 1825–1831.
- Delamaire, M.a.G.L., 2010. Nurses in Advanced Roles: a description and evaluation of experiences in 12 developed countries. *OECD Health Working Papers* 54.
- Deschodt, M., Flamaing, J., Haentjens, P., Boonen, S., Milisen, K., 2013. Impact of geriatric consultation teams on clinical outcome in acute hospitals: a systematic review and meta-analysis. *BMC Med.* 11, 48.
- DiCenso, A., Auffrey, L., Bryant-Lukosius, D., Donald, F., Martin-Misener, R., Matthews, S., Opsteen, J., 2007. Primary health care nurse practitioners in Canada. *Contemp. Nurse* 26 (1), 104–115.
- DiCenso, A., Bryant-Lukosius, D., Martin-Misener, R., Donald, F., Abelson, J., Bourgeault, I., Kilpatrick, K., Carter, N., Kaasalainen, S., Harbman, P., 2010a. Factors enabling advanced practice nursing role integration in Canada. *Nurs. Leadersh. (Tor Ont)* 23, 211–238 (Spec No 2010).
- DiCenso, A., Martin-Misener, R., Bryant-Lukosius, D., Bourgeault, I., Kilpatrick, K., Donald, F., Kaasalainen, S., Harbman, P., Carter, N., Kioke, S., Abelson, J., McKinlay, R.J., Pasic, D., Wasyluk, B., Woha, J., Charbonneau-Smith, R., 2010b. Advanced practice nursing in Canada: overview of a decision support synthesis. *Nurs. Leadersh. (Tor Ont)* 23, 15–34 (Spec No 2010).
- Donald, F., Bryant-Lukosius, D., Martin-Misener, R., Kaasalainen, S., Kilpatrick, K., Carter, N., Harbman, P., Bourgeault, I., DiCenso, A., 2010. Clinical nurse specialists and nurse practitioners: title confusion and lack of role clarity. *Nurs Leadersh. (Tor Ont)* 23, 189–201 (Spec No 2010).
- Donald, F., Martin-Misener, R., Carter, N., Donald, E.E., Kaasalainen, S., Wickson-Griffiths, A., Lloyd, M., Akhtar-Danesh, N., DiCenso, A., 2013. A systematic review of the effectiveness of advanced practice nurses in long-term care. *J. Adv. Nurs.* 69 (10), 2148–2161.
- Donald, F., Kilpatrick, K., Reid, K., Carter, N., Bryant-Lukosius, D., Martin-Misener, R., Kaasalainen, S., Harbman, P., Marshall, D., DiCenso, A., 2015. Hospital to community transitional care by nurse practitioners: a systematic review of cost-effectiveness. *Int. J. Nurs. Stud.* 52 (1), 436–451.
- Dunn, K., Nicklin, W., 1995. The status of advanced nursing roles in Canadian teaching hospitals. *Can. J. Nurs. Adm.* 8 (1), 111–135.
- Engelhardt, J.B., Toseland, R.W., O'Donnell, J.C., Richie, J.T., Jue, D., Banks, S., 1996. The effectiveness and efficiency of outpatient geriatric evaluation and management. *J. Am. Geriatr. Soc.* 44 (7), 847–856.
- Enguidanos, S., Gibbs, N., Jamison, P., 2012. From hospital to home: a brief nurse practitioner intervention for vulnerable older adults. *J. Gerontol. Nurs.* 38 (3), 40–50.
- Epstein, A.M., Hall, J.A., Fretwell, M., Feldstein, M., DeCiantis, M.L., Tognetti, J., Cutler, C., Constantine, M., Besdine, R., Rowe, J., et al., 1990. Consultative geriatric assessment for ambulatory patients. A randomized trial in a health maintenance organization. *JAMA* 263 (4), 538–544.
- Expert Panel on effective ways of investing in Health (EXPH), 29 February 2016. Report on Disruptive Innovation. European Commission.
- Franks, H., 2014. The contribution of nurse consultants in England to the public health leadership agenda. *J. Clin. Nurs.* 23 (23–24), 3434–3448.
- Ganz, D.A., Koretz, B.K., Bail, J.K., McCreath, H.E., Wenger, N.S., Roth, C.P., Reuben, D.B., 2010. Nurse practitioner comanagement for patients in an academic geriatric practice. *Am. J. Manag. Care* 16 (12), e343–e355.
- Garrard, J., Kane, R.L., Radosevich, D.M., Skay, C.L., Arnold, S., Kepferle, L., McDermott, S., Buchanan, J.L., 1990. Impact of geriatric nurse practitioners on nursing-home residents' functional status, satisfaction, and discharge outcomes. *Med. Care* 28 (3), 271–283.
- Golden, A.G., Silverman, M.A., Issenberg, S.B., 2015. Addressing the shortage of geriatricians: what medical educators can learn from the nurse practitioner training model. *Acad. Med.* 90 (9), 1236–1240.
- Graverholt, B., Forsetlund, L., Jamtvedt, G., 2014. Reducing hospital admissions from nursing homes: a systematic review. *BMC Health Serv. Res.* 14, 36.
- Hall, S., Koliakou, A., Petkova, H., Froggatt, K., Higginson, I.J., 2011. Interventions for improving palliative care for older people living in nursing care homes. *Cochrane Database Syst. Rev.* 3 (CD007132).
- Hamby, D.L., Christian, R., 2015. The clinical effectiveness of a nurse practitioner versus a non-nurse practitioner on hospital admissions of older adults residing in skilled or long-term care nursing facilities: a systematic review protocol. *JBHI Database Syst. Rev. Implement Rep.* 13 (5), 24–35.
- Hamric, A.B., Hanson, C.M., Tracy, M.F., O'Grady, E.T., 2014. *Advanced Practice Nursing: An Integrative Approach*, fifth edition. Elsevier/Saunders, St. Louis, Missouri.
- Heman, A., Rastegar, D.A., Hill, C., al-Ibrahim, M.S., 1999. A comparison of resource utilization in nurse practitioners and physicians. *Eff. Clin. Pract.* 2 (6), 258–265.
- Horrocks, S., Anderson, E., Salisbury, C., 2002. Systematic review of whether nurse practitioners working in primary care can provide equivalent care to doctors. *BMJ* 324 (7341), 819–823.
- Howie-Esquivel, J., Fontaine, D.K., 2006. The evolving role of the acute care nurse practitioner in critical care. *Curr. Opin. Crit. Care* 12 (6), 609–613.
- Huang, T.T., Liang, S.H., 2005. A randomized clinical trial of the effectiveness of a discharge planning intervention in hospitalized elders with hip fracture due to falling. *J. Clin. Nurs.* 14 (10), 1193–1201.
- Hwang, J., Christensen, C.M., 2008. Disruptive innovation in health care delivery: a framework for business-model innovation. *Health Aff. (Millwood)* 27 (5), 1329–1335.
- Iannuzzi, M.C., Iannuzzi, J.C., Holtsberg, A., Wright, S.M., Knohl, S.J., 2015. Comparing hospitalist-Resident to hospitalist-midlevel practitioner team performance on length of stay and direct patient care cost. *J. Grad. Med. Educ.* 7 (1), 65–69.
- Institute of Medicine, 2010. *The Future of Nursing: Leading Change, Advancing Health*. National Academy of Science, Washington DC, pp. 586.
- International Council of Nurses, 2014. *ICN Nurse Practitioner/Advanced Practice Nursing Network Country Profiles*. International American Association of Nurse Practitioners, pp. 1–33.
- International Council of Nurses, 2002. *International Council of Nurses: Definition and Characteristics for Nurse Practitioner/Advanced Practice Nursing Roles*. ([official position paper] Geneva).
- Joseph, A., Boulton, C., 1998. Managed primary care of nursing home residents. *J. Am. Geriatr. Soc.* 46 (9), 1152–1156.
- Kane, R.L., Garrard, J., Skay, C.L., Radosevich, D.M., Buchanan, J.L., McDermott, S.M., Arnold, S.B., Kepferle, L., 1989. Effects of a geriatric nurse practitioner on process and outcome of nursing home care. *Am. J. Public Health* 79 (9), 1271–1277.
- Kane, R.L., Keckhafer, G., Flood, S., Bershady, B., Siadat, M.S., 2003. The effect of Evercare on hospital use. *J. Am. Geriatr. Soc.* 51 (10), 1427–1434.
- Kane, R.L., Flood, S., Bershady, B., Keckhafer, G., 2004. Effect of an innovative medicare managed care program on the quality of care for nursing home residents. *Gerontologist* 44 (1), 95–103.
- Kauh, B., Polak, T., Hazelett, S., Hua, K., Allen, K., 2005. A pilot study: post-acute geriatric rehabilitation versus usual care in skilled nursing facilities. *J. Am. Med. Dir. Assoc.* 6 (5), 321–326.
- Kilpatrick, K., Reid, K., Carter, N., Donald, F., Bryant-Lukosius, D., Martin-Misener, R., Kaasalainen, S., Harbman, P., Marshall, D., Charbonneau-Smith, R., DiCenso, A., 2015. A systematic review of the cost-effectiveness of clinical nurse specialists and nurse practitioners in inpatient roles. *Nurs. Leadersh. (Tor Ont)* 28 (3), 56–76.
- Klaasen, K., Lamont, L., Krishnan, P., 2009. Setting a new standard of care in nursing homes. *Can. Nurse* 105 (9), 24–30.
- Kotowycz, M.A., Cosman, T.L., Tartaglia, C., Afzal, R., Syal, R.P., Natarajan, M.K., 2010. Safety and feasibility of early hospital discharge in ST-segment elevation myocardial infarction—a prospective and randomized trial in low-risk primary percutaneous coronary intervention patients (the Safe-Depart Trial). *Am. Heart J.* 159 (1), e111–e116 (117).
- Krichbaum, K., 2007. GPN postacute care coordination improves hip fracture outcomes. *West. J. Nurs. Res.* 29 (5), 523–544.
- Lacny, S., Zarrabi, M., Martin-Misener, R., Donald, F., Sketris, I., Murphy, A.L., DiCenso, A., Marshall, D.A., 2016. Cost-effectiveness of a nurse practitioner-family physician model of care in a nursing home: controlled before and after study. *J. Adv. Nurs.* 72 (9), 2138–2152.
- Lambing, A.Y., Adams, D.L., Fox, D.H., Divine, G., 2004. Nurse practitioners' and physicians' care activities and clinical outcomes with an inpatient geriatric population. *J. Am. Acad. Nurse Pract.* 16 (8), 343–352.
- Laurant, M., Reeves, D., Hermens, R., Braspenning, J., Grol, R., Sibbald, B., 2007. Substitution of doctors by nurses in primary care. *Cochrane Database Syst. Rev.* 4 (CD001271).
- Levac, D., Colquhoun, H., O'Brien, K.K., 2010. Scoping studies: advancing the methodology. *Implement Sci.* 5, 69.

- Leveille, S.G., Wagner, E.H., Davis, C., Grothaus, L., Wallace, J., LoGerfo, M., Kent, D., 1998. Preventing disability and managing chronic illness in frail older adults: a randomized trial of a community-based partnership with primary care. *J. Am. Geriatr. Soc.* 46 (10), 1191–1198.
- Litaker, D., Mion, L., Planavsky, L., Kippes, C., Mehta, N., Frolkis, J., 2003. Physician – nurse practitioner teams in chronic disease management: the impact on costs, clinical effectiveness, and patients' perception of care. *J. Interprof. Care* 17 (3), 223–237.
- Looman, W.M., Fabbriotti, I.N., Huijsman, R., 2014. The short-term effects of an integrated care model for the frail elderly on health, quality of life, health care use and satisfaction with care. *Int. J. Integr. Care* 14, e034.
- Lovink, M.H., Persoon, A., van Vught, A.J., Koopmans, R.T., Schoonhoven, L., Laurant, M.G., 2015. Physician substitution by mid-level providers in primary healthcare for older people and long-term care facilities: protocol for a systematic literature review. *J. Adv. Nurs.* 71 (12), 2998–3005.
- Maier, C.B., Aiken, L.H., 2016. Task shifting from physicians to nurses in primary care in 39 countries: a cross-country comparative study. *Eur. J. Public Health*.
- Martin-Misener, R., Harbman, P., Donald, F., Reid, K., Kilpatrick, K., Carter, N., Bryant-Lukosius, D., Kaasalainen, S., Marshall, D.A., Charbonneau-Smith, R., DiCenso, A., 2015. Cost-effectiveness of nurse practitioners in primary and specialised ambulatory care: a systematic review. *BMJ Open* 5 (6), e007167.
- Martinez-Gonzalez, N.A., Djalali, S., Tandjung, R., Huber-Geismann, F., Markun, S., Wensing, M., Rosemann, T., 2014a. Substitution of physicians by nurses in primary care: a systematic review and meta-analysis. *BMC Health Serv. Res.* 14, 214.
- Martinez-Gonzalez, N.A., Tandjung, R., Djalali, S., Huber-Geismann, F., Markun, S., Rosemann, T., 2014b. Effects of physician-nurse substitution on clinical parameters: a systematic review and meta-analysis. *PLoS One* 9 (2), e89181.
- Martinez-Gonzalez, N.A., Tandjung, R., Djalali, S., Rosemann, T., 2015. The impact of physician-nurse task shifting in primary care on the course of disease: a systematic review. *Hum Resour Health* 13, 55.
- Meyer, S.C., Miers, L.J., 2005. Cardiovascular surgeon and acute care nurse practitioner: collaboration on postoperative outcomes. *AACN Clin. Issues* 16 (2), 149–158.
- Miller, S.K., 1997. Impact of a gerontological nurse practitioner on the nursing home elderly in the acute care setting. *AACN Clin. Issues* 8 (4), 609–615.
- Moher, D., Shamseer, L., Clarke, M., Ghersi, D., Liberati, A., Petticrew, M., Shekelle, P., Stewart, L.A., Group, P.-P., 2015. Preferred reporting items for systematic review and meta-analysis protocols (PRISMA-P) 2015 statement. *Syst. Rev.* 4, 1.
- Morilla-Herrera, J.C., Garcia-Mayor, S., Martin-Santos, F.J., Kaknani Uttumchandani, S., Leon Campos, A., Caro Bautista, J., Morales-Asencio, J.M., 2016. A systematic review of the effectiveness and roles of advanced practice nursing in older people. *Int. J. Nurs. Stud.* 53, 290–307.
- Naylor, M.D., Brooten, D., Campbell, R., Jacobsen, B.S., Mezey, M.D., Pauly, M.V., Schwartz, J.S., 1999. Comprehensive discharge planning and home follow-up of hospitalized elders: a randomized clinical trial. *JAMA* 281 (7), 613–620.
- Naylor, M.D., Brooten, D.A., Campbell, R.L., Maislin, G., McCauley, K.M., Schwartz, J.S., 2004. Transitional care of older adults hospitalized with heart failure: a randomized, controlled trial. *J. Am. Geriatr. Soc.* 52 (5), 675–684.
- Naylor, M.D., 2000. A decade of transitional care research with vulnerable elders. *J. Cardiovasc. Nurs.* 14 (3), 1–14 (quiz 88–19).
- Newhouse, R.P., Stanik-Hutt, J., White, K.M., Johantgen, M., Bass, E.B., Zangaro, G., Wilson, R.F., Fountain, L., Steinwachs, D.M., Heindel, L., Weiner, J.P., 2011. Advanced practice nurse outcomes 1990–2008: a systematic review. *Nurs. Econ.* 29 (5), 230–250 (quiz 251).
- Newhouse, R.P., Weiner, J.P., Stanik-Hutt, J., White, K.M., Johantgen, M., Steinwachs, D., Zangaro, G., Aldebron, J., Bass, E.B., 2012. Policy implications for optimizing advanced practice registered nurse use nationally. *Policy Polit. Nurs. Pract.* 13 (2), 81–89.
- North, L., Kehm, L., Bent, K., Hartman, T., 2008. Can home-based primary care: cut costs? *Nurse Pract.* 33 (7), 39–44.
- Optum, Inc., 2013. The impact of OptumTM CarePlus on nursing homes and residents. White Paper. Optum Inc. (pp. 4).
- Ornstein, K., Smith, K.L., Foer, D.H., Lopez-Cantor, M.T., Soriano, T., 2011. To the hospital and back home again: a nurse practitioner-based transitional care program for hospitalized homebound people. *J. Am. Geriatr. Soc.* 59 (3), 544–551.
- Paez, K.A., Allen, J.K., 2006. Cost-effectiveness of nurse practitioner management of hypercholesterolemia following coronary revascularization. *J. Am. Acad. Nurse Pract.* 18 (9), 436–444.
- Pulcini, J., Jelic, M., Gul, R., Loke, A.Y., 2010. An international survey on advanced practice nursing education, practice, and regulation. *J. Nurs. Scholarsh.* 42 (1), 31–39.
- Rawl, S.M., Easton, K.L., Kwiatkowski, S., Zemen, D., Burczyk, B., 1998. Effectiveness of a nurse-managed follow-up program for rehabilitation patients after discharge. *Rehabil. Nurs.* 23 (4), 204–209.
- Reuben, D.B., Borok, G.M., Wolde-Tsadiq, G., Ershoff, D.H., Fishman, L.K., Ambrosini, V.L., Liu, Y., Rubenstein, L.Z., Beck, J.C., 1995. A randomized trial of comprehensive geriatric assessment in the care of hospitalized patients. *N. Engl. J. Med.* 332 (20), 1345–1350.
- Reuben, D.B., Schnelle, J.F., Buchanan, J.L., Kington, R.S., Zellman, G.L., Farley, D.O., Hirsch, S.H., Ouslander, J.G., 1999. Primary care of long-stay nursing home residents: approaches of three health maintenance organizations. *J. Am. Geriatr. Soc.* 47 (2), 131–138.
- Reuben, D.B., Ganz, D.A., Roth, C.P., McCreath, H.E., Ramirez, K.D., Wenger, N.S., 2013. Effect of nurse practitioner comanagement on the care of geriatric conditions. *J. Am. Geriatr. Soc.* 61 (6), 857–867.
- Rigolosi, R., Salmond, S., 2014. The journey to independent nurse practitioner practice. *J. Am. Assoc. Nurse Pract.* 26 (12), 649–657.
- Ritchie, C., Andersen, R., Eng, J., Garrigues, S.K., Intinarelli, G., Kao, H., Kawahara, S., Patel, K., Sapiro, L., Thibault, A., Tunick, E., Barnes, D.E., 2016. Implementation of an interdisciplinary, team-based complex care support health care model at an academic medical center: impact on health care utilization and quality of life. *PLoS One* 11 (2), e0148096.
- Robles, L., Slogoff, M., Ladwig-Scott, E., Zank, D., Larson, M.K., Aranha, G., Shoup, M., 2011. The addition of a nurse practitioner to an inpatient surgical team results in improved use of resources. *Surgery* 150 (4), 711–717.
- Roland, M.B.R., et al., 2006. Evercare Final Report. In: Population Health. National Primary Care Research and Development Centre, Manchester, United Kingdom (pp. 227).
- Sangster-Gormley, E., Martin-Misener, R., Downe-Wamboldt, B., Dicenso, A., 2011. Factors affecting nurse practitioner role implementation in Canadian practice settings: an integrative review. *J. Adv. Nurs.* 67 (6), 1178–1190.
- Sangster-Gormley, E., Martin-Misener, R., Burge, F., 2013. A case study of nurse practitioner role implementation in primary care: what happens when new roles are introduced? *BMC Nurs.* 12, 1.
- Sastre-Pullana, P., De Pedro-Gómez, J.E., Bennasar-Veny, M., Serrano-Gallardo, P., Morales-Asencio, J.M., 2014. Competency frameworks for advanced practice nursing: a literature review. *Int. Nurs. Rev.* 61 (4), 534–542.
- Stanik-Hutt, J., Newhouse, R.P., White, K.M., Johantgen, M., Bass, E.B., Zangaro, G., Wilson, R., Fountain, L., Steinwachs, D.M., Heindel, L., Weiner, J.P., 2013. The quality and effectiveness of care provided by nurse practitioners. *J. Nurse Pract.* 9 (8), 492–500 (e413).
- Stuck, A.E., Aronow, H.U., Steiner, A., Alessi, C.A., Bula, C.J., Gold, M.N., Yuhus, K.E., Nisenbaum, R., Rubenstein, L.Z., Beck, J.C., 1995. A trial of annual in-home comprehensive geriatric assessments for elderly people living in the community. *N. Engl. J. Med.* 333 (18), 1184–1189.
- Stuck, A.E., Egger, M., Hammer, A., Minder, C.E., Beck, J.C., 2002. Home visits to prevent nursing home admission and functional decline in elderly people: systematic review and meta-regression analysis. *JAMA* 287 (8), 1022–1028.
- Swan, M., Ferguson, S., Chang, A., Larson, E., Smaldone, A., 2015. Quality of primary care by advanced practice nurses: a systematic review. *Int. J. Qual. Health Care* 27 (5), 396–404.
- Takahashi, P.Y., Haas, L.R., Quigg, S.M., Croghan, I.T., Naessens, J.M., Shah, N.D., Hanson, G.J., 2013. 30-day hospital readmission of older adults using care transitions after hospitalization: a pilot prospective cohort study. *Clin. Interv. Aging* 8, 729–736.
- Tinetti, M.E., Baker, D.I., McAvay, G., Claus, E.B., Garrett, P., Gottschalk, M., Koch, M.L., Trainor, K., Horwitz, R.I., 1994. A multifactorial intervention to reduce the risk of falling among elderly people living in the community. *N. Engl. J. Med.* 331 (13), 821–827.
- Tung, T.K., Kaufmann, J.A., Tanner, E., 2012. The effect of nurse practitioner practice in home care on emergency department visits for homebound older adult patients: an exploratory pilot study. *Home Healthc. Nurse* 30 (6), 366–372.
- United Nations, D.o.E.a.S.A., Population Division, 2015. World Population Prospects: The 2015 Revision, Key Findings and Advance Tables. United Nations, New York.
- Van Craen, K., Braes, T., Wellens, N., Denhaerynck, K., Flamaing, J., Moons, P., Boonen, S., Gosset, C., Petermans, J., Milisen, K., 2010. The effectiveness of inpatient geriatric evaluation and management units: a systematic review and meta-analysis. *J. Am. Geriatr. Soc.* 58 (1), 83–92.
- World Health Organization, 2015. World health statistics 2015. World Health Organ.
- Zimmer, J.G., Groth-Juncker, A., McCusker, J., 1985. A randomized controlled study of a home health care team. *Am. J. Public Health* 75 (2), 134–141.
- ter Maten-Speksnijder, A., Grypdonck, M., Pool, A., Meurs, P., van Staa, A.L., 2014. A literature review of the Dutch debate on the nurse practitioner role: efficiency vs. professional development. *Int. Nurs. Rev.* 61 (1), 44–54.
- van Haastregt, J.C., Diederiks, J.P., van Rossum, E., de Witte, L.P., Crebolder, H.F., 2000. Effects of preventive home visits to elderly people living in the community: systematic review. *BMJ* 320 (7237), 754–758.