

A systematic review of the effectiveness and roles of advanced practice nursing in older people

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ABSTRACT

Objectives: To identify, assess and summarize available scientific evidence about the effect of interventions deployed by advanced practice nurses when providing care to older people in different care settings, and to describe the roles and components of the interventions developed by these professionals. **Background:** In older people, evidence of advanced practice roles remains dispersed along different contexts, approaches and settings; there is little synthesis of evidence, and it is not easy to visualize the different practice models, their components, and their impact. **Design:** Systematic review. **Data sources:** Sixteen electronic databases were consulted (1990–2014). The research also included screening of original studies in reviews and reports from Centers of Health Services Research and Health Technology Agencies. **Review methods:** Studies were assessed by two reviewers with the Cochrane risk of bias tool. They were classified depending on the type of follow-up (long and short-term care) and the scope of the service (advanced practice nurses interventions focused on multimorbid patients or focused on a specific disease). **Results:** Fifteen studies were included. In long-term settings, integrative, multi-component and continuous advanced practice nursing care, reduced readmissions, and increased patients' and caregivers' satisfaction. Advanced practice nurses were integrated within multidisciplinary teams and the main interventions deployed were patient education, multidimensional assessments and coordination of multiple providers. **Conclusion:** Positive results have been found in older people in long-term care settings, although it is difficult to discern the specific effect attributable to them because they are inserted in multidisciplinary teams. Further investigations are needed to

evaluate the cost-effectiveness of the two modalities detected and to compare internationally the interventions developed by advanced practice nurses.

What is already known about the topic?

_ Advanced practice nursing is getting an expanding presence around the world. Older people with multiple chronic conditions and functionality problems are the most frequent target populations for these services.

_ There are many studies about advanced practice nursing services, but they are dispersed along different contexts, approaches and settings.

What this paper adds?

_ In long-term care settings, significant results were found in the reduction of mortality, admissions, improvements in patients' self-care, and the increase in patients' and caregivers' satisfaction.

_ Inconclusive results were found in quality of life, and no effects were detected in falls reduction.

_ The mechanisms by which the outcomes are achieved seem to be related with educational interventions, advanced skills for multidimensional assessments and ensuring continuity of patient care by the coordination of multiple providers.

Introduction

The Association des Infirmie` res et Infirmiers du Canada (AIIC) (2008), defines advanced practice nursing (APN), as “an advanced level of nursing practice that maximizes the use of specialized skills and nursing knowledge in order to respond to the customers' needs in the health sphere”. In the United States, the introduction of these nursing roles with a high level of autonomy, dates back to the mid1960s, whereas in Canada, those roles were introduced in the 1970s (Martin-Misener et al., 2010), but in many other countries they are irregularly developed. Many of these initiatives were launched to fulfill gaps in services traditionally carried out by physicians (DiCenso et al., 2010), in order to improve access to care, particularly in under-served areas (Delamaire and Lafortune, 2010), and as a consequence to the reduction of physicians workforce internationally (Dowling et al., 2013; Olson and Chioffi, 2005; Por, 2008). Despite this expansion, advanced practice roles are still difficult to define precisely because he term

encloses a heterogeneous variety of practices, usually associated to local circumstances belonging to the setting where they are developed (Gardner et al., 2007).

Background

In recent years, use of APN has been widely extended in several countries. Their roles can be distinguished from basic practice through their level of specialization, advancement, and role expansion (Dowling et al., 2013). They usually integrate research, training, practice, and management (Bryant-Lukosius et al., 2004). They tend to develop a high degree of professional autonomy, with their own caseload of patients, advanced skills for health status assessment and decision-making or diagnostic reasoning. Moreover, they are able to act as consultants for different health professionals (Mantzoukas and Watkinson, 2007). Leadership, professional autonomy, and working in multidisciplinary teams are key to effective performance of the APN role (Dowling et al., 2013). Newhouse et al. (2011) concluded that a collaborative approach between APNs with physicians and other providers leads to higher quality of care and better health care systems.

All of these previous features contribute to the integration of additional skills and responsibilities, which seem to be essential for APNs' autonomy (Dowling et al., 2013). Reimanis et al. (2001) carried out an evidence-based literature review aimed to examine the provider and patients satisfaction associated with nurse case management in acute and community care settings. This review resulted in the extraction of variables that could define their role in a holistic, comprehensive and complete way. Those variables describe provider satisfaction, autonomy, multidisciplinary collaboration, patient satisfaction, nurse case management's effect on staff nurses, professional status, job stress, and role conflict. On the other hand, Manley's (Manley, 1997) model is more centered on the skills and competencies that the APN should develop for their performance. Those skills are classified into three groups. Firstly, the academic grade to access to this role (which usually is master or PhD), an extensive client-based practice, and a certification of expertise in practice. Secondly, defined sub-roles as expert practitioner, educator, researcher and consultant. Finally, the skills and competencies previously mentioned were put in place as a change agent, a collaborator, a clinical leader, a role model and a patient advocate. In recent years, the concept of 'complex chronic disease' has been introduced, which is linked to the concept of aging and frailty, and determined by the presence of multiple and complex chronic conditions. The most differential characteristics of this

group of patients are the simultaneity of several chronic diseases, the occurrence of multiple hospital admissions and health services utilization, the presence of polypharmacy, and a reduced personal autonomy. In addition, there are additional factors such as older age, living alone or lack of family support, or risk of falling, among others (Contel et al., 2012). In this sense, APNs are in an ideal position to cover many of the demands of care of this population group (Carroll et al., 2007; Clark et al., 2010; Contel et al., 2012). Moreover, several models of APN delivery of services for older people have been developed in a wide variety of health contexts (Low et al., 2011; Oeseburg et al., 2009), such as transitional care (Brand et al., 2004), case management (Leung et al., 2004) or services for older people with heart diseases (Blaha et al., 2000; Duffy et al., 2010), aimed to improve quality of life or reduce hospital admissions. Also, APNs have been employed to carry out interventions in patients with dementia (Callahan et al., 2006), in older people with low incomes and acute health problems (Counsell et al., 2007), or in the community, giving support to families and patients to manage resources Thompson et al. (2008) and Donald et al. (2013), found positive results in terms of improvement of health status, behavior and patient satisfaction in residential settings. The domains of practice do not appear to have a central role in the design of APN roles in many instances, and a widespread variability in the level of practice and job content have been reported (Chang et al., 2012), despite the availability of some instruments to define the service parameters of these professionals (Gardner et al., 2013). There exists a broad range of APN modalities, as well as a lack of conceptual frameworks to categorize the scope of interventions and services by APNs in the elderly population (Morales Asencio, 2010). Many of the interventions have little conceptual substrate and act upon local schemes. On the other hand, interventions usually have a multicomponent nature, which implies some methodological difficulties that are not always addressed successfully. Today, conceptual developments that help to isolate complex interventions are available, but scarcely used in many APN evaluation studies (Campbell et al., 2007). Nonetheless, one of the main problems is that the APN figure is usually embedded within other organizational interventions, and it is difficult to discern which outputs are attributable to the APN. Clearly, much research has been done about APNs and many of these studies have used older people as a target population. However, the research varies, and there is little consensus about best practices, making it difficult to obtain an adequate overview of the different models experienced, their specific components, and their specific outcomes

(Morales Asencio, 2010). Therefore, a systematic review would contribute to clearing up some of these uncertainties.

The review

Aims: The aims of this SR were to identify, assess and summarize available scientific evidence about the effect of interventions deployed by APNs when providing care to older people in different settings (hospital, home, outpatient, residential) as well as to describe the roles and components of the interventions developed by these professionals.

Design

The study consisted of a systematic review, whose protocol was registered in PROSPERO and published elsewhere (Morilla-Herrera et al., 2013).

1. Types of studies

The studies were randomized controlled trials, quasi-experimental, and interrupted time series that include a longitudinal analysis of the results with at least three observations before and after the intervention. Studies were excluded in the case that the publication date was before 1990 because the context of provision of health care and nursing services and the demand of health care for older people were very different beyond this date.

2. Types of patients

Older people over 65 years who receive hospital care for chronic or acute conditions, or as outpatients for different health problems, in home (HC) or residential care programs, with or without the presence of family, or social support. Patients suffering from dementia were also included. Studies were excluded if patients were admitted to acute psychiatric units or referred to community and/or specialized mental health units as a result of a severe mental health disorder (bipolar disorder, schizophrenia, psychosis or personality disorders).

3. Types of interventions

Studies that included any modality of service in which APNs could develop their role through different interventions. Interventions were conceptualized as defined by the Nursing Interventions Classifications (Bulechek et al., 2012), as any treatment, based upon clinical judgment and knowledge, that a nurse performs to enhance patient

outcomes. These could include specific interventions (assessment, test ordering, prescription, etc.), or more complex interventions (case management, making diagnoses, provision of consultancy for other professionals, referral, etc.). The type of providers included practice nurses, or advanced practice nurses, with or without the participation of physicians. Reimanis et al. (2001) and Manley's (1997) criteria were applied to identify APNs' role in the studies (Table 2). Other professionals considered were community workers, social workers, occupational therapists, rehabilitation therapists, podiatrists, physiotherapists, and nutritionists. These staff members were included only if they were associated with the intervention of an APN, as members of the team, in order to highlight the APN leadership role in a multidisciplinary team.

4. Types of outcome measures

Patients' outcomes involved functionality, mortality, quality of life, morbidity, satisfaction, cognitive status, and adverse events (drug adverse events, falls, and failure to rescue). The results of service considered included resources used by professionals (referrals, diagnostic tests, length of stay, prescriptions), by patients (readmissions, consultations, number of home visits), and economic outcomes (cost-benefit-utility-effectiveness analyses). Expected outcome measures were published elsewhere (Morilla-Herrera et al., 2013).

Search methods

The databases consulted were: PubMed, CINAHL, Web of Science, PsychINFO, ENFISPO, COCHRANE, EMBASE, Cochrane Library (incl. Cochrane Central Register of Controlled Trials, DARE), Joanna Briggs Institute, Centre for Review and Dissemination, HEN (EuroWHO), MEDLINE, EMI, CUIDEN, DIALNET, SCOPUS, and SCIELO. The search also included papers, reviews, and evaluations from the following research health services centers and Health Technology Agencies: INAHTA, Agency for Health Care Research and Quality (AHRQ), Centre for Health Economics and Policy Analysis at the University of McMaster, and the King's Fund. Google Scholar was also consulted, together with documents from the International Council of Nurses, OECD reports and the American Academy of Nurse Practitioners. Secondary searches were carried out on the references of the studies found. The languages of papers were English, Spanish, and French. The search was carried out by using specific methodological filters proposed by the Health Information Research Unit at McMaster University

for randomized controlled trials and SRs. Supplementary files are provided with the search strategies. Also, an example is provided in Fig. 1.

Search outcome

Selection of studies In the first stage of the review, a detailed double blinded assessment of titles and abstracts was performed by two independent reviewers to determine whether each item met the pre-determined requirements for inclusion. If this step was not clear, the full text of the article was evaluated. Two blinded reviewers evaluated the full text of the references potentially eligible to assess whether they met the inclusion criteria for review. Discrepancies were resolved by discussion and the intervention of a third evaluator if necessary. Additionally, a pilot test was developed with 15 papers, randomly selected, to test the reviewers' accuracy in applying the inclusion/exclusion criteria, and the interobserver reliability.

Data abstraction

Data gathered from each study were methods, interventions, participants, results under consideration, and the reviewer's observations. When the original studies failed to provide necessary data for extraction, the authors were contacted for clarification or requesting the original data if possible. Studies were classified according to the following criteria: composition of the care team, contexts where the service was provided, and type of diseases.

Quality appraisal

Two reviewers conducted this process independently. The methodological quality was evaluated using the Cochrane risk of bias tool included in RevMan 5. The biases assessed were: random sequence generation, allocation concealment, blinding of participants and personnel, blinding of outcome assessment, attrition bias, selective reporting and other bias. Each criteria could be high, low or unclear risk.

Synthesis

The performance of a meta-analysis was considered but, due to the heterogeneity of the included studies, this possibility was discarded. This heterogeneity was related to differences in follow-up periods and outcomes among studies and, consequently, we summarized the findings narratively rather

Results

The search produced 2692 papers, including duplicates. Fig. 2 reflects the study selection process. After removing duplicates and screening, 1880 studies were eliminated, due to exclusion criteria, language, and date of publication. Finally, fifteen studies met the inclusion and quality criteria (Fig. 1). The excluded studies and the reasons for exclusion are detailed in the supplementary files.

1. General characteristics of included studies

The fifteen studies (Berglund et al., 2013; Callahan et al., 2006; Elley et al., 2008; Griffiths et al., 2001; Hordam et al., 2010; Huang and Liang, 2005; Imhof et al., 2012; Mion et al., 2003; Naylor et al., 2004, 1999; Parsons et al., 2012; Rosted et al., 2013; Strömberg et al., 2003; Stuck et al., 1995, 2000) were published between 1999 and 2014. All of them were RCT and the interventions were delivered by a multidisciplinary care team, excluding one (Hordam et al., 2010). Patients' age was over 65 years old in all the studies. Health conditions more frequently reported were: dementia, hip fractures, chronic heart disease and people with multimorbidity. Outcome measures evaluated in the included studies were hospital and/or acute care admissions, mortality, morbidity, institutionalization, cognitive status mobility, and quality of life. The main outcomes analyzed in the studies were acute care admission, rate of falls, quality of life, quality of care, hospital admission, mortality and institutionalization. The characteristics of the included studies are described in Table 1.

2. Risk of bias of included studies

The risk of bias of selected studies is represented in Fig. 3. Most studies had low quality in the blinding of participants and personnel, and uncertainty in blinding of outcomes assessment.

3. Role of advanced practice nurses in the studies

APN's functions were not detailed extensively. We found that APNs had mostly a post grade educational level, such as master, specialist or PhD, and a high evidence-based approach in their practice (structured use of clinical guidelines, protocols and pathways based on the best evidence) (Table 2). The main reported interventions were patients'

education and training; relationship with families; physical, social and psychological comprehensive assessment; interdisciplinary care management during a defined period of time; direct clinical interventions and counseling. APNs were inserted in many cases into multidisciplinary teams, having an active role as consultants and collaborating with other health professionals to develop individualized evidence-based care plans (EBP) after an initial assessment. All those characteristics increased APN autonomy in the process of care (Table 3).

4. Results by settings

Long-term settings

We classified in this category those settings that provided care over an extended period, usually for a chronic condition or disability, requiring periodic, intermittent, or continuous care. The differences with other contexts are based on intervention intensity, frequency and complexity, requiring a long-term monitoring. A longitudinal provision of care between patients-caregivers and APNs favored continuity of patient care. These settings also favored the creation of a confidence-based relationship between patients-caregivers and APNs. The main differences between those contexts were the initial point of the intervention (hospital in TC and patient's home in HC), and the type of follow-up, mostly with home visits in HC with ITCs.

- Home care. Two different approaches were found in this environment, depending on the scope of the APN's services: focused on patients with a specific disease (disease management), or on multimorbid patients. In all the studies included in this category, the APN belonged to a multidisciplinary team. Mortality, hospital admission, patient institutionalization and quality of life were the main outcomes assessed. Eventually, rate of falls and admission in acute care settings due to falling was also measured. Follow-up periods ranged from 12 to 36 months. Interventions in all of the studies had the same provision scheme: firstly, the nurse performed a comprehensive geriatric assessment. After identifying potential needs and risks, the nurse, within a multidisciplinary team, developed an individualized care plan, which included, if necessary, referrals to other health professionals. Nurses also followed-up the participants periodically by telephone, and managed the use of additional economical or health resources (Table 1).

- Specific diseases approach. This group included those patients who had been discharged from the hospital due to a specific care problem, so APNs developed specific interventions directed to those diseases. In Elley et al. (2008), aimed at falls prevention, the interventions did not reduce the falls rate. Data about the effectiveness of the program can be found in Table 1.

- Multimorbid approach. The five articles included in this category followed similar schemes. The main outcome was the improvement in functional status, in order to avoid patient admissions in the hospital or in nursing homes. Additionally, Stuck et al. (2000) also measured institutionalizations and mortality, and Imhof et al. (2012) measured the incidence of falls. All patients underwent a comprehensive assessment. With the obtained data, and in collaboration with the geriatrician and other health professionals, the APNs developed an individualized care plan, based on patient needs. Stuck et al. (1995, 2000) found that a program of comprehensive in-home geriatric assessment, with an emphasis on health education, giving patients and caregivers skills to promote self-care, always supported by the APN, resulted in a significant improvement in functionality, and a reduction in mortality and institutionalization. Particularly, in Stuck et al. (2000), patients were divided in groups determined by biological, psychological, social, and environmental risk factors for disabilities. Those classified as 'low baseline risk' were significantly less dependent in instrumental ADL in the intervention groups, at three years of follow-up. However, no differences were found between groups in patients classified as 'high baseline risk'. Satisfaction with the intervention was also measured, obtaining positive outcomes. In Stuck et al. (1995), patients admitted permanently in nursing homes in the intervention group were significantly lower than those in the control group. These results in terms of institutionalization rate were similar to those obtained by Parsons et al. (2012), which was more focused on resources management and referrals. However, although Imhof et al. (2012) found reductions in the rate and consequences of falls, acute events and hospitalizations, results on quality of life were not conclusive. Rosted et al. (2013) only found positive results in mental health at 6 months of follow-up (Table 1).

- Transitional care. The key ingredients of this modality of service were discharge planning and the continuity of care, which allowed patients and nurses to develop a confidence-based relationship. These services are specifically targeted to the hospital-to-home transition phase, reinforcing inpatient education and medication management with subsequent outpatient contact and monitoring. It is more comfortable for patients that

cannot move from their homes to the care center. APNs acted as links between patients, community resources and the health system, using phone calls to contact patients during the follow-up period. Participants' health problems differed between studies: from those that had different chronic diseases, to those who suffered hip fractures. Except in one study (Hordam et al., 2010), the APN was inserted in a multidisciplinary team. Outcomes evaluated were hospital admission, quality of life and mortality. Follow-up periods were different in each study, and varied between 1 and 13 months (Table 1). In all the included studies, APNs used phone calls to contact patients during the follow-up period.

- Specific diseases approach. Three studies were included in this category: two focused on hip fracture (Hordam et al., 2010; Huang and Liang, 2005), and the other one on heart failure (Naylor et al., 2004) The process started at the hospital, where the APN made an evidence-based discharge plan in collaboration with patients, caregivers and other clinicians. Later on, at the patient's home, the APN evaluated the environment in order to reduce the risk of adverse events like falls. APNs also gave information and educated patients and caregivers about the disease, drugs, nutritional advice (e.g., reduction of sodium intake) and psychological support. In some cases, a brochure with information, or videotapes were given to patients and caregivers. APNs were available by telephone, and followed up with patients and caregivers by telephone and home visits. They also were in contact with the GP and the health care team to inform them about patient progress, and to make changes in the care plan, if necessary. This modality aimed to reduce readmissions in acute care units due to a specific disease. That means that the nurse should have expert knowledge and specific training to attend to patients' needs, and to prevent adverse events. In Huang and Liang (2005), the discharge planning intervention decreased length of stay, rate of readmission and survival and improved activities of daily living for intervention group. In Hordam et al. (2010), patients both in the intervention and control group improved their general health status at 3 and 9 months of follow-up, whereas development in health status, measured by physical function, general health and mental health was significantly improved in the intervention group. Naylor et al. (2004) measured readmissions in hospital and acute settings. APN interventions were focused on education, but also on monitoring patients' health status and improving cardiac function, which reduced re-hospitalizations. It is important to highlight that patient satisfaction, assessed only through 6 weeks, was also improved.

Results showed improvements in general: except for the rate of repeated falls, all the outcomes were significantly better for patients in the intervention group (Table 1).

- Multimorbidity approach. The outcomes measured in the three articles included in this category (Berglund et al., 2013; Mion et al., 2003; Naylor et al., 1999) were improvements in functional status, hospital readmission, mortality and quality of care. APNs interventions were focused on patient's health education, support to caregivers, program development, and case management. The follow-up was initiated in the hospital, where APNs interviewed patients to assess their specific needs. With the data obtained, and the recommendations of other health members of the health care team, the nurse designed a discharge plan that included caregivers' needs. The APN also managed community resources and health agencies if necessary. In the first home visit after discharge, APNs gave information to patients and caregivers about their health problem, and planned with the patient the outcomes that they would achieve. Follow-up was performed by telephone and home visits. Berglund et al. (2013) and Mion et al. (2003) found significant differences between groups in patient's satisfaction. Mion et al. (2003) detected differences in the admission rates to nursing homes and no differences in health costs, whereas in Naylor et al. (1999), APNs reduced hospital readmissions, lengthened the time until the first readmission, and decreased the cost of care (\$1 238 928 CG vs \$642 595 IG [P = .001]) (Table 1).

Short-term settings

- Ambulatory and hospital care. Studies were classified under ambulatory care (AC) if patients followed-up at a primary health care clinic, with eventual home visits, or under hospital care (HospC) if patients were admitted in a hospital ward. We only obtained one study in HospC (Griffiths et al., 2001) and two in AC (Callahan et al., 2006; Stromberg et al., 2003)

- Hospital care. In Griffiths et al. (2001), patients with different conditions were admitted into a nurse-led inpatient unit. Interventions developed by APNs were case management, health assessment and discharge planning. Outcome measures were those related with patients' quality of life. Authors did not find significant differences between groups in the Barthel index, but the length of stay was significantly higher in the intervention group (Table 1). Care in the unit had not significant impact in discharge destination.

- Ambulatory care. The two studies included in this context fulfill the criteria of the “specific disease” approach. In the case of Callahan et al. (2006), patients had dementia. They were followed-up in a primary health care clinic by the APN. The main outcome measure was acute care readmission. Interventions performed by APNs in this context were focused not only on patients’ education and direct care, but also on family caregivers’ well-being. The interventions showed behavioral improvements on patients, and revealed lower anxiety levels in patients and caregivers, due to the behavioral symptoms associated to dementia. In Strömberg et al. (2003), patients had chronic heart failure (CHF), and consequently, APN interventions were aimed at preventing cardiac events. Readmissions, hospital stays and mortality were significantly lower in the intervention and control groups at 12 months of follow-up. The intervention was also successful in improving self-care behavior in daily weight, and restriction of fluid intake (Table 1).

Discussion

The aim of the present study was to determine the models and effectiveness of APN developed for the care of older people over 65 years old in different settings in terms of types of treated patients, deployed interventions, and outcomes achieved. The main features identified in the studies concerning APNs’ role in all the contexts were: high level of professional autonomy, case management, advanced skills for assessment, diagnosis and decision-making, consultancy to other team members or institutions, development of health programs, and TC management. Those attributes were common with some key concepts of NCM roles in Reimanis’ model (Reimanis et al., 2001): autonomy, collaboration, patient’s satisfaction, and professional status. The other concepts suggested by Reimanis et al. (2001), were not found themselves, because they are more related with perceptions and feelings of the APNs upon other clinicians and the consequences of their role, which were not measured in the present study. Those concepts were role conflict, effect upon staff nurses, job satisfaction and job stress. In long-term care settings, significant results were found, such as reduction of mortality and admissions, improvements in patients’ self-care, and the increase in patients and caregivers’ satisfaction. These settings allow the APN to establish a long-term relationship with patients and family caregivers, giving them the opportunity to evaluate the effectiveness

in patients' health status, and make changes if necessary. That means that the APN can develop and fulfill all the expected outcomes related to her role in a complete way. Berglund et al. (2013) stated that interventions extended along the comprehensive continuum of care seemed to be successful from the older people's views of care planning, and moreover, guarantees the knowledge of whom to contact for their needs of care. Effective communication, receiving continuous feedback, and ensuring that they get the planned outcomes are key elements for the continuity of patient care (Callahan et al., 2006; Schraeder et al., 2009). To this purpose, apart from home visits, the APN used telephone to follow-up patient progress and adherence to their individualized care plan in home care (Elley et al., 2008; Imhof et al., 2012; Stuck et al., 1995, 2000) and transitional care (Hordam et al., 2010; Huang and Liang, 2005; Mion et al., 2003; Naylor et al., 1999, 2004). Additionally, APNs used the telephone to act as a consultant, being accessible by telephone for patients and caregivers to solve any doubt or health problem that they could have., with impact on quality of life and a reduction in readmissions. However, it is difficult to discern if those positive outcomes are related to this intervention, or to further actions developed by the APNs. Eklun and Wilhelmson (2009) highlighted the importance of including family caregivers in the patients' care process, not only as a resource for care, but also taking into account their own health needs. We found two articles that showed positive results in terms of patients' and caregivers' satisfaction (Mion et al., 2003; Naylor et al., 2004). This approach, although it has not been significant in some studies (Lin et al., 2009), has shown higher degrees of satisfaction among older people who received case management in home care (He' bert et al., 2010; Morales- Asencio et al., 2008). In long-term settings, the APN is the link between health system and patients, and between themselves and providers of external care services, providing a continuity of care that other clinicians could not guarantee. Consequently, the APN is not only a single additional ingredient in the multidisciplinary team, but an unquestionable leader in patient care management (Williamson et al., 2012). Quality of life outcomes obtained were heterogeneous. We found positive results in 11 of the studies in HC and TC (Berglund et al., 2013; Hordam et al., 2010; Huang and Liang, 2005; Imhof et al., 2012; Mion et al., 2003; Naylor et al., 1999, 2004; Parsons et al., 2012; Rosted et al., 2013; Stuck et al., 1995, 2000), and neutral results in Elley et al. (2008). Older adults in long-term care frequently receive fragmented service and any action intended to offer a coordinated coherent response to their needs is a key issue in the design of health services. APN services, potentially, meet many of the characteristics that reinforce continuity of patient

care and if well-developed care management models designed to facilitate aging in place are used, home care seems to be one of the best options (Parsons et al., 2012). The studies aimed at a specific condition or disease, such as heart failure (Naylor et al., 2004; Stroömberg et al., 2003), showed positive outcomes in terms of mortality, readmissions, and self-care behavior. All of them had an important component based on educational interventions, which have a direct impact on self-management, aspects developed many times by nurses with non-advanced roles, but if they are combined with other APN ingredients, they have a notable effect (Shao et al., 2013; Stamp et al., 2013; Stroömberg et al., 2003; Takeda et al., 2012). Likewise, the same finding was detected in the multimorbid approaches, where educational interventions provided to patients and family caregivers prevented admissions to the hospital or nursing home (Huang and Liang, 2005; Imhof et al., 2012; Mion et al., 2003; Naylor et al., 1999, 2004; Parsons et al., 2012; Rosted et al., 2013; Stroömberg et al., 2003; Stuck et al., 1995, 2000). Conversely, inconclusive results were detected in preventing falls (no changes in Elley et al., 2008, and improvements in Imhof et al., 2012). Systematic reviews (Gillespie et al., 2012) and original studies (Tinetti et al., 1994; Vassallo et al., 2004) suggest that a multifactorial intervention integrating assessment with a tailored intervention, usually involving a multi-professional team, is effective in reducing the rate of falls, but not the risk of falling (Gillespie et al., 2012). The success of this approach could be explained by the fact that, in the event of falling, there are many causative factors other than age, that include clinical complexity, co-morbidity, illness severity, reduced functional ability, and lower quality of care (Long et al., 2013). All these factors need a comprehensive approach by multidisciplinary teams and it is likely that APN alone cannot be able to make a direct impact, although their ability to coordinate multiple providers and improvements on assessments, contributes to greater service outcomes (Parsons et al., 2012). With respect to quality of life outcomes, older people included in studies generally present a mixture of patients with heterogeneous levels of chronic conditions and functionality, so that the impact on this outcome could be more related with changes in health conditions than with the APN intervention (Imhof et al., 2012; Tappenden et al., 2012). It is relevant to point out that some controversy exists around positive outcomes about home visits for older people. Both positive and inconclusive effects coexist in systematic reviews intended specifically to evaluate the effectiveness of this intervention (Huss et al., 2008; Mayo-Wilson et al., 2014). Nevertheless, the poor reporting of intervention components in home visit studies and the diversity of providers and their skill-mix along studies makes

it very difficult to confirm that some approaches may be more effective than others. Multidimensional preventive home visits have shown a reduction in disability burden among older adults when based on multidimensional assessment with clinical examination (Huss et al., 2008). These components are part of the majority of the APN interventions, and significant effects on reducing acute events have been detected in our review. Further investigation is needed, specifically aimed to detect if the APN's advanced level of education and clinical skills are differential factors from other ingredients usually included in home care services. The scarcity of results in the short-term care modalities in our review could be explained because of the difficulties to assess whether the outcomes registered in patients attended in the hospital or AC were attributable to the APNs' interventions. This problem was a limitation in Donald et al. (2013), who did not include in their SR any article with multidisciplinary care, in order to extract the outcomes obtained only by APNs' interventions, without the influence of other clinicians. We decided to include articles with multidisciplinary care because we considered that belonging to a multidisciplinary team was one of the main requisites that an APN should have to fully develop this role and the most likely way of deploying these services. This is supported in Newhouse et al. (2011), who concluded that a collaborative approach between APNs with physicians and other providers leads to higher quality of care and better health care systems (Callahan et al., 2006; Schraeder et al., 2009). It is important to mention that the full potential benefit of the APN interventions could not be completely considered because, sometimes, APN services are not integrated into a structured system (Imhof et al., 2012). All studies had concerns on blinding of participants and personnel. The reason for this weakness is the nature of the interventions that made it impossible to blind the personnel in the performance of the different activities. Nevertheless, although it is often impossible to blind study participants and intervention agents in nursing research, the blinding of data collectors, data analysts, and staff should be practiced, as well as the description of the possible limitations derived from this issue (Polit et al., 2011). One of the studies (Naylor et al., 2004) used blinding of data collectors and evaluators.

Limitations

Although our intention was to describe models of care among multiple environments, based on the interventions developed by APNs in different health settings, due to the

reduced amount of articles in AC and HospC (one in each setting), it was only possible to illustrate APNs' models of care in HC and TC. Nevertheless, this could be explained by the rigorous criteria employed in terms of quality appraisal for the studies included in the review. The heterogeneity of the included studies prevented the performance of meta-analysis. In the case of multidisciplinary teams, it is not easy to determine a direct causal association among APN interventions and outcomes, unless specific research methods for complex interventions are used. Most of studies describe poorly the details of APN interventions and consequently, international comparisons frequently face difficulties due to the lack of conceptualization and interpretation of the developed interventions. In this sense, the availability of a standardized language to describe nursing interventions (Bulechek et al., 2008) could provide an additional resource for classifying the components of different models and would facilitate the description of APNs in a universal language. There are some other APN roles that reflect advanced practice that were not included in the search strategy e.g. clinical nurse specialist, consultant nurse, nurse clinicians. Because of the wide range of definitions, training profiles and roles of APNs internationally, before we started the study we made an exhaustive analysis to determine a general description of an APN that could fit in each country. Accordingly to the four officially APN roles designated by the American Association of Nursing (ANA) (Dowling et al., 2013), and taking into account the context and type of population in which our study was developed, only the roles of nurse practitioner (NP) and clinical nurse specialist (CNS) were included. In fact, those roles were found in several of our included studies (Table 1). In addition, for those studies in which the APN was not defined as NP or CNS, the advanced practice role was characterized based on the 3 axes suggested by the ANA: specialization, development and progress (Fitzgerald et al., 2012). This strategy covered many any other advanced roles beyond the classical terms usually disseminated in the literature.

Conclusion

We have found two ways of implementing APN services for older people in different care settings: on one hand, a disease-oriented model that uses evidence-based inter-ventions to control risks and complications; on the other hand, a generalist model focused on improving the autonomy of patients with multiple conditions. In both cases, APN services are linked to positive results in older people, above all in long-term care settings, although in the majority of studies the APN is a member of a multidisci-plinary team and, for this

reason, it remains difficult to discern the specific effect attributable to them. Since both ways have shown positive results, nurse managers who have to implement APN services aimed at older people should estimate which of these two approaches would be more suitable for their organizations, in accordance with the nature of their health care teams, patients portfolio, organizational culture and environment of practice. The mechanisms by which the outcomes are achieved seem to be related with educational interventions, advanced skills for multidimensional assessments and achievement of continuity of patient care by the coordination of multiple providers, above all in long-term care settings. Education and professional development of APNs should endorse that these competencies are guaranteed, and current APNs should watch to improve their skills in these areas of competence.

Further investigations are needed to evaluate the cost-effectiveness of most of these services, as well as to compare the generalist and the specific approaches, or to test the pertinence of a mixed model. Furthermore, it is necessary to determine the nature of the interventions developed by APNs, as well as the utilization of complex intervention approaches to obtain a definitive understanding of the specific contribution of APN to outcomes within multidisciplinary teams. Conflict of interest: No conflict of interest has been declared by the authors. Funding: This research is funded by the Regional Health Ministry of Andalusia: PI-0703-2010. Ethical approval: This study operated with secondary data from primary research studies and therefore no form of consent was necessary. Reviewers made an explicit declaration of conflict of interest with any of the studies included or excluded from the review. Approval from the Ethics Committee was obtained in July 2010 and funding was obtained in March 2011 from the Regional Ministry of Health of Andalusia (Southern Spain).

Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at <http://dx.doi.org/10.1016/j.ijnurstu.2015.10.010>.

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Tables and Figures:

Table 1. Summary of findings in each study

Study	Setting	Country	Type of service (uni or multidisciplinary)/ type of patient (multimorbid or specific disease)	APN qualification and role	Aim	Design/ follow up	Sample	Main outcomes measures	Interventions developed by the APN	Findings
Berglund et al. (2013)	TC	Sweden	MC/multimorbid	Registered nurse with geriatric expertise at the geriatric department Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	Analysis frail older people's views of quality of care when receiving a comprehensive continuum of care interventions by APNs measured with a questionnaire.	RCT/12 months	N: 161 IG: 85 CG: 76	Quality of care	Health screening; case management; discharge planning; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education	Older people receiving a comprehensive continuum of care intervention perceived higher quality of care on items about care planning (P: 0.005), compared with those receiving the usual care. In addition, they had increased knowledge of whom to contact about care/ service, after three and 12 months (P < 0.03).
Callahan et al. (2006)	AC	USA	MC/dementia	Geriatric Nurse Practitioner Manager; educator; leader; expert practitioner; collaborator; consultant.	To test the effectiveness of a collaborative care model to improve the quality of care for patients with Alzheimer disease.	RCT/6-12-18 months	N: 153 IG: 84 CG: 69	Quality of care	Health screening; case management; environmental assessment; telephone follow-up; program design and development; support for patients and caregivers; health education	Intervention patients were more likely to receive cholinesterase inhibitors (79.8% vs 55.1%; P: 0.002) and antidepressants (45.2% vs 27.5%; P: 0.03). Intervention patients had significantly fewer behavioral and psychological symptoms of dementia as measured by the total NPI score at 12 months (mean difference, -5.6; P: 0.01) and at 18 months (mean difference, -5.4; P: 0.01). Intervention caregivers also reported significant improvements in distress as measured by the caregiver NPI at 12 months; at 18 months, caregivers showed improvement in depression as measured by the Patient Health Questionnaire-9. No differences were found on the Cornell Scale for Dementia, cognition, activities of daily living, or on rates of hospitalization, nursing home placement, or death.
Elley et al. (2008)	HC	New Zealand	MC/falls	Nurse coordinator with substantial gerontological experience, trained at a community-based fall-prevention program. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	To assess the effectiveness of a community based falls-and-fracture nurse coordinator and multifactorial intervention in reducing falls in older people.	RCT/12 months	N: 312 IG: 155 CG: 157	-Rate of falls. -Acute care admission	Health screening; case management; environmental assessment; telephone follow-up; program design and development; support for patients and caregivers; health education; referrals.	No significant differences in number of falls [285 IG vs 299 CG; Mean (95% CI): IG: 1.91 (1.70-2.16) vs CG: 2.01 (1.79-2.25)]
Griffiths et al. (2001)	HospC	UK	MC/multimorbid	Nurse Practitioner (F-Grade). Expert practitioner; manager.	To evaluate the outcome and cost of transfer to a nursing-led inpatient unit for intermediate care; the unit was designed to replace a period of care in acute hospital wards and promote recovery before discharge to the Community.	RCT/20 months	N: 176 IG: 89 CG: 87	Quality of life	Referrals; management of admission and discharge	Care in the unit had no significant impact on discharge destination or dependence. Length of inpatient stay was significantly increased for the treatment group (P = 0.036; 95% confidence interval 1.1-20.7 days). The daily cost of care was lower on the unit, but the mean total cost was £1044 higher-although the difference from the control was not significant (P = 0.150; 95% confidence interval -£382 to £2471).
Hordam et al. (2010)	TC	Denmark	UC/total hip replacement	Clinical Nurse Specialist. Manager; educator; leader; expert practitioner; collaborator; consultant.	To assess if by using telephone support and counseling 2 and 10 weeks after total hip replacement could improve health status.	RCT/3-9 months	N: 175 IG: 82 CG: 93	Quality of life	Health screening; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education;	All patients experienced significant improvements in health status, from baseline to 3 and 9 months of follow-up, in terms of physical and social function, bodily pain, general and mental health, vitality and bodily pain. Patients in the IG dropped out less than those in the CG [11 (16.4%) IG vs 28 (30.1%) P < 0.031]

Huang and Liang (2005)	TC	China	MC/hip fracture	Master's-prepared gerontological nurse with 7-years experience in hospital. Manager; educator; leader; expert practitioner; collaborator; consultant.	To examine the effectiveness of a discharge plan in hospitalized elderly patients with hip fracture due to falling	RCT/12 months	N: 126 IG: 63 CG: 63	Hospital admission	Health screening; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education;	The discharge planning intervention decreased significantly the length of stay ($P < 0.002$), rate of readmission and rate of survival and improved activities of daily living for intervention group compared with those of control group. Mean total SF-36 scores of patients in the experimental group were higher than for the control group and both groups had improved quality of life.
Imhof et al. (2012)	HC	Switzerland	MC/multimorbid	Registered nurse with a master's degree in Nursing Science. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	Effectiveness of health consultation programs implemented by APN in terms of quality of life, health indicators and healthcare utilization	RCT/3-6 months	N: 461 IG: 231 CG: 230	Quality of life Hospital admissions Falls	Health screening; case management; consultation; telephone follow-up; program design and development; referral; guidance and support through the health system for patients and caregivers; health education	Number of acute events reduced at 3 month of follow-up [IG: 116 (53%) vs CG: 168 (76%); $P < 0.001$]; Number of falls reduced at 3 month of follow-up [IG: 74 (34%) vs CG: 107 (48%); $P < 0.003$]; Number of hospitalizations reduced at 3 month of follow-up [IG: 47 (23%) vs CG: 68 (33%); $P < 0.003$]
Mion et al. (2003)	TC	USA	MC/multimorbid	Emergency Department APN. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	To assess effectiveness of a transitional model of care in the ED in reducing subsequent service use.	RCT/30 and 120 days	N: 650 Low risk IG: 180 CG: 179 High risk IG: 146 CG: 145	-Hospital admission -Quality of life -Mortality	Health screening; case management; discharge planning; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education; referral	The intervention had no effect on overall service use rates at 30 or 120 days. However, the intervention was effective in lowering nursing home admissions at 30 days (0.7% versus 3%; odds ratio 0.21; 95% confidence interval [CI] 0.05-0.99) and in increasing patient satisfaction with ED discharge care (3.41 versus 3.03; mean difference 0.37; 95% CI 0.13-0.62). The intervention was more effective for high-risk than low-risk aged people.
Naylor et al. (1999)	TC	USA	MC/multimorbid	Master's-prepared APN and post-degree experience in hospital and/or home care of older adults. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	To examine the effectiveness of an advanced practice nurse - centered discharge planning and home follow-up intervention for elders at risk for hospital readmissions.	RCT/2-6-12-24 weeks	N: 363 IG: 177 CG: 186	-Hospital admission -Acute care admission	Health screening; case management; discharge planning; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education; referral	The intervention had no effect on overall service use rates at 30 or 120 days. However, the intervention was effective in lowering nursing home admissions at 30 days (0.7% versus 3%; odds ratio 0.21; 95% confidence interval [CI] 0.05-0.99) and in increasing patient satisfaction with ED discharge care (3.41 versus 3.03; mean difference 0.37; 95% CI 0.13-0.62). The intervention was more effective for high-risk than low-risk aged people.
Naylor et al. (2004)	TC	USA	MC/heart failure	Clinical Nurse Specialist, APN, Master prepares nurses with general expertise in the management of older adults. Experienced nurses working at an advanced level. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	To examine the effectiveness of a transitional care intervention delivered by APNs to elders hospitalized with heart failure.	RCT/52 weeks	N: 239 IG: 118 CG: 121	-Hospital admission -Acute care admission -Quality of life	Health screening; case management; discharge planning; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education; referral	Time to first readmission or death was longer in intervention patients (Cox regression incidence density ratio: 1.65, 95% CI: 1.13-2.40). At 52 weeks, intervention group patients had fewer readmissions (104 vs 162, $P < 0.047$) and lower mean total costs (\$7636 vs 12,481, $P < 0.002$). For intervention patients, only short-term improvements were demonstrated in overall quality of life (12 weeks, $P < 0.05$), physical dimension of quality of life (2 weeks, $P < 0.01$; 12 weeks, $P < 0.05$) and patient satisfaction (assessed at 2 and 6 weeks, $P < 0.001$).
Parsons et al. (2012)	HC	New Zealand	MC/multimorbid	Experienced nurses working at an advanced level. Manager; educator; leader; expert practitioner; collaborator; consultant.	Effectiveness of a care management program on residential	RCT/3-6-12-18-24 months	N: 351 IG: 169 CG: 182	Institutionalization	Case management; program design and development; referral; guidance through the health system for patients and caregivers	The risk of permanent residential care placement or death was 0.36 for usual care (control group) and 0.26 for the care management initiative, a 102% absolute risk reduction, with the majority of the risk reduction seen in residential care placement (control group 0.25, intervention group 0.16).
Rosted et al. (2013)	HC	Denmark	MC/multimorbid	Aged-care nursing specialists, with more than 5 years of clinical experience and advanced education in geriatrics and gerontology. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	Effect of a two-stage nursing assessment and intervention to address older adults' uncompensated problems to prevent readmission and functional decline	RCT/30 and 180 days	N: 271 IG: 141 CG: 130	Quality of life	Health screening; case management; program design and development; referral; guidance through the health system for patients and caregivers; health education.	At 180 days of follow-up, they found positive results in mental health, measured with GDS5 [IG: 19 (13.48) vs. CG (28 (21.54); $P < 0.05$)] and quality of life, measured with SF-12 PCS [IG: 33.7 (9.4) vs 36.4 (9.9); $P < 0.04$]. There were also significant differences in the minutes/month spent by the community nurse between groups [34.5 (102.0) vs 96.1 (352.2); $P < 0.05$].

Author(s)	Country	Setting	Intervention	Comparison	Design	N	Risk of Bias	Outcomes	Results
Strömberg et al. (2003)	Sweden	MC/heart failure	Specially educated and experienced cardiac nurses, delegated the responsibility for making protocol-led changes in medications. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	To evaluate the effect of follow-up at a nurse-led heart failure clinic on mortality, morbidity and self-care behavior for patients hospitalized due to heart failure for 12 months after discharge.	RCT/12 months	N: 106 IG: 52 CG: 54	-Hospital admission -Mortality	Health screening; case management; discharge planning; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education	There were fewer patients with events (death or admission) after 12 months in the intervention group compared to the control group (29 vs 40, P=0.03) and fewer deaths after 12 months (7 vs 20, P=0.005). The intervention group had fewer admissions (33 vs 56, P=0.047) and days in hospital (350 vs 592, P=0.045) during the first 3 months. After 12 months the intervention was associated with a 55% decrease in admissions/patient/month (0.18 vs 0.40, P=0.06) and fewer days in hospital/patient/month (1.4 vs 3.9, P=0.02). The intervention group had significantly higher self-care scores at 3 and 12 months compared to the control group (P=0.02 and P=0.01)
Stuck et al. (1995)	Switzerland	MC/multimorbid	Registered Nurse with an additional degree in public health nursing. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	To test the effect of combining comprehensive geriatric assessment and preventive home visits by the APNs on the rate of disability in older persons living in the community	RCT/3 years	N: 414 IG: 215 CG: 199	-Institutionalization -Mortality -Quality of life	Health screening; case management; discharge planning; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education	People in the IG had better functional status (an CG, based on the independence to develop IADL [OR (95% CI): 3.0 (0.6-5.4); P: 0.02] and combined BADL and IADL [OR (95% CI): 2.9 (4.0-5.4); P: 0.03] and less number of persons institutionalized [OR (95% CI): 0.4 (0.2-0.9); P: 0.02]
Stuck et al. (2000)	Switzerland	MC/multimorbid	Certified registered nurses with an additional degree in public health nursing based on an 8-month postgraduate course. Manager; educator; leader; expert practitioner; collaborator; consultant; researcher.	To test the effect of combining comprehensive geriatric assessment and preventive home visits by the APNs on the rate of disability in older people with low risk of decline of functional status and nursing home admissions	RCT/3 years	N: 791 Low risk IG: 148 CG: 296 High risk IG: 116 CG: 231	Quality of life	Health screening; case management; discharge planning; telephone consultation; telephone follow-up; program design and development; support for patients and caregivers; health education	People with low baseline risk in the IG had better functional status (an CG, based on the independence to develop IADL [OR (95% CI): 0.6 (0.3-1.0); P: 0.04] and less number of persons with high baseline risk institutionalized [OR (95% CI): 2.1 (1.1-3.8); P: 0.02]

MC: multidisciplinary care/UC: unidisciplinary care; HC: home care; AC: ambulatory care; HospC: hospital care; TC: transitional care; IG: intervention group; CG: control group; RCT: randomized controlled trial.

Table 2. APNs role/specialization in the included studies

Study	APNs role
Berglund et al. (2013)	Registered nurse with geriatric expertise at the geriatric department
Callahan et al. (2006)	Geriatric Nurse Practitioner
Elley et al. (2008)	Nurse coordinator with substantial gerontological experience, trained at a community-based fall-prevention program
Griffiths et al. (2001)	Nurse Practitioner (F-Grade)
Hordam et al. (2010)	Clinical Nurse Specialist
Huang and Liang (2005)	Master's-prepared gerontological nurse with 7-years experience in hospital
Imhof et al. (2012)	Registered nurse with a master's degree in Nursing Science
Mion et al. (2003)	Emergency Department APN
Naylor et al. (1999)	Master's prepared APN and post-degree experience in hospital and/or home care of older adults
Naylor et al. (2004)	Clinical Nurse Specialist, APN, Master prepares nurses with general expertise in the management of older adults
Parsons et al. (2012)	Experienced nurses working at an advanced level
Rosted et al. (2013)	- Aged-care nursing specialists - More than 5 years of experience - Advanced education in geriatrics and gerontology
Strömberg et al. (2003)	Cardiac nurses
Stuck et al. (1995)	Registered nurse with an additional degree in public health nursing
Stuck et al. (2000)	Certified registered nurses with an additional degree in public health nursing based on an 8-month postgraduate course

Table 3. Adapted Reiman is criteria

Authors	Autonomy	NCM and MD collaboration	NCM and other health professionals collaboration	Patient/caregiver satisfaction	Job stress
Callahan et al. (2006)	X	X	X	X	-
Elley et al. (2008)	X	X	X	-	-
Griffiths et al. (2001)	X	X	-	-	X
Hordam et al. (2010)	X	-	-	-	-
Huang and Liang (2005)	X	X	X	-	-
Mion et al. (2003)	X	X	X	X	-
Naylor et al. (1999)	X	X	X	X	-
Naylor et al. (2004)	X	X	X	X	-
Strömberg et al. (2003)	X	X	X	-	-
Stuck et al. (1995)	X	X	X	X	-
Stuck et al. (2000)	X	X	X	X	-
Berglund et al. (2013)	X	X	X	X	-
Imhof et al. (2012)	X	X	X	-	-
Parsons et al. (2012)	X	X	X	-	-
Rosted et al. (2013)	X	X	X	-	-

NCM: nurse case manager; MD: medical doctor.

Figure 1. Search strategy in SCOPUS

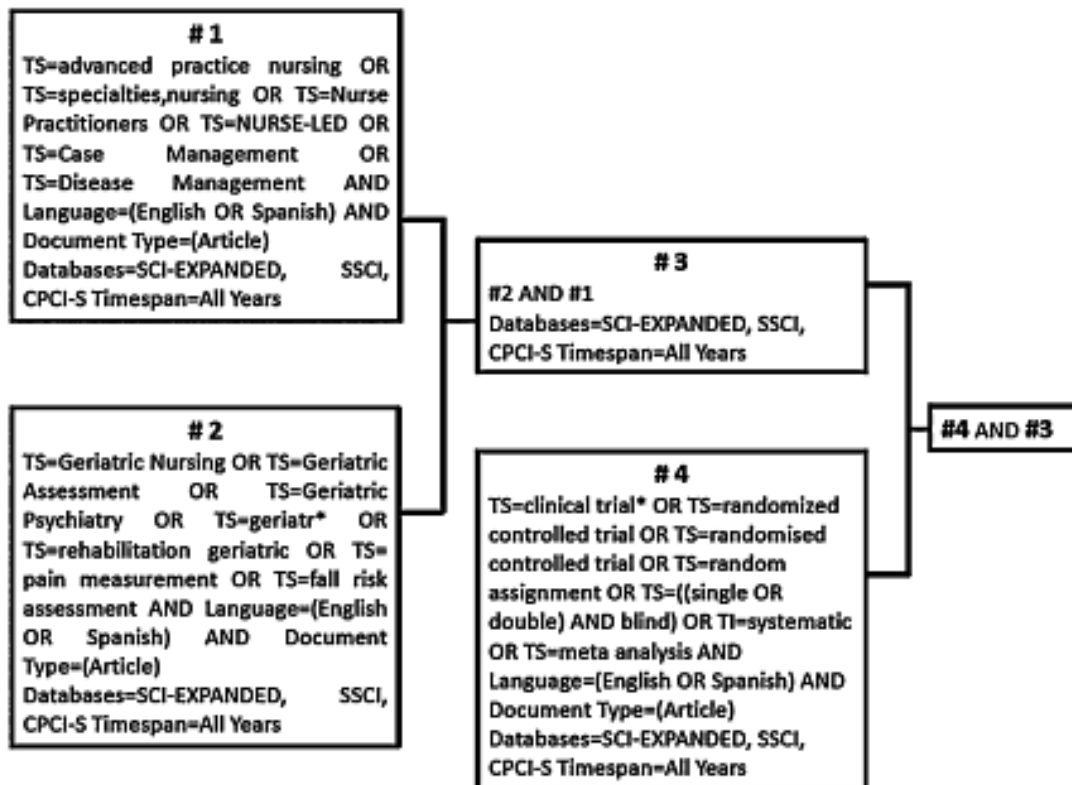


Figure 2. Reference flowchart

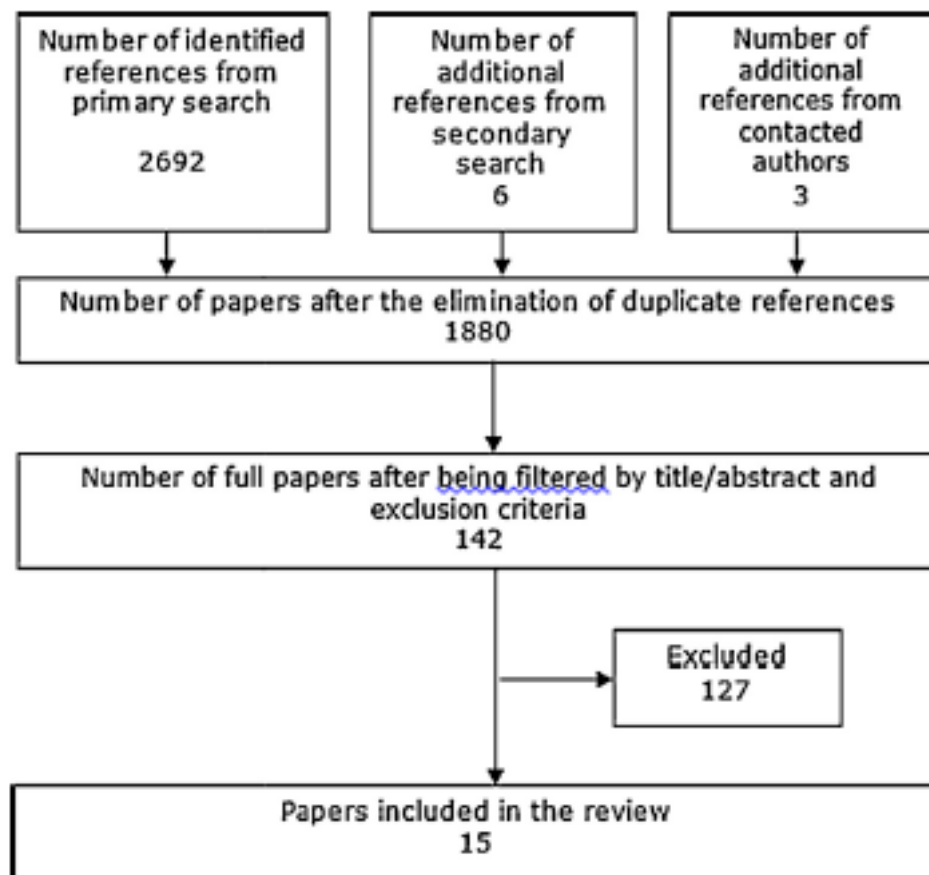
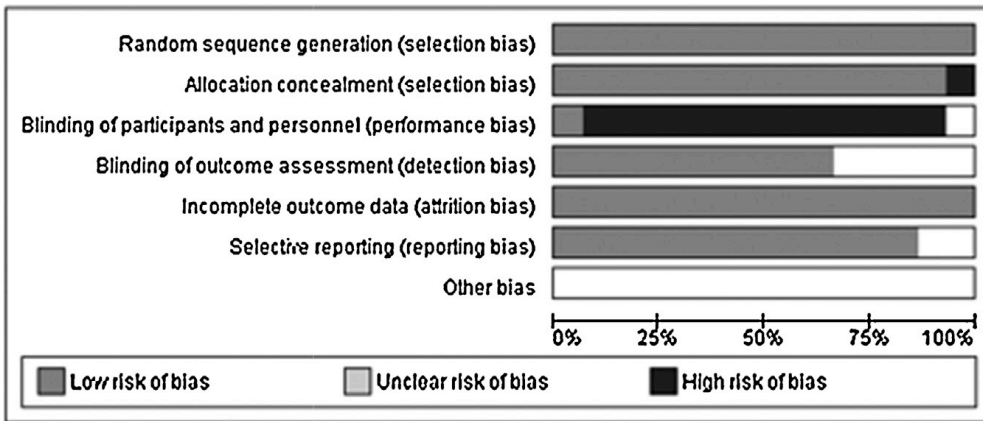


Figure 3. Risk of bias of included studies (percentages across all included studies and for each included study).



	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Berglund 2013	+	+	-		+	+	
Callahan 2006	+	+	-		+	+	
Elley 2006	+	+	-	+	+	+	
Griffiths 2001	+	+	-		+	+	
Hordam 2010	+	+			+		
Huang 2005	+	+	-	+	+	+	
Imhof 2012	+	+	-		+	+	
Mion 2003	+	+	-	+	+	+	
Naylor 1999	+	+	-	+	+	+	
Naylor 2004	+	+	+	+	+		
Parsons 2012	+	+	-	+	+	+	
Rosted 2013	+	+	-	+	+	+	
Strömberg 2003	+	+	-	+	+	+	
Stuck 1995	+	-	-	+	+	+	
Stuck 2000	+	+	-	+	+	+	