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Review Article

Who Should Deliver Primary Care in Long-term Care Facilities to Optimize Resident Outcomes? A Systematic Review

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A B S T R A C T

Objective: Across the world, health care for residents in long-term care facilities (LTCFs) is provided by a range of different professionals, and there is no consensus on which professional group(s) deliver the best outcomes for residents. The objective of this review is to investigate how the health outcomes of older adults in LTCFs vary according to which professional group(s) provides first-line medical care.
Design: A systematic review and narrative synthesis were performed. Medline, Embase, the Cochrane Central Register of Controlled Trials, and Scopus were searched for studies from high-income countries, of any design, published after 2000. Quality was assessed using the Cochrane Risk of Bias and ROBINS-I tools. The exposure of interest was the professional group(s) involved in the delivery of first-line primary care.
Setting and participants: Older adults living in LTCFs.
Measures: The principal outcomes were unplanned transfer to hospital, prescribing quality, and mortality.
Results: Searches identified 10,532 citations after removing duplicates. Twenty-six publications (across 24 studies) met the inclusion criteria. A narrative synthesis was conducted of the 20 experimental and 4 observational studies, involving approximately 98,000 residents. Seven studies were set in the USA, 6 in Australia, 3 in Canada, 2 in New Zealand, and 6 in European countries. Interventions were varied, complex and multi-faceted. Nineteen interventional studies, including 4 randomized trials, involved the addition of a specialist practitioner, either a doctor or nurse, to supplement usual primary care. The most commonly reported outcomes were unplanned hospital transfer and prescribing quality. Interventions based on specialist nurses were associated with reductions in unplanned hospital transfers in 10 out of 12 publications. There was no consistent evidence of a positive impact of specialist doctor interventions on unplanned hospital transfers. However, specialist doctors were associated with improvements in prescribing quality in all 7 relevant studies. There was a paucity of evidence on the impact of specialist nurse interventions on prescribing, and of specialist practitioners on mortality, and no improvements were reported.
Conclusions: Addition of specialist doctors or nurses to the first-line medical team has the potential to improve key health outcomes for residents in LTCFs.
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Health care in long-term care facilities (LTCFs) is a challenging area of clinical practice, where comorbidities, frailty, and polypharmacy are common.[1,2] Concerns have been voiced about the quality of acute and scheduled medical care for residents, and in particular, the high rates of in-hospital mortality,[3] inappropriate prescribing,[4] and suboptimal chronic disease management.[5] In the search for ways to enhance health care in LTCFs, a key question is which professional group(s) achieves the best outcomes for residents when delivering first-line health care.

The expertise of the medical professional involved in managing acute illness is thought to be one of the key influences on hospitalization of nursing home residents.[6] Residents of LTCFs are frequent users of secondary care. They account for up to 2.4% of all emergency department (ED) presentations,[7] and are almost twice as likely to be hospitalized as their peers living in the community.[8] Rates of avoidable hospitalization from nursing homes may be as high as 60%.[9] The

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estimated cost of potentially avoidable rehospitalization from US skilled nursing facilities alone is approximately $3.4 billion per annum.[10] A retrospective notes review of 235 ED attendances from residential facilities in Australia suggested that nearly one-third could have been avoided with improved primary care.[11] Prescribing is influenced by training and disciplinary background, and can be associated with adverse outcomes for nursing home residents, including falls, hospital admission, and mortality.[12,13]

Primary care generalists, such as family physicians and general practitioners, are commonly responsible for the delivery of first-line health care to LTCF residents. Primary care generalists provide first-line care without prior vetting for a variety of conditions across the whole age range.[14] In some countries, geriatricians (specialist doctors who adopt a generalist approach for older adults[14]) look after residents of LTCFs, but the Netherlands is the only country in the world where "elderly care physicians" in nursing homes have a stand-alone 3-year training program.[15,16] Specialist nurses or nurse practitioners may also deliver first-line primary care, often with delegated clinical responsibility. The level of involvement of nurse practitioners varies widely from country to country. Nurse practitioners have worked in US long-term care homes for approximately 30 years,[17] where they have performed diverse roles including first-line clinical assessments of residents (acting as the clinician), care manager, coach, and educator for nursing staff.[18]

There is no international consensus on which professional group should provide care for residents in LTCFs. Specialist practitioners with enhanced training and experience in the medical needs of residents in LTCFs may be better placed to manage the medical complexity of residents.[19] In the United Kingdom, greater involvement of geriatricians is suggested as a means to improve the quality of medical care for residents in LTCFs,[2] and there have been calls to adopt a geriatrician-led model in US LTCFs.[19] Multidisciplinary teams (MDTs) and the involvement of specialist practitioners have also been suggested as a means to improve prescribing outcomes.[20] It is plausible that specialist doctors or nurses may recognize acute illness and intervene promptly.[21] Practitioners with a specific remit for nursing home residents may be able to prioritize advanced care planning and develop expertise in complex prescribing to enhance chronic disease management.[19,22,23]

It is an international priority to improve health care for residents in LTCFs and find the most effective way of delivering primary medical care. The aim of this review is to systematically identify and synthesize evidence on which professional group should provide first-line medical care (routine and/or unscheduled) for residents in LTCFs to enhance health outcomes. In doing so we will address the question of how the health outcomes of residents vary according to which professional group (primary care generalist, generalist specialist, nurse practitioner, and specialist multidisciplinary team) provides first-line medical care. We will also ask how health outcomes for residents who receive first-line primary care from primary care generalists differ from those who receive care from specialist practitioners. The hypothesis is that improved health outcomes will be observed when practitioners, with enhanced expertise and experience relevant to this patient population, are involved in the delivery of first-line primary care.

Methods

Search Strategy

We searched for empirical research involving adults aged 65 years or older and living in LTCFs that compared health outcomes for different practitioners involved in the delivery of first-line primary care. The following bibliographic database searches were initially conducted in October 2016: Medline, Embase, Cochrane Central Register of Controlled Trials (CENTRAL), and Scopus. An individual search strategy was used for each database. The keywords used were common for Medline, Embase, and CENTRAL but the MeSH headings were individually tailored to the different databases. The searches were updated in October 2017 to identify any further studies published in the period of undertaking the review. Bibliography searches and citation searches were performed for publications included in the final synthesis. A gray literature search was conducted for articles published by key organizations: the British Geriatrics Society, King's Fund and Nuffield Trust. The review protocol was registered on PROSPERO (CRD42016049019).

Eligibility Criteria

Studies of any design conducted in high-income countries, published after 2000 in any language, were included if they focused on older adults in LTCFs (including institutions with and without on-site nursing input) and represented quantitative data. The exposure or intervention of interest is the professional group(s) involved in the delivery of first-line primary care. Studies without a defined comparator group were excluded as they do not allow comparison between different professional groups. To be included, the practitioner had to have the expertise to respond to, and manage, primary care problems, that is, to act as the main first-line primary care figure, either with autonomous or delegated clinical responsibility.[24] This includes specialist doctors such as care home physicians and geriatricians, primary care generalists including general practitioners and family physicians, and specialist multidisciplinary teams. Nurse practitioners and physician assistants, who may receive support in decision making from a doctor, are also eligible for inclusion. Exposures or interventions based solely on medication review by a clinical pharmacist, who then makes a prescribing recommendation to the responsible clinician, were excluded.

The health outcomes of interest were quantitative and those expected to be influenced by first-line medical care providers. The principal outcomes were unplanned transfer to hospital (such as ED visits or unplanned hospitalization), prescribing quality outcomes (including appropriateness of prescribing and number of medications prescribed), chronic disease management indicators, and mortality. Other important quality indicators (eg, fall frequency and restraint use) that are dependent on other factors such as the quality of nursing care were only included if reported in conjunction with one of the principal outcomes described above. Inclusion criteria were tested independently by 2 researchers on 10% of the records and minor revisions made before proceeding with study selection.

Study Screening and Data Extraction

At the title and abstract screening phase, all citations were screened by a single author, and one-third of citations were double-screened. Screening discrepancies (less than 5%) were discussed individually. If a consensus was not achieved, the citation was put forward for full text review. Full texts were then read and assessed for inclusion in the review by 2 authors independently. Study details and data were extracted into an Excel spreadsheet for the included studies. Data extraction was performed by one researcher and independently checked for accuracy by a second researcher.

Methodologic Quality

Quality assessment was performed independently by 2 members of the research team. The Cochrane Risk of Bias tool was chosen for the 5 randomized studies. For the nonrandomized studies, the Cochrane ROBINS-I (Risk Of Bias In Non-randomized Studies of Interventions) tool was employed.

Data Synthesis

The possibility of pooling data for a meta-analysis was explored but this was not possible because of the high degree of heterogeneity in study setting, exposures/interventions, and the outcomes reported. Therefore, only a narrative synthesis was performed.

Results

After the removal of duplicates, the searches produced 10,532 citations. Following title and abstract screening, 125 full-text articles were assessed for eligibility. Twenty-six publications[23,25–49] from 24 different studies were included in the synthesis. The study selection process is shown in Figure 1.

Descriptive Synthesis

There were 22 experimental[25–46] and 4 observational[23,47–49] publications (across 24 studies), involving approximately 98,000 residents in 9 different countries. Eight publications (7 studies) were set in the United States,[23,35,37,38,43,46–48] 3 in Canada,[25,33,40] 6 in Australia,[11,31,34,36,39,45] 3 (2 studies) in New Zealand,[27,29,30] and 6 in European countries (United Kingdom,[41,42] Germany,[49] Spain,[32] Austria,[44] and the Netherlands[26]). Two studies were non-English publications.[32,44] Among the 22 experimental publications, there were 5 randomized controlled trials (RCTs)[26,27,29–31] and 17 non-randomized experimental studies.[25,28,32–46] All studies were conducted in LTCFs caring for older adults, although the age is not reported in 5 instances.[25,28,32,37,41] A wide range of terms were used to describe the facilities, as shown in Table 1. Sixteen publications used the term *nursing home*,[23,31,32,35,37–44,46–49] 6 contained *residential facility* within the description of the facility,[26–28,34,36,45] and 4 publications employed the term *long-term care home*[29,30] or *long-term care facility*.[25,33]

Interventions, summarized in Table 2, are diverse, complex, and multifaceted, incorporating the input of geriatricians, geriatrician-led MDTs, nurse practitioners, geriatric nurse specialists, ED-trained nurses, and general practitioner–led MDTs. No studies of physician assistants were identified. All but one study[39] involved an intervention or exposure comprising a specialist practitioner, either a doctor or nurse, being compared against usual primary care. We define a specialist practitioner as a professional with a specific remit for older patients or nursing home residents, and/or specialist training (such a geriatrics) relevant to this patient population. Specialist practitioner is an umbrella term used to describe medically trained "specialist doctors" and "specialist nurses." In all studies, the comparator group is the usual primary care provider. This is a primary care generalist in the majority of cases—either specifically stated,[26,28,41,44] ascertained by contacting the authors[29,30] or deduced from knowledge of the health care system (for UK, Australian, and New Zealand studies).[27,31,34,36,39,42,45] However, it is clear that in 2 US studies,[35,46] the usual primary care provider may also have training in geriatrics in addition to primary care training.

The most frequently encountered outcome was unplanned transfer to hospital, reported on 18 occasions,[23,25–30,32,33,36,38,40–45,47] followed by prescribing[26,31,35,37,39,40,42,46–49] and mortality,[26,29,30,37,39,44] reported on 11 and 6 occasions, respectively. There was a wide range of prescribing outcomes reported with minimal replication across multiple studies, although psychotropic medication prescribing was

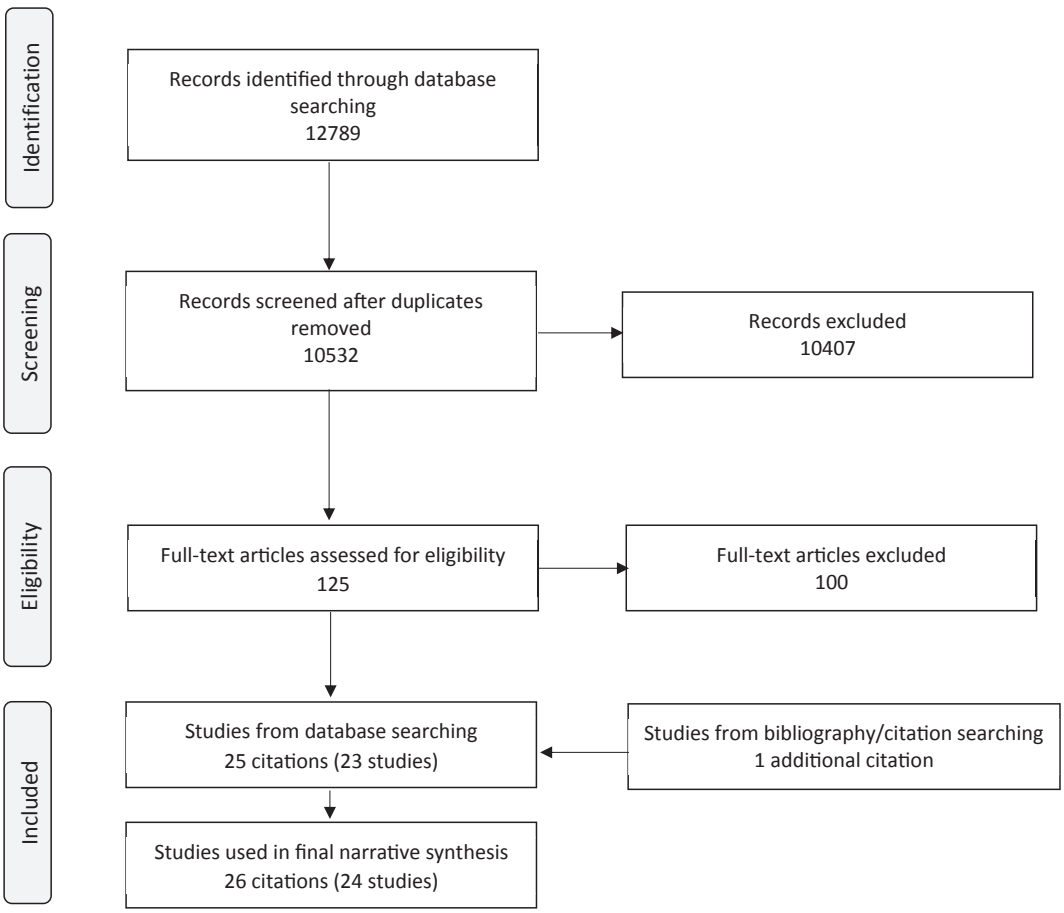

Fig. 1. PRISMA diagram showing study selection.

Table 1
Summary of Included Studies

Author (year)	Study Design Category	Study Design as Described (as Interpreted if Not Stated)	Description of Long-term Care Facility	Country	Number of Participants	Resident Age	Quality Assessment (Domains of Serious Risk for ROBINS-I Tool)
Specialist doctor interventions							
Boorsma[26] (2011)	Randomized trial	Cluster RCT	Residential care facilities	The Netherlands	Intervention: 291 Control: 171	Mean (SD): Intervention: 85.8 (6.2) Control: 85.8 (8.0)	See Figure 2
Connolly[29] (2015)*	Randomized trial	Cluster RCT	Long-term care facilities (rest home, rest home and hospital combined)	New Zealand	Intervention: 1123 Controls 875	More than 95% of participants, >65 y	See Figure 2
Connolly[30] (2016)*	Randomized trial	Post hoc analysis of cluster RCT	Long-term care facilities (rest home, rest home and hospital combined)	New Zealand	Intervention: 1123 Controls 875	Mean: 82.9 y	See Figure 2
Crotty[31] (2004)	Randomized trial	Cluster RCT	Nursing home	Australia	Intervention: 50 Control—in: 50 Control—out: 54	Mean (95% CI): Control: 83.8 (81.3-85.9) Within-facility controls: 84.6 (83.2-86) Intervention: 85.3 (84-86.6)	See Figure 2
D'Arcy[23] (2013)	Observational	Retrospective cohort	Nursing home	US	66,551 residents (with a history of cardiovascular disease and a common geriatric diagnosis)	>66 y	Serious (confounding)
Díaz-Gegúndez[32] (2011)	Nonrandomized interventional	Nonrandomized controlled study	Nursing home	Spain	857 beds in interventional facilities (occupied by 1151 residents >3 y) 1200 beds across the control facilities.	Not reported	Serious (confounding)
Gloth[35] (2011)	Nonrandomized interventional	Controlled before/after	Nursing home	US	2 nursing homes Intervention: 390 residents Control: 364 residents	Mean (SD): Intervention: 75 (13) Control: 78 (13)	Serious (measuring outcomes)
Hutchinson[36] (2015)	Nonrandomized interventional	Retrospective cohort, interrupted time series	Residential care facilities	Australia	1327 patients	Mean (SD): 84 (8.01)	Moderate
Lisk[41] (2011)	Nonrandomized interventional	Not stated (before/after study)	Nursing home	UK	3 care homes, part 1 (165 beds) 3 care homes, part 2 (unknown number of beds)	Not reported	Serious (confounding)
McKee[42] (2016)	Nonrandomized interventional	Service development and evaluation	Nursing home	UK	50 patients reviewed in 12 nursing homes	Mean (SD): 85.3 (9.7)	Serious (confounding, classification of intervention)
Monroe[48] (2011)	Observational	Retrospective chart audit, nonequivalent 2-group analysis	Nursing home	US	92	Mean: 81 y Geriatric-trained: 83 Non—geriatric trained: 80	Serious (confounding)
Pittrow[49] (2003)	Observational	Retrospective longitudinal study	Nursing home	Germany	Nursing home—based physician: 263 Office-based physician: 733	>60 y	Serious (confounding)
Schippinger[44] (2012)	Nonrandomized interventional	Controlled prospective observational study	Rest home/nursing home	Austria	One intervention (n = 168) and 1 control nursing home (n = 100)	Mean: Control: 88 y Intervention: 89 y	Moderate
Tamura[46] (2011)	Nonrandomized interventional	Quality improvement study (before and after)	Nursing home/skilled nursing facility/ intermediate care facility	US	Single center 74 eligible participants but 2 died and 2 left the facility	Mean: 82.7 y	Moderate

Specialist nurse interventions							
Aigner[47] (2004)	Observational	Retrospective chart review	Nursing homes	US	203 residents, 8 nursing homes Nurse practitioner/physician group: 132 (65%) Physician-only group: 71 (35%).	Mean (SD): 82 (9) y	Serious (confounding, missing data)
Bandurchin[25] (2011)	Nonrandomized interventional	Not reported (before/after; uncontrolled)	Long-term care homes	Canada	969 calls and visits	Not stated	Serious (confounding and selection bias)
Boyd[27] (2014)	Randomized trial	Randomized controlled trial	Residential aged care	New Zealand	Intervention: 1425 beds Control: 1128 beds	Mean (SD): Intervention: before 85 (6.8), after 84.3 (7.7) Control: before 85.5 (6.9), after 84.7 (6.5)	See Figure 2
Codde[28] (2010)	Nonrandomized interventional	Before/after	Residential aged care facilities	Australia	503 episodes of care	Not stated	Moderate
El-Masri[33] (2015)	Nonrandomized interventional	Observational prospective cohort	Long-term care facilities	Canada	311 participants (total 1353 case presentations)	Mean (SD): 84.2 (9.37)	Moderate
Fan[34] (2016)	Nonrandomized interventional	"Quasi-randomized"	Residential aged care facilities	Australia	Intervention: 2127 beds before intervention, 2485 postintervention Control: 921 beds preintervention, 1313 postintervention	95% participants >65 y	Moderate
Kane[38] (2003)	Nonrandomized interventional	Quasi-experimental posttest design, 2 control groups	Nursing homes	US	EverCare: 1936 Control—in: 1123 Control—out: 1745	Mean (SD): EverCare: 83.7 (8.7) Control—in: 81.4 (11.9) Control—out: 84 (9.9)	Moderate
Kane[37] (2004)	Nonrandomized interventional	Not stated (assumed to be same as above)	Nursing homes	US	6-mo assessments—EverCare: 399, Control—in: 996, Control—out: 1400 12-mo assessments—EverCare: 606, Control—in: 918, Control—out: 1467 18-mo assessments: EverCare: 664, Control—in: 855, Control—out: 1490	Not stated	Moderate
Klaasen[40] (2009)	Nonrandomized interventional	Not reported (before/after)	Nursing home	Canada	116-bed nursing home	"Generally over 85"	Serious (confounding and reporting bias)
Rantz[43] (2017)	Nonrandomized interventional	Prospective single-group intervention	Nursing home	US	Total enrolled: 5168 (average enrolment: 1750/d)	Median: 82	Serious (confounding)
Street[45] (2015)	Nonrandomized interventional	Retrospective cohort study	Residential aged care facilities	Australia	Before = 2278 presentations to ED After = 2051	Mean (SD): Before: 85.5 (7.1) After: 85.3 (7.1)	Serious (confounding)
Intervention without a specialist practitioner							
King[39] (2001)	Nonrandomized interventional	Before and after study	Residential aged care facilities	Australia	Intervention group: 76 medication review (75 patients as 1 patient was reviewed twice)	Mean (median): All: 79.8 (82.3) Intervention (medication review): 78.9 (80.7) Control: 80.2 (83)	Serious (selection bias)

RCT, randomized controlled trial; SD, standard deviation; ROBINS, Risk Of Bias In Non-randomized Studies of Interventions.
*Also forms part of the specialist nurse category.

Table 2
Description of the Intervention, or Exposure, and Comparator Group for Included Studies

Author/year	Nature of the Intervention (Experimental Studies) or Exposure (for Observational Studies)	Cointervention	Description of the Comparator
Specialist doctor interventions			
Boorsma[26] (2011)	Geriatric multidimensional assessment every 3 mo (web-based tool); care plan discussed with resident, family, family physician; twice-a-year MDT meetings for complex residents: family physician, nursing home physician, nurse, psychotherapist, and other disciplines	Tool for comprehensive geriatric assessment Staff education	Usual care from family physician
Connolly (2015[29] and 2016[30])*	Baseline facility assessment (gerontology nurse specialist); monitoring and benchmarking of resident indicators; three 1-h MDT meetings including medication review by the geriatrician, gerontology nurse specialists, GP, pharmacists, and nurse manager	Gerontology nurse specialist performing staff education and coaching	GPs (after clarification from authors)
Crotty[31] (2004)	Two multidisciplinary case conferences conducted 6-12 wk apart; GP formulated a problems list and did a medication review prior to the MDT; MDT GP (chair), geriatrician, pharmacist, care staff, representative of the Alzheimer's Association; problems discussed including behavioral problems	Pharmacist, education sessions on challenging behavior	Not stated—presumed to be usual care
D'Arcy[23] (2013)	Geriatrician	Not stated	Family physician
Díaz-Gegúndez[32] (2011)	Three-year intervention: comprehensive geriatric assessments and follow-up visits for those patients with most complex needs, on a regular basis and on demand, regular meetings with medical and nursing staff	Extended clinical investigations, staff training and protocol development, joint case management with specialists	Usual care (Spain)
Gloth[35] (2011)	Geriatrician—acting as attending physician for at least 70% of residents and present in facility 3 times per week	Aligning residents with 1 practitioner; nurse practitioner in the intervention (no attending duties)	Community physicians, some with geriatrics training or internal medicine/family medicine
Hutchinson[36] (2015)	Geriatrician-led multidisciplinary model of care including assessment, care planning, arrange interventions, referral to hospital in the home if required, develop long-term care plan with primary care, physician, and care home staff	Aged care specialist nurse	Not stated—presumed to be usual care from GP
Lisk[41] (2011)	Geriatricians performed medical advisory meetings and clinical review with GPs and daily telephone advice	Nurses providing extended treatment, eg, IV fluid	GP
McKee[42] (2016)	Consultant geriatrician doing outreach clinics	Working with a pharmacist	Usual care (UK)
Monroe[48] (2011)	Medical provider with geriatrics training	Not stated	General family medicine training
Pittrow[49] (2003)	Nursing home physician (presumed to be specialist doctors)	Not stated	Office-based physicians
Schippinger[44] (2012)	Mobile consultant geriatric service	Interventions normally delivered in hospital	General practitioner
Tamura[46] (2011)	Geriatricians and geriatric medicine fellows used tools, eg, Beers criteria, to identify potentially inappropriate medications; primary care physician contacted with recommendations	Use of the MDS QI instrument	Nursing home primary care physician (frequently a faculty geriatrician)
Specialist nurse interventions			
Boyd[27] (2014)	Geriatric nurse specialist providing "proactive outreach," consisting of: 1. Clinical support (including bimonthly site visits, quality initiatives) 2. Education and clinical coaching 3. Care coordination for high-risk patients (including comprehensive geriatric assessment, liaison with specialists)	As described to the left	Usual primary care provider (GP from knowledge of the health care system)
Kane[38] (2003) Kane[37] (2004)	Nurse practitioners: one-third time spent with clinical contact, one-fourth communicating with families, primary care physician; nurse practitioners also train the care home staff	Payments for care home to deliver some hospital-level treatments	Usual primary care
Bandurchin[25] (2011)	Registered nurses with expertise in geriatric care and emergency care working with the physician; visiting care homes to identify residents with health issues early; conducting rounds alongside care home nurses; performing assessment to identify signs of acute illness	Education of care home staff	Not stated—assumed to be usual care
Klaasen[40] (2009)	Nurse practitioner doing histories, physical examinations, diagnoses, managing acute illness and chronic disease, orders medication and investigations, performs minor procedures	Not detailed	Usual primary care physician providing out-of-hours care
Codde[28] (2010)	Primary care service provided by ED-based nurses (not aged care training); direct clinical review/procedures for acute illness, eg, intravenous fluid, management of urine infection; education of staff was also provided	Additional procedures normally associated with secondary care	Pre-existing model of GP care

Fan[34] (2016)	ED-based nurses; components to the intervention: (1) Clinical staff allocated to manage acute illness in the care home; (2) Support and education for care staff and GPs	Education for the care home staff	Usual care from GP
Rantz[43] (2017)	Advanced practice registered nurse—either nurse practitioner or clinical nurse specialist	INTERACT tool, quality improvement, mentoring, and education	Usual care
Street[45] (2015)	Specialist practice nurses (supported by a geriatrician)—assessment when residents unwell	Geriatrician support education	Usual care
El-Masri[33] (2015)	Nurse practitioners part of the ED team with independent treatment authority	Not stated	MD (and registered nurse)
Aigner[47] (2004)	Nursing home nurse practitioner (acute visits, scheduled care, annual reviews)	Not stated	Physician working alone
Intervention without a specialist practitioner			
King[39] (2001)	Three case conferences attended by GP, nursing staff, allied health care professionals, and a clinical pharmacist	Allied health care professionals and a clinical pharmacist	Usual care

GP, general practitioner; INTERACT, Interventions to Reduce Acute Care Transfers program; IV, intravenous; MDS QI, Minimum Data Set Quality Indicator.
*Also forms part of the specialist nurse category.

reported on 5 occasions,[26,31,37,39,40] numbers of medication on 4 occasions,[40,46,47,49] and medication appropriateness on 3 occasions.[31,42,48] Four studies[26,31,35,37] reported other quality indicators acknowledged as important for nursing home residents, such as falls and the presence of a urinary catheter, which are dependent on a range of other influences, such as nursing care. There were some noteworthy outcomes not reported, for example, chronic disease outcomes for key conditions, such as stroke, diabetes, hypertension, and heart failure.

The Cochrane Risk of Bias tool[50] was used to assess the randomized trials (Figure 2). There were 2 well-conducted cluster randomized studies across 3 publications.[26,29,30] However, the quality of the other cluster randomized[31] and patient-level randomized trials was low.[27] Blinding of personnel or participants was not possible in any of the studies because of the nature of the intervention. According to the Cochrane ROBINS-I tool,[51] the nonrandomized studies had a moderate[28,33,34,36–38,44,46] or serious[23,25,32,35,39–43,45,47–49] risk of bias. Overall, the nonrandomized studies were of low quality, principally because of the potential for confounding.

Analysis Strategy

The studies were grouped according to whether the intervention involved a specialist doctor or a specialist nurse. Although there was a high degree of heterogeneity in study setting and intervention, the

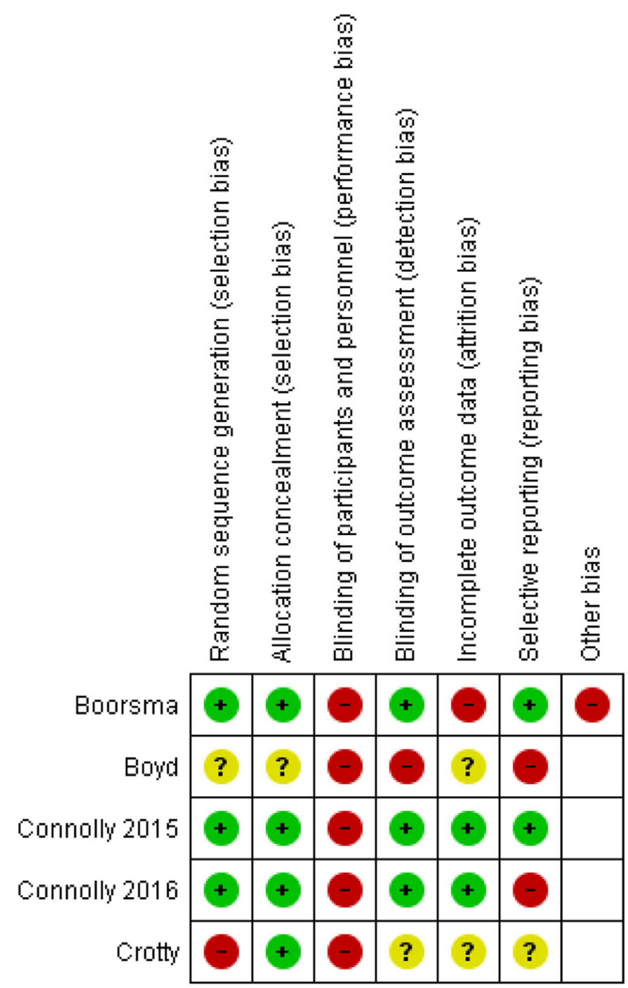

Fig. 2. Cochrane risk of bias results for randomized studies for each domain (+, low risk; −, high risk; ?, uncertain).

heterogeneity was particularly marked for the outcomes reported. Within the most commonly reported outcome domain of unplanned hospital transfer, there was ambulance callouts, ED room attendance, admission to hospital, and length of stay. In addition, the way of measuring the same outcome varied widely. In the prescribing domain, there were 2 specialist doctor studies reporting psychotropic use, which was the most commonly used prescribing indicator. One study reported the use of antipsychotics[26] and the other used medication appropriateness index for benzodiazepines.[31] Overall, this heterogeneity meant that pooling would not have been possible for more than 2 studies reporting the same outcome and using sufficiently similar units of measurement. Hence, we performed a narrative synthesis.

Interventions Involving a Specialist Doctor

Ten publications with an experimental study design[26,29–31,35,36,41,42,44,46] and 3 observational studies[23,48,49] compared an intervention, in which a specialist doctor is involved in delivering first-line primary care. There was a mixture of low- and moderate-quality studies; 3 well-conducted randomized trials,[26,29,30] one relatively low-quality RCT,[31] 3 nonrandomized studies with a moderate risk of bias,[36,44,46] 4 with a serious risk of bias[32,35,41,42] and 3 observational studies with a serious risk of bias.[23,48,49] One specialist doctor intervention involved a nursing home physician,[26] whereas all of the rest were based on a geriatrician. The aim of the interventions was to supplement, rather than supplant, the existing primary care model. The interventions were complex and involved more than simply supplementing usual care with a specialist doctor. Co-interventions were wide-ranging, as shown in Table 2, and included specialist nurses,[29,30,35,36] extended treatment options,[41,44] a multidimensional assessment tool,[26] staff education,[26,29,30] and a clinical pharmacist in the MDT.[31,42] The comparator group is the usual primary care provider in all studies. There were 2 occasions when the normal primary care provider appeared to have generalist and specialist geriatrics training,[35,46] which would tend to attenuate the observed effect of the intervention. There was a spectrum of collaborative working, ranging from formal MDTs incorporating geriatricians[26,29–31] to less formal arrangements.

The main findings from interventions involving a specialist doctor are summarized in Figure 3 (and detailed in supplementary online material). First, although the majority of studies showed specialist doctor input to be associated with reduced unplanned hospital transfer, the 2 well-conducted randomized trials conducted by Boorsma[26] and Connolly[29] did not find a positive association. However, Connolly[30] did subsequently report improvements in hospital admission specifically for 5 common conditions in a post hoc analysis. Second, a consistent association with improved prescribing practice was demonstrated. This reaches statistical significance in 2 randomized trials,[26,31] one nonrandomized interventional study,[46] and 2 observational studies.[48,49] Third, specialist doctor interventions were not associated with improvements in mortality.[26,29,44]

Interventions Involving a Specialist Nurse

Twelve publications with an experimental study design[25,27–30,33,34,37,38,40,43,45] and 1 observational study[47] involving an intervention of a specialist nurse. Two publications (from the same study) included in this specialist nurse group also contained a specialist doctor because, after contacting the authors, it was clear that both professionals were involved in the delivery of first-line medical care.[29,30] The studies were conducted in a range of different care home settings: 4 residential aged care facilities,[27,28,34,45] 4 long-term care facilities,[25,29,30,33] and 5 nursing homes.[37,38,40,43,47] There was also a wide variation in the terminology used to describe specialist nurses: specialist gerontology nurses,[27,29,30,45] nurse practitioners,[33,37,38,40,43,47] ED-trained nurses,[28,34] and nurse consultants.[25] Broadly speaking, the majority of specialist nurses had a specific remit for older patients,[25,27,29,30,33,37,38,40,43,45,47] and 2 had emergency medicine training.[28,34] As with the specialist doctor group, the interventions were complex; specialist nurses performed more than simply a clinician role, extending to coaching, training, and staff education. The comparator group is usual primary care for all studies. As with the specialist doctor studies, these interventions complemented the usual primary care provider, as opposed to supplanting it. Approximately half of the nonrandomized studies had a moderate risk of bias,[28,33,34,37,38] half had a high risk of bias,[25,40,43,45,47] in addition to 2 publications from a well-conducted RCT[29,30] and one low-quality RCT.[27]

The main findings from interventions involving a specialist nurse are summarized in Figure 3 (and detailed in supplementary online material). First, all studies with the exception of 1 RCT[29] and 1 observational study[47] reported an association with reduced unplanned hospital transfer, and this reached statistical significance in 7 studies.[27,28,30,33,34,37,38,45] Second, whereas 2 studies[40,48] reported an association with improved prescribing outcomes, 2 publications[37,47] concluded no improvement. Third, 2 studies assessed the impact on mortality, and improvement is not demonstrated.[29,37]

Discussion

To our knowledge, this is the first review to systematically identify and synthesize evidence on which professional group(s) should provide first-line medical care for residents in LTCFs to enhance health outcomes. We found that interventions based on a specialist doctor are strongly associated with improved prescribing outcomes, but the relationship with unplanned hospital transfer is less clear. There is a strong association between interventions involving a specialist nurse and decreased unplanned hospital transfers. However, in the few studies that assessed the impact of specialist nurse interventions on prescribing, and of specialist practitioners (doctors and nurses) on mortality, no improvements were reported. No study performed a head-to-head comparison of specialist nurses and specialist doctors, which limits comparison of the 2 main types of intervention. However, there is good evidence to support the addition of specialist practitioners (doctors or nurses) to the first-line primary care team to improve key health outcomes for residents in LTCFs.

The association between specialist nurse interventions and decreased hospital transfer is supported by Christian et al,[52] who identified 7 studies in a systematic review reporting this finding, but all were conducted before the year 2000. Previous systematic reviews have not specifically evaluated the impact of specialist doctor interventions on health outcomes, apart from a systematic review by Graverholt[53] who identified only 2 studies, both of which focused on unplanned hospital transfer and were included in this review. Although the majority of studies in our review report a positive association between the inclusion of a specialist doctor and unplanned hospital transfer, there were 2 publications by Boorsma[26] and Connolly[29] showing no association. However, Connolly subsequently performed a post hoc analysis reporting reductions in admissions,[30] specifically in relation to 5 common medical comorbidities. Both of these studies were based on MDTs incorporating specialist doctors (Connolly et al[29,30] also included specialist nurses) and primary care generalists, similar to the integrated model of primary care frequently advocated by policy makers.[54] These interventions bring specialist expertise and would therefore be expected to decrease unplanned hospital transfer. Both interventions were specifically aimed at those perceived to be at increased risk of adverse health outcomes (such as hospitalization), according to facility characteristics[29,30] or resident health status.[26] Health outcomes in this group may be minimally

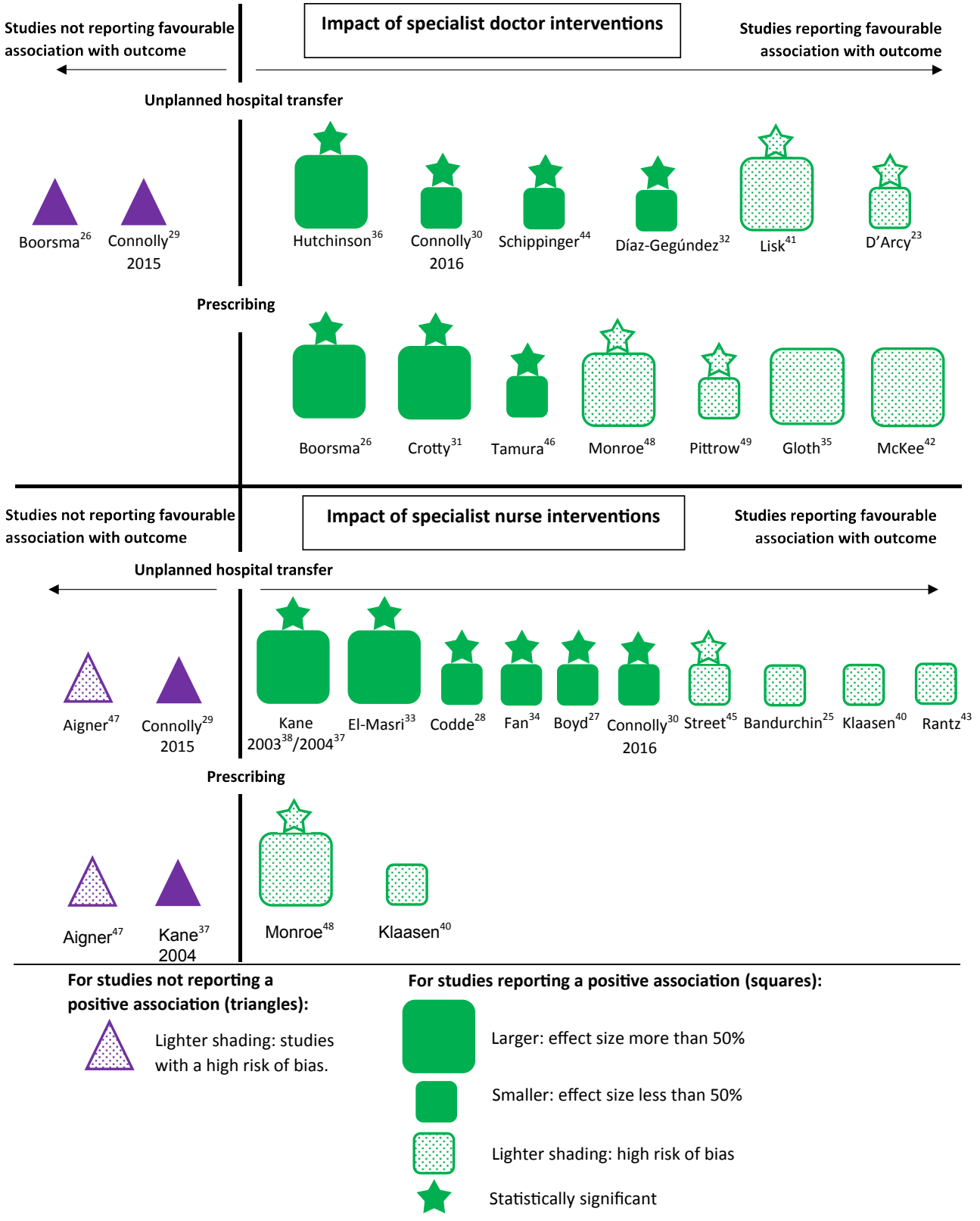

Fig. 3. Impact of exposures or interventions of specialist practitioners (doctors above and nurses below) compared to the usual primary care.

amenable to intervention regardless of the professionals involved. On the other hand, it could be argued that residents with the most complex medical needs have the most to gain from specialist practitioner input. Both studies found no association with mortality; it is possible that higher-quality medical care leads to improvement in residents' experience of care without influencing mortality rates.

A broad range of health outcomes were eligible for inclusion in this review to encapsulate the range of activities in primary care. However, the majority relate to unplanned hospital transfer and prescribing quality. This is consistent with other authors who have observed that research in nursing homes has focused on health service outcomes, such as unplanned hospital admission, as opposed to "resident focused goals."[20] There is no consensus on which health outcomes are most relevant. For example, the number of medications prescribed[31,49] or rates of unplanned hospital transfer may tell us little about the appropriateness of care delivered.

Limitations of the Evidence Base

Included studies were drawn from a range of different countries, which means that the findings are internationally relevant, but the applicability to specific health care settings requires careful consideration. The risk of bias across all studies was moderate or high; many of the studies were not randomized and faced challenges in accounting for confounding variables. There was a high degree of heterogeneity in the interventions and, in addition to the specialist practitioners, studies often included cointerventions[51] that may also influence the outcomes. These extra ingredients included staff training, other professionals in the MDT, and the availability of enhanced treatment options in the LTCF. Consequently, as with other reviews of complex interventions in the nursing home setting, we are not able to address the "black box effect," that is, understanding the individual effects of the component parts of the intervention.[55] For example, in interventions where specialist nurses deliver first-line medical care, the option to seek advice from supervising specialist doctors may have impacted on the rate of unplanned hospitalization.

Conclusion/Relevance

To our knowledge, this is the first systematic review to evaluate how a broad range of health outcomes vary according to which professional group(s) contribute to the first-line primary medical care of residents in LTCF. We conclude that the addition of specialist doctors or nurses to the first-line primary care medical team has the potential to improve key health outcomes for nursing home residents, providing some evidence to support the multidisciplinary team approach. Further high-quality randomized studies are needed to evaluate the comparative impact of specialist doctors and specialist nurses. The findings are important for commissioners across the world because of the shared challenges of population ageing and increasingly constrained health care funding.

Supplementary Data

Supplementary data related to this article can be found at https://doi.org/10.1016/j.jamda.2018.07.006.

References

1. British Geriatrics Society. Quest for quality: An inquiry into the quality of healthcare support for older people in care homes: A call for leadership, partnership and improvement; 2011. Available at: http://www.bgs.org.uk/campaigns/carehomes/quest_quality_care_homes.pdf. Accessed April 4, 2018.
2. Gordon A. What is the case for care home medicine? The geriatrician's perspective. J R Coll Physicians Edinb 2015;45:148–153.
3. National Audit Office. End of Life Care; 2008. Available at: https://www.nao.org.uk/wp-content/uploads/2008/11/07081043.pdf. Accessed April 4, 2018.
4. Shah SM, Carey IM, Harris T, et al. Quality of prescribing in care homes and the community in England and Wales. Br J Gen Pract 2012;62:e329–e336.
5. Shah SM, Carey IM, Harris T, et al. Quality of chronic disease care for older people in care homes and the community in a primary care pay for performance system: Retrospective study. BMJ 2011;342:d912.
6. Ouslander JG, Lamb G, Perloe M, et al. Potentially avoidable hospitalizations of nursing home residents: Frequency, causes, and costs: [see editorial comments by Drs. Jean F. Wyman and William R. Hazzard, pp 760–761]. J Am Geriatr Soc 2010;58:627–635.
7. Arendts G, Howard K. The interface between residential aged care and the emergency department: A systematic review. Age Ageing 2010;39:306–312.
8. Ingarfield SL, Finn JC, Jacobs IG, et al. Use of emergency departments by older people from residential care: A population based study. Age Ageing 2009;38:314–318.
9. Spector WD, Limcangco R, Williams C, et al. Potentially avoidable hospitalizations for elderly long-stay residents in nursing homes. Med Care 2013;51:673–681.
10. Mor V, Intrator O, Feng Z, Grabowski DC. The revolving door of rehospitalization from skilled nursing facilities. Health Aff (Millwood) 2010;29:57–64.
11. Codde J, Frankel J, Arendts G, Babich P. Quantification of the proportion of transfers from residential aged care facilities to the emergency department that could be avoided through improved primary care services. Australas J Ageing 2010;29:167–171.
12. Olazarán J, Valle D, Serra JA, et al. Psychotropic medications and falls in nursing homes: A cross-sectional study. J Am Med Dir Assoc 2013;14:213–217.
13. Lau DT, Kasper JD, Potter DE, et al. Hospitalization and death associated with potentially inappropriate medication prescriptions among elderly nursing home residents. Arch Intern Med 2005;165:68–74.
14. Howe A. Medical Generalism: Why expertise in whole person medicine matters; 2012. Available at: file:///C:/Users/mathandrob/Downloads/Medical-Generalism-Why_expertise_in_whole_person_medicine_matters.pdf. Accessed April 4, 2018.
15. Koopmans RTCM, Pellegrom M, van der Geer ER. The Dutch move beyond the concept of nursing home physician specialists. J Am Med Dir Assoc 2017;18:746–749.
16. Conroy S, Van Der Cammen T, Schols J, et al. Medical services for older people in nursing homes—comparing services in England and the Netherlands. J Nutr Health Aging 2009;13:559–563.
17. McAiney CA, Haughton D, Jennings J, et al. A unique practice model for nurse practitioners in long-term care homes. J Adv Nurs 2008;62:562–571.
18. Abdallah LM. EverCare nurse practitioner practice activities: Similarities and differences across five sites. J Am Assoc Nurse Pract 2005;17:355–362.
19. Katz PR, Karuza J, Intrator O, Mor V. Nursing home physician specialists: A response to the workforce crisis in long-term care. Ann Intern Med 2009;150:411–413.
20. Burns E, Nair S. New horizons in care home medicine. Age Ageing 2014;43:2–7.
21. Szczepura A, Nelson S, Wild D. In-reach specialist nursing teams for residential care homes: Uptake of services, impact on care provision and cost-effectiveness. BMC Health Serv Res 2008;8:269.
22. The American Geriatrics Society. Geriatric Medicine: A clinical imperative for an ageing population, part 1A policy statement from the American Geriatrics Society. Ann Longterm Care 2005;13:18–22.
23. D'Arcy LP, Stearns SC, Domino ME, et al. Is geriatric care associated with less emergency department use? J Am Geriatr Soc 2013;61:4–11.
24. Martínez-González NA, Djalali S, Tandjung R, et al. Substitution of physicians by nurses in primary care: A systematic review and meta-analysis. BMC Health Serv Res 2014;14:214.
25. Bandurchin A, McNally MJ, Ferguson-Pare M. Bringing back the house call: How an emergency mobile nursing service is reducing avoidable emergency department visits for residents in long-term care homes. Nurs Leadersh (Tor Ont) 2011;24:59–71.
26. Boorsma M, Frijters DH, Knol DL, et al. Effects of multidisciplinary integrated care on quality of care in residential care facilities for elderly people: A cluster randomized trial. CMAJ 2011;183:E724–E732.
27. Boyd M, Armstrong D, Parker J, et al. Do gerontology nurse specialists make a difference in hospitalization of long-term care residents? Results of a randomized comparison trial. J Am Geriatr Soc 2014;62:1962–1967.
28. Codde J, Arendts G, Frankel J, et al. Transfers from residential aged care facilities to the emergency department are reduced through improved primary care services: An intervention study. Australas J Ageing 2010;29:150–154.
29. Connolly MJ, Boyd M, Broad JB, et al. The Aged Residential Care Healthcare Utilization Study (ARCHUS): A multidisciplinary, cluster randomized controlled trial designed to reduce acute avoidable hospitalizations from long-term care facilities. J Am Med Dir Assoc 2015;16:49–55.
30. Connolly MJ, Broad JB, Boyd M, et al. The "Big Five." Hypothesis generation: A multidisciplinary intervention package reduces disease-specific hospitalisations from long-term care: A post hoc analysis of the ARCHUS cluster-randomised controlled trial. Age Ageing 2016;45:415–420.

31. Crotty M, Halbert J, Rowett D, et al. An outreach geriatric medication advisory service in residential aged care: A randomised controlled trial of case conferencing. Age Ageing 2004;33:612–617.
32. Díaz-Gegúndez M, Paluzie G, Sanz-Ballester C, et al. Evaluación de un programa de intervención en residencias geriátricas para reducir la frecuentación hospitalaria. Rev Esp Geriatr Gerontol 2011;46:261–264.
33. El-Masri MM, Omar A, Groh EM. Evaluating the effectiveness of a nurse practitioner-led outreach program for long-term-care homes. CJNR 2015;47:39–55.
34. Fan L, Hou X-Y, Zhao J, et al. Hospital in the Nursing Home program reduces emergency department presentations and hospital admissions from residential aged care facilities in Queensland, Australia: A quasi-experimental study. BMC Health Serv Res 2016;16:46.
35. Gloth FM 3rd, Gloth MJ. A comparative effectiveness trial between a post-acute care hospitalist model and a community-based physician model of nursing home care. J Am Med Dir Assoc 2011;12:384–386.
36. Hutchinson AF, Parikh S, Tacey M, et al. A longitudinal cohort study evaluating the impact of a geriatrician-led residential care outreach service on acute healthcare utilisation. Age Ageing 2015;44:365–370.
37. Kane RL, Flood S, Bershadsky B, Keckhafer G. Effect of an innovative medicare managed care program on the quality of care for nursing home residents. Gerontologist 2004;44:95–103.
38. Kane RL, Keckhafer G, Flood S, et al. The effect of EverCare on hospital use. J Am Geriatr Soc 2003;51:1427–1434.
39. King MA, Roberts MS. Multidisciplinary case conference reviews: Improving outcomes for nursing home residents, carers and health professionals. Pharm World Sci 2001;23:41–45.
40. Klaasen K, Lamont L, Krishnan P. Setting a new standard of care in nursing homes. Can Nurse 2009;105:24–30.
41. Lisk R, Yeong K, Nasim A, et al. Geriatrician input into nursing homes reduces emergency hospital admissions. Arch Gerontol Geriatr 2012;55:331–337.
42. McKee H, Miller R, Cuthbertson J, et al. Nursing Home Outreach Clinics show an improvement in patient safety and reduction in hospital admissions in residents with chronic conditions. Eur J Pers Cent Healthc 2016;4:650–655.
43. Rantz MJ, Popejoy L, Vogelsmeier A, et al. Successfully reducing hospitalizations of nursing home residents: Results of the Missouri Quality Initiative. J Am Med Dir Assoc 2017;18:960–966.
44. Schippinger W, Hartinger G, Hierzer A, et al. Mobile geriatric consultant services for rest homes. Study of the effects of consultations by internal medicine specialists in the medical care of rest home residents. Z Gerontol Geriatr 2012;45:735–741.
45. Street M, Considine J, Livingston P, et al. In-reach nursing services improve older patient outcomes and access to emergency care. Australas J Ageing 2015;34:115–120.
46. Tamura BK, Bell CL, Lubimir K, et al. Physician intervention for medication reduction in a nursing home: The polypharmacy outcomes project. J Am Med Dir Assoc 2011;12:326–330.
47. Aigner MJ, Drew S, Phipps J. A comparative study of nursing home resident outcomes between care provided by nurse practitioners/physicians versus physicians only. J Am Med Dir Assoc 2004;5:16–23.
48. Monroe T, Carter M, Parish A. A case study using the Beers List criteria to compare prescribing by family practitioners and geriatric specialists in a rural nursing home. Geriatr Nurs 2011;32:350–356.
49. Pittrow D, Krappweis J, Rentsch A, et al. Pattern of prescriptions issued by nursing home-based physicians versus office-based physicians for frail elderly patients in German nursing homes. Pharmacoepidemiol Drug Saf 2003;12:595–599.
50. Higgins JPT, Green S, editors. Cochrane Handbook for Systematic Reviews of Interventions Version 5.1.0 [updated March 2011]. The Cochrane Collaboration; 2011. Available at: www.handbook.cochrane.org. Accessed August 1, 2017.
51. Sterne JAC, Higgins JPT, Elbers RG, et al. Risk Of Bias In Non-randomized Studies of Interventions (ROBINS-I): Detailed guidance. Available at: https://www.bristol.ac.uk/media-library/sites/social-community-medicine/images/centres/cresyda/ROBINS-I_detailed_guidance.pdf. Accessed August 1, 2017.
52. Christian R, Baker K. Effectiveness of nurse practitioners in nursing homes: A systematic review. JBI Libr Syst Rev 2009;7:1333–1352.
53. Graverholt B, Forsetlund L, Jamtvedt G. Reducing hospital admissions from nursing homes: A systematic review. BMC Health Serv Res 2014;14:36.
54. NHS England. Enhanced health in care homes vanguards.Available at: https://www.england.nhs.uk/ourwork/futurenhs/new-care-models/vanguards/care-models/carehomes-sites. Accessed March 1, 2018.
55. Alldred DP, Kennedy M-C, Hughes C, et al. Interventions to optimise prescribing for older people in care homes. Cochrane Database Syst Rev; 2016:2.