



CHSRF

# Better Care:

## An Analysis of Nursing and Healthcare System Outcomes

CNA/CHSRF series of reports to inform the CNA National Expert Commission  
*The Health of Our Nation – The Future of Our Health System: Paper 2*

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## KEY MESSAGES

### **Problems arise when circumstances in the world change and conventional wisdom does not.**

- ▼ The present federally funded Canadian healthcare system has been driven principally by insured physicians and hospitals providing acute and episodic care that is a poor match to the changing demographics of persons with chronic disease living longer. The current health system consumes nearly one-half of provincial budgets.

### **There are solutions.**

- ▼ Recent analysis of 2005 expenditures by member countries of the Organisation for Economic Co-operation and Development on health and social services has empirically demonstrated that, after adjusting for overall gross domestic product per capita, it is the ratio of social service expenditures to health service expenditures that is better associated with improved outcomes in key health indicators and not the amount spent on health services.
- ▼ Models of proactive, targeted nurse led care that focus on preventive patient self-management for people with chronic disease are either more effective and equally or less costly, or are equally effective and less costly than the usual model of care.
- ▼ Additional key components of more effective and efficient healthcare models involve community-based, nurse led models of care with an interdisciplinary team that includes the primary care physician. Such complex intervention requires specially trained or advanced practice nurses who supplement the care provided by physicians and other healthcare professionals. The proactive, comprehensive, coordinated model of community care is patient and family centred, targeted at community-dwelling individuals with complex chronic conditions and social circumstances.
- ▼ Telemonitoring offers added effectiveness and efficiencies to healthcare, especially for remote populations.
- ▼ The monitoring, evaluation and performance measurement system for the provision of healthcare should build on and link to pan-Canadian efforts already under way, such as the Longitudinal Health and Administrative Data Initiative.
- ▼ Nurse-led models of care can be financed by costs averted from hospitals and emergency departments to home or community care. For example, after managing the current hospital caseload of patients awaiting alternative levels of care, the number of hospital beds could be reduced to free up funds for this reallocation of funding.
- ▼ In Ontario alone, representing 37% of the Canadian population, independent reports estimate that millions of dollars could be saved in direct healthcare costs within one year by:
  - ▼ having nurses provide leading practices in home wound care
  - ▼ integrating nurse-led models of care to reduce high hospital readmissions by 10% for those with chronic conditions
  - ▼ providing 25% of palliative care in the home as opposed to in acute hospital settings
  - ▼ providing community care for patients in hospital designated as needing an alternative level of care
  - ▼ providing proactive community care and patient self-management for those with congestive heart failure and other chronic conditions

## Getting from problems to solutions is possible.

These recommended models of nursing for chronic illness align with the *Principles to Guide Health Care Transformation in Canada* put forward by the Canadian Nurses Association and the Canadian Medical Association (CMA) in July 2011 (available at [http://www.cma.ca/multimedia/CMA/Content\\_Images/Inside\\_cma/Advocacy/HCT/HCT-Principles\\_en.pdf](http://www.cma.ca/multimedia/CMA/Content_Images/Inside_cma/Advocacy/HCT/HCT-Principles_en.pdf)).

Further, the models align with the CMA's proposed Charter for Patient-centred Care and other recommendations made in the 2010 report *Health Care Transformation in Canada: Change That Works, Care That Lasts* (available at [http://www.cma.ca/multimedia/CMA/Content\\_Images/Inside\\_cma/Advocacy/HCT/HCT-2010report\\_en.pdf](http://www.cma.ca/multimedia/CMA/Content_Images/Inside_cma/Advocacy/HCT/HCT-2010report_en.pdf)). For example, the following points apply fundamentally to both the CMA's recommendations and the models recommended here:

- ▼ The central role of all levels of government is to provide for and sustain the well-being of its citizens and future generations.
- ▼ The question of direction for government is one of continued growth and expansion of health (illness) care or sustainability of the quality of life and the human service system that determines health.
- ▼ Addressing the source of and reasons for excessive and growing health expenditure would include (a) providing nurse-led proactive, comprehensive and preventive care for those with chronic illness, (b) financing by reducing resources for current acute hospital care, and (c) having physicians and nurse practitioners continue to practise acute and episodic care.



## EXECUTIVE SUMMARY

The purpose of this review of nursing intervention literature was to document the comparative effects and costs of models of nursing intervention on patient outcomes, such as morbidity and mortality, and on system outcomes, such as health resource use. This information will be used to provide suggestions about innovative, effective and efficient models of nursing intervention in preparation for the 2014 new federal health accord.

Eligible reviews and studies were those of interventions provided by nurses that documented:

- ▶ patient outcomes related to mortality and morbidity, such as functional status, quality of life, coronary or adverse events, and caregiver burden; *and*
- ▶ system outcomes related to use of emergency departments, hospitalizations, length of stay, admissions to nursing homes, and/or total direct cost of health service use from a payer perspective; *or*
- ▶ patient impacts related to wait times or access to care.

This review was conducted in three stages:

1. In the initial stage we evaluated high-quality *reviews*.
2. The second stage involved reviewing high-quality *studies* of nursing interventions because of limitations in the initial reviews.
3. In the third stage we reviewed studies from McMaster University's System-Linked Research Unit on Health and Social Service Utilization (SLRU) that involved economic evaluations conducted from a societal perspective alongside clinical trials. In addition, these studies included not only patient outcomes but also health and social effects – direct, indirect and cash transfer effects – of comparative treatments for various illnesses. We did this third stage because the description of costing methods in the previous studies lacked detail.

## Results

To determine whether nurse interventions were comparatively more effective and less costly, we used an analytic framework for economic evaluations to simultaneously summarize the patient effects and system costs qualitatively and in aggregate. We initially examined over 4,000 reviews and studies to determine whether they met both eligibility criteria and “high-quality standards” for the conduct of reviews and studies. Twenty-seven reviews, 29 studies and nine economic evaluations met the initial minimum eligibility criteria and 75% of the 21 standards of quality for reviews and studies. Included studies were conducted in the United Kingdom, Canada, Australia, the United States and the Netherlands. Included economic evaluations were conducted in southern Ontario.

Our review of data from 27 *high-quality reviews* of comparative models of nursing care for people with chronic conditions supported the following conclusions about nursing models of care with interdisciplinary teams (whether nurse-involved,  $n = 13$ , or nurse-led,  $n = 14$ ) versus usual care: 13 reviews indicated that nursing interventions were more effective and less costly than usual care; six showed that they were more effective and equally costly; four suggested that they were equally effective but less costly; three indicated that they were equally effective and equally costly; and one review suggested that such models were more effective and more costly than usual care.

Our review of data from 29 *high-quality studies* of comparative models of nursing care for people with chronic conditions supported the following conclusions about nursing models of care (whether nurse-involved, n = 4, or nurse-led, n = 25) versus usual care: 14 studies indicated that nursing interventions were more effective, and 12 of these, also less costly; two of these 14 showed them to be no more costly; seven studies suggested nursing models were equally effective and less costly; five, equally effective and equally costly; and three, equally effective and more costly.

Eight of the nine Ontario economic evaluation studies done by McMaster's SLRU concluded that the nurse model for people with chronic conditions was more effective. Specifically, three studies showed that the more effective nurse model was less costly; four other studies concluded that the more effective nurse model was no more costly; one study found that the nurse model was more effective and more costly, but only for a particular subgroup of patients; and one study demonstrated that the nurse model was equally effective as usual care and equally costly.

### **Innovative Nursing Interventions Documenting Similar Patient and System Outcomes at a Provincial Level**

The limited time available for preparing this report necessitated the use of recent independent reports that estimated patient situations well served by nursing best practice interventions, both on their own and as part of interdisciplinary teams. Most of these recent reports came from Ontario, representing 37% of the Canadian population. The following highlights of these reported nursing intervention innovations could potentially produce healthcare savings for other provinces as well:

- For 22% of Ontario patients with pressure ulcers who were treated in the community with best practice nursing and for 30% of such patients treated in non-acute settings, there was a reduction in healing time that yielded an estimated savings of \$18,000 (\$9,000 per month) per patient.
- In Ontario in 2007 there were 90,000 patients with diabetic foot ulcers and 15,000 more patients with leg ulcers; their community care cost \$511 million yearly. It was estimated that \$338 million in community costs could be saved by leading practices of nurses in wound care and that \$24 million in further savings would be possible as a result of reduced hospitalizations for infections and amputations.
- Shifting 25% of the 6,084 palliative care patients who were in acute care beds (costing \$19,900 per patient) in 2006 to home care (costing \$4,700 per patient) could result in estimated savings of \$15,200 per patient, which would translate to \$23 million in annual savings for Ontario.
- An analysis of the 2007 Ontario Chronic Disease Prevention and Management Framework estimated that every 10% reduction in expenditures for chronic illness in Ontario would result in annual savings of \$1.2 billion for the province.
- According to a 2010 collaborative report, 1% of the Ontario population accounted for 49% of combined hospital and home care costs, and 5% of the population accounted for 84% of these costs, driven principally by high hospital readmission rates for chronic diseases. Based on forecasted 2009 hospital expenditures in Ontario, a 10% reduction in the \$8 billion spent on acute care for the 1% of citizens (approximately 130,000) could result in potential savings of \$800 million annually that could be used for chronic disease management in the community or at home.
- In Alberta, a study of heart failure care following hospitalization showed an average reduction in hospital use of 3.6 days per participant, resulting in savings of roughly \$2,500 per case.
- More than 3,000 Ontarians in acute care hospitals actually needed an alternative level of care in 2010 and were awaiting placement in a long-term care facility. Doubling the home care daily maximum to \$200 to maximize the care for these people at home would save \$750,000 per day per 3,000 Ontarians and would result in annual savings of \$273.75 million in hospital costs that could be reallocated to home care.

## Components in clinical programs across the range of determinants of health: Implications for achieving better care for Canadians

Components of effective and efficient clinical care programs have been identified, especially for the chronically ill. They include:

- ▶ working within a system where the amount of money spent on social services is higher than that spent on health services (The ratio of social service expenditures to health service expenditures is associated with better outcomes in key health indicators in countries belonging to the Organisation for Economic Co-operation and Development.)
- ▶ integrating nurse-led models of care with interdisciplinary teams that are based on an ecological understanding of the interplay among a myriad of personal and environmental factors determining patients' health (These complex interventions require a high-quality primary healthcare system and patient-centred care practices led by specially trained nurses or advanced practice nurses as well as adequate investments in social programs.)
- ▶ using nurse-led models of care (especially supplemental care models) that are proactive, comprehensive, coordinated and targeted, whether nurses are operating alone or as part of interdisciplinary teams that provide managerial continuity of care (This type of model entails a consistent and coherent approach from several professions to provide the agreed upon management of chronic, complex and changing patient needs.)
- ▶ telemonitoring solutions advocated by Canada Health Infoway, especially for remote populations
- ▶ implementing and using electronic health records

## Recommended investments required for monitoring, evaluation, performance measurement and research

The monitoring, evaluation and performance measurement system should build on and link to pan-Canadian efforts already under way to establish *one* interprofessional healthcare monitoring and evaluation system. For example, the Vital Statistics Council of Canada, Statistics Canada, the Canadian Institute for Health Information and the Canadian Council of Cancer Registries have partnered together to form the Longitudinal Health and Administrative Data Initiative. This initiative will provide information about patients' conditions, status, use of computerized health and social services, and can be used for monitoring, evaluating performance measurement and conducting population health research.

## Real world

Implementing these recommended models of nursing care for people with chronic illness could begin with continuing the discussions between the Canadian Nurses Association (CNA) and the Canadian Medical Association (CMA) that resulted in the July 2011 *Principles to Guide Health Care Transformation in Canada*. Integrating models of nursing care is an idea that aligns with CMA's recommendation to gain government support for CMA's proposed Charter for Patient-centred Care and other recommendations in its 2010 report *Health Care Transformation in Canada: Change That Works, Care That Lasts*. Specifically, CNA's recommended models of nursing care in this report align with CMA's call for government to:

- ▶ create national standards of continuing care provision
- ▶ provide support for informal caregivers and long-term care patients
- ▶ invest in recruitment and retention strategies for physicians, nurses and other healthcare workers

- ▼ examine partial activity-based funding for hospitals
- ▼ implement pay for performance to encourage quality of care and associated reductions in the use of hospital resources

In addition, CNA's recommendations about monitoring and evaluating performance are consistent with CMA's recommendation to require "public reporting on system performances and outcomes." However, there may be considerable disagreement between CNA and CMA on which indicators to measure and report, requiring ongoing deliberation and the inclusion of indicators recommended by both professional associations.

## INTRODUCTION

In preparation for the 2014 Canadian health accord, Denis and colleagues (2011)<sup>1</sup> recommended the development of models of care that are more responsive to:

- ▼ demographic changes (the aging population)
- ▼ changing patterns of disease (increased prevalence of complex comorbid chronic diseases)
- ▼ evolving socio-economic contexts (growing inequities in determinants of health) *and*
- ▼ the need to harness escalating healthcare costs that have accompanied technological advances and investments in acute care

Since the 2003 First Ministers' Accord on Health Care Renewal, which related to citizens' access to healthcare, there have been improvements in the healthcare system in Canada, especially for hip and knee replacements and cataract surgery. However, the Health Council of Canada's 2008 report *Rekindling Reform: Health Care Renewal in Canada, 2003–2008* identified areas where progress had lagged. These areas were safe and appropriate prescribing of medication and adherence to these regimes, home care, primary healthcare, the healthcare work force, electronic health records and information technology, and accountability.<sup>2,3</sup>

Our report documents the results of a systematic review of recent literature reviews and studies about the effect of models of nursing care on patient and health system outcomes related to chronic disease management, home care, community care, primary care and mental health settings. The report also has implications for the educational preparation of the nursing workforce. It was prepared for the Canadian Nurses Association (CNA) National Expert Commission (The Health of Our Nation – The Future of Our Health System), commissioned by the Canadian Health Services Research Foundation (CHSRF) and funded by CNA.

Broadly speaking, our report provides evidence that addresses the following objectives:

1. an analysis of recent studies and literature reviews about the impact of nursing care across a range of outcome variables: patient health outcomes related to mortality and morbidity; system impacts, including costs and readmissions; and patient impacts, including wait times and access to care
2. a robust list of promising nurse-led or nurse-involved service innovations
3. highlights of service innovations at provincial and national levels
4. recommendations about key clinical programs across the range of determinants of health, the health system and policy implications for achieving better care for Canadians
5. comments on the strategic investments that would be required for monitoring, evaluation, performance measurement and research

Section 1 covers the first two objectives, and Section 2 discusses the remaining three.

## SECTION 1: LITERATURE REVIEW AND PROMISING NURSE-LED PRACTICES

### 1.1 Types of reviews of the literature

The Social Care Institute for Excellence in the United Kingdom made the following distinctions related to academic reviews and analyses,<sup>4</sup> to which we have added some further descriptions:

- ▼ A *narrative review* is a literature review in which reviewers have sought to collate relevant studies and draw conclusions from them but do not make explicit their methods or decision-making rules. Narrative reviews are useful for discussing data in light of an underlying theory or context.<sup>5</sup>
- ▼ A *systematic review* is one in which reviewers have sought to identify all relevant primary studies that they have systematically appraised and summarized according to an explicit and reproducible methodology.
- ▼ A *meta-analysis* is a statistical method of combining and summarizing the results of studies in a systematic review that meet minimum quality criteria.
- ▼ *Qualitative reviews* carried out in parallel with systematic reviews are meant to inform, enhance, extend or supplement the quantitative approaches to reviews. They are designed to answer why an intervention works or not (feasibility, appropriateness, meaningfulness) and to address how participants experience the intervention.<sup>6</sup> Qualitative reviews (also called “realist reviews”) explain – rather than judge – not only how and why but also in what circumstances, for whom and to what extent an intervention works.<sup>7</sup>

*Theory* also may help to explain how, why, for whom and in what circumstances an intervention works.<sup>8</sup> Many reviews fail to locate the nursing interventions within a theoretical model,<sup>9</sup> and many studies within reviews only analyze for “main effects.” With some exceptions, few studies explore answers to the above questions by conducting subanalysis.<sup>10,11</sup>

Given the extent of the studies and reviews of nursing care strategies on patient outcomes in various practice settings, we examined both reviews and studies and used standard measurement tools to assess their quality. We included reviews assessing the effect of nursing care on patient and health system outcomes that met at least 75% of the 21 standards for assessing reviews of reviews, including those standards in the recently developed AMSTAR tool with high interrater reliability<sup>12</sup> and the Cochrane criteria outlined by Richards and Coast.<sup>13</sup>

We classified the nursing intervention literature and quality reviews by outcomes (mortality, morbidity [symptoms], access, waiting time, quality of life, hospital admissions, length of stay, emergency room use or economic analysis), by setting (acute, community or residential care) and by model of nursing intervention. This classification process helped us to ascertain innovative models of nursing care that are effective and efficient and sometimes explained how and why they work. We were then able to identify common characteristics of these models.

We also discovered additional reviews that estimated savings that could be achieved by implementing models of nursing interventions for many different types of chronic illnesses that are the most costly health conditions. These reviews estimated the strategic investments that could be recovered within one year along with additional savings under different assumptions about improving the capacity of a proportion of citizens who live with chronic illness at home.

Finally, we described an approach to the development and implementation of a data system for ongoing monitoring, evaluation, performance measurement and research, which acknowledges several existing efforts to do the same type of monitoring and evaluation in Canada.

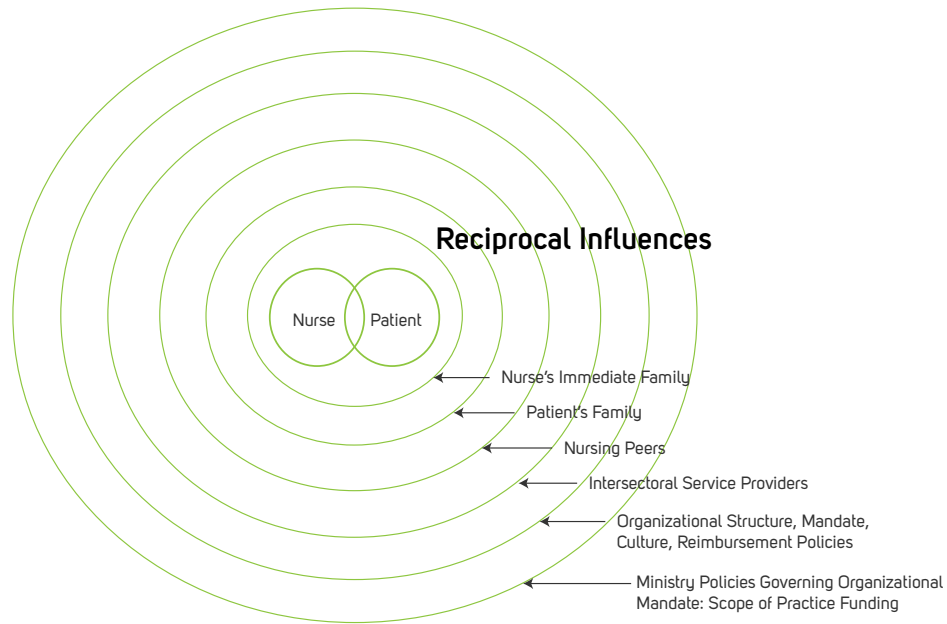
## 1.2 Outline of the conceptual framework and methods approach used

We used two frameworks to guide this inquiry into models of nursing care. The first one (Figure 1) is an *ecological framework* similar to the ecological framework for the determinants of health. It acknowledges the cumulative and multiple levels of dynamic reciprocal influences on nursing practice and patient situations:<sup>14,15</sup>

1. competencies and talents of the *nurse(s)* that provide care across the patient's lifespan and settings
2. cognitive, emotional and behavioural competencies of *the patient*
3. supportive nature and demands of a *nurse's immediate family*
4. competencies and talents of personal supports from the *patient's family*
5. support or conflict with *nursing peers*
6. competencies, involvement and talents of a range of *intersectoral service providers* with whom the nurse (or at least the patient) interact
7. larger *organizational issues*, such as the culture, structure and economic (reimbursement) policies and their effects on the nurse, nurse workload, scope of practice, development, interdisciplinary collaboration and provider attitudes
8. competing goals and practice reimbursement, or funding policies, within and between *different ministries* of the same and other provincial governments

Single studies and reviews of studies of comparative nursing practices using the randomized controlled trial (RCT) design within an agency and serving a particular type of patient problem can control for the effects of a variety of these multiple levels of influence on the quality and standard of nursing practice hypothesized to affect patient and system outcomes. However, sometimes high-quality data about healthcare delivery were not amenable to the RCT design but did demonstrate the effect of nursing staffing levels on patient outcomes.<sup>16</sup> Most reviews of nursing care access high-quality studies with many other comparative designs. A major weakness of these reviews was the imprecise definition of nursing care that was provided.<sup>17</sup>

**Figure 1: Ecological and Developmental View of Reciprocal Influences on Nursing Practice**

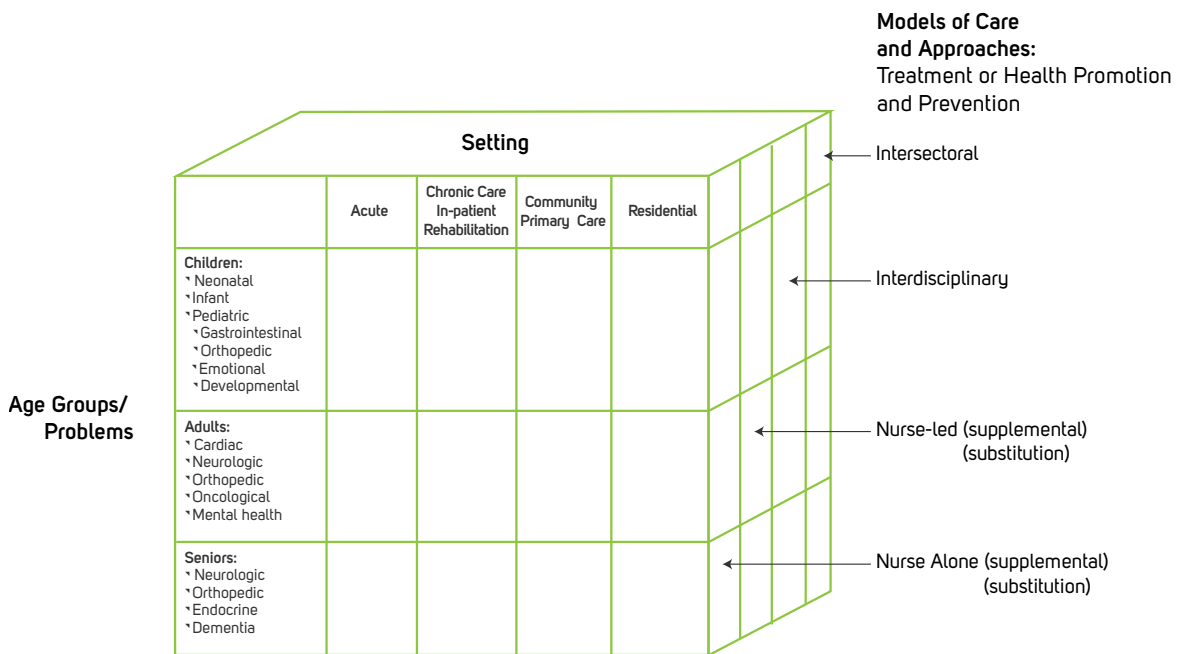


Source: This framework was adapted from ideas about reciprocal and multi-level influences in Brofenbrenner (1979)<sup>18</sup> and Brofenbrenner and Morris (2011).<sup>19</sup>

The second framework (Figure 2) acknowledges the variety of models of nursing practice in terms of where and how nurses' care is provided. Models can vary based on the settings (acute, chronic, community or virtual), patient age groups (infant, child, adolescent, adult, senior or frail elderly) and specific patient problems (such as emotional, developmental, wound, cardiac, gastrointestinal, neurologic, orthopedic or oncological). Additionally, they can use a range of modalities of care (bedside care, visits, endoscopy, enterostomal care, infection control, intravenous therapy, telephone support or traction). As in Figure 2, a systematic review of the literature about the effects of different models of nursing care can also be categorized by organizational practice settings (for example, hospital nurse staffing models and patient outcomes), patient problems (such as complex chronic diseases), interdisciplinary collaboration by setting and age group (for example, nurse-led specialist home-based nursing for seniors with heart failure), and by modality, problem, setting and age group (for example, telehealth for home care adult patients with mental health problems).



**Figure 2: Models of Nursing: Populations, Settings and Approaches in Nursing Practice**



### 1.3 Problems of meta-analysis of complex interventions and patient/system outcomes

Advanced or specialty practice nurse-led, proactive, comprehensive and multi-dimensional integrated nursing and team interventions for patients with complex illnesses who use a complex health and social system unfortunately are not amenable to any meaningful meta-analysis.

Complex interventions for complex chronic disease involve numerous potentially interacting factors, such as the nurse provider’s level of preparation and whether the focus is on prevention, health promotion or treatment. These provider characteristics further interact with the patient’s transition between some combination of hospital, primary care, specialists’ clinics and home care. The patient’s comorbid diseases, characteristics (such as age) and circumstances (for example, whether the patient lives alone) also add to the complexity. As well, some models of nursing practice serve a “substitution-for-the-physician” function, while others supplement the care provided by physicians as part of an interdisciplinary team or alone.

As if the complexity related to the intervention and patient is not enough, decision-makers also want studies of efficiency to judge effectiveness and efficiency, not simply effectiveness on patient outcomes in isolation. This separation of comparative effect and cost has characterized most nursing intervention research to date. Regression and subgroup analysis are the best statistical tools for exploring this web of heterogeneity. However, these techniques should not be misused to identify the contributions of single active components of the intervention (such as intensity or duration of the intervention on the overall patient and system outcomes). Meta-analyses require the separation of active components of an intervention and are only appropriate if the components work independently of each other. Components of interventions should not be disassembled if they work interdependently or synergistically.<sup>20</sup> Pooling outcomes in meta-analyses across different interventions is also usually inappropriate. Instead, the relative importance of patient and system outcomes as a function of treatment goals should be described in detail.

## 1.4 Methods

In keeping with the goals of this review, we have used Figure 3 as an analytic framework to classify the reviews and specific studies of the effects of models of nursing interventions. There are nine possible outcomes of economic evaluation of nursing care models, as depicted in Figure 3.<sup>21</sup> Boxes 4, 7 and 8 represent unambiguous improvements in efficiency because more (or the same) effects are produced with the same (or less) costs. Boxes 2, 3 and 6 represent unambiguous reductions in efficiency because fewer (or the same) effects are produced with the same (or more) costs. Box 5 signifies simply maintaining the same levels of effects and costs, and therefore efficiency is constant.

**Figure 3: Framework for Evaluating Possible Outcomes of Economic Evaluation of Healthcare Programs or Models of Nursing Care**

		Effects Produced		
		Increased	Same	Reduced
Costs for Resources Consumed	Increased	More Effective/ More Costly <b>1</b>	Equally Effective/ More Costly <b>2</b>	Less Effective/ More Costly <b>3</b>
	Same	More Effective/ Equally Costly <b>4</b>	Equally Effective/ Equally Costly <b>5</b>	Less Effective/ Equally Costly <b>6</b>
	Reduced	More Effective/ Less Costly <b>7</b>	Equally Effective/ Less Costly <b>8</b>	Less Effective/ Less Costly <b>9</b>

Source: Adapted from Birch and Gafni (1996)<sup>22</sup>

Nothing can be concluded about costs for care falling in boxes 1 and 9. For models of nursing care classified as being in Box 1, additional resources need to be found from other current uses to support them. Hence, the effect on health gain will depend on whether the reduction in health effects caused by removing these resources from their current uses is more than compensated for by the gain in effects from the intervention being evaluated. For models of nursing care falling in Box 9, resources are released for other uses, but effects are reduced. The impact on total effects will depend on whether the uses to which the released resources are put produce more health effects than those lost from the intervention being evaluated.

We used this conceptual framework to classify the main effects and costs of comparative nursing interventions. In addition, we used this approach to classify who (with what characteristics) benefits most, and at what cost, from various health interventions (especially in systems of national health insurance, where people will use, however (in)appropriately, some other insured service if a service is made unavailable).

Appendix A provides the details about our use of criteria and guidelines for appraising the quality of the conduct of systematic reviews (tables A1 and A2); our search strategy and methods, including eligibility, exclusion and inclusion criteria; an overview and summary of the literature review process (Figure A1); and the results of grading reviews and studies included in this review (Table A3). It also contains an overall tracking sheet of the various search results and key word combinations.

In general, our review of studies and reviews was confined to the following types:

- ▀ studies and reviews that simultaneously focused on nursing interventions, patient outcomes (morbidity, mortality, access and wait times) and system outcomes (comparative resource use and costs)
- ▀ studies and systematic reviews of studies of nursing interventions versus usual care that controlled for organizational setting and policies, age, and types of problems and that provided some assessment of fidelity to, or intensity of, the intervention
- ▀ reviews of studies that included subanalyses of mediating or moderating factors between nursing care and patient or system outcomes

We used data about patient outcomes and system resource use from the above types of studies and reviews to classify and support our conclusions about the effects and costs of models of nursing care, as in Figure 3.

Appendix B presents our appraisal of the excluded reviews and studies by search method and review phases as well as a complete reference list of all reviews and studies excluded from this analysis.

## 1.5 Results of our review of high-quality reviews

Table C1 of Appendix C offers an overview of the population, content, contexts, methods and results of 27 systematic reviews that met our inclusion criteria related to measures of patient and system outcomes. These reviews scored at least 16 out of 21 (75%) of the quality standards for assessing such reviews.

In an informal analysis of the initial studies we found, those falling below 16 of the 21 criteria often reported on more resource use or cost. We excluded those scoring 16 or higher if they did not report on resource use or costs along with the patient outcome. A majority of the reviews we included did not meet two of the 21 particular review criteria: the use of a funnel plot to assess publication bias and the inclusion of a statement about conflicts of interest.

In the two-month timeframe for this report, it wasn't possible to identify a second reviewer. However, we used the AMSTAR criteria with demonstrated high interrater reliability (described in Appendix A).

The complex, multi-faceted interventions included in the reviews were usually offered to people with complex comorbid problems that accompanied an index condition. The majority of illnesses reported in the reviews we included that were treated by specialty-trained nurse interventions related to some combination of the following chronic conditions: heart failure, chronic obstructive pulmonary disease, rheumatoid arthritis, dementia, mental disorders, diabetes, palliative care, child or youth eczema and debilitating neurological disorders.

The sites where this type of nursing was provided were medical specialty clinics, primary care facilities, home care, hospital wards and nursing homes. The approaches that nurses used in these settings were some combination of face-to-face meetings, in-home visits, telephone support and/or telemonitoring, and counselling. The role taken by the nurse usually involved case management, disease management, education for self-management, symptom monitoring and counselling about lifestyle modifications.

Most of the reviews included studies of various designs and rigour, such as randomized controlled trials, quasi-experimental studies and case-control studies. As well, they usually assessed some patient outcomes and only use of acute care resources or nursing homes. The high-quality reviews included in our report were all published between 2004 and 2011, and they summarized studies of situations where nurses were either involved in or leading a multidisciplinary or multi-faceted complex intervention. The high-quality studies included in the reviews were published between 1985 and 2005 and were performed in the United Kingdom, Australia, the United States, Canada and Scandinavian countries.

## 1.6 Aggregate analyses of the reviews

In keeping with the framework for evaluating economic evaluations of health interventions, the primary outcomes of interest for this review were reports of *both* patient outcomes *and* resources used or total direct cost from the payer's perspective. Reports that provide information only on the effectiveness of nursing interventions leave out important information about resource or cost implications. On the other hand, reports containing information only on costs or resources used with nursing interventions miss important information about the good and the harm that may arise from these interventions.

Given that the focus of our review of reviews is on nursing care models where the primary outcome is one of comparative patient effects and system cost, we have organized the reviews by the following characteristics:

- ▼ nurse-involved versus nurse-led models of nursing interventions
- ▼ level of nurse preparation and site of practice (Table 1)
- ▼ patient condition and site of practice (Table 2)
- ▼ simultaneous evaluation of comparative patient effects and costs (use of system-costly resources) (Table 3)

We also discuss various nursing goals used within each model category (substitution or supplementation).

Most reviews were of modalities or approaches (case management, outreach, telemonitoring, patient education) rather than the type of professional providing the intervention. Some of the reviews were of interventions led by a nurse, and some reviews included studies of interventions led by other disciplines, such as pharmacists and geriatricians. To be included in our review of reviews, at least 50% of the interventions had to be provided by nurses. As a result of this mix of intervention variables, some caution should be applied when drawing conclusions from these reviews about the effectiveness and efficiency of nurses who were working with different levels of preparation, types of collaboration (substitution versus supplemental) and intensities of collaborative practice (nurse-led versus nurse-involved).

To illustrate the complicated situation, Table 1 cites the high-quality reviews of interventions provided by nurses in terms of the nurses' different types of academic or continuing education training, their functioning in different locations and the different intensities of their role in the intervention, whether nurse-led or nurse-involved, with multidisciplinary teams or providers. As well, the reviews we included involved nursing practices that can be characterized as either substitution (or replacement) for usual care (for example, Laurant et al., 2009) or as supplemental to usual care (for example, Keleher et al., 2009).

**Table 1: Levels of Nurse Preparation by Care Site and Level of Involvement in Models of Team Care Reported in 27 High-Quality Reviews**

Training Level and Care Site	Reviews of Nurse-Involved Interventions	Reviews of Nurse-Led Interventions
<b>BASIC NURSE TRAINING</b>		
Hospital	Halbert et al. (2007) Kane et al. (2007) Milisen et al. (2005)	Griffiths et al. (2009) Kim & Soeken (2005) Oredsson et al. (2011)
Primary Care		Keleher et al. (2009)
Home/Community	Beswick et al. (2008) Spijker et al. (2008)	Phillips et al. (2004) Ram et al. (2004)
<b>DISEASE-SPECIFIC TRAINING ADDED TO BASIC TRAINING</b>		
Hospital	Ellis et al. (2011) Klersy et al. (2011)	
Primary Care	Holland et al. (2005) Loveman (2009)	Hastings & Heflin (2005) Inglis et al. (2010) McLean et al. (2011) Raman et al. (2008) Schadewaldt & Schultz (2011)
Home/Community	Dieterich et al. (2010) Huss et al. (2008) Malone et al. (2009) Langhorn et al. (2005)	Wong et al. (2011)
<b>MASTER'S-PREPARED (ADVANCED PRACTICE NURSE, CLINICAL NURSE SPECIALIST)</b>		
Hospital		
Primary Care		Gibson et al. (2009) Laurant et al. (2004) (replacement for usual care)
Home/Community		

In Table 2, we classified reviews that featured nurse-involved or nurse-led interventions by type of setting and patient problem. Some reviews included studies where half were nurse-involved and half were nurse-led models of care (for example, Loveman, 2009). Some reviews were of patients in a single location, such as a hospital (for example, Kane et al., 2009; Griffiths et al., 2009) or primary care (for example, Laurant et al., 2004), while others were of patients with an index condition who received care from a nurse-led team while transitioning from hospital to the community (for example, Hastings & Heflin, 2005). Other reviews involved patients with index conditions that combined both recognition and treatment studies with other studies focused on prevention, such as the index condition of delirium (for example, Milisen et al., 2005), where prevention was more effective and efficient than treatment.

**Table 2: Types of Patient Problems by Setting Where Nurse Intervention Was Provided, From Included High-Quality Reviews**

<b>IN-HOSPITAL CARE FOR PATIENTS WITH ONE OF THE FOLLOWING CONDITIONS</b>
▼ Delirium (Milisen et al., 2005)
▼ Heart failure with COPD (Kim & Soeken, 2005) or without COPD (Phillips et al., 2004)
▼ Frailty in the elderly (Ellis et al., 2011)
▼ Acute exacerbations of complex comorbid medical problems in adults or seniors (Kane et al., 2007; Kim & Soeken, 2005; Griffiths et al., 2009)
▼ Seniors with hip fractures (Halbert et al., 2007)
▼ Stroke (Langhorne et al., 2005)
<b>PRIMARY AND COMMUNITY CARE FOR ADULTS OR SENIORS WITH ONE OF THE FOLLOWING CONDITIONS</b>
▼ Chronic heart failure (Inglis et al., 2010)
▼ Dementia (Spijker et al., 2008)
▼ Severe mental illness (Malone et al., 2009; Dieterich et al., 2010)
▼ Complex comorbid medical problems (Beswick et al., 2008; Keleher et al., 2009; Laurant et al., 2004)
▼ Heart failure (Holland et al., 2005; Raman et al., 2008; Klersy et al., 2011)
▼ Asthma (McLean, 2011 [study includes children]; Gibson et al., 2009)
▼ Coronary artery disease (Schadewaldt & Schultz, 2011)
▼ Chronic obstructive pulmonary disease (COPD) (Wong et al., 2011; Ram et al., 2004)
▼ Frailty in the elderly (Huss et al., 2008)
▼ Diabetes (Loveman et al., 2009)
<b>EMERGENCY CARE</b>
▼ Triage for non-urgent problem (Oredsson et al., 2011)
▼ Emergency department discharge care for frail elderly (Hastings & Heflin, 2005)
<b>PRIMARY CARE CLINICS ALONE</b>
▼ General medical problems (Laurant et al., 2004)

Table 3 indicates where the 27 high-quality reviews fall with respect to the economic evaluation scheme represented in Figure 3. By considering the dual impact of the intervention on effectiveness and efficiency, these depictions show a qualitative economic evaluation of the reviews simultaneously. The circled “L” by some of the reviews identifies reviews of interventions that were nurse-led, and more confidence can be placed in these reviews when addressing questions about the comparative effects and costs of nurse-led care models for people with complex medical conditions and social circumstances. In addition, the circled “R” indicates that the review focused on nurse-led physician-replacement models of care.

Fourteen of the 27 high-quality reviews were of nurse-led models of care, and 13 were of nurse-involved models. Twenty reviews concluded that a nursing model of practice (whether nurse-led or nurse-involved) was more effective than usual care. Thirteen of these 20 also concluded that a nursing model resulted in less use of costly, often crises-related, health services, such as situations involving one or more of the following: emergency departments, hospitalizations, hospital days or nursing home admissions.

**Table 3: Economic Evaluation of High-Quality Reviews of the Effectiveness and Efficiency of Nursing Practices**

Effects of Nursing Intervention					
INCREASED	INCREASED		SAME		REDUCED
		<b>1</b> More Effective/ More Costly	Keleher et al. (2009) (L)	<b>2</b> Equally Effective/ More Costly	
SAME	<b>4</b> More Effective/ Equally Costly	Milisen et al. (2005)	<b>5</b> Equally Effective/ Equally Costly	Kim and Soeken (2005) (R) (L)	<b>6</b> Less Effective/ Equally Costly
		Ellis et al. (2011)		Laurant et al. (2004) (R) (L)	
		Halbert. et al (2007)		Huss et al. (2008)	
		Schadewaldt & Schultz (2011) (L)			
		Wong et al. (2011) (L)			
		Loveman et al. (2009)			
REDUCED	<b>7</b> More Effective/ Less Costly	Klersy et al. (2011)	<b>8</b> Equally Effective/ Less Costly	Malone et al. (2009)	<b>9</b> Less Effective/ Less Costly
		Raman et al. (2008) (L)		Spijker et al. (2008)	
		Holland et al. (2005)		McLean et al. (2011) (L)	
		Beswick et al. (2008)		Ram et al. (2004) (L)	
		Dieterich et al. (2010)			
		Griffiths et al. (2009) (L)			
		Langhorne et al. (2005)			
		Inglis et al. (2010) (L)			
		Kane et al. (2007)			
		Oredsson et al. (2011) (L)			
		Phillips et al. (2004) (L)			
		Gibson et al. (2009) (L)			
		Hastings & Heflin (2005) (L)			

Note: The circled “L” identifies reviews of nurse-led interventions, while the circled “R” identifies any review of nurse-led physician-replacement models (e.g. Laurant et al., 2004).

An additional four of the total reviews reported that the model of nursing intervention was equally effective as usual care and used fewer crises-related or costly resources. Six of the 20 reviews demonstrating more effective nursing intervention concluded that the nursing model was no more costly than usual care.

Only one review (Keleher et al., 2009) concluded that using a nurse-led model was more effective than usual care but used more costly resources. This review included 14 studies, and the conclusion was based on nine of those studies.

Three of the 27 reviews concluded that the model of nursing was equally effective as usual care and equally costly. In two of these three reviews (Kim & Soeken, 2005; Laurant et al., 2004) the nurse-led model was a substitution model, while in the third (Huss et al., 2008) the nurse was augmenting usual care but was functioning alone and had basic nursing training, suggesting an inadequate intensity of the intervention given the complexity of the patients' situations.

## 1.7 Limitations of high-quality reviews and need to review recent high-quality studies

By the end of the first stage of our review, we had identified the following limitations with the high-quality reviews of nursing practice:

- The reviews may have classified identical nursing practices in two ways: “nurse-led” and “multi-faceted” (which we called “nurse-involved” in our review).
- The reviews were heterogeneous with respect to the level of the nurse’s preparation, the nurse’s role in the intervention, the emphasis of the care (health promotion or secondary prevention versus treatment), the site(s) of the care, the patient’s index medical condition and the severity of the patient’s condition.
- The nursing interventions (for example, community nursing) were conducted in qualitatively different ways and were not just single interventions. In other words, nursing care is usually a complex, multi-faceted intervention.
- Results of the included literature reviews about outcomes of nursing care differed when reporting on generalist versus specialist nurses.
- The reviews combined nursing care that was designed to substitute for the function of a physician and nursing care that was supplemental to another health professional’s care. The supplemental, or complementary, approach enhances favourable outcomes for both the patient and the system.
- The reviews rarely included an assessment of uptake, engagement and fidelity to the model of nursing under investigation.
- The included reports did not capture information about patients in sufficient detail to describe improvements in discrete subgroups of patients, such as the chronically ill in general versus the chronically ill who were poorly adjusted.
- For interventions that were intensive and comprehensive, the reporting of assessment outcomes at 12-24 months, which was driven by funding regulations, was too early.
- The questions directing the included reviews and their study analyses were too simple. They often asked, “Does it work?” rather than “Who, with what characteristics and under which circumstances, most benefits from the nursing intervention?” and “In what way do they benefit and at what cost?”



- In some cases the nursing intervention was too specific and not grounded in a conceptual framework that addressed the range and mix of patient needs, resources and influences. In other words, the intervention was aimed at a “sliver” of the patient’s situation and context, rather than at all the factors that perpetuate the problems or determine health.
- The descriptions of nursing and best practice guidelines were generalized and failed to describe components of the guidelines about for whom and in what context.
- It was difficult to separate out the effect of nursing alone in multi-faceted, multidisciplinary and even nurse-led interventions for complex patients.
- The outcomes measured were often not nurse-sensitive (such as skin care and incontinence).
- Most outcomes (for example, length of hospital stay) were influenced by multiple levels of practitioner, hospital admission and community factors, not just by patient and individual nurse factors.
- It is possible that these reviews were limited by publication bias, whereby studies describing higher costs were not published.

In our review of high-quality reviews, we could perform only aggregate qualitative analyses (as shown in tables 1-3). Most reviews examined studies of the main effects of two approaches to care, addressing the question of whether the approach worked in general. Very few reviews had subanalyses that identified at the outset the patient situation or characteristics that were more likely to benefit. One study (Loveman et al., 2009), however, identified the effectiveness and efficiency of specialist diabetic nurses when patients’ diabetes was more unregulated ( $HbA_{1c} \geq 8\%$ ).

Finally, the high-quality reviews studied interventions for conditions in various jurisdictions (countries) that differed in professional regulations, scopes of practice, and policies governing the provision of all health and social care. Because of the limitations described above, we undertook a review of recent (2004-2011) studies containing more detail about the interventions and levels of nurse preparation, which was the second stage of our literature review.

## 1.8 Characteristics of high-quality studies, participants and intervention programs

Using the same eligibility, inclusion and exclusion criteria outlined in Appendix A, we identified 29 comparison *studies* of models of nursing interventions that met at least 16 of 21 quality criteria for a good study (Appendix D, Tables D1 and D2). All 29 studies included information about effects on patient functioning or quality of life and reported at least one of the following health resources: hospitalizations, hospital readmissions, emergency department visits or nursing home admissions. Whenever total direct cost from a payer’s perspective was available, we used that. The three separate rounds of review and exclusions of studies we undertook are described in Figure A1 (Appendix A).

Table D1 describes the criteria we applied to each high-quality study, and Table D2 describes the relevant content of each study included in this phase of the review (Appendix D). The content (and number) of the trials in the 29 studies covered people in the community with chronic coronary disease (2), patients following gastroscopy or endoscopy (2), palliative care at home (2), home care for people with Parkinson’s disease (1), general older medical outpatients (2), COPD or asthma (2), nursing home patients with pneumonia (1), medical in-patients (1), people with types 1 and 2 diabetes mellitus in primary care (2), in-patients and outpatients with rheumatoid arthritis (1), critical care in-patients (1), children at home with eczema (1), hospitalized chronically ill patients undergoing transition to home (4), enterostomal wound care therapy for acute and chronic home care patients (1), women having undergone major gynecological surgery (1), people in primary care with common depression and/or anxiety problems (1), women genetically at risk for breast cancer (1), frail elderly patients (2) and caregivers of persons surviving stroke (1).

The locations where the nursing interventions took place and the levels of nurse preparation for specific conditions are provided in Table 4. We classified the studies by the type of nurse preparation, site of the intervention, and model and intensity of the nursing role with patients' conditions. Those with a circled "R" beside the study in the Table were of nurse-led physician replacement (or substitution) models, and those not circled "R" were of supplemental nursing care models. The majority of these high-quality studies were primarily of the supplemental nurse-led model of care by nurses with different amounts of training.

The mean age of participants in the trials ranged from one year to 85 years. None of the studies commented on the multicultural mix of patients. For conditions that affect both men and women, the proportion of females in the studies ranged from 19% to 70%. The length of follow-up in the trials ranged from three months after surgery to four years. Twenty-four of the trials were about nurse-led models of care, and six of these 24 trials were about models of nursing designed to substitute for (replace) general practitioner (GP) or specialist medical doctor (MD) functions in hospitals or specialty clinics. In nine of the studies of nurse-led models, care was provided by a nurse prepared with a master's degree.

**Table 4: Levels of Nurse Preparation by Care Setting and Level of Nurse Involvement in Models of Team Care Reported in 29 High-Quality Studies**

Training Level and Care Site	Studies of Physician-Led Nurse Involved With Team	Studies of Nurse-Led Care With Team
<b>BASIC NURSE TRAINING</b>		
Hospital		Cuthbertson et al. (2009) Loeb et al. (2006)
Primary Care		
Community/Home Care		Hebert et al. (2008)
<b>DISEASE-SPECIFIC TRAINING ADDED TO BASIC TRAINING</b>		
Hospital/Specialty Clinic		Dunagan et al. (2005) Chan et al. (2009) (R) Scott et al. (2005) (R) Williams et al. (2009) (R) Torrance et al. (2006) (R)
Primary Care	Kalra et al. (2004) Vass et al. (2005)	Gary et al. (2009) Griffiths et al. (2004) Kendrick et al. (2006) Raftery et al. (2005) Latour et al. (2007)
Community/Home Care	Brumley et al. (2007) Davison et al. (2005) Ricauda et al. (2008)	Harris et al. (2008) Hurwitz et al. (2005)

Training Level and Care Site	Studies of Physician-Led Nurse Involved With Team	Studies of Nurse-Led Care With Team
<b>MASTER'S-PREPARED (ADVANCED PRACTICE NURSE, CLINICAL NURSE SPECIALIST, NURSE PRACTITIONER)</b>		
Hospital		Harris et al. (2005) <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">R</span> Higginson et al. (2009)
Specialty Clinic		Schuttellaar et al. (2011) <span style="border: 1px solid black; border-radius: 50%; padding: 2px;">R</span> Tijhuis et al. (2003)
Primary Care and Community		Goodman et al. (2008) Naylor et al. (2004)
Community/Home Care		Castro et al. (2004) Coleman et al. (2006) Dawes et al, (2007)

Note: The circled “R” identifies studies of nurse-led physician-replacement (substitution) models.

Fifteen of the high-quality studies were conducted in the United Kingdom, seven in the United States, four in the Netherlands or Denmark, one in Italy and two in Canada. In addition, 15 of the 29 studies had large sample sizes.

Table D3 examines system outcomes for replacement models of nursing, and Table D4 looks at costs for supplemental models of nursing (Appendix D). Using different yet comparable currencies in any given study, the supplemental nursing model is comparatively less costly per patient than the substitution (replacement) model of nursing because attention is paid to other risk circumstances and factors that lead to deteriorating health and more use of emergency or hospital resources.

In Appendix D, Tables D5 through D9 classify the high-quality studies by patient outcome (for example, mortality) and by system outcomes that measure specific direct costs. These Tables also provide comments about the comparative effectiveness and cost of care in each study. Not every study included in this review measured the same outcomes, and therefore not all studies are included in each of these outcome tables.

We classified models of nursing interventions from the 29 high-quality studies based on the economic evaluation framework we used for the previous 27 reviews. Table 5 shows that 14 of the 29 studies had nurse models categorized as more effective than usual care, and 12 of these 14 were also less costly. We designated another 2 of the 14 studies as more effective and no more costly. Seven of the total studies were classified as equally effective and as having nursing intervention that was less costly than usual care, while 5 of the 29 studies were classified as equally effective and equally costly as compared with usual care. These studies of equally effective and equally costly types of nurse models were usually (4 of 5) studies where the nurse model was designed to replace the physician function.

We categorized the nursing model in only three of the 29 studies as equally effective but more costly than usual care. In the case of the study by Kendrick and colleagues (2006), which involved the study of serious mental illness in primary care, it was recommended that the more costly community mental health nurse team be used only when the GP’s initial treatment failed. The study by Cuthbertson and colleagues (2009) added more nursing (by basically prepared nurses) to follow patients discharged from the intensive care unit (ICU) while still in hospital. We can conclude that existing hospital nursing was sufficient to manage patients discharged from the ICU. The Latour et al. (2007) study demonstrated reduced use of institutionalizations of patients who required more community support services.

Only four studies followed patients for longer than one year. This fact is important when considering the questions of the economic benefit of sustained (20 months-2 years) nursing interventions.

The three studies that followed patients from 20 to 24 months concluded that the nursing intervention was more effective than usual care. Two of these studies showed that the intervention was equally expensive (Hurwitz et al., 2005; Vass et al., 2005), whereas the third study showed that it was less expensive (Raftery et al., 2005).

Seven of the high-quality studies found the intervention with the nurse model to be equally effective and less expensive than usual care (for example, Loeb et al., 2006).

**Table 5: Economic Evaluation of High-Quality Studies of Nursing Interventions and Outcomes**

		Effects				
		INCREASED		SAME		REDUCED
Costs or Use	INCREASED	1 Nurse Model More Effective/ More Costly		2 Nurse Model Equally Effective/ More Costly	Cuthbertson et al. (2009) (L)	3 Nurse Model Less Effective/ More Costly
					Kendrick et al. (2006) (L)	
					Latour et al. (2007) (L)	
	SAME	4 Nurse Model More Effective/ Equally Costly	Hurwitz et al. (2005) (L)	5 Nurse Model Equally Effective/ Equally Costly	Hebert et al. (2008) (L)	6 Nurse Model Less Effective/ Equally Costly
			Vass et al. (2005)		Harris et al. (2005) (R) (L)	
					Schuttellaar et al. (2011) (R) (L)	
					Torrance et al. (2006) (R) (L)	
	REDUCED	7 Nurse Model More Effective/ Less Costly	Chan et al. (2009) (L)	8 Nurse Model Equally Effective/ Less Costly	Brumley et al. (2007)	9 Nurse Model Less Effective/ Less Costly
			Coleman et al. (2006) (L)		Castro et al. (2004) (L)	
Dawes et al. (2007) (L)			Davison et al. (2005)			
Gary et al. (2009) (L)			Dunagan et al. (2005) (L)			
Goodman et al. (2008) (L)			Griffiths et al. (2004) (L)			
Harris et al. (2008) (L)			Loeb et al. (2006) (L)			
Higginson et al. (2009) (L)			Tijhuis et al. (2003) (L)			
Kalra et al. (2004) (L)						

		Effects			
		INCREASED	INCREASED	SAME	REDUCED
Costs or Use	REDUCED	7 Nurse Model More Effective/ Less Costly	Naylor et al. (2004) (L)	8 Nurse Model Equally Effective/ Less Costly	9 Nurse Model Less Effective/ Less Costly
			Raftery et al. (2005) (L)		
			Ricauda et al. (2008)		
			Scott et al. (2005) (L)		

Note: The circled “L” identifies studies of nurse-led interventions, while the circled “R” identifies studies of nurse-led physician-replacement (substitution) models.

The conclusions made about efficiency from these high-quality studies could be challenged for three reasons:

- Some of the studies provided information only on comparative hospital and emergency department resource use.
- Other studies provided information on the use of these same resources and total direct costs from the payer’s perspective, but the costing methods were barely described.
- Others simply reported direct costs but provided little information on costing methodology.

Because of these problems, in Stage 3 of our review we undertook an assessment of our own economic evaluations to see if more detailed economic evaluations (Appendix E) supported the conclusions drawn from our Stage 2 review of high-quality studies.

## 1.9 Economic evaluations of nursing intervention programs

This section refers to detailed information collected and generated in the third stage of our review of nursing intervention literature, focusing on studies that involved economic evaluations from McMaster University’s Systems-Linked Research Unit on Health and Social Service Utilization (SLRU). In Table E1 of Appendix E, we assess every randomized controlled study of specialty-trained nurses conducted by the SLRU against the criteria for a rigorous study.

Table E2 describes the content, focus and design of these economic evaluation details of nursing intervention studies done by McMaster’s SLRU (Appendix E). We provide these because each study also met the criteria for high-quality economic evaluations established by Drummond, Sculpher and Torrance.<sup>23</sup> Each SLRU study examined expenditures from a total societal point of view and included the use of not only healthcare resources but also social resources, such as child welfare, police, school and social work. In addition to these total direct costs from the payer’s perspective, summarized in Table E3 (Appendix E), the SLRU economic evaluations included total indirect costs for patient or carer’s lost time from work while consuming care and the cash transfer expenditures for being out of work or disabled. To be consistent with the other studies discussed in this report, we included only direct costs from the payers’ perspective in Table E3. The Browne et al. (2001) study of nurse-led and other interventions also reports the reduction in cash transfers for social assistance within one year.<sup>24</sup> In each of the McMaster SLRU economic evaluations, the Canadian costs of the comparative interventions were included.

All of the McMaster SLRU studies were derived from comparative RCT studies conducted in the same southern Ontario region with the same available resources, policies governing use of services such as home care, and basic or specialized nurses. These studies examined costs for the use of all health and social personnel in both nursing and usual care, and they included the costs of the interventions. The studies illustrate that, typically, expenditures for interventions accumulate in one service sector in order to create savings in another service sector.

Table 6 summarizes the SLRU results in Table E3 to ascertain whether similar conclusions from the SLRU support the conclusions from the 29 high-quality studies from the point of view of costs or resources used.

The only study that found that the nursing intervention was more effective but more costly (Roberts et al., 1999) came to this conclusion based on a subanalysis illustrating more effect and more cost for services appropriate for caregivers of people with dementia with poor problem-solving skills. It was concluded that the greater use of community-based services for this group was appropriate. All the other McMaster SLRU studies supported the pattern of conclusions drawn from the high-quality reviews and other studies.

**Table 6: Formal Economic Evaluations of Randomized Controlled Trials of Nursing Interventions Performed by McMaster University’s SLRU Using the Same Economic Evaluation Methodology**

		Effects				
		INCREASED		SAME		REDUCED
Costs or Use	INCREASED	1 Nurse Model More Effective/ More Costly	Roberts et al. (1999)	2 Nurse Model Equally Effective/ More Costly		3 Nurse Model Less Effective/ More Costly
	SAME	4 Nurse Model More Effective/ Equally Costly	Mills et al. (2010)	5 Nurse Model Equally Effective/ Equally Costly		6 Nurse Model Less Effective/ More Costly
			Browne et al. (2002)			
			Markle-Reid et al. (2011)			
			Markle-Reid et al. (2010)			
	REDUCED	7 Nurse Model More Effective/ Less Costly	Browne et al. (2001)	8 Nurse Model Equally Effective/Less Costly		9 Nurse Model Less Effective/ Less Costly
			Harrison et al. (2002)			
			Markle-Reid et al. (2006)			
			Roberts et al. (1995)			

SLRU: Systems-Linked Research Unit on Health and Social Service Utilization

## 1.10 Discussion

Our review of nursing intervention literature was unique in that we conducted three stages of review, with the last two stages dealing with the limits of the previous stage. In our initial review of the 29 “high-quality reviews” of the literature, our ability to estimate the effectiveness and efficiencies of the nursing interventions was limited because many of these reviews were conducted in two or more of the following ways:

- ▶ All types of healthcare professionals were included in the reviews of approaches to care (for example, telephone support or chronic disease management), as if there would be no difference between types of professionals in their approach to the intervention or in what different providers would emphasize.
- ▶ Even reviews of multi-faceted approaches to the provision of team care for the chronically ill or seniors included both “nurse-involved” (versus nurse-led) and substitution/replacement (versus supplemental) roles of the nurse with and without collaborative team members, as if there would be no differences in outcomes based on different ways that nurses with different educational preparation might function with and without other team members.
- ▶ The reviews summarized the resources that were reduced (hospital, emergency) but failed to account for the cost of the intervention.
- ▶ The reviews included studies from many different countries, ignoring differences in policies, available resources and legislated roles of healthcare professionals.

Despite these limitations in the high-quality reviews, we summarized the evidence using an economic evaluation framework.

Then, to study the influence of the many components of nursing practice, we conducted a second review of recent studies of models of nursing interventions and their impact on patient and system outcomes. The details and location of the practice model for specific index conditions and levels of nurse preparation in the studies were highlighted, and some of the studies also included comparative resource use as well as total direct costs. We then summarized the conclusions drawn from these 27 studies about the comparative effectiveness and cost, and we analyzed this information using the same framework for economic evaluation we applied to the reviews.

From this analysis it was clearer that nursing roles of team leadership provided by specialty-trained or advanced practice nurses that supplemented rather than replaced the physician role constituted the most effective model of nursing and were as costly or less costly than usual care. However, because the description of costing methods was usually absent in the studies, it was difficult to tell whether resource costs for providing the novel model of care were included. Our conclusions about the cost-effectiveness and potential savings are contingent on releasing existing hospital and physician resources to finance the new models of care.

Because of this weakness in the economic evaluation of these studies, we conducted a third review of economic evaluations of nurse-led interventions performed by specialty-trained nurses who were functioning in supplemental care roles with interdisciplinary teams or at least one other provider. This third review of nursing intervention studies included studies using the identical approach (as our own) to evaluating economic outcomes from a societal perspective. We have reported here only the direct costs from these studies, which included the cost of the nursing intervention. These studies were conducted by researchers in the System-Linked Research Unit on Health and Social Service Utilization (SLRU) at McMaster University with oversight from a health economist.

This third review confirmed our previous conclusions about the features of the nurse model that were most effective and equally or less costly than usual care. In this way, we assessed the bias that could have affected the conclusions drawn from the reviews and studies.

## 1.11 Conclusions

### 1.11.a *Analysis of the literature*

Data from high-quality reviews, single studies and SLRU studies of models of nursing care support the conclusion that, compared with current usual care, it is effective and efficient to deploy specialty-trained nurses to lead teams of professionals (including physicians) assembled to reflect complex patients' needs. All of the evidence in these reviews and studies support the conclusion that this nurse-led model of proactive and supplemental care for the chronically ill would be more effective and less or no more costly, or at least equally effective but less costly, than the on demand physician-led model now in place. Physicians could continue along with replacement nurse practitioners to manage acute and episodic care.

### 1.11.b *Promising practices in the literature*

A nurse leader should be used to identify characteristics of the patient with chronic illness that signify a risk for deterioration and hospitalization, whether in primary care specialty clinics, home care or nursing homes and at the point of hospital or emergency room discharge. The assessment and ongoing monitoring should be proactive, rather than reactive or on demand, as is the norm under our current models of healthcare. The nurse leader would collaborate with homemakers, personal support workers, nursing home personnel, registered nurse assistants, hospital or emergency department staff, and caregivers in the development and implementation of a patient-centred plan of care, including end-of-life care. In formulating a plan, the roles of involved team members would be clarified along with types and schedules of monitoring, including specifics as to who would conduct the monitoring and reasons for the monitoring. In addition, clear lines of communication in the event of changing situations should be established by the nurse leader.

### 1.11.c *Potential methods of financing promising practices for people with chronic illness*

We recommend that these models of nursing care be financed by cost reductions from averting use of hospitals and emergency departments. After managing the current hospital caseload of patients awaiting alternative levels of care, hospital beds could be reduced to free up funds for this reallocation of funding. It is expected that the annual cost per nurse (including benefits) of \$130,000 could finance 7,692 nurses nationally for every \$1.0 billion averted from hospital use.

Some savings could also be reallocated to increase funding for social resources for patients receiving social assistance and the working poor. Failure to implement a nurse-led model of proactive and comprehensive care for those with chronic illness will perpetuate the fragmented, on-demand, costly system of health and social care that now characterizes the Canadian healthcare system.

Section 2 outlines potential sources of these savings for the province of Ontario, which represents 37% of Canada's population.



## SECTION 2: COSTS AVERTED, KEY CLINICAL PROGRAMS AND PERFORMANCE MEASUREMENT

### 2.1 Service innovations documenting similar outcomes at a provincial or national level

Between 2006 and 2010 a number of Canadian and Ontario reviews of the literature have also documented the estimated effectiveness and efficiency of advanced practice nurses (APNs) or specialist nurse-led multidisciplinary care for persons with comorbid chronic diseases – care that is proactive and comprehensive, whether team-based in the community or home-based. Most of the reviews caution that their conclusions are based on small sample sizes and also advise against short-term, piecemeal solutions. Instead, the reviews usually advocate for a multicomponent approach to care to improve a patient’s life despite all the factors that perpetrate deterioration of the chronic condition and circumstance. Our review supports those conclusions.

#### 2.1a Treatment for chronic pressure ulcers

The Medical Advisory Secretariat of Ontario’s Ministry of Health and Long-Term Care (MOHLTC) first reported on the treatment of chronic pressure ulcers in 2008 to its advisory committee, and the report was published as part of the Ontario Health Technology Assessment Series in 2009. A pressure ulcer is an injury to the skin or underlying tissue over a bony prominence as a result of pressure, shear or friction. These ulcers are prevalent in people with impaired mobility and are aggravated by other comorbid factors, such as poor nutrition, poor sensation, incontinence, and poor overall physical and mental health.<sup>25</sup>

The prevalence of pressure ulcers in Ontario in 2008 was estimated to range from a median of 22.1% in community settings to 29.9% in non-acute facilities. Pressure ulcers are associated with a 400% increase in mortality among geriatric patients, increased frequency and duration of hospitalization, and decreased patient quality of life. The cost of treating a person with pressure ulcers has been estimated at approximately C\$9,000 per month, or C\$108,000 per year, per client. Therefore, it follows that efforts to speed the rate of healing pressure ulcers could save \$9,000 monthly per person.<sup>26-28</sup>

In the 2009 MOHLTC review, the cost of separately treating each factor that causes pressure ulcers or aggravates poor wound healing was assessed and compared with the cost of combined treatment provided by a specialist nurse-led multidisciplinary team in an acute care setting. The review demonstrated an eight-week reduction in healing time to 100% closure for an estimated savings of \$18,000 per person. Approaches to managing other types of wounds (like diabetic foot ulcers or venous leg ulcers) in the community are currently being evaluated in Ontario. We await the results of the economic evaluation of the Integrated Client Care Project about home-care wound treatment, scheduled to begin in 2012.<sup>29</sup> However, based on the \$9,000 monthly cost estimate determined in the MOHLTC review, the full added cost of a specialty trained nurse at \$130,000 per year (including benefits) could be recovered if just 7.2 of these pressure ulcers in patients healed eight weeks earlier.<sup>30</sup>

#### 2.1b Adoption of leading practices in home wound care

The 2010 report *Ideas and Opportunities for Bending the Health Care Cost Curve: Advice to the Government of Ontario* was produced collaboratively by the Ontario Association of Community Care Access Centres (OACCAC) and two other Ontario organizations. They estimated that, in 2007, Ontario had 90,000 clients with diabetic foot ulcers and 15,000 clients with leg ulcers. The estimated yearly cost of providing “standard care in the community” for those clients was \$511 million.<sup>31 (p.14)</sup> A 2007 report published in *Wound Care Canada* estimated that, by adopting best practices (wound care provided by a specialist nurse), an estimated \$338 million could be saved; this would represent a 66% reduction in cost and an estimated further savings of \$24 million in reduced hospitalizations alone due to fewer infections and amputations.<sup>32</sup>

### *2.1c Palliative home care*

A study by the Hamilton Niagara Haldimand Brant Community Care Access Centre, entitled “Ontario’s Integrated Client Care Project on Palliative Care,” showed that the cost of palliative home care was half the cost of comparable care in hospital.<sup>33</sup> In the above-mentioned collaborative OACCAC report, additional preliminary estimates from the Integrated Client Care Project suggested that, for 6,084 palliative care patients in an acute care setting, the annual cost per patient was \$19,900 as compared with an annual home care cost of \$4,700 per client. With a cost differential of \$15,200 per client, shifting 25% of palliative care clients to a home care setting could result in \$23 million in savings, some of which could be redirected to home care.<sup>34 (p.15-16)</sup>

### *2.1d Ontario’s Chronic Disease Prevention and Management Framework*

Chronic disease is widely recognized as the major cause of worldwide death and disability. Based on 2003 Canadian Community Health Survey data, the 2007 MOHLTC Chronic Disease Prevention and Management Framework document estimated that 70% of Ontarians older than 45 with chronic diseases had at least two chronic conditions, often along with depression. The economic impact of chronic disease was estimated at more than \$9 billion over a decade, when measured in terms of lost productivity to the Canadian economy, health system costs and costs borne by individuals. Elements of chronic disease prevention and management extend well beyond traditional care provided by the existing health system. These elements involve substantial patient and caregiver education and self-management; use of standardized protocols of best practices; information systems, including electronic health records; and performance monitoring of patient health outcomes and health system impacts.<sup>35</sup>

It has been estimated that more than one-third of Canada’s direct healthcare costs arise from major chronic illness and injury. The 2010 OACCAC report extrapolated from this statistic using 2009 data for Ontario, concluding that it represented \$16 billion of Ontario’s \$48.5 billion in direct health expenditures. Therefore, if 25% of \$48.5 billion could be attributed to major chronic illness only (excluding injury), that would be \$12 billion annually, and every 10% reduction in expenditures for chronic illness would result in annual savings of \$1.2 billion.<sup>36 (p.8)</sup> These savings would be enough to finance 9,230 specialty nurses at \$130,000 annually.

The 2010 OACCAC report also reported on further savings in Canada mentioned in the MOHLTC’s Framework document that were based on a chronic care model similar to the Chronic Disease Prevention and Management Framework. A congestive heart failure discharge program resulted in over 60% fewer hospital readmissions; a primary care asthma intervention program yielded 50% fewer emergency visits; and an Alberta study of heart failure care following hospitalization demonstrated hospital use reduction of 3.6 days per participant with savings of roughly \$2,500 per case.<sup>37 (pp. 8-9)</sup> Achieving a savings of \$2,500 per case for 52 patients at home with congestive heart failure would cover the \$130,000 cost of a specialty nurse who could coordinate a team of existing resources for all the comorbid chronic conditions and circumstances.

### *2.1e Chronic disease management in the community or at home*

The collaborative 2010 OACCAC report also revealed that a large amount of Ontario’s health expenditures are concentrated on the care of a small proportion of the population.<sup>38 (p.5)</sup> Annually, 1% of the Ontario population accounts for 49% of combined hospital and home care costs, and their acute care costs are principally attributable to treatment for circulatory issues, neoplasms, and injury and poisoning. In addition, 5% of Ontario’s population accounts for 84% of its combined hospital and home care costs, many of which are attributable to high hospital readmission rates that could be

reduced through better prevention and management programs. Using 2009 data from the National Health Expenditure Database of the Canadian Institute for Health Information, the report stated that the Ontario government would spend \$16 billion on hospitals in a total population of 13 million people. If about half of this expenditure (\$8 billion, excluding physician and drug charges) is attributed to 130,000 people, and if a 10% reduction can be achieved on this \$8 billion spent on 1% of the population, the potential savings to the hospital budget would be \$800.0 million.<sup>(p.5)</sup>

An annual 10% provincial reduction in hospital costs could be achieved (and reallocated to home care) by some combination of the following actions:

- ▶ preventing 13,000 of 130,000 people from admission to hospital every year
- ▶ reducing the 100-day length of stay generated by every five hospitalized people to 90 days
- ▶ reducing the length of hospital stays from 20 days per person to 18 days per person for those requiring alternative levels of care and for those who would benefit from, and prefer, earlier discharge

To finance this shift in funding, there would have to be a simultaneous reduction in the number of available hospital beds.

### *2.1f Managing people requiring alternative levels of care*

In March 2010 more than 3,000 Ontarians in acute care hospitals were designated as needing an alternative level of care (ALC) and were awaiting placement in a long-term care facility.<sup>39 (p.12)</sup> The estimated daily cost incurred for acute care of these patients was \$450 in 2010, translating into nearly \$500 million per year. Ontario's average daily cost for maximum levels of home care in 2010 was estimated at \$100. Doubling the home care daily maximum to \$200 to maximize the care for these people at home (to cover the cost of a daily personal support worker and weekly health professional visits) would save \$250 per day in hospital costs per patient, or \$750,000 per day per 3,000 Ontarians. This would result in a total of \$273,750,000 per year in hospital costs that could be reallocated to home care.

A similar trend in savings associated with home care as a substitute for acute care was noted for Saskatchewan.<sup>40</sup>

### *2.1g Home telehealth for chronic disease management*

The Canadian Agency for Drugs and Technologies in Health produced a Technology Report in 2008 entitled *Home Telehealth for Chronic Disease Management*.<sup>41</sup> According to the report, chronic diseases that have been managed through real-time and asynchronous home telehealth in Canada and internationally include cardiovascular diseases, asthma, renal failure and dialysis, wound care, hypertension, HIV/AIDS, mental health, inflammatory bowel disease, pediatric oncology, cancer, chronic brain injury, arthritis, and chronic pain.

Six of 10 Canadian provinces have established home telehealth programs, and there are pilot or planned projects in other Canadian jurisdictions.

Among studies related to diabetes or heart failure since 2008, the telehealth interventions have been found to be clinically effective.<sup>42</sup> Patients receiving telehealth interventions used fewer costly crisis services, such as hospitalizations, emergency department visits and bed days of care. In contrast, patients receiving home telehealth had a greater number of community primary care, specialist, office (involving a family physician or specialist nurse) and home care visits, but the net costs of such community care amounted to a cost saving from the point of view of the payer.

## 2.2 Key clinical programs across the range of determinants of health: Implications for achieving better care for Canadians

The most recent analysis of 2005 expenditures by OECD countries on health and social services has empirically demonstrated that it is not the amount spent on health services that most directly influences population health outcomes. Instead, it is the ratio of social service expenditures to health service expenditures (after adjusting for overall gross domestic product per capita) that influences better outcomes in key indicators.<sup>43</sup> These findings suggest that, given the paradox of high health spending without improved health outcomes, perhaps differences within OECD countries on expenditures for social services and benefits are associated with better health outcomes, such as improvements in infant mortality, life expectancy and potential years of life lost. The social service benefits include pensions, support services for older adults, disability and sickness benefits, cash benefits, family support, employment services and training, unemployment benefits, and housing supports such as rent subsidies.

Other than being based purely on cost-effectiveness, there are other reasons for using a nurse-led proactive, comprehensive model of health and social care aimed at the determinants of health. More than any other healthcare professional, nurses have been trained to manage patient health and social care in general and to identify specific situations that require more expert input from members of the care team.

Within the healthcare sector, recent reports summarizing evidence from systematic reviews have highlighted the central role of primary and community care in the Canadian healthcare system with emphasis on the determinants of health, using health promotion, disease prevention, acute care and chronic disease management.<sup>44</sup> In addition, award-winning health journalist André Picard refers to primary care as the “front door” for coordination and gate-keeping, given the proliferation of drugs and technologies.<sup>45</sup> These reviews and reports acknowledge that team-based care has been the most effective kind of care if it was properly structured, governed, financed, and supported with ongoing education for protocol development and team collaboration as well as incentives for achieving targeted patient outcomes and reduced resource consumption. The findings from our review provide evidence that team-based care is cost-efficient because it is either only equally costly or less costly than usual care.

Earlier reports in the literature concluding that there were equivocal or disputable outcomes from team-based care were not limited to systematic reviews or studies of the highest quality, nor did they provide conclusions about what types of models of team-based care were most effective and efficient. Nevertheless, the 2009 CHSRF/Canadian Institutes of Health Research literature review by McMurphy of the critical attributes and benefits of a high-quality primary healthcare system concluded the following:<sup>46 (p.1)</sup>

- *Canada has not yet achieved a national primary care orientation in the sense of providing high quality patient-centred care – although there is evidence from other jurisdictions that this is achievable with demonstrable [patient and health system] benefits.*
- *Primary care practices that provide comprehensive and coordinated care confer the most benefits to patients [and potentially the health system]....*
- *The factors that facilitate the delivery of comprehensive and coordinated care are: governance and organizational effectiveness including a clear mission and vision, strong leadership and change management strategies; accountability supported by a culture of continuous quality improvement and ongoing performance measurement; and patient empowerment through education, shared decision making, access to their medical records, and improved access for at-risk patients....*
- *There should be further investment to support change within the context of research and evaluation, including the development of management tools....*

Examining only high-quality reviews and studies, our review of recent international and Canadian evidence on the role of the nurse-led interdisciplinary team (either in primary or home care) supports the above conclusions. Further, the conclusions reached in our review make explicit just *how* comprehensive and coordinated care is most likely to be achieved, namely, by having a nurse supplement physician care and direct attention to the determinants of health using health promotion and secondary disease prevention strategies. As well, although our review revealed some evidence about the cost-effectiveness and equivalence to usual care of the nurse-as-a-substitute model, more compelling evidence from our review of the role of the nurse supports the model of an advanced practice or specialty-trained nurse-led interdisciplinary team over the general practitioner to medical specialist models. Such a comprehensive model results in more efficient use of the physician and is more likely to operate in some form of capitation arrangement versus fee-for-service practice, where fragmented care is the foreseen but unintended consequence.

In the 2009 McMurchy review,<sup>47 (p. 25)</sup> the author cites Boerma (2006)<sup>48</sup> and Haggerty et al. (2003)<sup>49</sup> to distinguish three main types of continuity of care: (1) *relational* continuity – “the ongoing therapeutic relationship between patient and provider(s)”; (2) *managerial* continuity – “the consistent and coherent approach of several professions to the management of health conditions (especially of chronic or complex) that is responsive to a patient’s changing needs”; and (3) *informational* continuity – “the use of information, either documented or in the memory of providers, on past events and personal circumstances, to make current care appropriate for the individual” over time.

With reference to numerous studies from the 1990s, McMurchy<sup>(p.25)</sup> concludes that effective managerial continuity of care is related to greater patient satisfaction, better patient compliance, saved consultation (physician) time, fewer laboratory tests, less hospitalization and emergency department use, and lower costs – as does our review regarding the role of nurse-led care. Indeed, McMurchy goes on to state that the Smith et al. (2007) review<sup>50</sup> of shared chronic disease care between generalist and specialist physicians found “no consistent improvements in physical or mental health outcomes, psychosocial outcomes, measures of disability and functioning, hospital admissions, default or participation rates, recording of risk factors, or satisfaction with treatment.” McMurchy reports that “the authors concluded that these results were likely due to methodological shortcomings, the multifaceted nature of the interventions, and short follow up.”<sup>51 (p. 26,27)</sup> Another explanation could be that the GP/specialist MD model fails to address the complexities of interacting determinants of health in patients with complex needs that are addressed in multi-faceted, proactive nurse-led team models of care.

Our conclusion from the present review of the value of proactive specialist nurse-led team care for targeted patients is that such a model satisfies all of McMurchy’s criteria for a high-quality primary care system: accessibility; continuity; coordination; comprehensiveness, with attention to health promotion; secondary disease prevention; and chronic disease management. It also fulfills the criteria for critical supporting factors, such as increasing patient impact and controlling system costs.

The 2010 report subtitled “Advice for the Government of Ontario” was produced collaboratively by three Ontario healthcare provider associations to advise on ways to reduce healthcare costs for the province with 37% of Canada’s population. It suggests, as does our review, that focusing on the 1% to 5% subpopulation with comorbid chronic conditions has the most potential for large rewards with regard to the quality and efficiency of care. According to the 2010 report, Ontario’s forecasted 2009 expenditure for hospital care was \$16 billion for a total population of 13 million. If half of this expenditure (\$8 billion) was attributable to 130,000 people (1% of the population), then for every 10% reduction in hospital expenditure attributable to the 1% subpopulation, annual savings of \$800 million could be used

to enhance models of community care in Ontario.<sup>52</sup> Projecting these savings nationally to include the remaining (roughly) two-thirds of the Canadian population would result in a total of \$2.4 billion in savings that could be used to enhance community care and social determinants of health in Canada.

The College of Family Physicians, representing 35,000 family doctors in Canada, suggests a model called the “Patient’s Medical Home,” which features a family practice that serves as the central hub for timely provision and coordination of a comprehensive menu of community health and medical services that any given patient may need. To its credit, the College fully embraces the need for interdisciplinary care including nurses, pharmacists and other professionals, and it advocates that they be located at the same site or linked virtually.<sup>53</sup> Models providing primary care by teams in Canada include the community health clinics (CLSCs) in Quebec, Alberta’s primary care networks, Ontario’s family health teams and, most recently, Ontario’s nurse practitioner clinics. These clinics have moved to the next step of recognizing the value of having the nurse practitioner in primary care as the lead coordinator of the team of professionals to ensure timely access to care, managerial continuity of care and comprehensive care for patients.

Other trends that are emerging in Canadian healthcare are store-and-forward transmissions of data, images or video applications in radiology, pathology, wound care, ophthalmology and dermatology. The 2010 Canada Health Infoway telemonitoring solution involves remote monitoring and transmission of clinical data from a patient’s home to a centralized facility for review and action by a care team. The “information highway” has also provided an opportunity to conduct an analysis of a pan-Canadian aggregate study of the current benefits of drug information systems. Drug information can be included in the patient’s e-record as a measure of a person’s health and medication use. This information can be further linked to health resource use by health condition.

Canada Health Infoway’s 2011 analysis of reported telehealth use in Canada in 2010 reported 187,385 clinical events, 44,600 educational events and 27,538 administrative events. Nearly 2,500 patients in Ontario were receiving telehome-care – the largest telehealth care program in Canada. The greatest proportion of telehealth services was for mental health and addictions (54%), followed by internal medicine (15%), oncology (13%), renal/nephrology (15%), and surgery and anesthesia (5%). More progress is needed for telehealth coverage related to the growing, wide range of chronic diseases. The report described the benefits of pan-Canadian implementation of electronic health records (picture archiving communication) that included a 30%-40% improvement in turnaround times for clinical decisions and patient treatment, reduced patient wait-times, reduced lengths of hospital stays, and elimination of 10,000-17,000 unnecessary patient transfers annually (or 1.3-2.2 transfers per month per hospital).<sup>54</sup>

### **2.3 Strategic investments made and required for monitoring, evaluation, performance measurement and research**

Ideally, an administrative database should be built to monitor outcomes of models of care in interaction with patients’ health and social characteristics. The database should link pan-Canadian efforts already under way to establish an interprofessional collaborative health treatment monitoring and evaluation system. In terms of sources of information for the database, an optimal approach would be to link the following:

- ▼ The Vital Statistics Council of Canada and Statistics Canada. These groups have information about every Canadian resident as well as information about the characteristics of their family unit. This information could be updated periodically for births, deaths, and migration in and out of the population.

- ▼ The Canadian Institute for Health Information (CIHI). CIHI collates information from provincial and territorial governments. This information could be linked to the Statistics Canada data to determine the proportion of the Canadian population that uses health services and their characteristics.
- ▼ The Canadian Council of Cancer Registries. The information in this registry and other data registries could be linked to the CIHI information.

This linkage has begun with the Longitudinal Health and Administrative Data (LHAD) Initiative, a partnership among provincial and territorial ministries of health, Statistics Canada, CIHI, the Canadian Council of Cancer Registries, and the Vital Statistics Council for Canada. The objective of the LHAD Initiative is to ensure that key administrative data routinely collected throughout the health system can be used to undertake pan-Canadian research to improve the understanding of relationships among risk factors, socio-economic characteristics, health status measures and healthcare utilization. The Initiative complements important record linkage already being done within individual provinces. LHAD studies allow for comparisons among jurisdictions and larger studies for less common conditions or events. The LHAD Initiative is intended to establish the foundation for a Canadian record linkage system to help further the advancement of knowledge about health determinants, outcomes and their relationships. Statistics Canada is the operational arm of the LHAD partnership. Two divisions within Statistics Canada, the Health Statistics Division and the Health Analysis Division, collaborate in supporting the LHAD Initiative (<http://www.statcan.gc.ca/about-apercu/pia-efrvp/lhad-dlas-eng.htm>).

The LHAD Steering Committee set the monitoring research agenda in 2008. One of its first projects examined hospitalizations related to ambulatory care sensitive conditions (ACSCs) such as diabetes, congestive heart failure, COPD and asthma. These are commonly called “avoidable hospitalizations” and thus serve to measure the performance of the primary healthcare system.

A 2011 LHAD study identified “risk profiles” of those at greatest risk for hospitalizations. This information could be used to identify the characteristic caseload (in both primary care and home care) eligible for nurse-led team-based care. Women at the highest risk of experiencing an ACSC-related hospitalization ( $\geq 50\%$ ) were 64 years of age on average and at least 56 years old, were primarily from the lowest income quintile, had two or more comorbid conditions and were either past or current smokers. They tended to be underweight and inactive, were high users of specialist services and experienced at least one hospitalization in the previous 12 months. The characteristics of men at risk of an ACSC-related hospitalization were similar. However, the men also had the following characteristics: they were married or formerly married, they reported severe disabilities, and they used specialists four or more times in the previous year along with having one hospitalization. The study found that most of these people had family physicians and that greater access to primary care did not reduce the risk of an ACSC-related hospitalization.<sup>55</sup>

The LHAD study suggests and supports the findings and recommendations of our review, calling for different types of primary and community care services (such as access to multidisease care and prevention programs). As a result of our review, we would add that the care should be nurse-led, proactive, team-based and comprehensive as well as based on a supplemental managerial model of continuity of care. Such models are beginning to emerge in British Columbia and Newfoundland. Collaborative relationships improve health outcomes,<sup>56,57</sup> such as hospitalizations for ACSCs.<sup>58</sup>

In Ontario, provincial computerized home care data (RAI-Home Care) are available. The data document multiple dimensions of the patient’s bio-psychosocial functionalities, nurse and home care team visits and interventions, as well as the patient’s progress every six months. This system is, or can be, used to document the nursing model of care (for example, wound care for chronic diabetic foot or venous

leg ulcers), its intensity and how it combines with other health providers.<sup>59,60</sup> The Institute for Clinical Evaluative Sciences (ICES) can relate this database to the use of hospital, emergency, laboratory and physician services, making for more robust analysis. And, as is being done in Manitoba, ICES can also link social services information to this file.

Ultimately, an investment in such a multisectoral linked data system that is also linked to Statistics Canada and the LHAD database can provide the following:

- the age, sex, income and other socio-economic indicators for a whole provincial or pan-Canadian population
- the subgroups of each provincial population with one, two, three or more types of chronic comorbidities
- the cumulative use of home care, primary care, physician specialist care, and hospital, emergency and laboratory services by subgroups of persons with chronic comorbidities

After adjusting for differences in number and type of comorbidities, the analysis could identify socio-economic status, age, sex, living arrangements and the models of nurse home care or nurse primary care most associated with positive patient outcomes (gains in functional status, mood, etc.) and could determine the use of resources attributable to each model.

In addition, Canada Health Infoway receives federal funding to support the development of pan-Canadian individual patient electronic health records. These can also be used for monitoring and evaluation. The May 2011 Infoway report reported on the use of telehealth when clinicians and patients are not in the same location.<sup>61</sup> Telehealth refers to “live video conferencing,” “store and forward solutions,” and access to care and time to treatment. It has been estimated to save from \$8 million to \$14 million annually: a 30% to 40% saving of Canadian radiologists’ time to support care and improve access to remote populations.

Some of these savings could be reinvested to analyze patient and system outcomes associated with nurse-led or nurse-involved models of care. Large pan-Canadian variations in patient and system outcomes for common chronic illnesses could be identified, after adjusting for patient characteristics. A review of models of care used could occur. In this way, a much needed health system accountability device would evolve.

Most recently, the Kingbridge Forum (April 27-28, 2011) explored promising trends, such as the information technology-enabled patient, the mobile healthcare provider and new service delivery models inspired by social networks that, if implemented, should help us understand and measure how patients and health providers work together.<sup>62</sup> This annual forum is sponsored by the Health Division of the Information Technology Association of Canada (ITAC Health) and the Canadian Medical Association, with support from the Canadian Healthcare Association, the Canadian Pharmacists’ Association and the Canadian Nurses Association.

In summary, savings from efficiencies derived from nurse-led models of chronic care and by information systems could be invested in more data analyst personnel required for the evaluation of nursing team interventions.



## 2.4 A last word

Multiple award-winning journalist André Picard (2000) gave visibility to nurses and summarized their voice in his book *Critical Care: Canadian Nurses Speak for Change*. The following statements from that book highlight some ideas that are relevant to our review of nursing interventions:<sup>63</sup>

It is crucial for nurses that they speak up, to protect and defend their important role. But it is doubly important for patients, because nurses are not only their principal caregivers, but also their chief advocates. In the debate over health care reform, the collective voice of Canada's 263,000 nurses has been largely ignored, often with devastating results. (pp. 1–2)

This invisibility is, at once, a blessing and a curse. We don't really give much thought to what nurses do because we know, above all, that they do good. Nurses are, by far, the most trusted professionals in Canada. In the annual "Public Trust Index", a survey conducted by Pollara to gauge which professionals are the most trusted, nurses are always on top, garnering around 97 per cent. (pp. 3–4)

If nurses are so valued by patients, why is the profession not equally valued in our society? Regrettably, while it is rarely stated to be the case, caring is generally regarded as something lesser than medical intervention, and as women's work. There is also an unstated belief that caring and compassion, the hallmarks of a good nurse, can be provided by virtually anyone. (p. 4)

Make no mistake about it: nurses are tired of being taken for granted. (p. 4)

As a 90-year-old man with colon cancer said to me [Picard] in Victoria: "You only need to be a patient one time to know the value of nursing." (p. 8)

Nothing in the conclusions of our 2012 review is new. Picard also noted the following:

[In Mussallem's] 1963 CNA submission to the Royal Commission on Health Care, titled "Putting the Health Back into Health Care", she called for a shift to community care, and a massive investment in preventive medicine, not to mention a call for all doctors to be salaried; these recommendations were ignored by Mr. Justice Emmett Hall, but, almost forty years later, are being touted as the remedies for an ailing health-care system. (p. 12)

Mussallem wrote another groundbreaking report in 1969, titled "The Changing Role of the Nurse". Laid up after a serious back injury, she envisaged the idea of community-based health clinics run by nurses and established in shopping malls, nursing homes, churches, and other places people congregate. The idea was to have nursing posts as community institutions, and every citizen would report to the nurse, whether sick or well. They would be the gatekeepers to the health system. (p. 12)

... Mussallem held: that universality should apply not only to physician and hospital services, but also to community-based programs such as nurse-staffed clinics and home care. (p. 13)

Nurses are involved in usual care under a physician-led model and are instructed to function at the physician's direction, often below their ability.

We have had a physician-led model of healthcare for several centuries and an insured physician led model for the past 50 years that has focused on episodic acute care. In the current context of people with multiple chronic conditions, it is time to test the value of a nurse-led proactive, targeted model of comprehensive chronic care, with a physician as one member of a team where all are doing what they do best and the nurse is enlisting all the health and social services that can augment the determinants of a person's health.

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## APPENDIX A: SEARCH TERMS WITH RESULTS, CRITERIA AND STRATEGIES

### I) Search terms, sources and search results tracking sheet

The beginning of our search focused on “systematic reviews” and “nursing interventions” published in 2004-2011, which resulted in a large, unmanageable amount of papers. Therefore, we broke down these categories and included search terms such as “hospitalization rates,” “emergency use,” “access to care,” “symptom management,” “hypertension control,” “diabetes control,” “costs,” “economic analyses,” “functional status,” “activities of daily living” and “use of nursing homes.” We added additional keywords to “nursing interventions,” such as “elderly,” “caregivers,” “cognitive functional states,” “cardiovascular health – hypertension,” “oncology,” “diabetes,” “nursing specialists,” “nurse practitioner,” “symptom management,” “pressure ulcers,” “wound care,” “neonatal care,” “depression,” “psychosocial functioning,” “nurse staffing levels,” “models of care,” “acute care,” “community care” and “patient outcomes.”

We used the following search engines:

- United States Preventive Services Task Force – Agency for Health Care Research Quality (AHRQ)
- Scottish Intercollegiate Guidelines Network (SIGN)
- National Institute for Clinical Excellence (NICE)
- Health Evidence Network (HEN)
- The Cochrane Collaboration
- Canadian Agency for Drugs and Technologies in Health
- CINAHL
- PubMed
- www.bmj.com
- Thomson Reuters (formerly ISI) Web of Knowledge
- Trip Database
- www.health-evidence.ca
- Medscape
- Health Economic Evaluations Database (HEED)

We also searched the grey literature and undertook searches of Google, Google Scholar, and Advanced Google Scholar.

As the search continued we realized that this strategy also generated large volumes of paper, so we broke down the main search topics to include “randomized controlled trials.” We tried to be consistent in using the same words, but this was not always possible depending upon the database selected.

The main sources of literature were retrieved from extensive searches of the following electronic databases (the numbers in parentheses refer to search numbers):

- Cochrane Library (1)
- Thomson Reuters (formerly ISI) Web of Knowledge: Web of Science database (2)
- CINAHL (3)
- PubMed (4)
- Trip Database (6)

The tracking sheet that follows outlines the various search results and keyword combinations used to search 10 different databases. Further details of our search criteria and strategies appear after that.

Tracking Sheet: Search Results and Keyword Combinations

DATABASE AND KEYWORDS (COMMAS NOT USED IN SEARCH)	NUMBER OF HITS	SCREENED AND QUALITY ASSESSED	REVIEWED	EXCLUDED	INCLUDED	BEST REVIEWS/ STUDIES BY FIRST AUTHOR AND YEAR	EXCLUDED REVIEWS/STUDIES AT PHASE 3
Search 1: Cochrane Library Nursing interventions, systematic reviews, randomized controlled trials, patient outcomes, hospitalization, emergency use	408	56	56	44	12	4 (Reviews) Whellan 2005 Bussey-Smith 2007 Sinha 2011 Hastings 2005	3 (Reviews) <ul style="list-style-type: none"> <li>▶ Whellan 2005 – includes studies previously reviewed and included</li> <li>▶ Bussey-Smith 2007 – not nursing intervention but computerized asthma patient education programs</li> <li>▶ Sinha 201 – qualitative analysis of essential elements of an emergency department geriatric case management model</li> </ul>



Tracking Sheet: Search Results and Keyword Combinations

DATABASE AND KEYWORDS (COMMAS NOT USED IN SEARCH)	NUMBER OF HITS	SCREENED AND QUALITY ASSESSED	REVIEWED	EXCLUDED	INCLUDED	BEST REVIEWS/ STUDIES BY FIRST AUTHOR AND YEAR	EXCLUDED REVIEWS/STUDIES AT PHASE 3
Search 2: Web of Science (from former ISI Web of Knowledge) Nursing interventions, systematic reviews, randomized controlled trials	390	120 (6 duplicates)	114	56	58	22 (Reviews) Schadewald 2011, McLean 2011, Oredsson 2011, Gordon 2011, Clark 2010, Gallagher 2010, Polisena 2009, Mattila 2008, Renfrew 2009, Wilson 2009, Leis 2009, Duke 2009, Choi 2008, Parker 2008, Bouman 2008, Nilsson 2008, Beswick 2008, Halbert 2007, Wagg 2007, Milisen 2005, Taylor 2005, Huss 2008	15 (Reviews) <ul style="list-style-type: none"> <li>▶ Gordon 2011 – low score and poor economic evaluation</li> <li>▶ Clark 2010 – low score</li> <li>▶ Gallagher 2010 – low score</li> <li>▶ Polisena 2009 – poor quality of studies; no report of resource use or costs</li> <li>▶ Mattila 2008 – mixture of designs including descriptive and case studies</li> <li>▶ Renfrew 2009 – broad range of designs including case series</li> <li>▶ Wilson 2009 – not provided by nursing</li> <li>▶ Leis 2009 – not always provided by nurses or some level of professional (psychologist)</li> <li>▶ Duke 2009 – different approaches to providing education not provided by nursing</li> <li>▶ Choi 2008 – score too low</li> <li>▶ Parker 2008 – not nursing intervention, psychology and occupationally therapy</li> <li>▶ Bouman 2008 – score too low</li> <li>▶ Nilsson 2008 – not nursing, music</li> <li>▶ Wagg 2007 – no measure of resource use</li> <li>▶ Taylor 2005 – poor quality of studies included</li> </ul>

Tracking Sheet: Search Results and Keyword Combinations

DATABASE AND KEYWORDS (COMMAS NOT USED IN SEARCH)	NUMBER OF HITS	SCREENED AND QUALITY ASSESSED	REVIEWED	EXCLUDED	INCLUDED	BEST REVIEWS/ STUDIES BY FIRST AUTHOR AND YEAR	EXCLUDED REVIEWS/STUDIES AT PHASE 3
<b>Search 3: CINAHL</b> Nursing interventions, systematic reviews, randomized controlled trials Systematic reviews, nursing outcomes, randomized controlled trials Systematic reviews nursing interventions outcomes	85	17 (2 duplicates)	15	6	9	1 (Review) Wong 2001	0
<b>Search 4: PubMed</b> Systematic reviews, randomized controlled trials, nursing outcomes, hospitalization costs Systematic reviews, randomized controlled trials, nurse case manager Systematic reviews, randomized controlled trials, nursing outcomes	28	13 (8 duplicates)	5	0	5	0	0

Tracking Sheet: Search Results and Keyword Combinations

DATABASE AND KEYWORDS (COMMAS NOT USED IN SEARCH)	NUMBER OF HITS	SCREENED AND QUALITY ASSESSED	REVIEWED	EXCLUDED	INCLUDED	BEST REVIEWS/ STUDIES BY FIRST AUTHOR AND YEAR	EXCLUDED REVIEWS/STUDIES AT PHASE 3
<p><b>Search 5: Cochrane Database of Systematic Reviews</b>                      Systematic reviews, randomized controlled trials, nurse case management                      Systematic reviews, randomized controlled trials, nursing outcomes, emergency                      Systematic reviews, randomized controlled trials, nursing outcomes, hospitalization costs                      Patient outcomes, hospitalization costs, emergency use, economic evaluations, randomized controlled trials                      Systematic reviews, nursing outcomes                      Reviews, randomized controlled trials, nursing care, patient costs                      Reviews, randomized controlled trials, effect of nursing care on patient and health system outcomes                      Systematic reviews, randomized controlled trials, nursing outcomes</p>	200	93 (47 duplicates)	46	27	19	12 (Reviews) De-Morton 2009, Gibson 2009, Dieterich 2011, Dowsell 2009, Hesse 2011, Malone 2010, Ellis 2011, Ram 2009, Loveman 2009, Inglis 2010, Bunn 2009, Laurant 2009	4 (Reviews) Dowsell 2009 – only 3 trials (biased sample sizes too small) De-Morton 2009 – exercise provided by physiotherapy, poor quality trials Hesse 2011 – case management probably not provided by nurses Bunn 2009 – telephone consultation provided by MDs

Tracking Sheet: Search Results and Keyword Combinations

DATABASE AND KEYWORDS (COMMAS NOT USED IN SEARCH)	NUMBER OF HITS	SCREENED AND QUALITY ASSESSED	REVIEWED	EXCLUDED	INCLUDED	BEST REVIEWS/ STUDIES BY FIRST AUTHOR AND YEAR	EXCLUDED REVIEWS/STUDIES AT PHASE 3
<p><b>Search 6: Trip Database</b>                      Nursing interventions,                      systematic reviews,                      health costs</p>	Evidence-based = 356 Systematic reviews = 1035	250 (38 duplicates)	212	149	63	6 (Reviews) Raman 2008 Kim 2005 Holland 2005 Kane 2007 Langhorne 2005 Phillips 2004  30 (Studies) Graves 2009, Hurwitz 2005, Williams 2009, Harris 2005, Steuten 2007, Dawes 2005, Torrance 2006, Brumley 2007, Priebe 2006, Kenrick 2006, Harris 2008, Loeb 2006, Scott 2005, Aiken 2008, Cuthbertson 2009, Elia, 2008, Latour 2007, Dunagan 2005, Chan 2009, Higginson 2009, Goodman 2008, Rafferty 2005, Gary 2009, Castro 2004, Naylor 2004, Griffiths 2004, Davison 2005, Kalra 2004, Vass 2005, Svoren 2003	6 (Studies) Graves 2009 – low score Priebe 2006 – not nursing Elia 2008 – low score Svoren 2003 – low score Steuten 2007 – poor methodology Aiken 2008 – low score

Tracking Sheet: Search Results and Keyword Combinations

DATABASE AND KEYWORDS (COMMAS NOT USED IN SEARCH)	NUMBER OF HITS	SCREENED AND QUALITY ASSESSED	REVIEWED	EXCLUDED	INCLUDED	BEST REVIEWS/ STUDIES BY FIRST AUTHOR AND YEAR	EXCLUDED REVIEWS/STUDIES AT PHASE 3
<b>Search 6b: McMaster Nurse-Led Randomized Controlled Trials</b> Not part of the literature review process and therefore not included in Figure A1.	-	8	8	-	8	9 (Studies) Browne 2001, Browne 2002, Harrison 2002, Markle-Reid 2006, Markle-Reid 2010, Markle-Reid 2011, Mills 2010, Roberts 1995, Roberts 1999	0
<b>Search 7: Health Evidence</b> (www.health-evidence.ca) Nursing interventions Economic healthcare resource	162 (only allowed to access 50 results) + 5 = 55	6 (3 duplicates)	3	2	1	1 (Review) Spijker 2008	0
<b>Search 8: Medscape</b> Nurse led trials, hospitalization costs	163	20 (3 duplicates)	17	7	10	5 (Studies) Schuttelaar 2011, Tijhuis 2002, Tijhuis 2003, Ricauda 2008, Coleman 2006 4 (Studies) Krumbolz 2002, Rich 1995, Kasper 2002, Blue 2001 1 (Review) McAlister 2001 – generally poor low-quality studies	5 (Studies) Krumbolz 2002 – poor quality Rich 1995 – poor quality Kasper 2002 – poor quality Blue 2001 – poor quality Tijhuis 2002 – used the Tijhuis 2003 follow-up article 1 (Review) McAlister 2001 – generally poor low-quality studies

Tracking Sheet: Search Results and Keyword Combinations

DATABASE AND KEYWORDS (COMMAS NOT USED IN SEARCH)	NUMBER OF HITS	SCREENED AND QUALITY ASSESSED	REVIEWED	EXCLUDED	INCLUDED	BEST REVIEWS/ STUDIES BY FIRST AUTHOR AND YEAR	EXCLUDED REVIEWS/STUDIES AT PHASE 3
Search 9: Health Economic Evaluations Database (HEED)	69	6	6	4	2	1 (Review) Klertsy 2011 1 (Study) Herbert 2008	0
Search 10: Value in Health (www.onlinelibrary.wiley.com) Nurse led reviews, RCTs, hospitalization costs, economics	1131	15 (2 duplicates)	13	11	2	2 (Reviews) Keleher 2009 Griffiths 2009	0

## II) Criteria and guidelines for the conduct of systematic reviews of studies and reviews

Various guidelines and criteria exist for the appraisal of studies within a systematic review. One such guideline for assessing health care interventions is the PRISMA Statement (Preferred Reporting Items for Systematic Reviews and Meta-Analyses), which consists of a 27-item checklist and a four-phase flow diagram ([www.prisma-statement.org](http://www.prisma-statement.org)).<sup>i</sup> This statement addresses all criteria for a high-quality study including subgroup analysis, with the exception of a conceptual framework that could specify the mediators and moderators of the effectiveness of an intervention.<sup>ii</sup>

As well, there are suggested methods and recent guidelines for assessing the quality of systematic reviews of reviews.<sup>iii</sup> These guidelines are known as AMSTAR<sup>iv</sup> (Table A1), which is a recently developed measurement tool to assess systematic reviews. Additional quality criteria added to the AMSTAR criteria are reviews of nursing care studies that check for the following:

- a theoretical framework
- a measure of fidelity or intensity of the intervention
- a subanalysis or “realist review” that explores whether a patient subgroup benefits from the nursing intervention<sup>v</sup>

**Table A1: Assessment of the Interrater Agreement for AMSTAR**

Items	Kappa	(95% Confidence Limits)
1. Was an “a priori” design provided?	0.80	(0.63, 0.90)
2. Was there duplicate study selection and data extraction?	0.80	(0.17, 0.81)
3. Was a comprehensive literature search performed?	0.72	(0.40, 0.87)
4. Was the status of publication (e.g. grey literature) used as an inclusion criterion?	0.38	(0.28, 0.70)
5. Was a list of studies (included and excluded) provided?	0.56	(0.07, 0.79)
6. Were the characteristics of the included studies provided?	0.74	(0.45, 0.86)
7. Was the scientific quality of the included studies assessed and documented?	0.42	(0.23, 0.72)
8. Was the scientific quality of the included studies used appropriately in formulating conclusions?	0.74	(0.45, 0.87)
9. Were the methods used to combine the findings of studies appropriate?	0.45	(0.12, 0.70)
10. Was the likelihood of publication bias assessed?	0.88	(0.75, 0.94)
11. Were potential conflicts of interest included?	0.92	(0.83, 0.96)

AMSTAR: a measurement tool to assess systematic reviews<sup>vi</sup>

For assessing the quality of systematic reviews, we also added input, process and output criteria to the AMSTAR guidelines (Table A2).<sup>vii</sup>

**Table A2: Input, Process and Outcome Criteria for the Assessment of Systematic Reviews**

INPUTS	
1	Which populations are likely to benefit?
2	What is the context (setting) of the intervention?
3	What are the characteristics of providers?
PROCESSES – COMPONENT AND DOSAGE RECEIVED	
4	Which program components were most effective?
5	What was the visit intensity and duration?
6	What was the length of follow-up?
OUTPUT – EFFECTIVENESS	
7	Effects on mortality
8	Effects on health and functional status
9	Effects on care of users
OUTPUT – EFFICIENCY	
10	Wait times
11	Hospital admission/stay
12	Use of emergency room
13	Use of nursing homes
14	Use of other health and social services
15	Economic evaluation
OUTPUT – DURATION OF FOLLOW-UP	

### III) Specific objective of the review of literature and systematic reviews of nursing interventions

In our review of reviews and studies we simultaneously assessed the comparative effects and costs of augmenting usual healthcare with specialty models of nursing care interventions (with and without interdisciplinary teams) for people with chronic diseases and circumstances.

### IV) Search strategy and methods

We conducted a search of the systematic review literature published between 2004 and 2011 regarding the effects of nursing interventions on patient outcomes and health resource utilization, especially hospitalizations, use of emergency departments and physician visits, or on total direct costs for healthcare.

Reviews of such literature published between 2002 and 2004 were typically judged to be of poor quality, based on the CONSORT 2010 Statement.<sup>viii</sup> Often the older literature contained studies of varying research quality, which meant that the conclusions of the reviews, typically, were equivocal.<sup>ix</sup> Further, health resource use or costs only recently began to be consistently included in studies and therefore in reviews.



We searched years from 2004 to 2011 in the Cochrane Library and Cochrane Database of Systematic Reviews, CINAHL, Web of Science, PubMed, Trip Database and databases recommended by L. Piazza (personal communication) – Health Evidence, Medscape, Health Economic Evaluations Database and Value in Health – along with the System-Linked Research Unit studies from McMaster University.

The search terms and count of potentially relevant studies and reviews for each of our searches are all provided in Appendix A (Tracking Sheet and Figure A1). Generally, the searches included some combination of the following terms: “nurse interventions,” “reviews,” “hospitalizations” and “costs.” We also searched for individual studies between 2004 and 2011 because this information has often been missed in reviews during the same period.

Reviewer G. Browne performed an initial scan of titles and abstracts of reviews and studies, using the following eligibility, inclusion and exclusion criteria.

## V) Eligibility criteria

The reviews and studies of nursing interventions we reviewed were based on:

- interventions that replaced, or *substituted*, versus *supplemented* usual healthcare
- *nurse-led* interventions or situations where nurses were involved in special team care
- interventions involving nurses with *basic training* with *added* specific training for the index condition or interventions involving *advanced practice nurses* with disease-specific *master’s level training*, such as clinical nurse specialists and nurse practitioners (most recently referred to as advanced practice nurses)

## VI) Exclusion criteria

We excluded from our review studies of technological devices. We also excluded economic evaluations if the methodology required assumptions about resource use or costs, or provided estimates instead of measurement of actual resources used. As well, we excluded reviews of interventions typically provided by nurses, such as telephone support, if less than 50% of the interventions being studied were provided by nurses. (For example, pharmacists often provide telephone support; so if a study involved pharmacists and nurses providing support, we excluded the review or study if the nurse-provided support was for less than 50% of the interventions.)

## VII) Inclusion criteria

We included in our review of reviews and individual studies of nursing interventions only reviews and studies with comparative designs that met a minimum quality-of-study score of 16 (out of 21) with regard to specific criteria and that examined both patient outcomes and use of health system resources or costs. We were particularly interested in the following measures of resources:

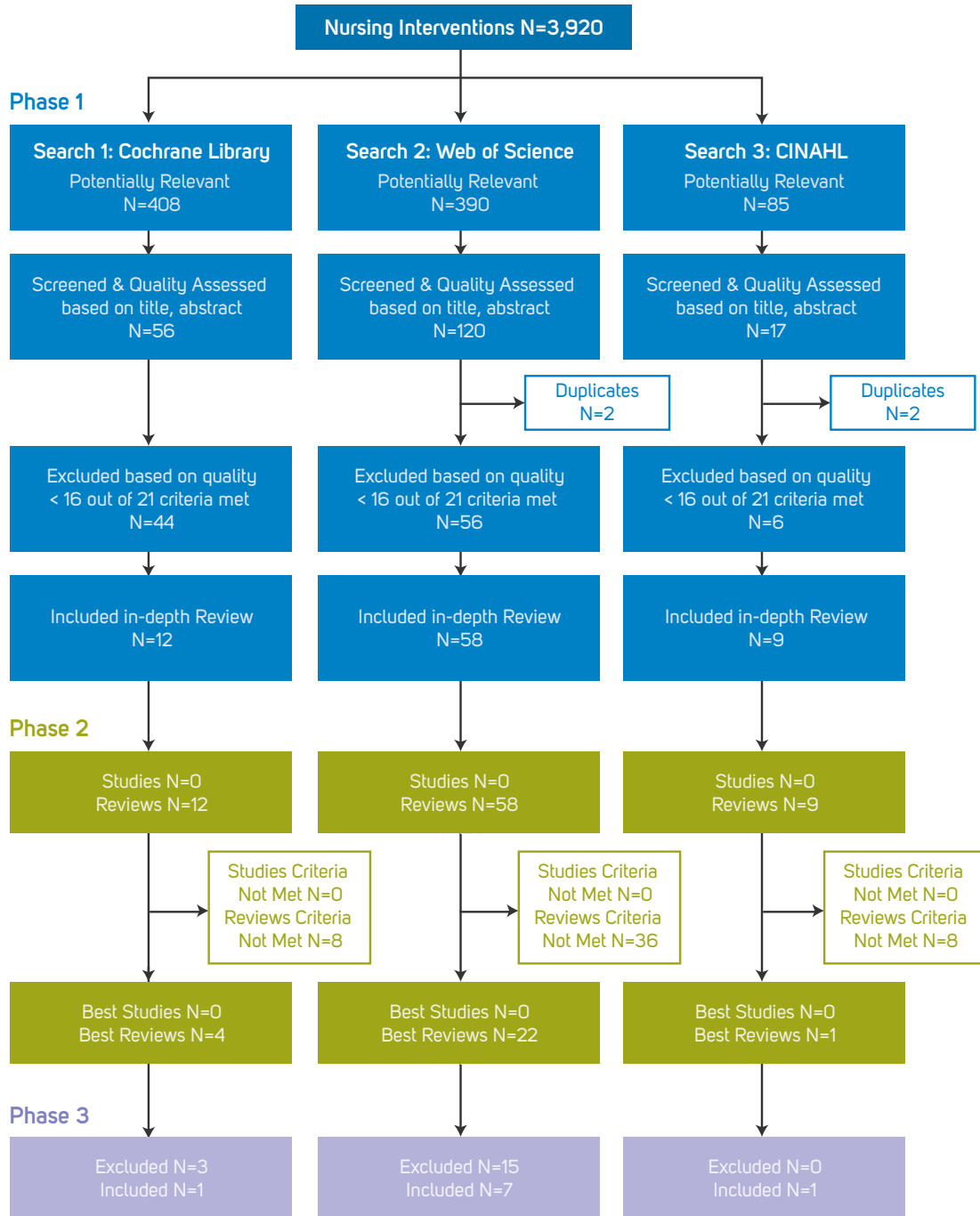
- hospitalizations
- hospital days
- emergency department visits
- nursing home admission
- total direct costs from the payer perspective, since these are the most costly resources (Very few studies featured a societal economic perspective, and we included only direct costs from those studies to consistently report the direct cost of health system resource use.)

## VIII) Grading the quality of the evidence

We graded the quality of the reviews using the AMSTAR<sup>x</sup> measurement tool, with additional items from Williams et al. (2009)<sup>xi</sup> and Sidani and Sechrest (1999).<sup>xii</sup> In grading the quality of reviews, this report's lead author (G. B.) assessed the study title and abstract of the review initially to determine if it should be included in this review and then a second time two weeks later when summarizing the quality of selected reviews. A third opportunity arose to determine whether to exclude studies and reviews if the intervention was not regularly provided by nurses or did not include nursing personnel. The reviews and studies that we selected, which met 75% of the quality criteria before we examined their results, are provided in Table A3. Excluded reviews and studies and reasons for their exclusion are listed in Appendix B.

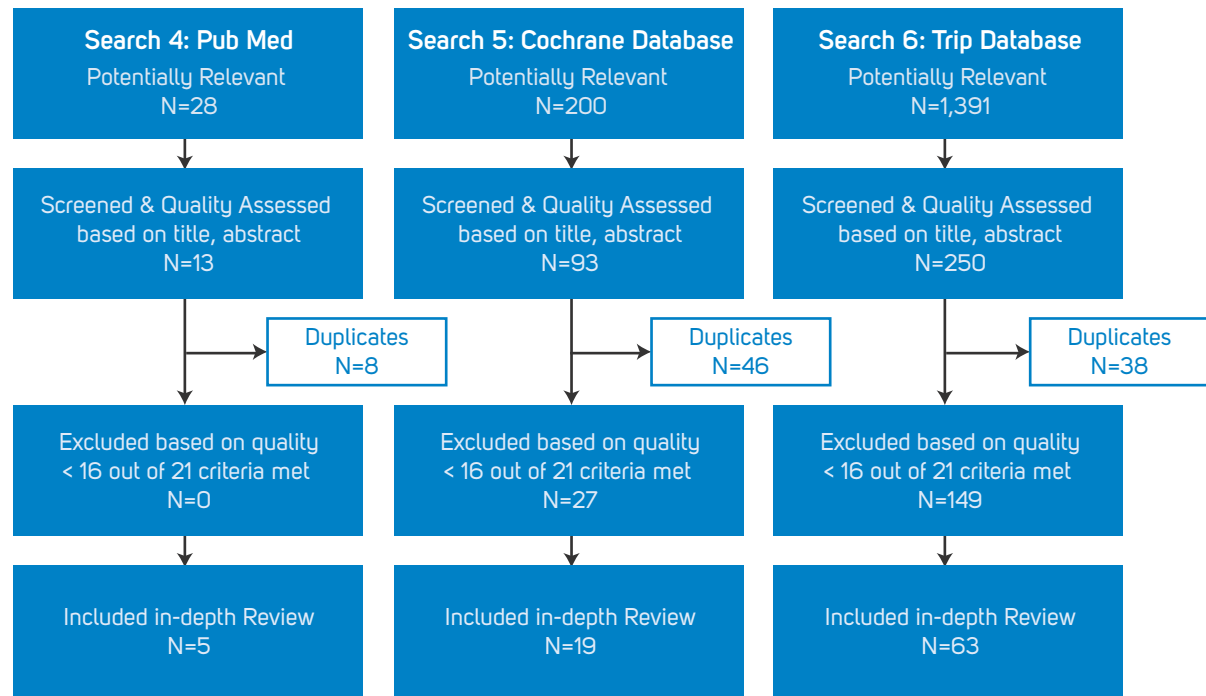
The 10 sources and the total number of reviews and studies about nursing practice included in this review are outlined in Figure A1.

Figure A1: Literature Review Process

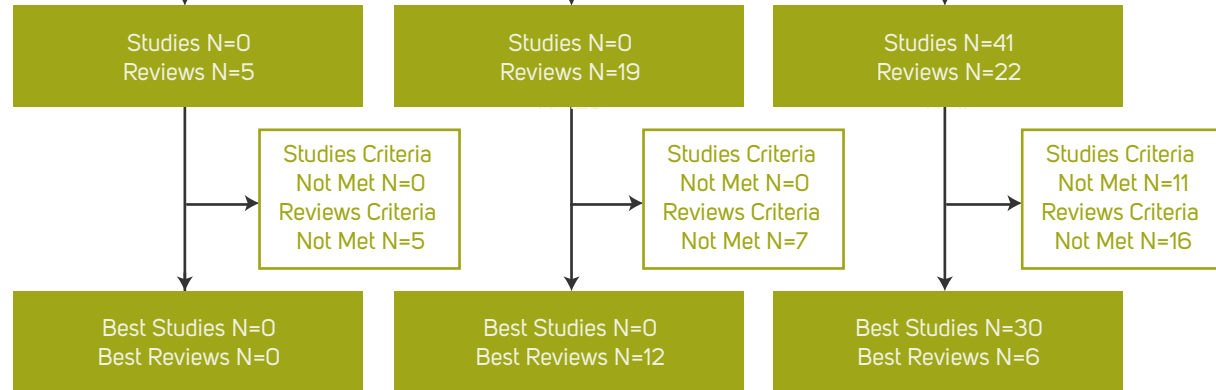


**Figure A1: Literature Review Process (continued)**

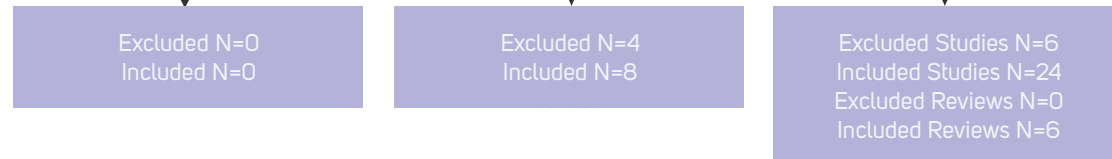
**Phase 1**



**Phase 2**

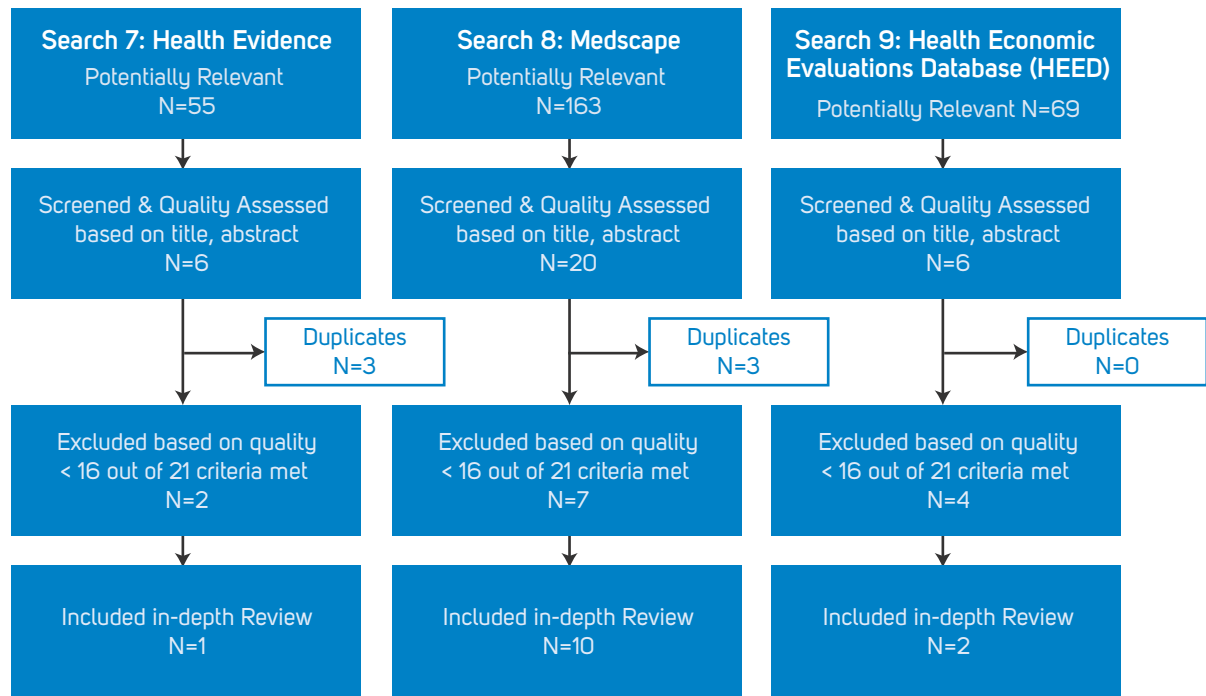


**Phase 3**

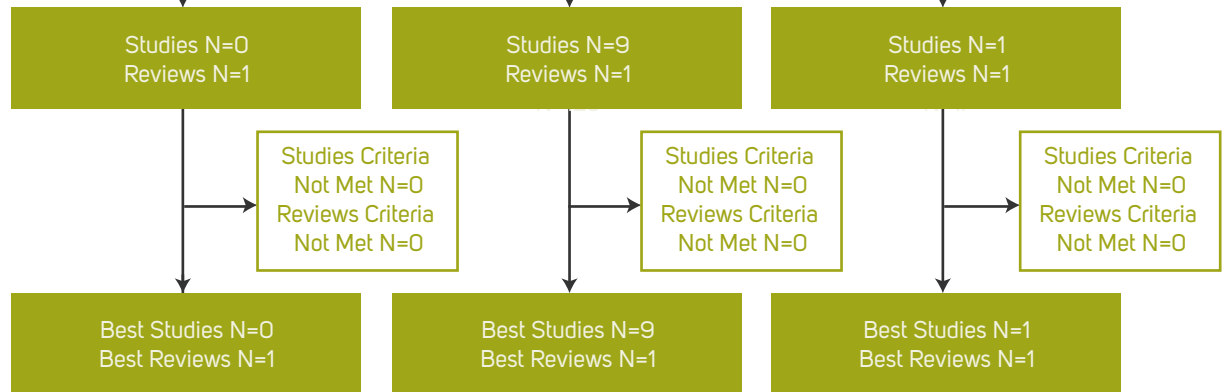


**Figure A1: Literature Review Process (continued)**

**Phase 1**



**Phase 2**



**Phase 3**

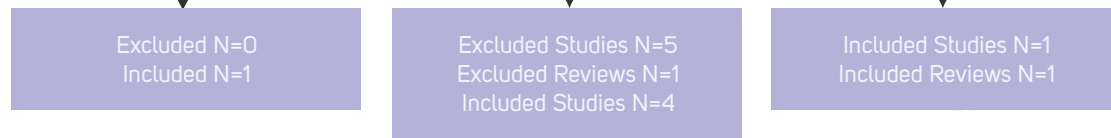


Figure A1: Literature Review Process (continued)

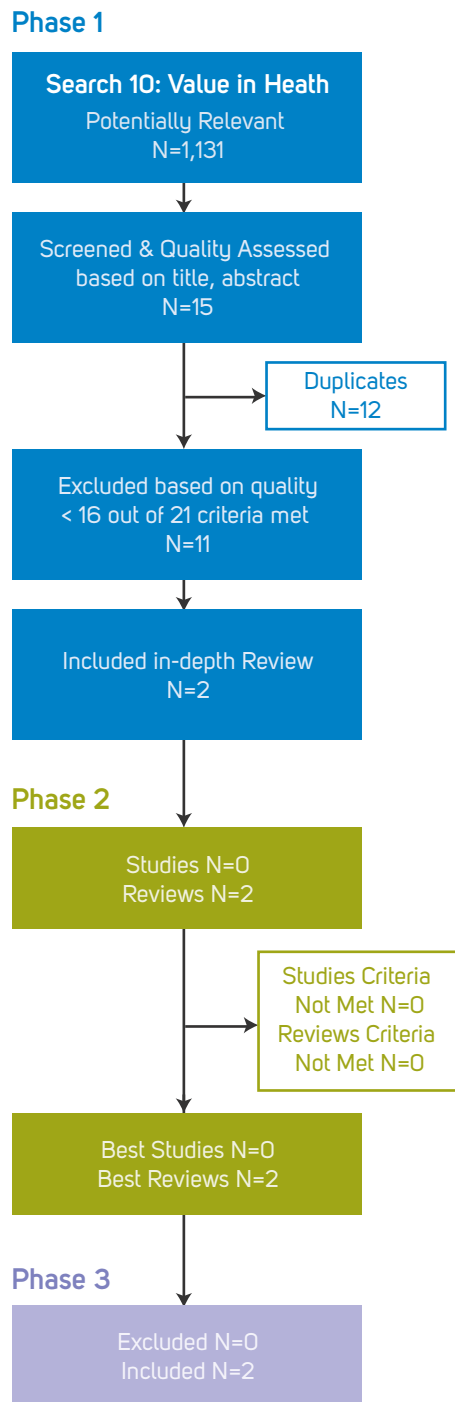
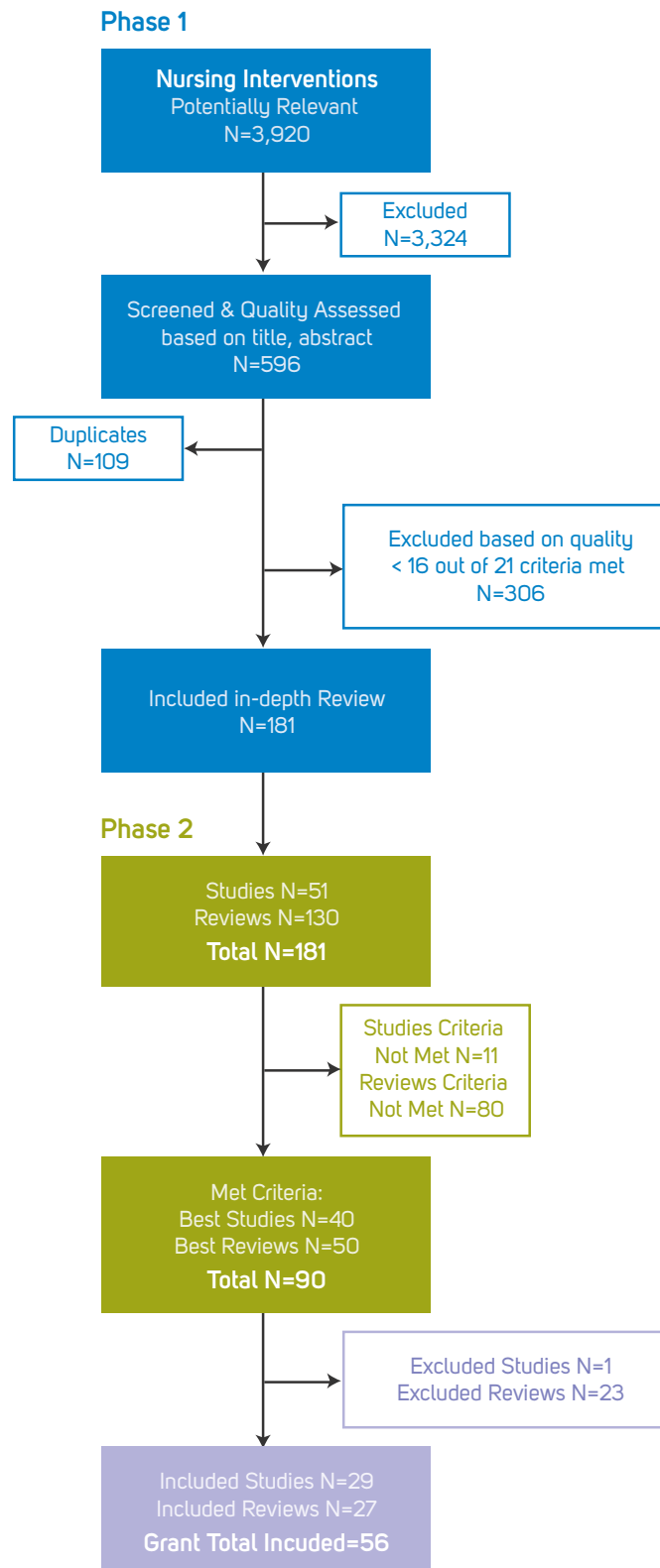


Figure A1: Literature Review Process (continued)



**Table A3: Quality Assessment of 27 Included Reviews**

CRITERIA FOR REVIEW	
1. Appropriate question design	12. Conflict of interest and source of support in both the reviews and included studies
2. At least 2 independent data extractors and consensus procedure	13. Theoretical framework
3. At least 2 electronic data sources and search strategy and key words	14. Fidelity to the intervention
4. Any reports excluded because of publication status or language	15. Subanalyses? Populations likely to benefit
5. A list of included studies	16. Context of the intervention
6. A list of excluded studies	17. Characteristics of providers
7. Characteristics of participants, interventions and outcomes	18. Program components
8. For effectiveness studies, RCTs with concealment	19. Visit intensity and duration
9. Scientific quality of included studies used in formulating conclusions	20. Effects
10. For pooled results, test for homogeneity/heterogeneity	21. Efficiency?
11. Assess publication bias: use of funnel plot or statistical tests	

**Codes**

+ = Yes, Addressed

NA = Not Applicable

- = Not Addressed

RA = Research Agenda

PM = Practice Model



**Table A3: Quality Assessment of 27 Included Reviews**

Review (Author, Year and Title)	Coding of Criteria Results																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Beswick, A. D. et al. (2008). Complex interventions to improve physical function in elderly people.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Dieterich, M. et al. (2010). Intensive case management for severe mental illness.	+	+	+	+	+	+	+	+	+	+	+	+	-	+	-	-	+	+	+	+	+	+
Ellis, G. et al. (2011). Comprehensive geriatric assessment for older adults admitted to hospital.	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+
Gibson, P. G. et al. (2009). Self-management education and regular practitioner review for adults with asthma.	+	+	+	+	+	+	+	+	+	+	-	-	-	-	-	+	+	+	+	+	+	+
Griffiths, P.D. et al. (2009). Effectiveness of intermediate care in nursing-led inpatient units.	+	+	+	+	+	-	+	+	+	+	-	+	+	+	-	+	+	+	+	+	+	+
Halbert, J. et al. (2007). Multi-disciplinary rehabilitation after hip fracture is associated with improved outcome.	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	+	+	-	+	+	+

**Table A3: Quality Assessment of 27 Included Reviews**

Review (Author, Year and Title)	Coding of Criteria Results																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Hastings, S. N. and Heflin, M. T. (2005). Interventions for elders discharged from the emergency department.	+	+	+	+	+	-	+	+	+	NA	-	+	+	+	-	+	+	+	+	+	+	+
Holland, R. et al. (2005). Systematic review of multidisciplinary interventions in heart failure.	+	+	+	+	+	-	+	+	+	+	+	-	+	+	-	+	-	+	+	+	+	+
Huss, A. et al. (2008). Multidimensional preventive home visit programs for community-dwelling older adults.	+	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Inglis, S. C. et al. (2010). Structured telephone support or telemonitoring for patients with chronic heart failure.	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+
Kane, R.L. et al. (2007). Association of registered nurse staffing levels and patient outcomes.	+	+	+	+	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+
Keleher, H. et al. (2009). Systematic review of the effectiveness of primary care nursing.	+	+	+	+	+	+	+	+	+	-	-	+	+	-	-	+	+	+	+	+	+	+

**Table A3: Quality Assessment of 27 Included Reviews**

Review (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Kim, Y. J. & Soeken, K. L. (2005). Meta-analysis of the effect of hospital-based case management on hospital length-of-stay and readmission.	+	+	+	+	+	-	+	+	+	+	+	-	+	-	+	+	+	+	-	+	+
Klersy, C. et al. (2011). Economic impact of remote patient monitoring.	+	+	+	+	+	-	+	+	+	+	-	+	+	+	-	+	+	+	+	+	+
Langhorne, P. et al. (2005). Early supported discharge services for stroke patients			+	+	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+
Laurant, M. et al. (2004). Substitution of doctors by nurses in primary care.	+	+	+	+	+	+	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+
Loveman, E. et al. (2009). Specialist nurses in diabetes mellitus.	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	+	+	-	+	+
Malone, D. et al. (2009). Community mental health teams for people with severe mental illnesses.	+	+	+	+	+	+	+	+	+	-	-	+	+	-	+	+	+	+	-	+	+
McLean, S. et al. (2011). Telehealth care for asthma.	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+	-	+	+
Milisen, K. et al. (2005). Multicomponent intervention strategies for managing delirium in hospitalized older people.	+	+	+	Multiple languages	+	-	+	+	+	-	-	+	-	+	+	+	+	+	+	+	+
Oredsson, S. et al. (2011). Triage interventions in emergency department.	+	+	+	+	+	-	+	+	+	-	-	+	+	-	+	+	+	+	+	+	+

**Table A3: Quality Assessment of 27 Included Reviews**

Review (Author, Year and Title)	Coding of Criteria Results																					
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	
Phillips, C.O. et al. (2004). Comprehensive discharge planning with post-discharge support for older patients with congestive heart failure.	+	+	+	+	+	-	+	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+
Ram, F. S. et al. (2004). Hospital at home for patients with acute exacerbations of COPD.	+	+	+	+	+	+	+	+	+	+	-	+	-	-	+	+	+	+	-	+	+	+
Raman, G. et al. (2008). Non-pharmacological interventions for post-discharge care in heart failure.	+	+	+	+	+	-	+	+	+	+	-	+	+	-	+	+	+	+	+	+	+	+
Schadewaldt, V. and T. Schultz, (2011). Nurse-led clinics as an effective service for cardiac patients.	+	+	+	+	+	-	+	+	+	+	+	+	+	-	-	+	-	+	-	+	+	+
Spijker, A. et al. (2008). Effectiveness of nonpharmacological interventions to delay the institutionalization of patients with dementia.	+	+	+	+	+	-	+	+	+	+	-	+	-	-	-	+	+	+	+	+	+	+
Wong, C. X. et al. (2011). Home care by outreach nursing for chronic obstructive pulmonary disease.	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	-	-	-	+	+	+

## References for Appendix A

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- 5 Williams, J., Russell, I., Durai, D., Cheung, W. Y., Farrin, A., Bloor, K. et al. (2009). Effectiveness of nurse delivered endoscopy: Findings from randomised multi-institution nurse endoscopy trial (MINuET). *BMJ*, 338, b231. PM: 19208714.
- 6 Shea, B. J., Hamel, C., Wells, G. A., Bouter, L. M., Kristjansson, E., Grimshaw, J. et al. (2009). Op. cit.
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- 11 Williams, J., Russell, I., Durai, D., Cheung, W. Y., Farrin, A., Bloor, K. et al. (2009). Op. cit.
- 12 Sidani, S. & Sechrest, L. (1999). Op. cit.

**APPENDIX B: EXCLUDED REVIEWS AND STUDIES [UNDER SEPARATE COVER]**

## APPENDIX C: RESULTS OF OUR REVIEW OF HIGH-QUALITY REVIEWS

Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Risk (CI)	Conclusion of This Reviewer
Beswick et al. (2008) Randomized controlled trials	Complex interventions to maintain independent living in the elderly Elderly and frail elderly	<p>Intensity:</p> <ul style="list-style-type: none"> <li>▶ Falls prevention</li> <li>▶ Geriatric assessment of frail elderly</li> <li>▶ Community-based care after discharge from acute hospital</li> </ul> <p>Intensity scored:</p> <ul style="list-style-type: none"> <li>▶ Number of multidisciplinary inputs</li> <li>▶ Number of scheduled visits</li> <li>▶ Duration of the intervention vs. usual care</li> </ul>	20/21	89 intervention studies 97,984 seniors	Mortality Not living at home = 40 trials Nursing home admission = 31 trials Hospital admission = 41 trials People with falls = 25 trials Physical function = 73 trials	Falls prevention = 4.3% mortality Geriatric assessment of general elderly Community-based care after hospital Geriatric assessment of general elderly Community-based care after hospital Geriatric assessment of frail elderly Community-based care after hospital Geriatric assessment and falls prevention Geriatric assessment in general and falls prevention	0.79 (0.66–0.96) 0.95 (0.93–0.97) 0.87 (0.83–0.90) 0.94 (0.91–0.97) 0.90 (0.86–0.95) SMD = -0.08 (0.11–0.06)	More effective, less costly

Abbreviations: CI = confidence interval; SMD = standard mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Results	Conclusion of This Reviewer
Dieterich et al. (2010) Randomized controlled trials	Intensive case management (ICM) for severe mental illness Ages 18-65 years	ICM versus non-ICM versus usual care Community-care setting	16/21	38 studies 7,328 participants	Length of hospital stay = 24 trials Improved global mental health (GAF scale) = 5 studies Accommodation status – not living independently Client Satisfaction Questionnaire	ICM superior to other two interventions (unclear as to the extent of types of interprofessional involvement)	Mean difference favouring ICM -0.86 (-1.37–0.34) 3.40 (1.66–5.66)	More effective, less costly
							<b>Relative Risk (CI)</b>	
							0.65 (0.49–0.88)	
							3.23 (2.31 to 4.14)	

Abbreviations: CI = confidence interval



**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Odds Ratio (CI)	Conclusion of This Reviewer
Ellis et al. (2011) Randomized controlled trials	Comprehensive geriatric assessment (CGA) for older adults admitted to hospital Dementia	Outpatient setting = 6 studies CGA on acute wards versus post-CGA acute community teams versus usual care	18/21	32 trials 10,315 participants across 6 countries	Living at home = 18 studies Reduced death or deterioration = 5 studies Reduction in institutionalization: <ul style="list-style-type: none"> <li>▼ At 6 months = 14 studies</li> <li>▼ At follow-up (MD = 12 months) = 19 studies</li> </ul> Similar readmission rate Reduced or equitable hospital costs = 4 studies	CGA on hospital wards versus in community versus usual care	1.16 (1.05–1.28)  0.76 (0.64–0.90)   0.72 (0.61–0.85) 0.78 (0.69–0.88)  .03 (0.89–1.18)	More effective, equally costly

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Ratio	Conclusion of This Reviewer
Gibson et al. (2009) Randomized controlled trials	Asthma self-management education and regular review by nurse practitioner or physician Adults > 16 years	Self-management education versus no self-management education Participants recruited from hospital, emergency department, outpatient clinics, general practice, community settings	16/21	36 studies Optimal self-management, n = 15 Self-monitoring and regular review, n = 7	Reductions in: <ul style="list-style-type: none"> <li>▶ Hospitalizations = 18 studies</li> <li>▶ Emergency room visits = 20 studies</li> <li>▶ Unscheduled doctor visits = 12 studies</li> </ul> Improved quality of life = 6 studies Reduced total direct cost = 4 studies	(Most intensive)  Optimal self-management <i>and</i> Regular review of medications	Favouring intervention  0.64 (0.50–0.82)  0.82 (0.73–0.94)  0.37 (0.14–0.99)  0.68 (0.56–0.81)  SMD = 0.29 (0.11–0.47) Effect size: 0.39 (0.10–0.68)	More effective, less costly

Abbreviations: CI = confidence interval; SMD = standard mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Odds Ratio (CI)	Conclusion of This Reviewer
Griffiths et al. (2009) Randomized controlled trials	Effectiveness of intermediate care in nursing-led units	Usual in-patient care following admission for an acute medical condition	18/21	10 RCTs or quasi-RCTs 1,896 patients	Similar mortality  Reduced discharge to institutional care  Increased functional status  Reduced early readmissions  Costs of nurse-led units	Nurse-led in-patient care	1.10 (0.56–2.16)  0.44 (0.22–0.89)  SMD = 0.37 (0.20–0.54)  0.52 (0.34–0.80)  UK studies = higher costs US studies = lower costs	More effective, less costly

Abbreviations: CI = confidence interval; RCT = randomized controlled trial; SMD = standard mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Risk (CI)	Conclusion of This Reviewer
Halbert et al. (2007)	Multidisciplinary rehabilitation after hip fracture Mean age range = 78–95 years	Proactive multidisciplinary team assessment and psychosocial care Goal to reduce disability by improving task-oriented behaviour as compared with orthopedic ward or standard care	17/21	11 studies	Mortality = 11 trials Return home = 11 trials Nursing home admission = 10 trials Length of hospital stay = 6 trials Readmission to hospital = 5 trials	Multidisciplinary team Multidisciplinary team Multidisciplinary team 4 studies = 21–56 days 2 similar = 10 days 4 trials = no difference 1 trial = less in intervention group	0.89 (0.74–1.07) 1.07 (1.00–1.15) 0.84 (0.73–0.96) n.s. n.s.	More effective, equally costly

Abbreviations: CI = confidence interval; n. s. = not significant; SMD = standard mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Number of Studies	Effective Interventions	Outcomes	Conclusion of This Reviewer	
Hastings & Heflin (2005)	<p>Improving outcomes of community-dwelling elderly 65+ and 75+</p> <p>Nurse-led emergency department (ED)- based discharge planning</p> <p>Geriatric assessment in ED, at home discharge and 4 weeks at home</p> <p>Review by multi-disciplinary team</p> <p>Referral to primary care</p> <p>Nurse case management; monthly phone call, home visit at 6 weeks</p>	Usual emergency department discharge	<p>6 randomized controlled trials (RCTs)</p> <p>2 non-RCTs with comparison group</p>	Nurse-led emergency department-based discharge planning	<p>Reduction in functional and cognitive decline</p> <p>SF-36 similar quality of life</p> <p>Similar satisfaction of carer/patient</p> <p>Increased medicine adherence</p> <p>Increased perceived well-being</p> <p>▶ Similar depression</p> <p>▶ Similar caregiver health status</p>	<p>Lower hospital admission at 30 days</p> <p>Lower emergency department admission at 18 months</p> <p>Similar mortality</p> <p>Lower nursing home admission</p>	More effective, less costly

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Risk (CI)	Conclusion of This Reviewer
Holland et al. (2005)	Multidisciplinary interventions in heart failure 1 or more planned home visit for patient self management or video phone use or physiological monitoring Intervention provided in general practice or community clinic High intensity – monthly contact multi-faceted interventions Low intensity – less frequent contact or a narrow (single) intervention	1 or more telephone calls to patient's home Education or symptom management mailings Intervention provided in hospital	17/21	30 trials	Reduced: <ul style="list-style-type: none"> <li>▶ All-cause admission to hospital</li> <li>▶ All-cause mortality</li> <li>▶ Heart failure admission</li> </ul>	Multidisciplinary interventions delivered at least partly in the home	0.87 (0.79–0.95), p = 0.002  0.79 (0.69–0.92), p = 0.002 0.70 (0.61–0.81), p < 0.001	More effective, less costly

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Odds Ratio (CI)	Conclusion of This Reviewer
Huss et al. (2008) Randomized controlled trials	Cost- effectiveness of multi-dimensional preventive home visit programs for community-dwelling older adults aged 73-83 years Younger and older adults	Home visits by MD (mean of 4.3), duration = 4 months-4 years, with geriatric assessments with clinical examinations versus usual care (4 of 21 studies had interventions in the control group) Intensity of program visits not associated with outcome	19/21	21 trials 14,603 patients	Nursing home admissions Functional decline Mortality	No effect on outcomes Younger seniors Older seniors	0.86 (0.68-1.10) 0.89 (0.76-1.03) 0.74 (0.58-0.94) 1.14 (0.90-1.43)	Equally effective, equally costly
Inglis et al. (2010) Randomized controlled trials	Structured telephone support (TS) or tele-monitoring (TM) for patients with chronic heart failure 12-18-month follow-up	Structured TS or TM versus standard practice	18/21	Structured TS = 15 studies; 5,613 participants TM = 11 studies; 2,710 participants	Reduced all-cause mortality Chronic heart failure-related hospital admissions Cost = 12 studies	TM = 112 vs. 127/1000 TM and Structured TS TM more costly than structured TS Both TM and structured TS result in cost savings compared with standard practice, ranging from 35% to 86%	0.66 (.054-0.81) p < 0.0001 0.79 (0.67-0.94) p = 0.008 0.77 (0.68-0.87) p < 0.0001	More effective, less costly

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Odds Ratio (CI)	Conclusion of This Reviewer
Kane et al. (2007) High-quality observational studies	Association between nurse staffing levels and patient outcomes	Not applicable	19/21	7 cross-sectional 4 case-control 17 cohort	Lower hospital mortality <ul style="list-style-type: none"> <li>▶ ICU</li> <li>▶ Surgical</li> <li>▶ Medical</li> </ul> In ICU: <ul style="list-style-type: none"> <li>▶ Decreased hospital acquired pneumonia</li> <li>▶ Unplanned extubation</li> <li>▶ Respiratory failure</li> <li>▶ Cardiac arrest</li> <li>▶ 24% shorter length of stay</li> </ul> In Surgical: <ul style="list-style-type: none"> <li>▶ Lower risk of failure to rescue</li> <li>▶ 31% shorter length of stay</li> </ul>	1 full-time equivalent nurse per patient day	0.91 (0.86–0.96) 0.84 (0.80–0.89) 0.94 (0.94–0.95)  0.70 (0.56–0.88)  0.49 (0.36–0.67) 0.40 (0.27–0.59) 0.72 (0.62–0.84) 0.76 (0.62–0.94)  0.84 (0.79–0.90) 0.69 (0.55–0.86)	More effective, less costly

Abbreviations: CI = confidence interval; ICU = intensive care unit



**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Result Between Groups	Conclusion of This Reviewer
Keleher et al. (2009)	<p>Primary care or community care nurses for general health problems:</p> <ul style="list-style-type: none"> <li>▶ Incontinence</li> <li>▶ Parkinson's disease</li> <li>▶ Non-emergent conditions</li> <li>▶ Bronchiectasis</li> <li>▶ Dystonia</li> <li>▶ Falls</li> <li>▶ Excessive drinking</li> </ul>	<p>Nurse-led versus doctor-led = 9 studies (replacement role)</p> <p>Specialist nursing studies excluded (supplemental)</p>	17/12	31 studies	<p>Mortality = 2 studies</p> <p>Quality of life = 7 studies</p> <p>Better compliance = 2 studies</p> <p>More knowledge = 2 studies</p> <p>More satisfaction with care</p> <p>More resource utilization</p>	<p>Nurse-led substitution for physician</p> <p>Similar</p> <p>Similar</p> <p>For nurse-led intervention = 100% vs. 81%, p = 0.024</p> <p>For nurse-led intervention</p> <p>For nurse-led intervention</p> <p>For nurse-led intervention</p>	<p>Similar</p> <p>Similar</p> <p>For nurse-led intervention = 100% vs. 81%, p = 0.024</p> <p>For nurse-led intervention</p> <p>For nurse-led intervention</p> <p>For nurse-led intervention</p>	<p>More effective, more costly</p>
Kim & Soeken (2005)	<p>Effect of hospital-based case management on hospital length of stay</p> <p>Low dose; no team</p> <p>Patients with heart failure, stroke, COPD, epilepsy; frail elderly; critically ill</p> <p>Age range = 64.5–75.6 years</p> <p>Excluded patients with mental illness</p>	<p>Nurse-led hospital-based case management:</p> <ul style="list-style-type: none"> <li>▶ Assessment</li> <li>▶ Education</li> <li>▶ Collaboration</li> <li>▶ Discharge plan</li> <li>▶ Use of protocol</li> <li>▶ Linking to resources</li> <li>▶ Monitoring home visit and phone follow-up</li> </ul>	17/21	12 studies	<p>Average weighted effect size (AWES) = 10 studies</p> <p>Readmission</p>	<p>No difference, even for high-quality versus low-quality studies, country.</p> <p>Case management effective for heart failure patients</p> <p>No difference even for:</p> <ul style="list-style-type: none"> <li>▶ high-quality studies</li> <li>▶ diagnostic group</li> </ul>	<p>Effect Size (AWES)</p> <p>0.09 (-0.03–0.22)</p> <p><b>Odds Ratio (CI)</b></p> <p>0.87 (0.64–1.1)</p> <p>0.75 (0.45–1.05)</p>	<p>Equally effective, equally costly</p>

Abbreviations: CI = confidence interval; ICU = intensive care unit

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Risk (CI)	Conclusion of This Reviewer
Klersy et al. (2011) 6 additional randomized controlled trials	Remote monitoring Either regular structured telephone contact with or without home visit and referral of symptoms and/or physiological data or Technology-assessed monitoring of physiological data Heart failure patients Median follow-up = 6 months	Remote monitoring versus usual care/ specialist clinic visits/ emergency room	18/21	21 randomized controlled trials 52% were high-quality studies	Lower hospitalizations for heart failure Lower hospitalizations = all causes Length of stay  Lower cost of care for remote monitoring per year	Remote monitoring	0.77 (0.65–0.91), p < 0.001  0.87 (0.79–0.96), p = 0.003  SMD = -0.08 (0.18–0.02), p = 0.83  Range of difference = £300–£1,000	More effective, less costly

Abbreviations: CI = confidence interval; SMD = standard mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Odds Ratio	Conclusion of This Reviewer
Langhorne et al. (2005) Randomized controlled trials	Early supported discharge services for stroke patients with rehabilitation at home Provided by multidisciplinary specialty teams	Early supported discharge from hospital versus usual hospital care	19/21	11 trials 1,597 patients	<p>Patient Outcomes:</p> <ul style="list-style-type: none"> <li>▶ Death = 11 studies</li> <li>▶ Death or institution = 9 studies</li> <li>▶ Extended activity of daily living score = 9 studies</li> <li>▶ Satisfied with outpatient services = 5 studies</li> <li>▶ Reduced adverse events</li> </ul> <p>Carer Outcomes:</p> <ul style="list-style-type: none"> <li>▶ Mood = 2 studies</li> </ul> <p>Resource Use:</p> <ul style="list-style-type: none"> <li>▶ Length of hospital stay = 9 studies</li> </ul> <p>Readmission to hospital = 5 studies</p>	<p>Early supported discharge</p> <ul style="list-style-type: none"> <li>▶ 8 days shorter</li> </ul>	<p>0.79 (0.64–0.97) p = 0.02</p> <p>0.74 (0.56–0.96) p = 0.02</p> <p>0.12 (0–0.25) p = 0.05</p> <p>1.60 (1.08–2.38) p = 0.79</p> <p>SMD = -0.19 (1.6–1.22)</p> <p>WMD = -7.7 (-10.7–-4.2) p &lt; 0.0001</p> <p>Odds ratio = 1.14 (0.80–1.63), p = 0.48</p>	More effective, less costly

Abbreviations: SMD = standard mean difference; WMD = weighted mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Conclusion of This Reviewer
Laurant et al. (2004) Randomized controlled trials Clinical controlled trials Interrupted time series	Substitution of doctors by nurses in primary care Supplemental nursing excluded	Nurse practitioners, clinical nurse specialists, advanced practice nurses, health visitors First contact and ongoing care = 7 studies First contact for urgent problems = 5 studies Management of chronic disease = 4 studies	18/21	16 studies	25 outcomes: <ul style="list-style-type: none"> <li>▶ 23 other outcomes (e.g. health status)</li> <li>▶ 2 outcomes, satisfaction and distress relief</li> </ul> Resource utilization <ul style="list-style-type: none"> <li>▶ Emergency room</li> <li>▶ Doctor visits</li> <li>▶ Hospital admission</li> </ul>	Both interventions equivalent No differences in 23 of 25 outcomes More satisfaction and relief with nurse No difference in resource use	Nurses equally effective, equally costly

Abbreviations: SMD = standard mean difference; WMD = weighted mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Significance	Conclusion of This Reviewer
Loveman et al. (2009) Randomized controlled trials and clinical controlled trials	Specialist nurses in diabetes mellitus 3 studies = nurse directly responsible 3 studies = nurse recommended to physician Age range = 45-61 years	Specialist nurse: <ul style="list-style-type: none"> <li>▶ Education</li> <li>▶ Advice on controlling diabetes</li> <li>▶ Dealing with inter-current illness</li> <li>▶ Advice and initiation of prescriptions</li> <li>▶ Learning to live with illness and routine care</li> </ul> versus Routine care and no specialist nurse	16/21	6 trials 1,382 participants	Adult HbA <sub>1c</sub> Adolescent HbA <sub>1c</sub> Subgroup analysis of HbA <sub>1c</sub> Emergency Hospitalizations Costs	Main effect, no difference Main effect, no difference Specialist nurses if HbA <sub>1c</sub> ≥ 8.0% at baseline <ul style="list-style-type: none"> <li>▶ Significant reduction</li> </ul> No difference No difference None reported	n.s. n.s. p = 0.04 n.s. n.s. n.s.	More effective for a subgroup, equally costly
Malone et al. (2009)	To evaluate the effects of a community mental health team (CMHT) for people with severe mental illness and personality disorder Adults	CMHT care versus standard non-team care UK community-dwelling adults Team = greater intensity and comprehensive care	17/21	3 studies 587 participants	More satisfied Lower hospital admissions No difference in use of: <ul style="list-style-type: none"> <li>▶ Emergency</li> <li>▶ Primary care</li> <li>▶ Social services</li> </ul>	Community mental health team	0.37 (0.2-0.8) 0.81 (0.7-1.0) 0.86 (0.7-1.1) 0.94 (0.8-1.1) 0.76 (0.6-1.0)	Equally effective, less costly

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Mean Difference	Conclusion of This Reviewer
McLean et al. (2011) Randomized controlled trials	Telehealth care for asthma Children and adults	Telephone = 9 studies Video-conferencing = 2 studies Internet = 2 studies Network communications = 1 study Text short messaging Provided by GP nurses, specialist nurses, MD specialists	16/21	21 trials	No difference in asthma quality of life	Telehealth care	0.08 (0.01–0.16)	Equally effective, less costly
							<b>Odds Ratio</b>	
							1.16 (0.52–2.58)	
							0.47 (0.01–36.46)	
							0.21 (0.07–0.61)	
							Favours nurse intervention	

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Outcomes	Effective Interventions	Results	Conclusion of This Reviewer
Milisen et al. (2005)	Multicomponent intervention strategies for managing delirium in hospitalized older people Selected 3 of 6 studies with 8/8 criteria Prevention = 1 study Recognizing and treating = 2 studies	Initial assessment by geriatrician or geriatric psychiatrist Daily visits by liaison nurse during hospitalization for staff adherence to protocol: <ul style="list-style-type: none"> <li>▶ Environment</li> <li>▶ Orientation</li> <li>▶ Familiarity</li> <li>▶ Communication</li> <li>▶ Restraint minimization</li> </ul>	17/21	Incidence of delirium	Medical assessment and in-hospital visits by liaison nurse focused on prevention versus prescription	Incidence of delirium in 1 of 3 studies: intervention group = 32% control group = 50% 36% relative risk reduction during hospital stay favouring intervention	More effective, equally costly
		Evaluation of causes of delirium: oxygen, fluid and electrolytes, pain, elimination of unnecessary medications, bladder/bowel function, nutrition, mobilization, prevention, detection and treatment of post-op complications, environment, treatment of agitation versus Usual ward care		Cognitive functioning	Early intervention and treatment for medical in-patients not effective but effective for surgical in-patients	2 of 3 studies showed improvement on Short Portable Mental Status Questionnaire compared with controls who showed deterioration = n.s. No difference found = 1 study	
				Duration of delirium and severity Length of stay Mortality	No statistical difference, therefore equally costly No statistical difference	Reductions in severity of delirium = 1 study	

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Results for High-Quality Studies	Conclusion of This Reviewer
Oredsson et al. (2011) 7/25 randomized controlled trials	4 = triage related interventions to improve patient flow in the emergency department	Streaming such as Fast Track to handle patients with serious symptoms	16/21	13 = Fast Track  6 = team-triaged  6 = point of care testing (limited evidence) Nurse requested X-ray (limited evidence)	Shorter waiting time  Shorter length of stay  Fewer patients leaving without being seen	All triage-related interventions were more effective interventions	Median (min./max.): 24.5 (2-51) minutes 27 (4-74) minutes 1.3% (1.2%-6.8%)  3.1% (0.2%-4.1%)	More effective, less costly



**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Risk	Conclusion of This Reviewer
Phillips et al. (2004) Randomized controlled trials, blind assessment of outcome	Comprehensive discharge planning plus post-discharge support to reduce readmission of older patients with congestive heart failure Follow-up range: 3–12 months Mean age ≥ 70 years 38% female	Some combination of home visits Increased clinic follow-up Frequent telephone contact Extended home care services Day hospital services	19/21	18 studies from 8 countries with 3,304 older in-patients	Lower hospital readmissions: intervention group = 555/1,590 control group = 741/1,714 Lower all-cause mortality = 14 studies Similar initial length of stay Great improvement (%) in quality-of-life scores = 6 studies Similar or lower total cost of care per month	Comprehensive discharge planning plus post-discharge support	0.75 (0.64–0.88) 0.87 (0.73–1.03)	More effective, less costly
							<b>0</b>	<b>SE</b>
							8.4	2.5
							8.5	2.2
							25% (11%–40%) versus 13.5% (5.1–22%), p = 0.81 -\$359 (-\$763–\$45), p = 0.10	Favoured patients in US Non-intervention trials -\$536 (-\$956–-\$115) US trials

Abbreviations: () = mean days of hospital stay; SE = standard error

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Risk	Conclusion of This Reviewer
Ram et al. (2004) Randomized controlled trials	Hospital-at-home for acute exacerbations of chronic obstructive pulmonary disease	Hospital-at-home versus standard in-patient care provided by nursing team	17/21	7 trials	Hospital in-patient readmissions = 7 studies Mortality = 6 studies Direct costs per patient = 2 studies	Hospital-at-home  No significant difference (p = 0.08)	0.89 (0.72–1.12)  0.61 (0.36–1.05)  No conclusion	Equally effective, equally costly

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Results	Conclusion of This Reviewer
Raman et al. (2008) Randomized controlled trials	Effectiveness and efficiency, non-pharmacological interventions for post-discharge care in heart failure Mean length of follow-up = 1 year Mean age range = 57–81 years Prevention home visits and transition to home	Nurse-led multidisciplinary home visiting Some combination of increased telephone support, increased clinic visits, increased home telemonitor, and education Education emphasis on: <ul style="list-style-type: none"> <li>▶ Symptoms and disease management</li> <li>▶ Self-management</li> <li>▶ Dietary advice</li> <li>▶ Medication review</li> <li>▶ Exercise recommendations</li> </ul> versus Usual care by cardiologist or GP	18/21	49 trials 10,572 patients	Reduction in all-cause readmission = 4 studies Reduction in length of stay: I = 3.9–6.9 days C = 6.2–11.6 days Improved quality-of-life changes = 4 studies <ul style="list-style-type: none"> <li>▶ 2 improved</li> <li>▶ 2 similar</li> </ul> Costs = 12 studies	Increased visits  Longer term follow-up ≥ 12 months  Initiated in the hospital setting (20 studies) for patients ≥ 75 years Not when initiated after discharge  No distinct combination of interventions associated with better outcomes  Statistically significant lower costs with intervention = 2 studies Non-significant lower costs = 10 studies	0.78 (0.67–0.92), p = 0.005  0.80 (0.62–0.94), p = 0.01  0.80 (0.71–0.90), p = 0.02  0.82 (0.73–0.93)	More effective, less costly

Abbreviations: C = control group; I = intervention group

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Odds Ratio (MH)	Conclusion of This Reviewer																				
Schadewaldt & Schultz (2011) Randomized controlled trials Added 4 new studies, changed findings	Nurse-led clinics for patients with coronary artery disease: <ul style="list-style-type: none"> <li>▶ Patient education</li> <li>▶ Risk factor assessment</li> <li>▶ Continuity of care</li> <li>▶ Adherence to medication</li> <li>▶ Healthy lifestyle</li> </ul>	Primary care = 6 studies Hospital-based home follow-up = 1 study	16/21	7 studies	Improved: <ul style="list-style-type: none"> <li>▶ Lipid management</li> <li>▶ Smoking cessation</li> </ul> Improved 1-year SF-36 quality-of-life functioning: <ul style="list-style-type: none"> <li>▶ Physical function</li> <li>▶ Physical role limitations</li> <li>▶ Emotional role limitation</li> <li>▶ General health</li> </ul> Less angina: <ul style="list-style-type: none"> <li>▶ Symptoms</li> <li>▶ Frequency</li> <li>▶ Chest pain</li> </ul> Reduced total mortality  Hospitalizations 10 years later = 1 study	Nurse-led	0.42 (0.31–0.58) 0.92 (0.72–1.17)	More effective, equally costly																				
							<table border="1"> <thead> <tr> <th>Z</th> <th>p</th> </tr> </thead> <tbody> <tr> <td>2.56</td> <td>0.01</td> </tr> <tr> <td>1.97</td> <td>0.05</td> </tr> <tr> <td>2.11</td> <td>0.03</td> </tr> <tr> <td>2.36</td> <td>0.02</td> </tr> <tr> <td></td> <td>0.001</td> </tr> <tr> <td></td> <td>0.045</td> </tr> <tr> <td></td> <td>0.025</td> </tr> <tr> <td></td> <td>0.038</td> </tr> <tr> <td colspan="2" style="text-align: center;">No difference</td> </tr> </tbody> </table>	Z	p	2.56	0.01	1.97	0.05	2.11	0.03	2.36	0.02		0.001		0.045		0.025		0.038	No difference		
Z	p																											
2.56	0.01																											
1.97	0.05																											
2.11	0.03																											
2.36	0.02																											
	0.001																											
	0.045																											
	0.025																											
	0.038																											
No difference																												

Abbreviations: MH = Mantel-Haenszel test; p = probability; Z = Z standard score

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Odds Ratio	Conclusion of This Reviewer
Spijker et al. (2008) 10/13 randomized controlled trials	Non-pharmacological interventions in delaying institutionalization in patients with dementia  Meta-analysis	In-home or day program setting Choice and involvement in some combination of caregiver: <ul style="list-style-type: none"> <li>▶ Psycho-education</li> <li>▶ Cognitive behaviour therapy</li> <li>▶ Respite care</li> <li>▶ Environmental modification</li> <li>▶ Skills training</li> <li>▶ problem solving</li> <li>▶ Case management</li> <li>▶ Personal worker with dementia- focused memory training</li> <li>▶ General support</li> </ul> Intense versus usual care	16/21	13 studies 9,043 patients	Decreased odds of institutionalization  Increased time to institutionalization	2 of 13 included studies were nurse-led case management with a team; for 11 others, nurse involvement was unclear	0.66 (0.43–0.99) p = 0.05  SMD = 1.44 (0.07–2.81) p = 0.04	Equally effective, less costly

Abbreviations = SMD = standard mean difference

**Table C1: Content of 27 Reviews of Nursing Interventions Included in This Review**

Review	Focus	Comparative Interventions, Context, Intensity	Quality Score	Number of Studies	Outcomes	Effective Interventions	Relative Risk Favours Nursing	Conclusion of This Reviewer
Wong et al. (2011) Randomized controlled trials 5 new studies in this update No blinding	Home care by outreach nursing for chronic obstructive pulmonary disease At least 3-month follow-up	Nurse outreach home visiting providing support, education, monitoring health, and liaison with physicians versus routine care	16/21	9 studies 1,498 patients	Better St. George respiratory function questionnaire Lower mortality Hospitalization = no difference	Respiratory nurses  Need further longer-term follow-up	-2.60 (-4.81- 0.39)  0.72 (0.45-1.15)  1.01 (0.71-1.44)	Equally effective, equally costly

## APPENDIX D: CHARACTERISTICS OF HIGH-QUALITY STUDIES, PARTICIPANTS AND INTERVENTION PROGRAMS

Table D1: Quality Assessment of 29 Studies Included in This Review

QUALITY CRITERIA FOR STUDIES	
1. Study design	11. Selection criteria described?
2. Treatment schedules compared (setting, content, intensity, duration)	12. Inclusion criteria
3. Was there adequate concealment?	13. Exclusion criteria (summary characteristics)
4. Was the client blinded?	14. Age
5. Was a power calculation performed?	15. % Female
6. Number randomized/participants	16. Health condition/other/outcomes measures
7. Number included in analysis	17. Were assessors blind to the assignment?
8. Number withdrawn (giving reasons)	18. Length and timing of follow-up(s)
9. Was analysis on the basis of intention to treat?	19. Lists health service/social services measures
10. Lists participants	20. Lists client measures/lists any other measures

### Codes

+ = Yes, Addressed

NA = Not Applicable

NS = Not Stated

- = Not Addressed

RA = Research Agenda

PM = Practice Model

CT = Can't Tell

**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		a												(Mean)							
Brumley, R. et al. (2007). Increased satisfaction with care and lower costs.	RCT	+	+	+	+	310	297	13	+	+	+	+	+	74	49%	In-home palliative care	+	120 days	+	+	+
Castro, M. et al., (2004). A time limited nurse led intervention reduced hospital readmissions in patients with asthma..	RCT	+	+	+	-	96	96	0	+	+	+	+	+	36.5	39.5%	Asthma	-	12 months	+	+	+
Chan, D. et al. (2009). Randomised controlled trial of structured nurse-led outpatient clinic follow-up for dyspeptic patients after direct access gastroscopy.	RCT	+	+	-	+	175	160	15	+	+	+	+	+	48.4	57%	Dyspeptia	+	6 months	+	+	+
Coleman et al. (2006). The Care Transitions Intervention	RCT	+	+	+	-	750	712	38	+	+	+	+	+	76.5	50%	Chronically ill seniors	+	180 days	+	+	+



**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14 (Mean)	15	16	17	18	19	20
Cuthbertson, B.H. et al. (2009). The PRaCTiCal study of nurse led, intensive care follow-up programmes for improving long term outcomes from critical illness.		a +				286	192	92	+	+	+	+	+	60	40%	Intensive care unit	+	12 months	+	+
Davison, J. et al. (2005). Patients with recurrent falls attending Accident & Emergency benefit.						406	406	0	+	+	+	+	+	77	72.5%	Recurrent falls	+	1 year	+	+
Dawes, H. A. et al. (2007). Specialist nurse supported discharge in gynaecology.						106	102	4	+	+	+	+	+	46	100%	Abdominal/pelvic gynecology surgery	+	6 weeks	+	+
Dunagan, C. et al. (2005). Randomised trial of a nurse-administered, telephone-based disease management program for patients with heart failure.						151	UC 75/76	0	+	+	+	+	+	70	56%	Heart failure	+	1 year	+	+

**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		a												(Mean)							
Gary, T.L. et al. (2009). The effects of a nurse case manager and a community health worker team on diabetic control.	RCT	+	+	-	+	522	488	34	+	+	+	+	+	58	73%	Diabetes	+	24 months	+	+	+
Goodman, H. et al. (2008). Randomised controlled trial to evaluate a nurse-led programme of support and lifestyle management for patients awaiting cardiac surgery.	RCT	+	+	-	188	94/94	0	+	+	+	+	+	+	64	19% male	Awaiting cardiac surgery	-	3 months after surgery	+	+	+
Griffiths, C. et al. (2004). Specialist nurse intervention to reduce unscheduled asthma care in a deprived multiethnic area.	RCT	+	+	-	324	319	5	+	+	+	+	+	+	22.9	59%	Asthma	+	12 months	+	+	+
Harris, C. & Shannon, R. (2008). An innovative enterostomal therapy nurse model of community wound care delivery.	Retro- spec- tive cohort	+	N/A	+	360	237	123	+	+	+	+	+	+	69	43%	Chronic wounds	+	Mean = 165 days	Only RN visits	+	+

**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		a												(Mean)							
Harris, R. et al. (2005). Economic evaluation of a nursing-led inpatient unit.	RCT	+	+	-	-	175	159	16	+	+	+	+	+	78.5	67%	Medically stable	+	20 months	+	+	
Hebert, P. et al. (2008). Cost effectiveness of nurse-led disease management for heart failure in an ethnically diverse urban community.	RCT	+	+	+	-	406	406	0	+	+	+	+	+	59.4	46%	Heart failure	+	12 months	+	+	
Higginson, I. et al. (2009). Is short-term palliative care cost-effective in multiple sclerosis?	RCT	+	+	-	-	52	47	5	+	+	+	+	+	0 = 53	73%	Multiple sclerosis	-	12 weeks	+	+	
Hurwitz, B. et al. (2005). Scientific evaluation of community-based Parkinson's disease nurse specialists on patient outcomes and health care costs.	RCT	+	+	+	SB	1,859	1,504	355	+	+	+	+	-	75	56.5	Parkinson's	-	2 years	+	+	
Kalra, L. et al. (2004). Training carers of stroke patients.	RCT	+	+	+	-	300	268	32	+	+	+	+	+	76	20%	Stroke carers	+	12 months	+	+	

**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		a	b											(Mean)							
Kendrick, T. et al. (2006). Cost effectiveness of referral for mental health nurses compared with usual general practitioner care for common mental disorders.	RCT	+	+	-	+	247	184	63	-	+	+	+	+	34	70%	Common mental disorder	+	26 weeks	+	+	+
Latour, C. et al. (2007). Cost effectiveness of a nurse-led case management intervention in general medical outpatients compared with usual care.	RCT	+	+	-	+	208	121	87	+	+	+	+	+	63.5	48.5%	Discharged non-complex chronically ill	+	24 weeks	+	+	+
Loeb, M. et al. (2006). Effect of a clinical pathway to reduce hospitalizations in nursing home residents with pneumonia.	Cluster RCT	RN	UC	+	+	22	20	2	+	+	+	+	+	85	70%	Nursing home pneumonia	+	3 years	+	+	+

**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14 (Mean)	15	16	17	18	19	20	
Naylor, M. D. et al. (2004). Transitional care of older adults hospitalized with heart failure.		a +				239	239	0	+			+		75.5	58%	Heart failure	+	1 year	+		
Raifery, J.P. et al. (2005). Cost effectiveness of nurse led secondary prevention clinics for coronary heart disease in primary care.																					
Ricauda, N.A. et al. (2008). Substitutive "hospital at home" versus inpatient care for elderly patients with exacerbations of chronic obstructive pulmonary disease.						1,342	1,173	169	+			+		66.3	42%	Coronary disease	-	4 years	+		
Schuttelaar, M. L. et al. (2011). Cost effectiveness analysis of treatment in children with eczema by nurse practitioner vs. dermatologist.						160	152	8	+			+		<4 years = 1.6 >4 years = 9.3	26% 51%	Child eczema	-	12 months	+		

**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		a												(Mean)							
Scott, F et al. (2005). Prospective, randomized, controlled, single-blind trial of the costs and consequences of systematic nutrition team.	RCT	+	+	-	-	112	101	11	+	+	+	+	+	68	55%	Percutaneous gastrostomy	+	12 months	+	+	
Tijhuis, G. et al. (2003). Two-year follow-up of a randomised controlled trial of a clinical nurse specialist intervention, inpatient, and day patient team care in rheumatoid arthritis.	RCT	+	+	-	+	210	210	0	+	+	+	+	+	58	47%	Rheumatoid arthritis	+	2 years	+	+	
Torrance, N. et al. (2006). Genetic nurse counsellors can be an acceptable and cost-effective alternative to clinical geneticists for breast cancer risk genetic counsellor.	RCT	RN genetic	+	-	+	342	325	17	+	+	+	+	+	40	100%	Genetic cause	- SR	12 months	+	+	

**Table D1: Quality Assessment of 29 Studies Included in This Review**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		a												(Mean)							
Vass, M. et al. (2005). Feasible model for prevention of functional decline in older people.	RCTs	+	+	+	+	4,060	3,486	74	+	+	+	+	+	0.75	N/A	Seniors' functional decline	+	3 years	+		
Williams, J. et al. (2009). Effectiveness of nurse delivered endoscopy.	RCT	+	+	-	+	1,888	1,296	+	-	+	+	+	+	0.52.5	52.5%	Endoscopy	+	1 year	-		+

*Abbreviations:* Gyn. = gynecology; RCT = randomized controlled trial; RN = registered nurse; SB = single blind; UC = usual care

**Table D2: Characteristics of 29 Studies Included in This Review, by Model of Nursing Care**

Study and Design	Quality Score	Country	Chronic Condition/Site	Onset of Study	Number of Participants Analyzed		Mean Age/ % Female	Nurse Model and Educational Preparation	Comparison	Length of Follow-up
					Nurse	Usual				
Brumley et al. (2007) RCT	21/21	United States	Palliative care	In home	145	752	74 years/ 49%	Supplemental specialty nurse and interdisciplinary team	Usual home care	120 days
Castro et al. (2004) RCT	17/21	United States	Frequently admitted to hospital, people with asthma	Primary care	50	46	36.5 years/ 39.5%	Supplemental advanced practice nurse-led interdisciplinary team	Usual GP care	12 months after the index hospitalization
Chan et al. (2009) RCT	19/21	United Kingdom	Dyspeptic patients in specialty clinic	Following gastroscopy	81	GP: 19	48.4 years/ 57%	Supplemental nurse-led follow-up clinic and usual GP care	Usual post-surgery care	6 months
Coleman et al. (2006) RCT	19/21	United States	Hospitalized chronically ill older persons	Transitional care from hospitals	360	352	76.5 years/ 50%	Supplemental advanced practice nurse home visiting, timely MD follow-up, list of red flag symptoms	Usual discharge	180 days
Cuthbertson et al. (2009) Multicentre RCT	19/21	United Kingdom	Critical care hospital patients	Following discharge from ICU for 3 months	92	100	60 years/ 40%	Supplemental nurse-led manual base self management	Usual hospital care	12 months (3 months after discharge)
Davison et al. (2005) RCT	21/21	United Kingdom	Frail elderly – cognitively intact and prior mix of recurrent falls	Primary care	141	141	77 years/ 72.5%	Nurse involved in interdisciplinary multifactorial proactive intervention	Usual on-demand care	1 year



**Table D2: Characteristics of 29 Studies Included in This Review, by Model of Nursing Care**

Study and Design	Quality Score	Country	Chronic Condition/Site	Onset of Study	Number of Participants Analyzed		Mean Age/ % Female	Nurse Model and Educational Preparation	Comparison	Length of Follow-up
					Nurse	Usual				
Dawes et al. (2007) RCT	19/21	United Kingdom	Women undergoing major gynecological surgery	Perioperative	50	52	46 years/ 100%	Supplemental master's -prepared nurse providing supported discharge and case management at home	Usual gynecological follow-up	6 weeks after discharge
Dunagan et al. (2005) RCT	20/21	United States	Heart failure in primary care	Home/ primary care	76	75	70 years/ 56%	Supplemental telephone-based, APN-led self-management and GP	GP care alone	1 year
Gary et al. (2009) RCT	20/21	United States	African Americans with type 2 diabetes mellitus	Primary care	253	235	58 years/ 73%	Supplemental culturally sensitive nurse case manager (1 visit/year) and community health worker (3 visits/year), mailings and phone calls every 6 months	Mailings and phone calls every 6 months	24 months
Goodman et al. (2008) RCT	18/21	United Kingdom	Awaiting cardiac surgery – CABG at home	Prior to surgery	90	91	64 years/ 19%	Supplemental nurse-led motivational counselling, manualized home-based management of lifestyle risks	Usual primary care	3 months after surgery

**Table D2: Characteristics of 29 Studies Included in This Review, by Model of Nursing Care**

Study and Design	Quality Score	Country	Chronic Condition/Site	Onset of Study	Number of Participants Analyzed		Mean Age/ % Female	Nurse Model and Educational Preparation	Comparison	Length of Follow-up
					Nurse	Usual				
Griffiths et al. (2004) RCT	20/21	United Kingdom	Asthma patients	Primary care	174	145	22.9 years/ 59%	Supplemental asthma nurse specialist liaised with primary care	Primary care alone	12 months
Harris et al. (2008) Retrospective cohort study	18/21	Canada	Enterostomal therapy (ET) model of wound care	Chronic and acute home care clients	154	206	69 years/ 43%	Supplemental community specialty nurse-led ET A/WOS care > 50% of time	Home care RN/RPN with ET A/WOS <50% of time	165 days
Harris et al. (2005) RCT	18/21	United Kingdom	Acute medical in-patients	In hospital	80	79	78.5 years/ 67%	Replacement nurse practitioner disease management in hospital	Usual hospital care	20 months
Hebert et al. (2008) RCT	19/21	United States	Ethnically diverse people with early heart failure	Specialist cardiac clinic	203	203	59.4 years/ 46%	Supplemental nurse-led disease management, 1 encounter face-to-face, regular phone follow-up, stress diet and medications	Usual specialist care	12 months
Higginson et al. (2009) RCT	18/21	United Kingdom	Home palliative care for patients with multiple sclerosis	Home/community	24	21	53 years/ 73%	Supplemental specialist APN in multiple sclerosis and usual care	Usual ward palliative care	12 weeks

**Table D2: Characteristics of 29 Studies Included in This Review, by Model of Nursing Care**

Study and Design	Quality Score	Country	Chronic Condition/Site	Onset of Study	Number of Participants Analyzed		Mean Age/ % Female	Nurse Model and Educational Preparation	Comparison	Length of Follow-up
					Nurse	Usual				
Hurwitz et al. (2005) RCT	18/21	United Kingdom	People with Parkinson's disease	Living at home	847	657	75 years/ 56.5%	Supplemental community nurse-led with special training	Usual care	2 years
Kalra et al. (2004) RCT	20/21	United Kingdom	Informal caregivers of patients surviving stroke	Home care	134	134	76 years/ 20%	Supplemental nurse-involved interdisciplinary team for hands-on skill in moving and handling	Information and advice	1 year
Kendrick et al. (2006) RCT	18/21	United Kingdom	People in primary care for common depression/anxiety problems	Primary care visit	CMHN using PST 71	Generic 62 GP 51	34 years/ 70%	Supplemental community mental health nurse (CMHN) using problem solving therapy (PST)	Generic CMHN or GP alone	26 weeks
Latour et al. (2007) RCT	20/21	Netherlands	General medical outpatients	GP and specialist clinics	78	69	63.5 years/ 48.5%	Supplemental nurse-led and MD care, lifestyle and psychosocial home visits and telephone contacts	Usual GP or specialist MD care	24 weeks
Loeb et al. (2006) Cluster RCT	20/21	Canada	Nursing home patient with pneumonia	Nursing home with onset of symptoms	10	10	85 years/ 70%	Supplemental nursing home general staff nurse with clinical pathway for care of pneumonia	Usual nursing home care	3 years

**Table D2: Characteristics of 29 Studies Included in This Review, by Model of Nursing Care**

Study and Design	Quality Score	Country	Chronic Condition/Site	Onset of Study	Number of Participants Analyzed		Mean Age/ % Female	Nurse Model and Educational Preparation	Comparison	Length of Follow-up
					Nurse	Usual				
Naylor et al. (2004) Multi-site RCT	19/21	United States	Heart failure with 6.4 (+2.2) comorbid conditions 36%	Hospital to home	239	239	75.5 years/ 58%	Supplemental APN 3-month case management intervention for patient and carer; daily visits while in hospital > 8 home visits	Liaison nurse to home care; discharge planning using critical paths	1 year
Raflery et al. (2005) RCT	20/21	Scotland	Coronary Disease in Primary Care	Discharged from hospital in previous year	593	580	66.3 years/ 42%	Supplemental nurse-led coronary secondary prevention clinic and interdisciplinary care	Usual GP care	4 years
Ricauda et al. (2008) RCT Single Blind	19/21	Italy	Acute exacerbation of COPD with multiple co-morbidities, functionally and cognitively impaired	From GP or specialist = 15% ER = 60% Hospital ward = 25%	52	52	80 years/ 65%	Supplemental nurse-led team with daily MD meetings: 14 nursing visits 10 MD visits	Usual MD follow-up care	6 months
Schuttellaar et al. (2011) RCT	19/21	Netherlands	Children at home with eczema	In home	79	73	<4 years = 1.2 years/ 26% >4 years = 9.3 years/ 51%	Replacement APN emphasizing nutrition, food allergies, parent 2-hour group	Dermatologist care	12 months

**Table D2: Characteristics of 29 Studies Included in This Review, by Model of Nursing Care**

Study and Design	Quality Score	Country	Chronic Condition/Site	Onset of Study	Number of Participants Analyzed		Mean Age/ % Female	Nurse Model and Educational Preparation	Comparison	Length of Follow-up
					Nurse	Usual				
Scott et al. (2005) RCT	17/21	United Kingdom	Endoscopic gastrostomy	Following surgery	47	54	68 years/ 55%	Supplemental nurse-led disease management, liaison with ward and primary care; proactive dietician advice	Usual ward and GP care	1 year
Tijhuis et al. (2003) RCT	20/21	Netherlands	Rheumatoid arthritis	In-patient and day patients	71	In-pt: 71 Day pt: 68	58 years/ 47%	Replacement clinical nurse specialist	Hospital in-patient care and day patient care	2 years
Torrance et al. (2006) RCT	18/21	Scotland: 342 Wales: 373	Genetically at-risk women for breast cancer	Outpatient genetic clinic	(S)163 (W)150	74 73	40 years/ 100%	Replacement APN genetic counselling	Geneticist counselling	12 months
Vass et al. (2005) RCT of 34 of 50 municipalities	20/21	Denmark	Older persons with functional decline; 69%-81% of 75- and 80-year-old cohorts not disabled	Home care	1,798	1,688	75 years/ % not reported	Supplemental nurse-led nurse visitor education and GP geriatric assessment	Usual GP care	3 years
Williams et al. (2009) RCT	17/21	United Kingdom	People with dyspeptic symptoms	Undergoing lower and upper endoscopy	655	641	52.5 years/ 52.5%	Replacement model, nurse endoscopy	MD endoscopy	1 year

*Abbreviations:* APN = advanced practice nurse; CABG = coronary artery bypass graft; COPD = chronic obstructive pulmonary disease; ER = emergency room; GP = general practitioner; MD = doctor of medicine; RN = registered nurse; RPN = registered practical nurse

Table D3: Comparative Costs of Nursing Models as Substitute Care

High-Quality Study (and Currency)	Hospitalizations/Readmissions				Total Direct Costs						Conclusion of This Reviewer			
	Nurse		Usual Care		P	Nurse		Usual		P				
	N	%	N	%		N	Cost	(SD)	N			Cost	(SD)	
Harris et al. (2005) (£) In-patient						80	£5,144		79	£4,100	(719)	n.s.	Equally costly	
Post-discharge						80	£375		79	£401				
Harris et al. (2008) (C\$)						154	\$600		2,006	\$3,782		<0.001	Less costly	
Schuttelaar et al. (2011) (€)						76	€981	(1,339)	71	€1,409	(2,289)	n.s.	Equally costly	
Tijhuis et al. (2003)														
In-patient:														
1 year	5/71	7%	10/71	14%										
2 years	20/71	28%	19/71	26%	n.s.									
Day patient														
1 year			9/68	13%	n.s.									
2 years			15/68	22%	(0.06-0.03)									
Torrance et al. (2006) (£)														
Scotland						193	£136		96	£148		n.s.	Scotland = less costly	
Wales						197	£140		100	£127			Wales = more costly due to higher nurse unit costs	
Williams et al. (2009) (£)						957	£683		931	£739		n.s.	Equally costly	

Abbreviations: n.s. = not significant; SD = standard deviation

**Table D4: Comparative Costs of Supplemental Models of Nursing**

High-Quality Study (and Currency)	Hospitalizations/Readmissions						Total Direct Costs						Conclusion of This Reviewer
	Nurse		Usual Care		p	Nurse		Usual Care		p			
	N	%	N	%		N	Cost	(SD)	N		Cost	(SD)	
Chan et al. (2009) (£)						89	£35.5	(48.8)	19	£71	(63.1)	<0.001	Less costly
Cuthbertson et al. (2009) (£)						90	£7,126		97	4,810		n.s.	More costly
Dunagan et al. (2005) (US\$)	27/76	36%	37/75	49%	0.06	76	\$1,323,166		75	\$1,745,675			Less costly
Goodman et al. (2008) (£)						93	£10,954	(3,660)	92	£12,771	(5,811)	0.01	Less costly
Higginson et al. (2009) (£)						26	£1,789		25			n.s.	Less costly
Hurwitz et al. (2005) (£)						1,028	£2.54	(34.6)	808	£2.80	(31.6)		Equally costly
Latour et al. (2007) (€)						69	€8,898	(19,521)	52	€4,612	(7,141)	n.s.	Less institutional; more costly community support
Loeb et al. (2006) (C\$)	8/314		20/347		.001	314	\$1,183		347	\$2,190		n.s.	Less costly
Rafferty et al. (2005) (£)	106/540	20%	145/518	28%	.003		£2,136						Equally costly but nurse cost is higher per patient
Scott et al. (2005) (£)						47	£13,330	(15,505)	54	£16,858	(16,351)	n.s.	21 % savings; less costly

Abbreviations: n.s. = not significant; SD = standard deviation

**Table D5: Study Results by Patient and System Outcomes: Mortality and Length of Follow-up**

High-Quality Study	Mortality			Length of Follow-up	Difference	P	Conclusion of This Reviewer
	Nurse	%	Usual Care %				
Brumley et al. (2007) Died at home	145	71%	152 51%	90 days	Odds ratio = 2.20 (1.3-3.7)	<0.001	More effective
Chan et al. (2009)				6 months			
Cuthbertson et al. (2009)				12 months			
Dawes et al. (2007)				6 weeks after discharge			
Dunagan et al. (2005) 6 months	6/76	8%	5/75 7%	1 year		0.73	Equivalent effectiveness
Dunagan et al. (2005) 1 year	13/76	17%	11/75 15%				
Goodman et al. (2008)				3 months after surgery			
Higginson et al. (2009)				12 weeks			
Hurwitz et al. (2005) 2 years	169/1016	17%	146/803 18%	2 years		0.38	Equally effective
Kendrick et al. (2006)				8 and 26 weeks			
Latour et al. (2007)				12 months			
Loeb et al. (2006)				3 years			
Rafferty et al. (2005)	100/673	14.5	128/670 19.1	4 years		0.038	Nurse more effective
Scott et al. (2005)				12 months			
Torrance et al. (2006)				6 months			
Williams et al. (2009)				1 year			



**Table D5: Study Results by Patient and System Outcomes: Mortality and Length of Follow-up**

High-Quality Study	n	Mean (SD)	n	Mean (SD)	Length of Follow-up	Difference	p	Conclusion of this Reviewer
Castro et al. (2004)					12 months			
Coleman et al. (2006)					180 days			
Davison et al. (2005)					12 months			
Gary et al. (2009)					24 months			
Griffiths et al. (2004)					12 months			
Harris et al. (2005)					20 months			
Harris et al. (2008)					I: Mean 86 days			
C: Mean 165 days								
Hebert et al. (2008)	22/203		22/203		18 months		n.s.	Equally effective
Kalra et al. (2004)	151	16	149	16	12 months			Equally effective
Naylor et al. (2004)					1 year			
Ricauda et al. (2008)	52	9 (17)	52	12 (23)	6 months		0.72	Equally effective
Schuttellaar et al. (2011)					12 months			
Tijhuis et al. (2003)					2 years			
Vass et al. (2005)					3 and 5 years	ARR: 1.06 (0.87-1.28)	0.59	More effective

*Abbreviations:* ARR = adjusted relative risk; C = control group; I = intervention group; n.s. = not significant; SD = standard deviation

**Table D6: Study Results by Patient and System Outcomes: Hospitalizations**

High-Quality Study	Results	Hospitalizations During Year						Adjusted Difference	p	Conclusion of This Reviewer
		Nurse		Usual Care		n	%			
		n	%	n	%					
Brumley et al. (2007)	Hospitalizations	145	33%	152	33%			<0.01	Less resource use	
	Hospice	145	25%	152	36%			n.s.		
Dawes et al. (2007)	Hospital days	n	MEAN (SD)	n	MEAN(SD)	54	6.06 (6.0)		n.s.	Less resource use
		n	%	n	%					
Dunagan et al. (2005)	1 year readmission or ER. visit	57/76	76%	63/75	84%			HR = 0.67 (0.47–0.96) CI	0.029	Less resource use
	1 year readmission for heart failure	27/76	36%	37/75	49%			HR = 0.62 (0.38–1.03) CI	0.06	Less resource use
Loeb et al. (2006)	Hospitalizations	8/314	.02%	20/347	.05%			12 (0–18)	0.001	Less resource use
	Hospital days/resident	n	MEAN (SD)	n	MEAN(SD)	347	1.74 (1.17–2.3)		0.004	Less resource use
Rafferty et al. (2005)		n	%	n	%					
		106/540	20%	145/518	28			-0.64–0.86	0.003	Less resource use
Ricauda et al. (2008)	Hospital days	n	MEAN (SD)	n	MEAN(SD)	52	34 (87)		0.001	Less resource use
		n	%	n	%					
Scott et al. (2005)	Hospitalizations 1 year	10/47	21%	21/54	38%				0.09	Less resource use

**Table D6: Study Results by Patient and System Outcomes: Hospitalizations**

High-Quality Study	Results	Hospitalizations During Year						Adjusted Difference	p	Conclusion of This Reviewer
		Nurse		Usual Care		IN-PATIENT	Usual Care			
		n	%	n	%					
Tijhuis et al. (2003)	HOSPITALIZATIONS		IN-PATIENT		Usual Care					
	1 year	5/71	7%	10/71	14%				Less resource use at 1 year, especially less home help	
	2 year	20/71	28%	19/71	26%		n.s.			
	DAY PATIENT		Usual Care							
	1 year			9/68	13%			n.s.	Same resource use	
2 year			15/68	22%		MEAN (SD)	(0.06–0.03)			
Williams et al. (2009)	Hospital days	n	MEAN (SD)	n	MEAN (SD)					
		928	0.35	953	0.27		Mean difference -0.075 (-0.141 to 0.009)	n.s.		
Study	Results	(Re) Hospitalizations/Patient/Year						Adjusted Difference	p	Conclusion of This Reviewer
		Nurse		Usual Care		n	Mean hosp. days at 3 yrs (%)			
		n	Mean hosp. days at 3 yrs (%)	n	Mean hosp. days at 3 yrs (%)					
Castro et al. (2004)	Readmissions	50	31 (62%)	46	71 (1.54%)			0.04	Less resource use	
	Hospital days	n	MEAN	n	MEAN					
Davison et al. (2005)	Hospital days	50	82	46	244			0.04	Less resource use	
		n	MEAN (SD)	n	MEAN (SD)					
Gary et al. (2009)	Hospital days	144	0.8 (3.4)	149	4.5 (22)			RRR = 3.6 (0.1–7.6)	Less resource use	
	ER visits	n	%	n	%					
Gary et al. (2009)	Hospital days	253	43.9% (34% decrease)	235	102.6% (14% increase)			0.05	Less resource use	
	Hospital days	253	30.4% (14% decrease)	235	32.1% (14% decrease)			n.s.	Equal resource use	

**Table D6: Study Results by Patient and System Outcomes: Hospitalizations**

Study	Results	(Re) Hospitalizations/Patient/Year				Adjusted Difference	p	Conclusion of This Reviewer
		Nurse		Usual Care				
		n	Mean hosp. days at 3 yrs (%)	n	Mean hosp. days at 3 yrs (%)			
STUDY	RESULTS	n	MEAN (SD)	n	MEAN (SD)			
Kalra et al. (2004)	12-month institutionalization	151	2	149	6	0.07		Less resource use
Naylor et al. (2004)	Rehospitalization	118	1.18	121	1.79	<0.001		Less resource use
	Hospital days	118	5.0 (7.3)	121	8.0 (12.3)	<0.07		Less resource use
	Comorbidity-related	118	23	121	50	<0.013		Less resource use
Vass et al. (2005)	Nursing home admission	1,798		1,688		Adjusted RR = 0.74 (0.50–1.09)		Less resource use
	Days after 3 years for 75 y.o.		6.78 (30)		10.97 (37)	0.13		Less resource use

*Abbreviations:* CI = confidence interval; ER = emergency room; HR = hazard ratio; n.s. = not significant; RR = relative risk; RRR = relative risk reduction; SD = standard deviation

**Table D7: Study Results by Patient and System Outcomes: Total Direct Costs**

High-Quality Study (and Currency)	Total Direct Costs						Adjusted Difference (CI)	P	Conclusion of This Reviewer
	Nurse		Usual Care		n	(SD)			
	n	Mean Cost	n	Mean Cost					
Brumley et al. (2007) (2002 US\$)	145	Adjusted \$12,670	152	20,222	152	(12,523)	33% less costs (-12,411 to -780)	0.03	Less costly
Castro et al. (2004) (1999 US\$)	50	\$3,650	46	\$8,079	46	(4,178)		0.07	Less costly
Chan et al. (2009) (2006 costs in Sterling)	81	£35.5	19	71.7	19	(48.8)	£39.6 lower (24.2 to 55.1)	<0.001	Less costly
Coleman et al. (2006) Log transfer	379	\$74,310	371	\$147,797	371		\$73,487 lower		\$73,487 savings in 180 days with nurse; less costly
Per person per 180 days		\$2,058		\$2,546					
Dawes et al. (2007) (2003-04 NHS £)	52	£4,253	54	£4,981	54	(3,643)	\$728 lower		Less costly
Goodman et al. (2008) (during waiting and in- patient episodes)	93	£9,092	92	11,047	92	(3,578)	(-3,251 to -658)	0.003	Less costly
Total costs per year	93	£10,954	92	12,771	92	(3,660)	£-1,795 lower (-3,224 to -401)	0.01	Less costly
Harris et al. (2005) In-patient total:	80	£5,144	7	£4,100	7				
Post-discharge: (1997-98 £ NHS)	80	£375	79	£401	79			n.s.	Equally costly

**Table D7: Study Results by Patient and System Outcomes: Total Direct Costs**

High-Quality Study (and Currency)	Total Direct Costs						Adjusted Difference (CI)	P	Conclusion of This Reviewer
	Nurse		Usual Care		n	(SD)			
	n	Mean Cost	Mean Cost	(SD)					
Harris et al. (2008) (2005 C\$)	154	\$600	\$3,782		2006		\$3,182 lower		Less costly
Hebert et al. (2008) (2001 US\$)	143	\$17,680	17,838		180			n.s.	Equally costly
Higginson et al. (2009) (2005 £)	26	£1,789 lower per patient		CI: (-5,224 to 1,902)	25		£1,789 lower	n.s.	Less costly
Kalra et al. (2004) (£)	151	£10,133	£13,794	(8,676)	149	(10,510)	£3,661 lower	0.001	Less costly
Kendrick et al. (2006) (2002 to 2003 £)	71	£631	£599	(501)	62	(366) generic nurse		<0.001	More costly
Naylor et al. (2004) (US\$)	118	\$6,152	\$9,618		121	(327) GP	\$3,466 lower	.002	Less costly
Rafferty et al. (2005) (1998-99 costs in Sterling)	-	£2,136 higher per patient			-		-	n.s.	Equally costly
Ricauda et al. (2008) Cost per person per day (US\$)	52	\$101.40/day	\$151.70/day	(61.3)	52	(94.4)	\$50.30 lower	.002	Less costly
Schuttellaar et al. (2011) (2011 €)	76	€981	€1,409	(1,339)	71	(2,289)	€428 lower (-910 to 197)	n.s.	Equally costly
Torrance et al. (2006) (2006 £)									
▶ Scotland	193	£136.55	£148.30		96				Scotland less costly;
▶ Wales	197	£140.10	£127.60		100				Wales more costly due to higher nurse unit costs

**Table D7: Study Results by Patient and System Outcomes: Total Direct Costs**

High-Quality Study (and Currency)	Total Direct Costs						Adjusted Difference (CI)	P	Conclusion of This Reviewer
	Nurse		Usual Care		n	(SD)			
	n	Mean Cost	n	Mean Cost					
Williams et al. (2009) (2002-03 £)	957	£683	931	£739			£56 (-100 to 213)	n.s.	Equally costly
<b>Study</b>	<b>n</b>	<b>Total Costs Over Year</b>	<b>n</b>	<b>Total Costs Over Year</b>			<b>Adjusted Difference</b>	<b>p</b>	<b>Conclusion of This Reviewer</b>
Cuthbertson et al. (2009) (2009 £)	90	£7,126	97	£4,810			£2,316 (-269 to 4,363)	n.s.	More costly
Dunagan et al. (2005) (US\$)	76	\$1,323,166	75	\$1,745,675			\$422,509 lower		Less costly
Hurwitz et al. (2005) (in mean 000's £ 1996 costs)	1,028	£2.54 (34.6)	808	£2.80 (31.6)			£-2.6 (-.98 to .045)	.47	Equally costly
Latour et al. (2007)(€)	69	€8,898 (19,521)	52	€4,612 (7,141)			€4,286 (-41 to 8,026)	n.s.	More costly, more community support, less institutionalizations
Loeb et al. (2006) (C\$)	314	\$1,183	347	\$2,190			-1,016 (-2,076 to 1,824)	n.s.	Less costly
Scott et al. (2005)	47	£13,330 (15,505)	54	£16,858 (16,351)			21% savings	n.s.	Less costly

Abbreviations: CI = confidence interval; GP = general practitioner; n.s. = not significant; SD = standard deviation

**Table D8: Study Results by Patient and System Outcomes: Quality of Life**

High-Quality Study	SF12 Physical				SF36 Physical				Adjusted Difference	P	Conclusion of This Reviewer
	Nurse		Usual Care		Nurse		Usual Care				
	n	Mean score (SD)	n	Mean score (SD)	n	Mean change (SD)	n	Mean change (SD)			
Chan et al. (2009)	89	754.5 (138.6)	86	634.8 (19.5)	89		86		-140 (-184.8 to 96.5)	<0.001	More effective
Cuthbertson et al. (2009)					90	42.0 (10.6)	97	40.8 (11.9)	Effect size: 1.1 (-1.9 to 46)	n.s.	Equally effective
Goodman et al. (2008)					61	.41 (7.50)	63	-3.33 (7.58)		0.04	More effective
Latour et al. (2007)							<b>Total Score</b>				Equally effective
Raflery et al. (2005)					Similar		Similar				
Scott et al. (2005)					511	4.71	497	-3.04	8.52 (4.16-12.88)	<0.001	More effective
Williams et al. (2009)					Higher		Higher				More effective
					575	44.61 (.278)	559	45.03 (.227)		n.s.	Equally effective

Abbreviations: n.s. = not significant; SD = standard deviation



**Table D9: Study Results by Patient and System Outcomes: Other Patient Outcomes**

High-Quality Study	Nurse			Usual			Adjusted Difference	P	Conclusion of This Reviewer
	n	Mean	(SD)	n	Mean	(SD)			
Chan et al. (2009)									
▶ Dyspeptic	89	4.9	2.9	86	7.2	3.1	2.3 (1.4-3.1)	<0.001	More effective
Davison et al. (2005)									
▶ Mean rate of falls	159	3.3	(5.0)	154	5.1	(7.9)	RRR = 0.64 (CI: 0.46-0.90)	n.s	Equally effective
Griffiths et al. (2004)									
▶ Quality of life	70	10.87		52	10.73			n.s.	Equally effective
▶ Emergency nurse	174			145					
▶ Unscheduled GP	174		58%			68%	RRR = 17%		Less resource use
▶ Length of stay			0.8 (3.4)		4.5 (22)		3.6 (0.1-7.6)		
Gary et al. (2009)									
▶ Decline in HbA <sub>1c</sub>		-0.68 diff.						0.03	More effective
Harris et al. (2005)									
▶ Barthel index of function	80	3.6		79	2.6			n.s.	Equally effective
Harris et al. (2008)									
▶ Time to closure	154	98.58 days	(9.17)	206 days	143.39	(13.20)		0.0006	More effective
Higginson et al. (2009)									
▶ POS pain	26	-0.46	(-0.98-0.05)	25	.30	(-0.16-0.76)	ANOVA F = 5.15	0.028	More effective
▶ Zarit burden	13	-2.88	(-5.99-0.24)	19	1.58	(-0.51-3.7)	ANOVA F = 7.96	0.001	More effective
Kendrick et al. (2006)									
▶ 26-week general health	71	2.32	(3.43)	62	1.78	(2.98) generic nurse		n.s	Equally effective
				51	2.87	(3.93) GP			
Ricauda, (2008)									
▶ Nottingham Health Profile	52	-3.1	(4.7)	52	0.7	(3.2)		<0.001	More effective

**Table D9: Study Results by Patient and System Outcomes: Other Patient Outcomes**

High-Quality Study	Nurse		Usual		Adjusted Difference	P	Conclusion of This Reviewer
	n	Mean (SD)	n	Mean (SD)			
Schuttellaar et al. (2011)	73	-13.2 (16.6)	70	-13.1 (17.1)		n.s.	Equally effective
	74	-4.7 (5.5)	71	-4.3 (6.3)		n.s.	Equally effective
Tijhuis et al. (2003)	71	15 (-21.0-9.2)					More effective
			71	-8.5 (-14.3-2.8)			
			68	-11.2 (-17.0- -5.4)		n.s.	
	<b>n</b>	<b>%</b>	<b>n</b>	<b>%</b>	<b>Proportional Hazards Model</b>	<b>p</b>	<b>Conclusion of This Reviewer</b>
Rafferty et al. (2005)	110/593	14.5	125/580	18.2	0.76 (0.58-1.0)	0.05	More effective

Abbreviations: CI = confidence interval; diff. = difference; GP = general practitioner; n.s. = not significant; RRR = relative risk reduction; SD = standard deviation

## APPENDIX E: ECONOMIC EVALUATIONS OF NURSING INTERVENTION PROGRAMS

**Table E1: Quality of McMaster–SLRU Randomized Controlled Trials With Economic Evaluations of Supplemental, Proactive Nurse-Led Interventions**

QUALITY CRITERIA FOR STUDIES	
1. Study design	11. Selection criteria described?
2. Treatment schedules compared (setting, content, intensity, duration)	12. Inclusion criteria specified
3. Was there adequate concealment?	13. Exclusion criteria Summary characteristics
4. Was the client blinded?	14. Age
5. Was a power calculation performed?	15. % female
6. Number randomized/participants	16. Health condition/Other/Outcomes measures
7. Number included in analysis	17. Were assessors blind to the assignment?
8. Number withdrawn (giving reasons)	18. Length and timing of follow-up(s)
9. Was analysis on the basis of intention to treat?	19. Lists health service/social services measures
10. Lists participants	20. Lists client measures/Lists any other measures

### Codes

+ = Yes, Addressed

NA = Not Applicable

NS = Not Stated

– = Not Addressed

RA = Research Agenda

PM = Practice Model

**Table E1: Quality of McMaster–SLRU Randomized Controlled Trials With Economic Evaluations of Supplemental, Proactive Nurse-Led Interventions**

Study (Author, Year and Title)	Coding of Criteria Results																			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
Browne et al. (2001). When the bough breaks: Provider-initiated comprehensive care is more effective and less expensive for sole-support parents on social assistance.		a +	+	-	-	+	+	+	-	+	+	+	+	+	+	+	-	+	+	+
Browne, G. et al. (2002). Sertraline and/or interpersonal psychotherapy for patients with dysthymic disorder in primary care.		+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Harrison, M. et al. (2002). Quality of life of individuals with heart failure.		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+
Markle-Reid, M. et al. (2006). The effectiveness and efficiency of home-based nursing health promotion for older people.		+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Markle-Reid, M. et al. (2010). Effects and costs of a multifactorial and interdisciplinary team approach to falls prevention for older home care clients 'at risk' for falling.		+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+

**Table E1: Quality of McMaster–SLRU Randomized Controlled Trials With Economic Evaluations of Supplemental, Proactive Nurse-Led Interventions**

Study (Author, Year and Title)	Coding of Criteria Results																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	
		a																			
Markle-Reid, M. et al. (2011). Interprofessional stroke rehabilitation for stroke survivors using home care.	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Mills, M. et al. (2010). A primary care cardiovascular risk reduction clinic in Canada was more effective and no more costly than usual on-demand primary care.	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
Roberts, J. et al. (1995). Effectiveness and efficiency of health promotion.	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+
Roberts, J. et al. (1999). Problem-solving counselling for caregivers of the cognitively impaired.	+	+	+	-	+	+	+	+	+	+	+	+	+	+	+	+	-	+	+	+	+

Abbreviations: SLRU = System-Linked Research Unit on Health and Social Service Utilization (at McMaster University)

**Table E2: Summary Details of McMaster-SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Quality Score	Eligible	Randomized	Analyzed	Target Group Characteristics	Comparison	Nurse Intervention
Browne et al. (2001)	17/21	765	765 Group I 151 II 153 III 155 IV 153 V 153	Group I 88 II 69 III 59 IV 68 V 93	Sole support parents on social assistance Mean age = 33 years (7.0) 2 or more physical disorders: 40% With hyperactive children: 33% Female: 96%	I. Public health nurse (PHN) ▶ Employment retraining ▶ Recreation II. Public health nurse III. Employment retraining IV. Recreation V. Control: self-directed care	▶ Supplemental proactive case management, PHN nurse-led, problem solving re parent issues: ▶ Child care ▶ Own health ▶ Housing ▶ Finances ▶ Supports ▶ Length of follow-up: 2 years
Browne et al. (2002)	20/21	736	707	586	Dysthymia in primary care Mean age = 42.1 years (12.1) Mean years of education = 14.0 (2.9) Mean number of children = 1.6 (1.4)	I. Nurse-led proactive Sertraline Rx II. Proactive Sertraline plus interpersonal psychotherapy (IPT) III. Proactive IPT	▶ Supplemental ▶ Specialist nurse providing IPT ▶ GP providing Sertraline ▶ Length of follow-up: 2 years
Harrison et al. (2002)	19/21	212	192 Group I. Transition 92 II. Usual Care 100	157 Group I. 79 II. 78	Discharged hospitalized persons with heart failure Female = 45% Mean age = 75.64 years (9.87) Mean comorbidity = 3.76 (1.87) 48% live alone 90% retired/disabled 67% NYHA 37% in hospital for 6 months	I. Nurse-led transitional care: > 2 visits ▶ Evidence-based education program ▶ Transfer letter to home nurse ▶ Phone outreach < 24 hrs ▶ Education booklet II. Usual discharge III. Consultation between community and hospital nurses	▶ Supplemental nurse-led disease management and transition ▶ Length of follow-up: 6 and 12 weeks

**Table E2: Summary Details of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Quality Score	Eligible	Randomized	Analyzed	Target Group Characteristics	Comparison	Nurse Intervention																							
Markle-Reid et al. (2006)	20/21	577	288 Group Intervention 144 Control 144	242 Group Interv. 120 Control 122	Seniors on home care receiving homemaking services Mean age = 83.37 years (5.47) Female = 77% With depression (CES-D) = 20% < \$40,000/year = 87%	I. Adding home care nurse to homemaker versus II. Homemaker alone	<ul style="list-style-type: none"> <li>▶ Supplemental</li> <li>▶ General home care nurse proactively added to homemaker services</li> <li>▶ Aimed at client and caregiver</li> </ul>																							
Markle-Reid et al. (2010)	21/21	267	109	92 Group Interv. 49 Control 43	Seniors newly referred to community care access centres (CCAC-Home Care) Eligible for home support service Age > 75 years (46% >85 years) Female: 71.7% 44.6% with fear of fall	Home care case manager versus nurse-led interdisciplinary team <ul style="list-style-type: none"> <li>▶ Routine assessment</li> <li>▶ Modification of fall risk factors</li> <li>▶ Intensive client support</li> <li>▶ Patient education</li> <li>▶ Fall risk-management protocol</li> <li>▶ Monthly team conference versus usual home care</li> </ul>	<ul style="list-style-type: none"> <li>▶ Supplemental</li> <li>▶ Nurse-led interdisciplinary care: created and trained existing home care providers</li> <li>▶ Length of follow-up: 6 months</li> </ul>																							
Markle-Reid (2011)	20/21	799	101 Group Intervention 52 Control 49	82 Group Interv. 43 Control 39	Recently discharged stroke survivors on home care <table border="0" style="width: 100%; border-collapse: collapse;"> <tr> <td></td> <td style="text-align: center;">Int.</td> <td style="text-align: center;">Control</td> </tr> <tr> <td>Male</td> <td style="text-align: center;">49%</td> <td style="text-align: center;">62%</td> </tr> <tr> <td>Living with others</td> <td style="text-align: center;">54%</td> <td style="text-align: center;">64%</td> </tr> <tr> <td>First stroke</td> <td style="text-align: center;">79%</td> <td style="text-align: center;">72%</td> </tr> <tr> <td>Time since stroke</td> <td></td> <td></td> </tr> <tr> <td>&lt; 6 months</td> <td style="text-align: center;">70%</td> <td style="text-align: center;">69%</td> </tr> <tr> <td>≥4 comorbid conditions</td> <td style="text-align: center;">35%</td> <td style="text-align: center;">36%</td> </tr> <tr> <td>Depression score (CES-D) &gt; 21</td> <td style="text-align: center;">28%</td> <td style="text-align: center;">33%</td> </tr> </table>		Int.	Control	Male	49%	62%	Living with others	54%	64%	First stroke	79%	72%	Time since stroke			< 6 months	70%	69%	≥4 comorbid conditions	35%	36%	Depression score (CES-D) > 21	28%	33%	Specialty interdisciplinary team stroke rehabilitation versus Usual care <ul style="list-style-type: none"> <li>▶ Supplemental CCAC nurse-led</li> <li>▶ Dedicated team with involved trained nurse</li> <li>▶ In-home assessment               <ul style="list-style-type: none"> <li>▶ reintegration</li> <li>▶ prevention</li> <li>▶ rehabilitation</li> </ul> </li> <li>▶ Monthly team meetings</li> <li>▶ Evidence-based</li> </ul>
	Int.	Control																												
Male	49%	62%																												
Living with others	54%	64%																												
First stroke	79%	72%																												
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< 6 months	70%	69%																												
≥4 comorbid conditions	35%	36%																												
Depression score (CES-D) > 21	28%	33%																												

**Table E2: Summary Details of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Quality Score	Eligible	Randomized	Analyzed	Target Group Characteristics	Comparison	Nurse Intervention
Mills et al. (2010)	20/21	841	653	634	Cardiovascular risks in primary care (blood pressure, cholesterol, weight, smoking, diabetes) Mean age = 75.64 years (9.87) Female = 45%	I. Proactive cardiovascular clinic II. Nurse proactive telephone support III. Usual on-demand GP care	<ul style="list-style-type: none"> <li>▶ Supplemental</li> <li>▶ Nurse-led proactive clinic with general practitioner</li> <li>▶ Disease management</li> <li>▶ Length of follow-up: 1 year</li> </ul>
Roberts et al. (1995)	19/21	490	293	6 mo = 250 12 mo = 237	Poorly adjusted chronically ill attending one of 28 MD specialist clinics Mean age = 46 years (14.8) Female = 66%	I. Nurse-led problem solving counselling: 10 sessions, 1 hour II. Same nurse: on telephone approximately 10 m. III. Specialist care alone	<ul style="list-style-type: none"> <li>▶ Master's-prepared, proactive nurse-led problem solving counselling with specialist physician care</li> <li>▶ Length of follow-up: 2 years</li> </ul>
Roberts et al. (1999)	18/21	140	83	57	Caregivers of relatives with dementia living at home Time since relative's diagnosis: 25.7 months on average Mean age = 61 years (12.9)	I. Nurse-led proactive problem solving counselling versus II. Usual registered nurse home visiting	<ul style="list-style-type: none"> <li>▶ Supplemental</li> <li>▶ Specific—targeted general registered nurses</li> <li>▶ Length of follow-up: 1 year</li> </ul>

Abbreviations: CES-D = Center for Epidemiologic Studies Depression (scale); NYHA = Functional Class III New York Heart Association; SLRU = System-Linked Research Unit on Health and Social Service Utilization (at McMaster University)



**Table E3: Results of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Results	Group I Public Health Employment and Child Recreation			Group II Public Health Nursing			Group III Employment Retraining			Group IV Child Recreation			Group V Self-Directed Care			Significance
		Total N	N	%	Total N	N	%	Total N	N	%	Total N	N	%	Total N	N	%	
Browne et al. (2001)	No use of social assistance after 1 year	88	22	25.0	69	15	21.7	59	12	20.3	85	17	20.0	60	6	10	Group I vs. V: $X_2 = 5.23$ $p = 0.02$ 15% greater exit = \$300,000/100 families offered the services
		N	X Score	(SD)	N	X Score	(SD)	N	X Score	(SD)	N	X Score	(SD)	N	X Score	(SD)	
	2-year total direct cost	88	\$1,789	(3,282)	69	\$1,777	(3,544)	59	\$4,159	(10,996)	85	\$1,344	(2,179)	60	\$1,987	(5,232)	F = 2.59, p = 0.04

**Comment:** More effective and less costly for parents and children

**Table E3: Results of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Results	Group I (Sertraline alone)			Group II (Sertraline + IPT)			Group III (IPT alone)		
		N	6 months X (SD) % resp.	2-Year Mean Change Score	N	6 months X (SD) % resp.	2-Year Mean Change Score	N	6 months X (SD) % resp.	2-Year Mean Change Score
Browne et al. (2002)	MADRS score	196	24.9 (6.5) 59.7	-13.2 (11.0)	212	26.0 (6.3) 57.5	-13.6 (10.9)	178	24.4 (5.9) 46.6	-10.2 (11.0)
	Between groups		p = 0.03	p = 0.02			p = 0.01			
		N	6 months	2 Years	N	6 months		N	6 months	2 Years
	Direct costs (payer perspective)	196	\$2,345 (\$3,647)	\$2,403 (\$4,240)	212	\$2,145 (\$2,967)		178	\$1,856 (\$2,371)	\$1,535 (\$1,985)
	Between groups		p < 0.001	KW x2 = 11.54, p < 0.01						

**Comment:** Sertraline and interpersonal psychotherapy (IPT) equally effective and no more costly than Sertraline alone

**Table E3: Results of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Results	Group I Transitional Care		Group II Usual Care		P	Conclusion of This Reviewer		
		N	X	(SD)	N			X	(SD)
Harrison et al. (2002)	<b>Total MLHFQ score:</b>								
	Baseline	79	27.25	(19.07)	76	37.54	(27.25)	0.002	More effective, less costly
	Similar	77	25.76	(19.44)	74	38.39	(18.24)	<.0001	
	<b>MLHFQ physical score:</b>								
	Baseline	79	16.37	(11.04)	76	23.21	(10.66)	0.01	<0.001
	Similar	77	14.89	(11.13)	74	23.21	(10.66)		
	<b>MLHFQ emotional score:</b>								
	Baseline	79	4.52	(5.17)	76	7.25	(6.15)	0.006	0.068
	Similar	77	4.97	(5.76)	74	6.92	(5.54)		
	<b>Resource Use</b>		<b>N</b>	<b>%</b>		<b>N</b>	<b>%</b>		
	Hospital admin.	12 weeks	77	23		74	31		n.s.
	Emergency room visits at 12 weeks	1st visit	77	29		74	46		X <sup>2</sup> = 4.86, p = 0.03
Multiple visits		77	32		74	50			

**Table E3: Results of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Results	Group I Nursing and Homemaker			Group II Homemaker Alone			P	Conclusion of This Reviewer	
		N	Mean Change Score	(SD)	N	Mean Change Score	(SD)			
Markle-Reid et al. (2006)	Physical score	120	-12.08	(25.04)	122	-6.69	(20.04)		More effective, less costly	
	Role emotion	120	-10.07	(35.47)	122	0.41	(30.53)			
	SF-36	Mental function	118	-6.47	(20.6)	122	0.99	(19.82)		0.009
		Mental health summary score	118	-10.8	(18.72)	122	-4.48	(18.44)		
	Depression score (CES-D)	113	3.89	(8.68)	115	1.17	(9.24)	F = 5.28, p = 0.022		
	Perceived social support	111	-2.96	(15.62)	114	2.30	(14.20)	F = 6.999, p = 0.009		
	Direct costs with hospital stay at follow-up (6 months)	N	X Score	(SD)	N	X Score	(SD)	P		
	44	\$15,030	(36,431)	50	\$19,260	(35,749)	No significant difference			
							MW	Z	P	
							912	-1.425	0.154	

SLRU Study	Results	Interdisciplinary Falls Prevention			Usual Homemaker Support from Home Care			P	Conclusion of This Reviewer	
		N	Mean Change Score	(SD)	N	Mean Change Score	(SD)			
Markle-Reid et al. (2010)	Number of falls in past 6 months	49	0.31 lower	43 (2.55)		0.35 lower	(3.34)	0.702	More effective, equally costly. Subgroup, most effective and equally costly, reducing falls for men 75-84 years old.	
	Number of slips/trips	49	0.53 lower	43 (3.54)		-4.44 more	(20.13)	0.027		
	SF-36 – Role emotional score		-27.89 improved	43 (39.77)		-13.76 improved	(29.54)	0.05		
			X Score	(SD)	N	X Score	(SD)	P		
	Direct costs with hospital stay at follow-up (6 months)		\$5,127 (3,914)			\$4,800 (4,305)		0.33		

**Table E3: Results of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Results	Intervention Multidisciplinary Team			Usual Care			P	Conclusion of This Reviewer
		N	Mean Change Score	(SD)	N	Mean Change Score	(SD)		
Markle-Reid et al. (2010)	Physical score	43	5.85	(15.88)	39	1.63	(17.13)		More effective, equally costly
	Mental competence summary score	43	6.61	(19.37)	39	6.32	(18.76)	0.027	
		Social functioning	43	11.92	(39.81)	39	2.88	(34.94)	
	Role emotion	43	10.47	(33.59)	39	7.68	(31.80)		
	Depression score (CES-D)	43	-30% reduction		39	-21% reduction			
		<b>N</b>	<b>X Change Score</b>	<b>(SD)</b>	<b>N</b>	<b>X Change Score</b>	<b>(SD)</b>		
	Direct costs at follow-up	43	\$20,795	(26,481)	39	\$18,044	(25,207)	n.s.	

**Table E3: Results of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Results	Group 1	CARR (n = 211)			Phone (n = 206)			Usual Care (n = 222)			CARR vs. Usual M-Hx2	Conclusion of This Reviewer
			n	X (SD)	%	n	X (SD)	%	n	X (SD)	%		
Mills et al. (2010)	Risk reduction >10%	Total group	146		69.2%	119		57.8%	128		59%	%4.33, p = 0.037 Group x CVD ANOVA 2-way F2, 628 = 3.95, p = 0.02 CARR x phone group F1, 413 = 5.90, vs. usual care F1, 424 = 4.96, p = 0.026 F2, 613 = 6.36, p = 0.002 F2, 613 = 5.07, p = 0.006 F2, 631 = 4.62, p = 0.010 n.s.	
		With CVD	83		71.1%	76		57.9%	78		59%		
		Without cardiovascular disease (CVD)	128		68.0%	130		57.7%	139				
	Self-efficacy		146	42.1 (6.3)		119	41.2 (7.1)		128	41.7 (7.2)			
		Do chores	146	26.0 (5.4)		119	25.0 (6.5)		128	25.8 (6.1)			
	Total direct costs	Social recreation activities	146	17.3 (3.5)		119	16.9 (3.9)		128	17.5 (3.3)			
			146	\$4,994 (5,247)		119	\$7,615 (21,989)		128	\$5,553 (9,763)			

**Table E3: Results of McMaster–SLRU Randomized Controlled Trials of Supplemental, Proactive Nurse-Led Interventions**

SLRU Study	Results		Group I		Group II		Group III			P	Conclusion of This Reviewer	
			MSc RN Counselling		MSc RN Phone		Usual Care – Physical					
			N=89	X	(SD)	N=	X	(SD)	N=			X
Roberts et al. (1995)	PAIS mean improvement scores	Lives alone	17	13.4	15	1.78	9	2.89		F <sub>2,247</sub> = 3.20, p = 0.04	More effective, less costly for subgroups	
		Lives with someone	72	6.06	72	9.08	74	(4.55)				
	12-month total direct costs	Lives alone/can't problem solve	N	X Score	(SD)	N	X	(SD)	N	X	(SD)	P
			17	\$4,000		15	\$13,500		9	\$39,900		3-way interaction F <sub>2,226</sub> = 5.4, p = 0.005

SLRU Study	Results		Problem Solving Counselling (Low/High)		Usual Home Care		Significance		Conclusion of This Reviewer
			X Change		X Change		Significance		
			N	X	N	X	N	X	
Roberts et al. (1999)	Psychosocial Adjustment	Low	13	2.86 (n/a)	13	-5.08 (n/a)			More effective and more costly for a subgroup of caregivers with difficulty in problem solving
		High	15	-3.27 (n/a)	16	6.63 (n/a)	F = 4.7, p = 0.035, 1,53		
	Total Caregiver Expenditures (Societal Perspective)			X Change		X Change	Significance		
	Low	13	\$7,533 (n/a)	13	\$1441 (n/a)				
	High	15	\$2,259 (n/a)	16	\$2464 (n/a)	F = 7.07, p = 0.01, 1,53			

*Abbreviations:* CES-D = Center for Epidemiologic Studies Depression (scale); MADRS = Montgomery Asberg Depression Rating Scale; MLHFQ = Minnesota Living with Heart Failure Questionnaire; n. s. = not significant; PAIS = Psychosocial Adjustment to Illness Scale; resp. = respiratory; SD = standard deviation; SF-36 = Medical Outcome Study Short Form-36; SLRU = System-Linked Research Unit on Health and Social Service Utilization (at McMaster University)