Abstract

**Context.** Systematic reviews and meta-analyses suggest that community specialist palliative care services (SPCSs) can avoid hospitalizations and enable home deaths. But more information is needed regarding the relative efficacies of different models. Family caregivers highlight home nursing as the most important service, but it is also likely the most costly.

**Objectives.** To establish whether community SPCSs offering home nursing increase rates of home death compared with other models.

**Methods.** We searched MEDLINE, AMED, Embase, CINAHL, the Cochrane Database of Systematic Reviews, and CENTRAL on March 2 and 3, 2011. To be eligible, articles had to be published in English-language peer-reviewed journals and report original research comparing the effect on home deaths of SPCSs providing home nursing vs. any alternative. Study quality was independently rated using Cochrane grades. Maximum likelihood estimation of heterogeneity was used to establish the method for meta-analysis (fixed or random effects). Potential biases were assessed.

**Results.** Of 1492 articles screened, 10 articles were found eligible, reporting nine studies that yielded data for 10 comparisons. Study quality was high in two
cases, moderate in three and low in four. Meta-analysis indicated a significant effect for SPCSs with home nursing (odds ratio 4.45, 95% CI 3.24–6.11; \(P<0.001\)). However, the high-quality studies found no effect (odds ratio 1.40, 95% CI 0.97–2.02; \(P=0.071\)). Bias was minimal.

**Conclusion.** A meta-analysis found evidence to be inconclusive that community SPCSs that offer home nursing increase home deaths without compromising symptoms or increasing costs. But a compelling trend warrants further confirmatory studies. Future trials should compare the relative efficacy of different models and intensities of SPCSs. J Pain Symptom Manage 2013;45:279–297. © 2013 U.S. Cancer Pain Relief Committee. Published by Elsevier Inc. All rights reserved.

**Key Words**
Palliative care, nursing, systematic review, home deaths

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**Introduction**

Many people with life-limiting illnesses prefer to be cared for and die at home rather than in the hospital.\(^1\) Enabling people to choose home death now underpins national palliative care policies\(^2,3\) and even has been suggested to be a legal right.\(^4\) The option to die at home is important not only for patients but also for family caregivers, for whom home deaths are associated with better physical and mental health after having relinquished the role.\(^5,6\)

Caring for people approaching the end of life is challenging and must address physical, psychosocial, and information needs in a timely way.\(^7\) Caregivers need practical and psychosocial support as well as education on symptom management to continue caring at home.\(^8–10\) Without appropriate services, patients who might otherwise prefer to stay at home may seek institutional care because of fear of uncontrolled suffering and caregiver burden.\(^11\) These considerations are equally as important for patients who wish to receive most of their care at home, while not necessarily wishing to die at home.\(^12\)

Systematic reviews and meta-analyses have generally supported the potential for community specialist palliative care services (SPCSs) to enable people to be cared for and die at home, and symptom control, quality of life (QOL), satisfaction, and health care costs have nearly always been found comparable or superior to standard care.\(^13–21\) However, interventions have varied widely with regard to the services offered, ranging from telephone support or education to domiciliary assistance, psychosocial support, physician visits, and 24-hour nursing care. Reviews to date have been broad ranging and offered limited analysis of the kinds of SPCSs that are most efficacious and cost-effective. The most informative review to date suggests that rate of home deaths may be predicted by home care intensity and accessibility.\(^13\) Caregivers have highlighted home nursing as the most important service component,\(^22\) but it is also likely to be the most resource intensive. Meanwhile, funding of, and access to, SPCSs remain inconsistent.\(^23,24\)

A further limitation of previous meta-analyses is that they have considered the rates of home death separately from other outcomes. Given challenges in managing symptoms at home,\(^25\) we consider evidence that symptom control/QOL is no worse in experimental services to be an important prerequisite for meaningful comparison of home death rates.

The work reported here aimed to further inform the evidence base for SPCSs by comparing the effect on rates of home deaths of SPCSs providing home nursing vs. other models of service delivery. Secondary aims were to determine whether SPCSs providing home nursing demonstrated increased rates of home death vs. alternatives in the context of no detriment to symptom control or QOL and no greater cost.

**Methods**

**Protocol and Registration**

No protocol was made publicly available for this review and meta-analysis.
**Eligibility Criteria**

To be included, articles had to be written in English, published in the peer-reviewed literature and 1) report original research evaluating a community-based SPCS providing home nursing for people with life-limiting illnesses; 2) compare the intervention concurrently, retrospectively, or prospectively with an alternative that did not include access to home nursing; 3) include rates of home deaths among their outcomes; and 4) provide place of death for a sample size deemed to yield an acceptable level of reliability ($n \geq 10$ patients per group).

To be eligible, interventions had to deliver nursing care exclusively in the home rather than only through a day hospital or inpatient services. Interventions providing only advisory home visits rather than hands-on nursing, telephone support services, caregiver education, training, information, and/or domiciliary assistance also were excluded. Studies that reported interventions exclusively for patients with disease identified as chronic rather than life limiting were further excluded. Comparative studies of any design were eligible. When the articles indicated that data on place of death had been collected but not reported, authors were e-mailed to ask for more details.

**Information Sources and Search**

We searched MEDLINE, AMED, Embase, CINAHL, the Cochrane Database of Systematic Reviews, and CENTRAL from their earliest records to March 2 and 3, 2011. Searches used Medical Subject Headings terms or equivalent as well as key words relating to palliative care, terminal care, hospice, home care, community or domiciliary, and nursing (see Table 1 for example). Reference lists of included articles and relevant reviews were searched manually for further relevant articles.

**Study Selection**

Returned articles were imported into Endnote version X4 (Thomson Reuters, New York, NY) and electronically coded by one researcher against each inclusion criterion. When it was suspected that two or more studies evaluated the same intervention, authors were e-mailed for confirmation. When authors confirmed or did not reply, meta-analysis included data from the highest quality study only.

**Data Collection Process**

Data were extracted by one researcher using an electronic pro forma. Article authors were contacted via e-mail to ask for more information on services provided to patients in each intervention and comparison group.

**Data Items**

Data items included characteristics of each intervention (target population, services provided, personnel involved, duration, and intensiveness) and its comparator as well as details of evaluation (research design, sampling, allocation, sample size, and outcomes).

**Risk of Bias in Individual Studies**

Study quality was independently rated by two researchers using criteria derived from the Cochrane grade, which is applicable for both randomized studies and nonrandomized studies, and uses four quality levels: high, moderate, low, and very low. Although the grades were originally intended for rating bodies of evidence rather than the individual studies, they have been adapted for the latter purpose. Differences in opinion were resolved through discussion. A separate meta-analysis was conducted for studies rated as high quality to check for consistency with the overall result.

**Summary of Measures**

For the primary analysis, rates of home deaths for SPCSs offering home nursing vs. alternatives

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**Table 1**

<table>
<thead>
<tr>
<th>Example of Search Terms—CINAHL</th>
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</thead>
<tbody>
<tr>
<td>1. (MM “Hospice and Palliative Nursing”) OR (MM “Palliative Care”) OR (MM “Hospice Care”) OR (MM “Terminal Care”)</td>
</tr>
<tr>
<td>2. (MM “Home Health Care+”) OR (MM “Home Nursing, Professional”) OR (MM “Home Visits”) OR (MM “Home Nursing”)</td>
</tr>
<tr>
<td>3. (MM “Community Health Nursing+”) OR (MM “Community Health Services+”)</td>
</tr>
<tr>
<td>4. S2 or S3</td>
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<td>5. S1 and S4</td>
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</table>
were compared using odds ratios (ORs) with 95% confidence intervals (CIs). The ORs were used because studies varied in design.

Synthesis of Results

Meta-analyses were conducted using Stata SE 10.1 (2009; StataCorp LP, College Station, TX) with specific modules. To determine which statistical model would be the most appropriate, a test of heterogeneity was conducted to test for the equity of parameter estimates. In this study, the maximum likelihood estimator method was applied. When a test of heterogeneity suggested no significant deviation from the hypothesis of equity of parameter estimate both within and between the subgroups, a fixed effects model was deemed to be appropriate. The inverse variance method was used for the calculation of ORs and corresponding 95% CIs. On the other hand, should the hypothesis be refuted, a random effects model was planned with the calculation of ORs based on the method of DerSimonian and Laird.27

Following meta-analyses of the whole pool, we repeated the analysis for high-quality studies only. We then conducted two further meta-analyses focusing on studies where symptoms/QOL and costs were reported and found to be significantly better or not significantly different for SPCSs offering home nursing. Statistical results comparing SPCS home nursing interventions with other services on symptoms/QOL and costs were coded as “favors SPCS home nursing,” “favors comparator,” or “no significant difference” against a $P$-value of 0.05. When relative costs were reported in the absence of a statistical comparison, findings were coded as favors SPCS home nursing or favors comparator on an absolute cost basis.

Risk of Bias Across Studies

Potential publication and other biases were assessed using three separate approaches. The funnel plot approach using the trim and fill method was first applied to the data.28 Begg’s rank correlation method also was applied to calculate the correlation between the standardized treatment effect and the variance of the treatment effect.29 This was followed with the Egger regression method, fitting a linear model of the standardized treatment effect on its precision (i.e., the inverse of the variance).30

Results

Study Selection

Of 1492 articles screened, 10 articles31–40 reporting nine studies and enabling 10 comparisons met eligibility criteria (Fig. 1).

Study Characteristics and Individual Results

Table 2 provides a summary of the nine SPCS home nursing interventions evaluated against key criteria. Table 3 outlines evaluative studies’ quality, designs, samples, comparative services, and findings. Two studies were rated as high quality,33–35 three as moderate,36,37,40 and four as low.31,32,38,39

Pooled Effect for Home Death

Fig. 2 outlines results from each of the 10 comparisons for home death. The test of heterogeneity yielded a result of $\chi^2 = 120.49, P < 0.0001$, suggesting that a random effects model could be applied to the data for the calculation of the pooled treatment effect. The result suggested a significant overall treatment effect ($z = 51.67, P < 0.001$) with a pooled OR of 4.45 (95% CI 3.24–6.11) in favor of community SPCSs offering home nursing vs. alternatives (Fig. 2).
<table>
<thead>
<tr>
<th>Article(s)</th>
<th>Setting</th>
<th>Population</th>
<th>Referral</th>
<th>Services Provided</th>
<th>Professionals Delivering Intervention</th>
<th>Availability of Nurses</th>
<th>Coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahlner-Elmqvist et al.</td>
<td>Malmo University Hospital and Community Care, Sweden</td>
<td>Cancer patients “in a palliative situation”</td>
<td>Doctors in charge at hospital departments with cancer caseload</td>
<td>Symptom management, technical support plus counseling, emotional, social, and family support</td>
<td>Nine experienced nurses, an oncologist, a physiotherapist, a social worker, and a secretary. A priest was involved on a consultation basis</td>
<td>24/7</td>
<td>NR</td>
</tr>
<tr>
<td>Axelsson and Christensen</td>
<td>County of Jämtland, Sweden</td>
<td>Incurable cancer</td>
<td>Hospital departments (primarily Department of General Surgery) and GPs</td>
<td>Nursing and occasional home visits from surgeon plus training of district nurses</td>
<td>Nurse with support from seven surgeons</td>
<td>Weekdays 8 am to 5 pm</td>
<td>Yes</td>
</tr>
<tr>
<td>Brumley et al.</td>
<td>Group-model, closed-panel, nonprofit health maintenance organizations providing integrated health care services in Hawaii and Colorado</td>
<td>Life-threatening disease and life expectancy of less than one year</td>
<td>Physicians, nurse practitioners, Kaiser Permanent liaison nurses (who visit seriously ill patients in a variety of settings), social workers, and hospital discharge planners; patients also may self-refer</td>
<td>Symptom control and psychosocial services (including FCG bereavement services) plus training of staff and families on use of medications and patients on self-management and crisis intervention</td>
<td>Physician; a nurse with experience in palliative care, pain management, and end-of-life issues; a social worker; and a chaplain. Other professionals, such as physical therapists, respiratory therapists, and home health aides, participate as needed</td>
<td>24/7 phone and nursing/medical home visits as needed</td>
<td>Yes</td>
</tr>
<tr>
<td>Grande et al.</td>
<td>Cambridge Health District, U.K.</td>
<td>Mostly terminal care during final two weeks of life, although respite care could be provided at any point during an illness requiring palliative care. No FCG requirement</td>
<td>Mainly from primary care (admission avoidance); less than one-third from secondary care (enabling discharge)</td>
<td>Practical nursing care (in addition to comparator services)</td>
<td>Six nurses (two ENs and four RGNs), two nursing auxiliaries, and a coordinator (also an RGN). Agency nursing as required</td>
<td>24/7 for up to two weeks</td>
<td>“Location of service appeared to facilitate informal cooperation between services and access to specialist medical advice”</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Article(s)</th>
<th>Setting</th>
<th>Population</th>
<th>Referral</th>
<th>Services Provided</th>
<th>Professionals Delivering Intervention</th>
<th>Availability of Nurses</th>
<th>Coordination</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gray et al.36</td>
<td>Western Australia</td>
<td>Terminally ill; unclear whether FCG is required</td>
<td>Factors determining referral “ill defined”</td>
<td>Medical care, regular and emergency nursing, family support</td>
<td>GP, nurses, and volunteers</td>
<td>Two to three visits a day plus night nurse; paging system</td>
<td>Yes</td>
</tr>
<tr>
<td>Greer et al.37</td>
<td>Hospices and oncology services across U.S.</td>
<td>Terminal illness</td>
<td>NR</td>
<td>Medical, nursing</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Mayor38 (more details available in Addicott and Dewar41)</td>
<td>Lincolnshire, U.K.</td>
<td>Terminally ill near end of life</td>
<td>District nurse</td>
<td>Support in transitioning from hospital to home plus rapid response team to provide planned and emergency home visits. Also FCG information and emotional support and training of community health professionals</td>
<td>Community link nurse and rapid response team</td>
<td>3 PM to 7 AM</td>
<td>Yes</td>
</tr>
<tr>
<td>Moinpour and Polissar40</td>
<td>Washington State, U.S.</td>
<td>Hospice patients not otherwise specified</td>
<td>NR</td>
<td>Hospice home care only, delivered by a Medicare-certified home health agency or general home and hospice home care delivered by a Medicare-certified home health agency</td>
<td>NR</td>
<td>NR</td>
<td>NR</td>
</tr>
<tr>
<td>Sessa et al.39</td>
<td>Servizio Oncologico Cantonale, Ticino region, Switzerland</td>
<td>Cancer, expected survival less than three months, cooperation from family physician</td>
<td>Medical oncology</td>
<td>Symptom control and information to patients</td>
<td>Physicians, nurses, and social workers</td>
<td>NR</td>
<td>Yes</td>
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</table>

Availability of FCG is an eligibility requirement unless otherwise indicated.
NR = not reported; GP = general practitioner; FCG = family caregiver; EN = enrolled nurse; RGN = registered general nurse.
### Table 3

Research Designs, Samples, and Findings on Symptoms/QOL and Costs From Nine Studies Evaluating Palliative Home Care Interventions

<table>
<thead>
<tr>
<th>Article(s)</th>
<th>Quality</th>
<th>Design</th>
<th>Comparison Group</th>
<th>Allocation</th>
<th>Intervention</th>
<th>Comparison</th>
<th>Intervention</th>
<th>Comparison Differences</th>
<th>Home Deaths (I vs. C)</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ahlner-Elmqvist *et al.*31</td>
<td>Low</td>
<td>NRS</td>
<td>Conventional care not otherwise described</td>
<td>Patient preference</td>
<td>Consecutive</td>
<td>Concurrent</td>
<td>Adults with cancer and life expectancy of two to 12 months, predominantly men</td>
<td>Shorter time since diagnosis, lower rates of KPS &lt; 70 and higher rates of lung and gastrointestinal but lower rates of genitourinary cancer</td>
<td>45/117 vs. 10/163*</td>
<td>I vs. C hospitalized lower % of time (P &lt; 0.005)</td>
</tr>
<tr>
<td>Axelsson and Christensen32</td>
<td>Low</td>
<td>Retrospective record review</td>
<td>No description of services received, if any</td>
<td>NR</td>
<td>Retrospective (before home care), matched on age, diagnosis, sex, and place of residence</td>
<td>Adults with incurable cancer in the realm of surgery (most commonly prostate and colorectal)</td>
<td>Shorter median survival time from diagnosis to death</td>
<td>13/41 vs. 8/41</td>
<td>I vs. C lower absolute per patient cost (SK17, 360; SCNR). I vs. C shorter duration of terminal hospitalization (P &lt; 0.05), more days spent at home (P &lt; 0.001), more favorable ratio of days at home/inclusion (P &lt; 0.001), more days at home in last two months of life (P &lt; 0.01), NNDS admissions or institutional days in last six months of life</td>
<td></td>
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<tr>
<td>Brumley *et al.*33</td>
<td>High</td>
<td>RCT</td>
<td>(In common with home care group) standard care to meet the needs of the patients and followed Medicare guidelines for home health care criteria.</td>
<td>Block randomization stratified by site</td>
<td>Consecutive</td>
<td>Concurrent</td>
<td>Homebound terminally ill patients with a prognosis of approximately one year or less to live plus one or more hospital or emergency</td>
<td>Less satisfied with health care at baseline</td>
<td>81/198 vs. 54/162</td>
<td>I vs. C lower costs of care per patient* ($212.80; t = −3.65, P = 0.02). I vs. C % “very satisfied” NSD at 60 days; OR = 3.37, 95% CI = 1.42–8.10 (P = 0.006) at 30 days; and OR = 3.37, 95%</td>
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<tr>
<th>Article(s)</th>
<th>Quality</th>
<th>Design</th>
<th>Group Allocation</th>
<th>Sampling</th>
<th>Sample Characteristics</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grande et al.</td>
<td>High</td>
<td>RCT</td>
<td>(with home care group)</td>
<td>Consecutive Concurrent</td>
<td>Multietnic, one-third low income</td>
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<tr>
<td>Services included</td>
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<tr>
<td>Various amounts and levels of home health services, acute care services, primary care services, and hospice care. Patients were treated for conditions and symptoms when they presented to attending physicians. Additionally, they received ongoing home care when they met the Medicare-certified criteria for an acute condition. Services included hospital, hospice, and/or community care in hospital, district/nursing, evening district nursing, social services, private care, and flexible care. Services were provided in the homecare group.</td>
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<td>CI = 0.65</td>
<td>e^{-4.96}</td>
<td>P = 0.03</td>
<td>I vs. C fewer emergency presentations (b = 0.35; P = 0.02), hospitalizations (P &lt; 0.001) and hospital days (b = 4.36; P &lt; 0.001)</td>
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<tr>
<td>Grande et al.</td>
<td>34,35</td>
<td>High RCT</td>
<td>(with home care group)</td>
<td>Consecutive Concurrent</td>
<td>Multietnic, one-third low income</td>
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<tr>
<td>Study</td>
<td>Methodology</td>
<td>Sample Selection</td>
<td>Outcomes</td>
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</tr>
<tr>
<td>Gray et al.</td>
<td>Moderate</td>
<td>Retrospective review of deaths listed on the cancer registry of people who did not access the service</td>
<td>Carer need for support in looking after the patient ($P &lt; 0.01$); GP-rated anxiety ($P &lt; 0.05$); and breathlessness ($P &lt; 0.01$)</td>
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</tr>
<tr>
<td>Greer et al.</td>
<td>Moderate</td>
<td>NRS “Good” conventional oncological care, Sites randomly selected from hospices and oncology departments. Patient allocation to services NR</td>
<td>None evident 58/98 vs. 16/98 NSD in per patient costs* ($A$6477/$A$6502). I vs. C lower mean number of institutional days in last 21 ($P &lt; 0.001$), 30 ($P &lt; 0.001$), and 90 days of life ($P = 0.005$)</td>
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<td></td>
</tr>
<tr>
<td>Mayor</td>
<td>Low</td>
<td>Retrospective review of patients in same region who did not access the service</td>
<td>All 1983 home care patient deaths in cancer registry Concurrently matched on primary cancer, age, and sex Adults who died of cancer, most commonly of the digestive organs/peritoneum and respiratory/intrathoracic organs None evident 58/98 vs. 16/98 NSD in per patient costs* ($A$6477/$A$6502). I vs. C lower mean number of institutional days in last 21 ($P &lt; 0.001$), 30 ($P &lt; 0.001$), and 90 days of life ($P = 0.005$)</td>
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<th>Article(s)</th>
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<th>Allocation</th>
<th>Sampling</th>
<th>Sample Characteristics</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moinpour and Polissar</td>
<td>Moderate</td>
<td>Retrospective record review</td>
<td>Patients in same region who did not access the service</td>
<td>NR</td>
<td>All who died during 1980–1985 with cancer as the primary cause of death</td>
<td>NR</td>
<td>1) 2018/3794 vs. 1798/11,033; 2) 678/1642 vs. 1798/11,033*</td>
</tr>
<tr>
<td>Sessa et al.</td>
<td>Low</td>
<td>Retrospective record review</td>
<td>Medical oncology and community services</td>
<td>NR</td>
<td>All cancer deaths over 2.5 year period</td>
<td>All concurrent</td>
<td>Adult patients with terminal cancer, most often lung, breast, hematological, and gastrointestinal</td>
</tr>
</tbody>
</table>

Moinpour, 1989a: General home and hospice home care delivered by a Medicare-certified home health agency; Moinpour, 1989b: Hospice home care only, delivered by a Medicare-certified home health agency; comparison group is the same for both.

QOL = quality of life; I vs. C = intervention group (specialist palliative care service offering home nursing) compared with the comparison group; NRS = nonrandomized study; NR = not reported; KPS = Karnofsky Performance Status; Sk = Swedish Krona; SCNR = statistical comparison not reported; NSD = no statistically significant difference; RCT = randomized controlled trial; A$ = Australian dollar; OR = odds ratio; GP = general practitioner; HB = hospital based; GBP = Great Britain pound.

*Indicates the study’s primary outcome measure (no superscript indicates the authors did not specify).
Diagnostic studies on publication and other potential biases yielded the following results. A funnel plot exhibited a pattern slightly deviated from the shape of an inverted funnel (data not shown). Begg’s rank correlation method yielded a result of an adjusted Kendall’s score of $\frac{1}{2}$ (SD = 11.18) with $z = 0.18$, $P = 0.858$, and the Egger regression plot yielded a bias coefficient of $1.52$ (nonsignificant). Taken together, these results suggested no evidence for publication or other biases.

Subgroup Analysis for Two High-Quality Studies

The test of heterogeneity was not statistically significant ($\chi^2_1 = 0.01$, $P = 0.924$), thus a fixed effects model was used for the analysis. The pooled treatment effect was nonsignificant ($z = 1.81$, $P = 0.071$) with a pooled OR of $1.40$ (95% CI 0.97–2.02) (Fig. 3). Diagnostic studies on publication and other potential biases were not conducted owing to the fact that there were only two studies.33–35

Subgroup Analyses Based on the Results of Symptoms/QOL and Cost

As reported in Table 3, two studies included comparisons on symptoms/QOL and five on cost.34,35,37–39 None of these studies found a significant effect in favor of a comparator. An effect in favor of the experimental intervention was found in one study on symptoms (although not QOL),37 and three studies found the experimental intervention to have lower costs in absolute and/or statistically significant terms.32,33,37

Subgroup Analysis of Two Studies Where Symptoms/QOL Were Not Inferior for Home Nursing

The test of heterogeneity yielded a significant result of $\chi^2_1 = 26.31$, $P < 0.001$.34,35,37 A random effects model yielded a pooled treatment effect that was not significant ($z = 1.38$, $P = 0.167$), with a pooled OR of 4.02 (95% CI 0.56–28.97) (Fig. 4).
Subgroup Analysis of Five Studies Where Costs Were Reported and No Higher for Home Nursing

The test of heterogeneity yielded a significant result ($\chi^2 = 55.70, P < 0.001$). A random effects model indicated a significant pooled treatment effect ($z = 14.04, P < 0.001$) with an OR of 4.16 (95% CI 1.60–10.79) (Fig. 5). Diagnostics on publication and other potential biases resulted in an adjusted Kendall’s score of $-4$ (SD = 4.08) with $z = -0.98, P = 0.327$; the Egger regression plot yielded a bias coefficient of $-16.37 (P = 0.540)$. These results suggested no evidence for publication or other biases.

Discussion

The current meta-analysis found evidence to be inconclusive that community SPCSs providing home nursing have increased the rate of home deaths compared with alternative services of various kinds. Although results have been heterogeneous, it is important to note that none of the studies found a significant effect in favor of an alternative intervention. When studies measured symptoms/QOL or costs, these outcomes either favored SPCSs offering home nursing or did not differ between interventions. Studies that analyzed costs showed a similar pooled effect to all studies combined, providing preliminary evidence for the cost-effectiveness of SPCSs including home nursing.

These findings update and expand evidence from previous meta-analyses and add to more general evidence from systematic reviews. When compared with previous meta-analyses, our results are consistent with the range of ORs reported for the use/intensity of home care in eight studies; and suggest that evidence may be greater for SPCSs offering home nursing than for SPCSs more generally vs. non-specialist “standard care” based on meta-analysis of eight studies, three of which also met inclusion criteria for the current review. Finally, our findings are consistent with population-level studies reporting multivariate analyses of the relationship between home death and access to a hospice program and family caregiver...
assertions that nursing support enables continued home care.\textsuperscript{8,10,22}

Limitations

Limitations in design and reporting of studies included in this meta-analysis impact on the interpretability of our results and the strength of evidence we can conclude. In common with previous systematic reviews in the area,\textsuperscript{14,15,17,20,21} we found study quality to be predominantly poor to moderate. Only two studies were rated as high quality;\textsuperscript{33} neither found a significant effect for experimental services. Reports of only three studies included reference to power calculations for their primary outcome;\textsuperscript{31,33,34} recruitment was insufficient to meet sample size requirements in one.\textsuperscript{34} These limitations are consistent with commentary in the literature that palliative care research faces challenges to randomization, recruitment, and retention.\textsuperscript{44} One of the high-quality studies in our pool resorted to an inefficient 4:1 randomization to address these challenges.\textsuperscript{34,35,45} The quality of studies also was limited by the lack of ideal comparators. Given variation in standard care even within the same health service, comparison groups tended to receive an eclectic mix of ill-defined services,\textsuperscript{46} with substantial variation between individual patients. Poor delineation of the level, intensity, and quality of home nursing (i.e., “dose”) within the context of access to medical care, equipment, social support, and patient/caregiver education and training limits the degree to which results can be ascribed to any one component. Preliminary evidence that live-in support persons may reduce hospitalizations and facilitate discharges raises the question of whether it is nursing expertise or support and reassurance that is more important.\textsuperscript{47} Equally, the degree to which the intervention was successfully delivered (i.e., adherence) was not described. Studies also were constrained by the way in which SPCSs were configured within existing health care systems, including the funding or remuneration model.

Few studies used an optimal design of standard care ± home nursing capable of providing information on incremental benefit.

\begin{table}
\centering
\begin{tabular}{|l|c|c|c|}
\hline
ID & Events, & Events, & Favors SPCS offering home nursing (%) & Favors comparators (%) \\
\hline
Grande et al., 1999 & 1.44 (0.73–2.84) & 124/186 & 48.95 \\
Greer et al., 1986 & 10.77 (7.48–15.51) & 516/833 & 51.05 \\
Overall (I^2 = 96.2\%, P = 0.000) & 4.02 (0.56–28.97) & 640/1019 & 100.00 \\
\hline
\end{tabular}
\caption{Rates of home deaths for SPCSs with home nursing vs. comparators in two studies where symptoms/quality of life were not significantly inferior. SPCS = specialist palliative care service.}
\end{table}
Unfortunately, the predominance of historical controls also limited opportunities to compare symptoms and QOL. Although studies commonly controlled for age, gender, and diagnosis, intervention and comparison groups may have varied on other sociodemographic, clinical, or caregiver (e.g., relationship) variables with potential to influence outcomes.

A final potential limitation concerns the fact that our meta-analysis did not take account of outcomes beyond rates of home death besides symptoms, QOL, and cost. On this point, it should be emphasized that no outcome was found to be significantly inferior for interventions offering home nursing in any of the studies.

**Future Directions**

This review demonstrates the need for future reports to give more detailed descriptions of interventions and comparators to inform replication, development, and evaluation. A number of reports offering detailed descriptions of community SPCSs providing home nursing were excluded because they did not compare these against an alternative,\(^{48-58}\) controlled evaluations of these interventions are encouraged. Ideally, future research should use designs (e.g., factorial) that enable comparisons among different aspects, intensities, and duration of service components to improve the understanding of incremental cost-effectiveness. Given that community SPCSs rely on multiple interacting components and coordination, researchers are encouraged to follow guidance on developing and evaluating “complex interventions.”\(^{59}\) Detailed process data are especially useful in assessing fidelity of implementation, clarifying causal mechanisms, and identifying influential contextual factors to inform ongoing modification and evaluation. A recommended minimum data set of variables is outlined in Table 4. Information of this kind may help service providers to overcome barriers in replicating models shown to be efficacious in research.\(^{60}\) Reporting of the service trialed by Brumley et al.\(^{33}\) is exemplary in this regard, with detailed information available online.

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### Table 4

<table>
<thead>
<tr>
<th>Study</th>
<th>Events, treatment</th>
<th>Events, control</th>
<th>OR (95% CI)</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axelsson and Christensen, 1998</td>
<td>13/41</td>
<td>8/41</td>
<td>1.92 (0.69-5.28)</td>
<td>17.74</td>
</tr>
<tr>
<td>Brumley et al., 2007</td>
<td>81/198</td>
<td>54/162</td>
<td>1.38 (0.90-2.13)</td>
<td>21.22</td>
</tr>
<tr>
<td>Gray et al., 1987</td>
<td>58/98</td>
<td>16/98</td>
<td>7.43 (3.80-14.53)</td>
<td>20.00</td>
</tr>
<tr>
<td>Greer et al., 1986</td>
<td>516/933</td>
<td>39/297</td>
<td>10.77 (7.48-15.51)</td>
<td>21.49</td>
</tr>
<tr>
<td>Mayor, 2008</td>
<td>21/39</td>
<td>30/168</td>
<td>5.37 (2.55-11.28)</td>
<td>19.55</td>
</tr>
<tr>
<td>Overall (I² = 92.8%, P = 0.000)</td>
<td>689/1209</td>
<td>147/766</td>
<td>4.16 (1.60-10.79)</td>
<td>100.00</td>
</tr>
</tbody>
</table>

Note: Weights are from random effects analysis.

Fig. 5. Rates of home deaths for SPCSs with home nursing vs. comparators in five studies where costs were not significantly higher. SPCS = specialist palliative care service.
Of the service variables involved, the role of the SPCS nurse vis-a-vis other community service providers is of special interest. A variety of models exist for education, training, and support of nonspecialist community health professionals and family caregivers. Use of technology to support nonspecialist home nursing is also increasing. Research is needed to guide optimal specialist-generalist communication and coordination. Increasingly, there is recognition of the need to tailor and target health care interventions to particular populations and also workforce characteristics. Nursing care can be independent in nature (e.g., nurse practitioner-based models where nurses diagnose and prescribe care) or dependent (i.e., based on delegation). Other models include substitution (e.g., physician assistants) and enhancement, such as in nurse-coordinated models. The resource requirements of providing community palliative care through generalist services (e.g., primary care providers and community nurses in partnership with domiciliary carers) should not be underestimated. Future evaluations should provide detailed cost-effectiveness data to inform the optimal combination of specialist and generalist provision, the role of nurses vs. other health professionals, and the necessary scope of practice and expertise in different service contexts.

Further research also should focus on adapting efficacious service models for health care systems in developing countries and meeting the needs of underserved groups. Although rates of home deaths are generally low across the world, underlying reasons are likely to vary between countries. When services are scarce, home deaths may occur simply because inpatient services are not available as an alternative. Preferences for place of care and/or death are only true choices where they occur in the context of best-practice services in all settings. The finding that patients who lack a home caregiver and who are socioeconomically disadvantaged are less likely to have access to community SPCSs is a special cause for concern.

A better understanding also is needed of who will benefit most from community-based SPCSs and the configuration of nursing services required to meet patient and caregiver needs. A better understanding of the barriers and facilitators for remaining at home is needed, including detailed exploration of known drivers of hospital admission near the time of death, such as problems with symptom management. Health professionals assessing the suitability of individual patients for home care would be assisted by validated tools for evaluating the viability of home death. Tools for assessing prognosis (with the aim of avoiding acute care admissions for people who are dying and prefer to die at home) also are required. Improved targeting of services will become increasingly important as Western populations age and informal caregivers diminish in availability and capacity.

Finally, more research should be aimed at improving the quality of hospital deaths for patients who either choose to be admitted or cannot be maintained at home. Even where evidence-based support for home care is available, patients and family caregivers should remain at liberty to choose the place of care and death. We also need to support families better in making an informed decision between home vs. institutional care, acknowledging that preferences may change over time and may differ for patients vs. caregivers and place of care vs. place of death.

### Table 4

<table>
<thead>
<tr>
<th>Elements</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nursing</td>
<td>Service provider</td>
</tr>
<tr>
<td></td>
<td>Focus (e.g., transitional support and end of life)</td>
</tr>
<tr>
<td></td>
<td>Time from referral to first home visit</td>
</tr>
<tr>
<td></td>
<td>Day nursing hours</td>
</tr>
<tr>
<td></td>
<td>Overnight nursing hours</td>
</tr>
<tr>
<td></td>
<td>Level of nurse and flexibility</td>
</tr>
<tr>
<td></td>
<td>Prior palliative care training</td>
</tr>
<tr>
<td>Personal care</td>
<td>Service provider</td>
</tr>
<tr>
<td></td>
<td>Personal care hours (maximum)</td>
</tr>
<tr>
<td></td>
<td>Level of personal carer</td>
</tr>
<tr>
<td>Medical/SPCS</td>
<td>Specialist providers involved</td>
</tr>
<tr>
<td></td>
<td>Coordination process</td>
</tr>
<tr>
<td></td>
<td>Liaison with GP</td>
</tr>
<tr>
<td>Education/information</td>
<td>Content (e.g., advance care planning)</td>
</tr>
<tr>
<td></td>
<td>Delivery (e.g., written or verbal)</td>
</tr>
<tr>
<td>Other support</td>
<td>Type (e.g., patient/caregiver support group)</td>
</tr>
<tr>
<td></td>
<td>Delivery (e.g., online)</td>
</tr>
</tbody>
</table>

SPCS = specialist palliative care service; GP = general practitioner.
Summary and Conclusion

Our systematic review and meta-analysis found evidence to be inconclusive that SPCSs that offer home nursing increase the rate of home deaths without compromising symptoms/QOL or increasing costs. The strength of evidence is especially limited by equivocal results from two high-quality randomized controlled trials. Differences in home care services and comparators are likely responsible for heterogeneity among results, but services were too poorly described to be informative regarding the relative efficacy of home nursing vs. other service components or the effect of varying nursing intensiveness and duration.

Future researchers are encouraged to provide more information about the services provided and compare standard care ± home-based nursing wherever possible. Discriminating between the type of nursing care provided (e.g., emotional support, personal hygiene, or more complex nursing tasks such as administering medication) may assist with understanding relative cost-effectiveness and replicating interventions. Understanding sociocultural-specific contexts and economic differences between care models would aid with health services planning in different countries.

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References


38. Mayor S. Pilot study shows cost effective approach to enable people to die at home. BMJ 2008;336:212–213.


