Safety risks associated with physical interactions between patients and caregivers during treatment and care delivery in Home Care settings: a systematic review

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Safety risks associated with physical interactions between patients and caregivers during treatment and care delivery in Home Care settings: a systematic review

Abstract

Objective: To explore the safety risks associated with physical interactions between patients and caregivers during treatment and care delivery in Home Care settings.

Design: Seven-stage framework from the PRISMA statement for research question, eligibility (definition), search, identification of relevant papers from title and abstract, selection and retrieval of papers, appraisal and synthesis.

Data sources: British Nursing Index (BNI), Allied and Complementary Medicine Database (AMED), Applied Social Sciences Index and Abstracts (ASSIA), Cinahl, Cochrane Library, Embase, Ergonomics Abstracts, Health Business Elite, Health Management Information Consortium (HMIC), Medline, PsycInfo, Scopus, Social Care online, Social Science Citation Index.

Review methods: The included references (n=42) were critically appraised using a modified version of Downs and Black checklist and the Mixed Methods Appraisal Tool.

Results: The risk factors are reported using the modified model of human factors of health care in the home to represent the roles of both patients and caregivers in the system. The results are grouped as environment (health policy, physical and social), artefacts (equipment and technology), tasks (procedures and work schedules) and care recipient/provider. These include permanent and temporary building design and access, communication and lone working, provision of equipment and consumables, and clinical tasks. The topics with strong evidence from at least 2 papers relate to risks associated with awkward working positions, social environment issues (additional tasks and distractions), abuse and violence, inadequate team (peer) support, problems with workload planning, needle stick injuries and physical workload (moving and handling patients).

Conclusions: As home care increases, there is a need to ensure the safety of both patients and caregivers with an understanding of the physical interactions and tasks to manage safety risks and plan safer care delivery systems.
Keywords
Home care services, moving and lifting patients, patient safety, occupational health, community health services

Highlights
What is already known:

- Providing care and treatment at a patient’s home presents risks to both caregivers and patients whether care is delivered from one or multiple organisation(s).
- There are different models of home care, including the hospital in the home, patient-centred medical home, home first policies and aging-in-place
- Care tasks are categorised as basic care, including personal hygiene, mobilisation, nutrition and social company, and advanced care, including medication administration, tube feeding, and operating home care technology (e.g. ventilator, electric wheelchair)

What this paper adds

- Risk factors for the environment of care are associated with health policies, physical location and social environment.
- The risks include permanent and temporary building design and access, communication and lone working, provision of equipment and consumables and clinical tasks.
- As home care increases, there is a need to ensure the safety of both patients and caregivers with an understanding of the physical interactions and tasks to manage risks and plan safer care delivery systems.
Introduction

‘A person’s home is not just the place where they live, but also a place of work for home care workers’ (Taylor and Donnelly, 2006). Planning and policy makers, guided by both patient (care recipient) preference for care and treatment in their own home and cost-containment pressures, have been increasingly focusing on community care (Craven et al, 2012; EU-OSHA, 2014). Initiatives have been implemented since the 1960s as deinstitutionalization, community care, continuous care, integrated care and home-based care (WHO, 2008). Home care aims to satisfy peoples’ health and social needs in their homes by ‘providing appropriate and high-quality home-based healthcare and social services, by formal and informal caregivers, with the use of technology when appropriate, within a balanced and affordable continuum of care’ (WHO, 2008). However the home setting presents challenges for the more established (acute) caregiver-patient interactions and requires adaptation of policies, protocols and routines (Duke et al, 2012).

The labelling of services as either social care or healthcare depends on the characteristics and boundaries of both systems and varies in different countries. In 2012 in England there were over 1.1 million people receiving care at home from approx. 1.8 million formal and 5 million informal caregivers (Department of Health, 2012). A study of elderly care in France (Davin et al, 2005) found that ‘more than 1 million people aged 60 years and older need assistance from another person to perform at least one ADL [activity of daily living] (bathing, dressing, going to toilet, eating, transferring, getting outside) and about 2.5 million persons for at least one IADL [instrumental activities of daily living] (shopping, food preparation, housekeeping)’. Care tasks have been categorised as basic and advanced, where basic care includes personal hygiene, mobilisation, nutrition and social company and advanced care has a more clinical focus including medication administration, tube feeding, and operating home care technology (ventilator, electric wheelchair, bed-lifts, oxygen devices) (Swedberg et al, 2013; EU-OSHA, 2014).

There are different models of home care, for example, hospital in the home (Duke et al, 2012), patient-centred medical home (Bitton et al, 2012) home first policies and aging-in-place (Craven et al, 2012). One of the challenges to providing care and treatment at the patient’s home is the safety and risk of injury to caregivers and patients when care is delivered by staff working alone (HSE, 2009) or as part of a
team (Simon et al, 2008). This could be within one organisation (Markkanen et al, 2007), interagency working (Miller and Cameron, 2011) or student supervision (Leh, 2011).

This paper reports the method and results for a systematic literature review to consider caregiver and patient safety and injury risks associated with physical interactions during home care and treatment in the community. It includes a wide range of care procedures from treatment (e.g. palliative care) to daily living care (hygiene and mobility). The term ‘patient’ is used to refer to the care recipient.

**Method**

A seven-stage framework was used in line with the PRISMA statement (www.prisma-statement.org) for research question, eligibility (definition), search, identification of relevant papers from title and abstract, selection and retrieval of papers, appraisal and synthesis.

1. **Research question**
   The question addressed in this review is ‘What are the safety risks associated with physical interactions between patients and caregivers during treatment and care delivery in Home Care settings?’

2. **Eligibility (inclusion/exclusion)**
   References were screened at the first stage by setting the database search parameters to all languages where the paper had an English abstract, (1980-), worldwide (region), adult (age range) and any study type.

3. **Search**
   The complexity of the topic proved challenging for literature searching. The first stage was a scoping exercise to explore and test the literature available for the key concepts associated with the research question. This included defining caregivers, context and activities by examining terminology used in published literature (e.g. Craib et al, 2007) so could include formal caregivers, nurses, home care assistants, home care support workers, social care workers, medical social workers, district nurses, occupational therapists and physiotherapists. The types of activities
included bathing, dressing wounds, activities of daily living, getting people in or out of bed, functional care, and physical care.

The first set of keywords were tested in preliminary searches for Medline and ASSIA using the following example string search: (housebound OR homebound OR "community care" OR domiciliary OR "home care" OR "house bound" OR house OR "home health") AND ("lifting and moving patients" OR mov* patient* OR OR lifting OR "patient handling" OR "manual handling") AND (safety OR injury* OR risk* OR occupational). The results were reviewed for relevance and additional keywords were added from retrieved references.

The searches were then divided into three areas to combine concepts for safety (A+B+C), working practices (A+B+D) and equipment (A+B+E).

A. Patients in their own home
B. Patient handling/moving and lifting
C. Safety, risks, injuries (patients and caregivers)
D. Working practices (solo working, team work etc.)
E. Use of equipment (hoists, lifts etc.)

The Medline search was adapted and then the same search string was used in HMIC, Health Business Elite, British Nursing Index (BNI) and Allied and Complementary Medicine Database (AMED). The Applied Social Sciences Index and Abstracts (ASSIA) search was also revised and extended, resulting in 3 strings (Figure 1). These formed the basis for searching PsycInfo, Scopus, Cochrane Library and Social Science Citation Index (SSCI, Web of Science). Minor modifications were needed for individual databases; in Scopus and SSCI the terms domestic and positioning were removed as they resulted in many irrelevant references. ‘Domestic’ mapped to financial markets and ‘Positioning’ automatically truncated to position which brought up hundreds of irrelevant references. In order to limit searches to references about humans (Scopus includes agriculture and veterinary literature) an additional line was added to the 3 searches: (patient* OR carer* OR nurs* OR therapist* OR healthcare OR elder*).

The full search strategy was run on 14 databases: AMED, ASSIA, BNI, Cinahl, Cochrane Library, Embase, Ergonomics Abstracts, Health Business Elite, Health Management Information Consortium (HMIC), Medline, PsycInfo, Scopus, Social
Care online, SSCI and supplemented by other search strategies (e.g. exploding reference lists).

Search 1.
(housebound OR homebound OR "community care" OR domiciliary OR "home care" OR "house bound" OR house OR "home health" OR domestic OR "district nurses" OR "at home" OR "own home") AND ("lifting and moving patients" OR "mov* patient" OR lifting OR "patient handling" OR "manual handling" OR "assisted mobility" OR "people handling" OR positioning OR reposition OR turning) AND (safety OR injury OR risk OR occupational OR accident OR "health and safety" OR exert OR overexert OR strain OR "back pain" OR "neck pain")

Search 2
(housebound OR homebound OR "community care" OR domiciliary OR "home care" OR "house bound" OR house OR "home health" OR domestic OR "district nurses" OR "at home" OR "own home") AND ("lifting and moving patients" OR "mov* patient" OR lifting OR "patient handling" OR "manual handling" OR "assisted mobility" OR "people handling" OR positioning OR reposition OR turning) AND (solo or lone or alone or team OR "with help" OR "without help")

Search 3
(housebound OR homebound OR "community care" OR domiciliary OR "home care" OR "house bound" OR house OR "home health" OR domestic OR "district nurses" OR "at home" OR "own home") AND ("lifting and moving patients" OR "mov* patient" OR lifting OR "patient handling" OR "manual handling" OR "assisted mobility" OR "people handling" OR positioning OR reposition OR turning) AND (equipment OR hoist OR sling OR sheet OR ergon OR belt OR device OR mechan OR engineer OR "bath aid" OR "hygiene aid")

Figure 1. String searches for ASSIA, PsycInfo, Scopus, Cochrane Library, Social Science Citation Index

The search from each database was imported into a shared RefWorks (https://www.refworks.com) account (for all authors). This central database was then checked for duplication and the references were screened by title and abstract.

4. Identification of relevant papers from title/abstract

The inclusion/exclusion criteria were adapted during the review process (emerging exclusion criteria) and the full dataset was checked for inclusion/exclusion before proceeding to critical appraisal.

References were included if they investigated, reported or reviewed:

1. Home care and treatment in the community.
2. Safety events or risks associated with interactions between patients and caregivers during physical care delivery.

3. Solo or team working for clinical treatment or care task (including physical assistance, medication or equipment checking activities).

References were excluded where:

- Location of care was hospital care, nursing home, residential care homes, and ambulance or emergency care.
- Citations were published as dissertations, conference abstracts or professional opinions.
- Care was only provided by informal caregivers (e.g. family).
- Only patient safety issues were discussed e.g. unwitnessed falls or development of pressure sore (no physical interaction).
- Care involved:
  - Remote monitoring technology rather than delivering care, for example falls sensors (accelerometers), dementia location (wandering) monitors and cardiac monitors.
  - Pharmacy/medication errors unless being directly administered by a caregiver (e.g. team to check).
  - Discharge planning and transitions-in-care (e.g. pre-discharge home visit).
  - Live-in care for people with learning disabilities.
  - Emergency response.
  - Solo working with respect to personal safety due to domestic violence and/or aggression.
  - Solo working with respect to travel to/from patient.

5. Selection and retrieval of papers

The database search produced 1613 references (Table 1). These were screened by title and abstract and checked for duplication (in RefWorks) resulting in 338 included papers. The screening and eligibility stages both reduced the number of references and also added papers by exploding relevant reference lists from individual papers (Figure 2).
Table 1. Search results

<table>
<thead>
<tr>
<th>Database (Provider)</th>
<th>Results</th>
<th>Reviewed by title</th>
<th>Reviewed by Abstract</th>
</tr>
</thead>
<tbody>
<tr>
<td>AMED (NHS Evidence)</td>
<td>59</td>
<td>22</td>
<td>11</td>
</tr>
<tr>
<td>ASSIA (Proquest)</td>
<td>59</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>BNI (NHS Evidence)</td>
<td>10</td>
<td>7</td>
<td>5</td>
</tr>
<tr>
<td>Cinahl (NHS Evidence)</td>
<td>42</td>
<td>19</td>
<td>14</td>
</tr>
<tr>
<td>Cochrane Library</td>
<td>121</td>
<td>10</td>
<td>8</td>
</tr>
<tr>
<td>CENTRAL (Wiley)</td>
<td>172</td>
<td>51</td>
<td>32</td>
</tr>
<tr>
<td>Embase (Ovid SP)</td>
<td>215</td>
<td>23</td>
<td>21</td>
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<tr>
<td>Ergonomics abstracts</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Health Business Elite(NHS Evidence)</td>
<td>61</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>HMIC (NHS Evidence)</td>
<td>23</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Medline (Ovid SP)</td>
<td>447</td>
<td>172</td>
<td>152</td>
</tr>
<tr>
<td>PsycInfo (EBSCO)</td>
<td>24</td>
<td>8</td>
<td>6</td>
</tr>
<tr>
<td>Scopus (Elsevier)</td>
<td>209</td>
<td>49</td>
<td>45</td>
</tr>
<tr>
<td>Social care online (SCIE)</td>
<td>96</td>
<td>13</td>
<td>10</td>
</tr>
<tr>
<td>SSCI</td>
<td>75</td>
<td>18</td>
<td>16</td>
</tr>
<tr>
<td>TOTAL</td>
<td>1613</td>
<td>417</td>
<td>338</td>
</tr>
</tbody>
</table>


The included references (n=42) were critically appraised using a modified version of Downs and Black (1998) checklist (Hignett et al, 2003) and the Mixed Methods Appraisal Tool (Pluye et al, 2009; 2011). The Mixed Methods Appraisal Tool has been validated across qualitative, quantitative and mixed methods empirical studies. It allocates a score from 0-100 (in quartiles) where the overall quality for a mixed methods score cannot exceed the quality of the weakest component. The Downs and Black Checklist was used to cross-check the Mixed Methods Appraisal Tool, with agreement within quartiles and then recorded as strong (100%), moderate (75%) and limited (50%) evidence.
Following critical appraisal, two papers were excluded with a low critical appraisal score (less than 50%). Three other papers were excluded as a preliminary baseline study where the follow-up paper was included (Beer et al, 2014; Brulin et al, 2001; Knibbe and Friele, 1999). This resulted in the 37 included papers listed in Table 2 for a qualitative synthesis. A quantitative synthesis is not included due to the diversity of study types, populations studied and variance in definitions of home care provision.
Table 2. Included papers (**strong evidence, **moderate evidence and *limited evidence)

<table>
<thead>
<tr>
<th>Author</th>
<th>Study type</th>
<th>Aim</th>
<th>Study population</th>
<th>Study design</th>
<th>Key findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Alamgir et al, 2007 [Canada] ***</td>
<td>Exploratory secondary database</td>
<td>To examine how injury rates and types differ across direct care occupations in relation to healthcare settings in Canada</td>
<td>1 year incident data resulting in time loss or medical care from 3 large health regions</td>
<td>Merged data from payroll, compensation claims and incidence reports as secondary data analysis with denominator of productive hours for Registered Nurses (RNs), Licensed Practice Nurses (LPNs) and Care Assistants</td>
<td>RNs were the least vulnerable for injuries in all sectors. Care Assistants were the most vulnerable. Home care rates were lower than both acute care and nursing homes</td>
</tr>
<tr>
<td>2. Beer et al, 2014 [US] **</td>
<td>Descriptive qualitative</td>
<td>To use a systems model to frame the challenges discussed by home care workers</td>
<td>8 certified nursing assistants, 8 RNs</td>
<td>Structured interviews about 7 tasks: medication management, transfer, bathing, toileting, wound care, infusion pump, device use.</td>
<td>Challenges related to care recipient needs for health-related decline or emotional stress e.g. physical / cognitive limitation. Developed Human Factors &amp; Ergonomics care model</td>
</tr>
<tr>
<td>3. Brown &amp; Mulley, 1997 [UK] *</td>
<td>Descriptive survey</td>
<td>To describe the occurrence of physical injuries experienced by informal caregivers whilst moving &amp; handling (M&amp;H) their elderly dependents</td>
<td>46 informal caregivers</td>
<td>In-depth interviews</td>
<td>38 caregivers received personal assistance with M&amp;H from family (26), home care services (20), friends/neighbours (16), district nurse (12). 16 patients had been injured when being lifted/handled. 19 caregivers had been instructed on M&amp;H; 15 informally during treatment session (3 on hoist). No caregivers aware of formal training packages; no handling techniques had been assessed.</td>
</tr>
<tr>
<td>4. Brulin et al, 2001 [Sweden] ***</td>
<td>Survey</td>
<td>To investigate physical and psychosocial risk factors and whether psychosocial factors could predict musculoskeletal disorders (MSD) after 5 years</td>
<td>234 home care workers</td>
<td>Questionnaire</td>
<td>Best predictor of low back problems was previous episode. Lack of involvement in work planning increased physical complaints. Risk factors include workload planning, M&amp;H patients, awkward working positions and working alone.</td>
</tr>
<tr>
<td>5. Cheung et al, 2006 [Hong Kong] ***</td>
<td>Exploratory cross-sectional study</td>
<td>To identify the magnitude of, and risk factors for, back pain in Hong Kong Home Care Nursing personnel</td>
<td>411</td>
<td>Self-reported workload, Nordic Questionnaire, functional outcomes, psychosocial factors</td>
<td>Annual prevalence for back pain was 71%. Three predictors: (1) physical risk factors in office, (2) static postures, (3) psychosocial job demands. Not primarily associated with patient lifting and transfers</td>
</tr>
<tr>
<td></td>
<td>Authors (Year, Country)</td>
<td>Study Type</td>
<td>Purpose</td>
<td>Sample</td>
<td>Methods</td>
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<tr>
<td>6.</td>
<td>Conneely, 1998 [UK]</td>
<td>Exploratory</td>
<td>To explore implications of Manual Handling Operations Regulations for use of hoist in community</td>
<td>10 patients</td>
<td>Qualitative interviews with thematic analysis</td>
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<tr>
<td>7.</td>
<td>Craib et al, 2007 [Canada]</td>
<td>Intervention</td>
<td>To determine the incidence of workplace injury among community health workers; to identify predictors of injury; to assess the effectiveness of a multicomponent intervention</td>
<td>648 home care staff at 5 agencies with 6th as control</td>
<td>Questionnaire, Interventions: (1) education &amp; training (E&amp;T); (2) Risk Assessment (RA) tool; (3) Lift (hoist) equipment registry (loan).</td>
</tr>
<tr>
<td>8.</td>
<td>Craven et al, 2012 [Canada]</td>
<td>Exploratory qualitative</td>
<td>To explore the types and patterns of safety concerns staff encountered in home care settings</td>
<td>115 home care staff</td>
<td>Semi-structured interviews</td>
</tr>
<tr>
<td>9.</td>
<td>Czuba et al, 2012 [US]</td>
<td>Exploratory mixed methods</td>
<td>To improve the understanding of risk factors that may lead to injury and increased turnover in home health aides (HHAs); to discover unexplained opportunities for interventions; to test those intervention ideas for potential effects, feasibility and acceptance by HHAs and their employers</td>
<td>One provider company. Observations with 17 HHAs and 36 patients. Workshops with 14 HHAs. Pilot intervention with 21 HHAs</td>
<td>(1) Secondary analysis of Workers Compensation injury data; (2) direct observation; (3) participatory testing of intervention to supply gait belts, cleaning supplies, and improve care plans and workload distribution for heavy patients</td>
</tr>
<tr>
<td>10.</td>
<td>Dellve et al, 2003 [Sweden]</td>
<td>Exploratory survey retrospective case control</td>
<td>To explore and estimate the impact of the work system on permanent work disability and its relative importance compared with home-life risks among home care workers</td>
<td>617 home care workers and 771 matched controls selected from employers database</td>
<td>Questionnaire</td>
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<tr>
<td>No.</td>
<td>Author(s)</td>
<td>Year/Location</td>
<td>Methodology</td>
<td>Topic</td>
<td>Sample Size</td>
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<tr>
<td>11</td>
<td>Denton et al, 2002 [Canada]</td>
<td>Exploratory</td>
<td>To examine the effects of working in clients homes on the mental health and well-being of visiting home care workers</td>
<td>674 visiting therapists, nurses and home support workers from 3 home care organisations</td>
<td>Focus groups; Questionnaire</td>
</tr>
<tr>
<td>12</td>
<td>Faucett et al, 2013 [US]</td>
<td>Exploratory survey</td>
<td>To identify functional, temporal, physical and relationship risk factors for transient and chronic conditions for MSDs and injuries among Personal Assistance Services (PAS) providers</td>
<td>855 PAS workers</td>
<td>Survey based on Nordic questionnaire,</td>
</tr>
<tr>
<td>13</td>
<td>Galinsky et al, 2010 [US]</td>
<td>Survey</td>
<td>To explore factors associated with assaults by patients on home healthcare aides and nurses</td>
<td>677 home healthcare aides and nurses</td>
<td>Questionnaire</td>
</tr>
<tr>
<td>14</td>
<td>Hale &amp; Piggot, 2005 [New Zealand]</td>
<td>Exploratory qualitative</td>
<td>To explore the content of present physiotherapeutic home intervention for people with stroke that resulted in the development of a conceptual framework to guide practice</td>
<td>20 physiotherapists</td>
<td>Semi-structured interviews</td>
</tr>
<tr>
<td>15.</td>
<td>Hoff, 2013 [US]</td>
<td>Exploratory qualitative</td>
<td>To gain a better understanding of how Patient-Centred Medical Home (PCMH) principles should be implemented by different subpopulations</td>
<td>51 staff from 6 practices; 22 primary care physicians, 5 nurse practitioners, 7 practice managers, 6 RNs, 7 LPN, 3 medical assistants, 2 clinical quality supervisors</td>
<td>Interviews</td>
</tr>
<tr>
<td>16.</td>
<td>Howard &amp; Adams, 2010 [US]</td>
<td>Exploratory survey secondary data analysis</td>
<td>To examine compensation claims for home healthcare (HHC) workers</td>
<td>Industrial insurance system included state-funded and self-insured claims from nursing home, hospitals and home care</td>
<td>Claims incidence calculated and expressed for 10,000 FTE</td>
</tr>
<tr>
<td>17.</td>
<td>Johansson, 1995 [Sweden]</td>
<td>Case control survey</td>
<td>To describe the psychosocial working environment and physical workload; assess MSD (neck, shoulder, back) symptoms prevalence, estimate rate ratio of self-reported MSD symptoms for potential risk indicators; analyse effects of a set of psychosocial and physical variables; examine the contribution of a combination of psychosocial work environment and physical workload</td>
<td>305 home care workers (HCW)</td>
<td>Questionnaire</td>
</tr>
<tr>
<td></td>
<td>Authors</td>
<td>Study Design</td>
<td>Methods</td>
<td>Participants</td>
<td>Findings</td>
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<td>18.</td>
<td>Kalman &amp; Andersson, 2014 [Sweden]</td>
<td>Exploratory qualitative</td>
<td>To observe and analyse strategies for framing intimate care in elderly care services and how the context of being an everyday service performed in the care recipients home affects the ways in which the care is provided.</td>
<td>23 care recipients; 7 care workers</td>
<td>Field notes Framing helps to ‘provide a distance that regulates and characterises the interactions’. General ‘providing care in homes that were not adapted for such work. As bathrooms and toilets were really too narrow at times … use of toilet buckets or the washing of intimate parts of the body might take place in the … Bedroom or sitting room’.</td>
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<td>19.</td>
<td>Kim et al, 2010 [Canada]</td>
<td>Prospective survey exploratory quant</td>
<td>To determine the 6 month incidence of MSD (neck, shoulder, back) to investigate the association with the physical demands of work.</td>
<td>1198 HCW</td>
<td>Interview Nordic questionnaire Physical demand scale 55% of HCW found work often or always demanding. The odds of developing new MSD symptoms at 6 months were significantly associated with increased physical demands.</td>
</tr>
<tr>
<td>20.</td>
<td>Knibbe &amp; Friele, 1999 [Netherlands]</td>
<td>Intervention</td>
<td>To evaluate if a self-administered log detects the nature and amount of exposure to patient handling induced by the introduction of patient lifting hoists in home care nursing.</td>
<td>355 (baseline) and n=298 post intervention</td>
<td>Nordic questionnaire. Intervention: 40 patient hoists / training / lift co-ordinators (n=104). Evaluated with Rated Perceived Exertion and Lift counter (work sampling) Focus on M&amp;H of patient</td>
</tr>
<tr>
<td>21.</td>
<td>Kraus et al, 2002 [US]</td>
<td>Cluster randomised trial</td>
<td>To determine the effect of back belt use on the incidence of low back injury in home attendants in 9 agencies in New York</td>
<td>Three group: 3,744 (back belt); 4,133 (advice-only); 4,531 (control)</td>
<td>Questionnaire and injury claim form Injuries were highest in control and advice only groups; lowest in the back belt group. Back belt v. Advice - not significant. Back belt v. Control - significant.</td>
</tr>
<tr>
<td>No.</td>
<td>Author(s)</td>
<td>Year</td>
<td>Methodology</td>
<td>Sample Size</td>
<td>Details</td>
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<tr>
<td>23.</td>
<td>Leiss, 2012</td>
<td><strong>Survey</strong></td>
<td>To examine whether the protective effect of home care/hospice work experience was greater for nurses who were subjected to 3 typical home care circumstances: (1) level of access to safety devices and Personal Protective Equipment; (2) time pressure during home visit; (3) adverse conditions in the homes</td>
<td>833 home care nurses</td>
<td>Questionnaire (postal) blood exposure rates per 100,000 home visits via 3 routes for blood exposure: (1) needle stick, (2) eyes, nose, mouth, (3) on non-intact skin</td>
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<td></td>
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<td>Experience in providing care in home care/hospice enables nurses to reduce the risk of blood exposure by 3-7x compared with less experienced workers. No difference in exposure to 3 routes,</td>
</tr>
<tr>
<td>24.</td>
<td>Markkanen et al, 2007</td>
<td><strong>Exploratory qualitative</strong></td>
<td>To characterise the work experience and hazards of home health care (HHC) clinicians with a focus on risk factors for blood borne pathogen exposures</td>
<td>17 nurses and 7 home aides</td>
<td>5 focus groups; 10 in-depth interviews</td>
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<td></td>
<td>Disadvantages of HHC working included abuse/violence, lack of space/clutter, isolation (support and safety), provision and use of equipment and consumables, unsafe disposal practices and M&amp;H of patients Not reporting due to fear of being blamed, non-severe exposure (scratch), fear of future job prospects, takes too much time. Safety features = retractable needles, butterfly needles, needleless IV systems, single medical device use (numerous styles, lack of standardisation. Suggest that 'sharps injuries and blood exposures can serve as a proxy for safety and quality practices in home care settings'.</td>
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<tr>
<td></td>
<td>Authors</td>
<td>Type</td>
<td>Description</td>
<td>Sample Size</td>
<td>Method</td>
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<td>25.</td>
<td>McCaughey et al, 2012 [US]</td>
<td>Secondary data analysis</td>
<td>To examine the relationship between injuries and work outcomes as reported by home health aides (HHAs) and (b) the likely efficacy of employee training and supervisor support in reducing worker risk of injury</td>
<td>3377 HHAs</td>
<td>National Home Health Aide Survey. Number of injuries, rating of training (preparedness), supervisor support, worker &amp; organisational outcomes</td>
</tr>
<tr>
<td>26.</td>
<td>Meyer &amp; Muntaner, 1999 [US]</td>
<td>Exploratory retrospective data analysis of compensation claims</td>
<td>To examine the distribution, frequency and costs of work-related injury in home health care workers</td>
<td>Workers compensation data</td>
<td>Extracted using occupational codes</td>
</tr>
<tr>
<td>27.</td>
<td>Munck et al, 2011 [Sweden]</td>
<td>Exploratory qualitative phenomenological</td>
<td>To describe district nurses (DN) conceptions of medical technology in palliative care</td>
<td>16 DNs</td>
<td>Interviews</td>
</tr>
<tr>
<td>28.</td>
<td>Ono et al, 1995 [Sweden]</td>
<td>Exploratory survey</td>
<td>To describe the nationwide occurrence of work related MSD in home care service workers; to identify relative risks and risk factors of the injuries</td>
<td>105,006 home care service workers</td>
<td>Annual reported injury incidence rate per 1000 workers</td>
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<tr>
<td>29.</td>
<td>Owen &amp; Staehler, 2003 [US]</td>
<td>Exploratory survey</td>
<td>To determine perceived physical stressfulness of home care tasks; to identify what HHAs and nurse observers thought contributed to making those tasks stressful; to develop ideas to reduce back stress</td>
<td>33 home care aides and 61 patients</td>
<td>Likert scale rating of stressfulness (0-10)</td>
</tr>
<tr>
<td>30.</td>
<td>Pohjonen et al, 1998 [Finland]</td>
<td>Intervention</td>
<td>To investigate the effects and feasibility of an ergonomic intervention on the work content and load of home care workers</td>
<td>34 (intervention); 36 (control)</td>
<td>12 months participatory ergonomics team work (group problem solving) by analysing the work with respect to content and load. Measures included pre/post work site assessment - work ability index (WAI), work sampling, heart rate and postural analysis</td>
</tr>
<tr>
<td>31.</td>
<td>Quinn et al, 2009 [US]</td>
<td>Survey</td>
<td>To quantify risks of sharps injuries and other blood and body fluid exposures among home care workers, to identify risk factors and assess the use of sharps within safety features, to evaluate under-reporting in workplace-based surveillance</td>
<td>1225 home care workers (9 agencies and 2 labour unions)</td>
<td>Questionnaire</td>
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<tr>
<td>No.</td>
<td>Author(s)</td>
<td>Year</td>
<td>Country</td>
<td>Study Type</td>
<td>Methodology</td>
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<td>32.</td>
<td>Simon et al, 2008</td>
<td>**</td>
<td>Germany</td>
<td>Secondary data analysis</td>
<td>To investigate physical and psychosocial risk factors associated with neck and back disability in nursing and assess the role of the type of health care institution within different countries</td>
</tr>
<tr>
<td>33.</td>
<td>Sims-Gould et al, 2013</td>
<td>**</td>
<td>Canada</td>
<td>Exploratory qualitative</td>
<td>To study the nature of crises experienced by Home Support Workers (HSW)</td>
</tr>
<tr>
<td>34.</td>
<td>Skoglund-Ohman &amp; Kjellberg, 2011</td>
<td>**</td>
<td>Sweden</td>
<td>Exploratory pilot qualitative</td>
<td>To explore whether home care service personnel used knowledge and skills in transfer technique in their daily work; to identify factors that could hinder/support their use</td>
</tr>
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<td><strong>35.</strong></td>
<td>Swedberg et al, 2013 [Sweden]</td>
<td><strong>Exploratory qualitative</strong></td>
<td>To investigate the work experience of Health Care (HC) assistants and explore how they manage when delivering 24/7 care to patients with substantial care needs outside the security that comes with a hospital setting</td>
<td>19 HC assistants</td>
<td>12 Interview and observation; 7 Observation only</td>
</tr>
<tr>
<td><strong>36.</strong></td>
<td>Szeto et al, 2013 [Hong Kong]</td>
<td><strong>Intervention</strong></td>
<td>To see if intervention effect can be sustained for longer periods of time; to see if program is effective as both secondary and primary intervention for community nurses</td>
<td>Pilot intervention n=15, Control n=12, Intervention n=23</td>
<td>8 week ergonomic program with expert advice, work and equipment modification (e.g. Portable back packs), M&amp;H training, exercise and Display screen Assessment training</td>
</tr>
<tr>
<td><strong>37.</strong></td>
<td>Wipfli et al, 2012 [US]</td>
<td><strong>Exploratory</strong></td>
<td>To address research gaps on hazardous exposures among HCWs and evaluate the generality of prior findings</td>
<td>7 focus groups (53 HCWs)</td>
<td>Work related injury and illness database</td>
</tr>
</tbody>
</table>
7. Synthesis

The risk factors have been grouped using the modified model of Human Factors and Ergonomics of health care in the home from Beer et al (2014) to represent the roles of both patients and caregivers in the system. The groups are environments (health policy, community, physical and social), artefacts (equipment and technology), tasks (clinical procedures, work schedules) and care recipient/provider.

7.1 Environments (health policy, community, physical and social)


7.2 Artefacts (equipment and technology)
Beer et al (2014) use the term ‘artefacts’ to include equipment, technology (medical devices) and supplies (consumables). Evidence was found that identified physical risks associated with inadequate and missing equipment, e.g. lifting or bathing equipment which was the incorrect size and/or weight capacity for the patient (strong evidence: Hale & Piggot, 2005; moderate evidence: Craven et al, 2012; Faucett et al, 2013; Leiss, 2012; Pohjonen et al, 1998; Simon et al, 2008; Sims-Gould et al, 2013) and a lack of support for maintenance and training in medical devices (moderate evidence: Munck et al, 2011).

The supply of different or new medical devices (model or supplier) could introduce safety issues with respect to use and set up of, for example ventilators, oxygen, infusion pumps, suction, and blood glucose meters (moderate evidence: Beer et al, 2014; Markkanen et al, 2007). The quantity and quality of supplies and consumables e.g. incontinence pads, bandaging, gloves can introduce and exacerbate physical interaction risks, e.g. leakage of pads (moderate evidence: Markkanen et al, 2007; Craven et al, 2012).

7.3 Tasks
Tasks are described by Beer et al (2014) as ranging from ‘simple tasks such as taking a care recipient on a walk to cognitively-challenging tasks (e.g., managing
7.4 Patient and Caregiver
This group was used by Beer et al (2014) to refer to the demographic and personal characteristics of both patient (care recipient) and caregiver. Examples from the literature include physical interactions which exposed the caregiver to infectious diseases (e.g. hepatitis, HIV, flu, TB, measles and chickenpox; EU-OSHA, 2014; strong evidence: Craib et al., 2007; moderate evidence: Leiss, 2012; limited evidence: Denton et al, 2002).

Discussion
This review has focussed on the physical interactions between patients and caregivers. The search produced over 1600 references covering a wide range of topics, leading to more detailed (emerging) exclusion criteria as the scope of physical interactions was explored. This resulted in papers on risks associated with care by informal caregivers being excluded due to the difference in status of caregivers with respect to organisational policies, procedures and training (Brown and Mulley, 1997). In Europe employed community caregivers are covered by the European Framework Directive on Safety and Health at Work (Directive 89/391 EEC; EU-OSHA, 2014). The directive obliges employers to take appropriate preventative measures to make work safer and healthier. However, self-employed and domestic workers are not covered by EU OSH legislation, so the organisation of care provision as basic and advanced levels may change an employer's obligations with respect to the safety of the work activities and working environment.

The quality appraisal for each paper is listed in Table 2 and summarised by topic in section 7. Most topics have several papers giving strong, moderate and limited evidence. The topics with strong evidence from at least 2 papers relate to risks associated with awkward working positions, social environment issues (additional tasks and distractions), abuse and violence, inadequate team (peer) support, problems with workload planning, needle stick injuries and physical workload (moving and handling patients).

The organisation of care (health policy) was found to be more complex than acute care provision with respect to leadership and peer support. This could contribute to risks for both patients and caregivers when visits were shortened due to concerns about abuse, physically challenging tasks (moving and handling), missing/inadequate equipment and consumables (Galinsky et al, 2010). There could
also be pressure from the patient (and family) to deliver care when the caregiver did not feel that they had the appropriate knowledge, training and skills (Faucett et al, 2013; Munck et al, 2011). Caregivers could feel very isolated and unsupported, especially if the equipment and consumables needed to provide the care were missing, inadequate or had changed (e.g. different medical device). This contributed to cognitive risks relating to stress and decision-making about medication reconciliation and medical device use, e.g. whether to use wrong size slings with moving and handling hoists (lifts).

The extensive literature on moving and handling included over-exertion (Galinsky et al, 2012) relating to physical interactions with both patients and furniture. Patient care can include lifting/transferring without help, bathing, putting on shoes and lifting legs, pushing in wheelchair, supporting when walking; domestic tasks can include cleaning the bathroom, moving boxes or furniture, making beds, climbing stairs, standing in one place for a long time (Kim et al, 2010). Caregivers were reported to address issues of clutter, obstacles and lack of space by moving and rearranging furniture; however, when this was not possible there were reports of awkward working postures (Cheung et al, 2006) and confined spaces. A report (EU-OSHA, 2014) has suggested that ‘about 40–48 % of a home healthcare worker’s time may be spent in poor posture combinations, including bent forward and twisted postures, which are associated with shoulder, neck and back problems’. Brown and Mulley (1997) commented that providing assistance using the toilet was ‘the single most difficult task as it involved a number of lifts and manoeuvres, timing is unpredictable and is often done without extra assistance’.

For some of the safety risks it was not clear whether the location introduced additional risks (e.g. sharps disposal and medication reconciliation) or if these would be similar in other settings. Some of risk factors which are specific to home care include the working environment, worker safety (isolation and peer support), equipment provision and maintenance, and supply and disposal of clinical consumables. Other physical interactions occur in both home care and care facilities but the tasks are more complex in home care, for example limited space for moving and handling tasks and poor lighting/flooring etc. Craven et al (2012) stated that ‘quality care in the home is dependent on having a safe environment to receive and provide care, despite the fact that the ‘home space’ of each client is highly variable’.
The issue of time provision and feeling rushed has recently been discussed in the UK, where the National Institute for Health and Care Excellence (NICE, 2015) has published recommendations that person-centred home care should be planned to deliver safe, high quality services. This includes a suggestion that scheduling of home care visits should allow for generally ‘half an hour with each person’.

The limitations of the review process include the use of emerging exclusion criteria; to address this, the entire data base was reviewed with the final exclusion criteria to ensure that all possible references were included/excluded. The decision to include all study types but to limit the papers to publications in peer reviewed journals rather than grey literature and conference proceedings may have excluded research from some topic areas but it was felt necessary to set a high publication standard for inclusion to generate trustworthy results and recommendations. Two critical appraisal tools were used to address individual limitations. The Downs and Black (1998) checklist has been widely used to appraise healthcare research but the more recent Mixed Methods Appraisal Tool (Pluye et al 2009, 2011) has been validated for different study types and, although less detailed, provides a useful categorization approach for critical appraisal.

Conclusion

As home care increases, there is a need to ensure the safety of both patients and caregivers with an understanding of the risks for physical interactions and tasks. This review has summarised the wide range of factors associated with the environment of care (health policy, physical and social), equipment and tasks (clinical practice). Although some of the safety risks are present wherever the tasks are carried out (e.g. sharps disposal and medication reconciliation) but home care seems to introduce additional risks associated with the working environment, isolation and peer support, equipment provision and maintenance, and supply and disposal of clinical consumables. As this care sector grows, it will become increasingly important to manage risks and plan safer care delivery systems or, it is suggested, the provision of services may be withdrawn formally (unsafe environment) and/or informally as caregivers shorten visits and fail to deliver some aspects of care.
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EU-OSHA European Agency for Occupational Safety & Health at Work. 2014. Current and emerging issues in the healthcare sector, including home and community care. Bilbao, Spain: EU-OSHA.


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