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REVIEW

Outcomes of inpatient mobilization: a literature review

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Aims and objectives. To review current research evidence on the outcomes of mobilising hospitalised adults.

Background. Although immobility is known to cause functional decline or complications, inpatient ambulation emerged as the most often missed element of nursing care. This study is designed to review research studies that give evidence as to the consequences of mobilising or not mobilising hospitalised adult patients.

Design. A literature review of published peer-reviewed empirical research was undertaken.

Methods. The electronic databases of MEDLINE (Ovid), CINAHL, and PubMed were accessed to search for relevant empirical articles, supplemented by a search of reference lists contained in retrieved articles and citation tracking.

Results. Thirty-six studies were identified for inclusion in the review. Four areas (study design, sample size, measurement and statistical analysis) were evaluated for methodological quality, and most studies showed strong quality. A synthesis of the findings generated four themes of the effects of inpatient mobilisation: (1) physical outcomes included pain, deep vein thrombosis, fatigue, etc.; (2) psychological outcomes included anxiety, depressive mood, distress, comfort and satisfaction; (3) social outcomes included quality of life and independence; and (4) organisational outcomes included length of stay, mortality and cost.

Conclusion. Mobilising hospitalised adults brings benefits for not only physical functioning, but also their emotional and social well-being. Moreover, ambulation yields important organisational benefits. These benefits of mobilisation on four areas required viewing the patient in a holistic manner. Even though each study approached different types of patients, illnesses and procedures, this review showed that most inpatients would benefit from mobilisation and would experience optimal functions.

Relevance to clinical practice. The importance of mobilisation for positive patient outcomes highlights the need to develop methods to ensure that this nursing action is completed on a systematic basis.

Key words: ambulation, early ambulation, early mobilisation, hospitalisation, inpatients, mobilisation, mobility

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Introduction

In several studies of missed nursing care, defined as required nursing care that is omitted or significantly delayed, ambulation of patients was identified as the most frequently missed element of inpatient nursing care, missed 76·1–88·7% of the time (Kalisch *et al.* 2009a,b, 2011). Callen *et al.* (2004) also found inpatient ambulation to be a missed component of nursing care during an observational study of hallway ambulation on three medical units where 19% of patients walked once, 5% walked twice, 3% walked more than twice and 73% did not walk at all during the study period. Brown *et al.* (2004) also uncovered inadequacies in inpatient mobilisation. Observation of 45 hospitalised medical patients indicated that, on average, 83% of the hospital stay was spent lying in bed. The amount of time spent standing or walked ranged from 0·2–21%.

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The fact that ambulation of hospitalised adults is regularly missed indicates that many patients are confined to bed or a chair and are mostly immobile throughout their hospital stay. Studies exploring inpatient immobility have uncovered several negative consequences of bed rest effecting the cardiovascular, respiratory, gastrointestinal, integumentary, musculoskeletal, renal, endocrine and nervous systems (Creditor 1993, Convertino 1997, Graf 2006). Patients begin to experience a decline in walking ability within two days of being hospitalised (Hirsch *et al.* 1990). Lack of inpatient mobility can be especially devastating to the older where the ageing process contributes to more rapid functional decline (Graf 2006). This new walking dependence among the older population may lead to discharge to a nursing home and has been found to result in continued walking dependence three months after discharge in 27% of older patients (Mahoney *et al.* 1998).

To understand the impact of mobilising patients in acute care hospitals, we reviewed the research literature to uncover and synthesise the relevant research evidence.

Aims

The aim of this paper was to provide a review of the literature related to the outcomes of mobilising (or not mobilising) adult patients in acute care settings. A review of current literature was conducted to identify relevant articles on inpatient mobilisation outcomes.

Methods

For this review, mobilisation was defined as walking, standing or sitting in a chair with or without assistance. The terms of early ambulation and early mobilisation were included in the definition of mobilisation. Early ambulation and early mobilisation refer to specific situations and are dependent upon the type of surgery, procedure or illness. For example, for cardiac catheterisation patients, early mobilisation was considered three to four hours after the procedure (Chair *et al.* 2007). For total knee replacement patients, early mobilisation was considered 24 hours after the surgery (Pearse *et al.* 2007). In addition, for stroke patients, early mobilisation was considered to be within 24–36 hours after symptom onset (Langhorne *et al.* 2010, Cumming *et al.* 2011).

Search strategy

The key terms used in the literature search included ('inpatients' or 'hospitalization' or 'hospitalized patients') AND ('ambulation' or 'early ambulation') OR ('mobilization' or 'early mobilization') OR ('mobility'). The electronic databases of MEDLINE (Ovid), CINAHL and PubMed were accessed. This process was supplemented by a search of reference lists contained in retrieved articles and citation tracking.

Study criteria

We reviewed published studies that met the following inclusion criteria: (1) empirical research that included a report of outcomes related to inpatient mobilisation, (2) published in peer-reviewed journals between 1999–2011 (to retrieve the most up-to-date evidence), (3) written in English and (4) whose population consisted of adult inpatients in acute care hospital settings.

Studies were excluded if they (1) took place in nonacute healthcare settings such as outpatient clinics, nursing homes, patient homes, etc.; (2) took place in an inpatient rehabilitation unit, psychiatric unit or the emergency department; (3) included a paediatric population; (4) included other types of mobilisation such as range of motion, turning or specialised mobilisation including aerobic exercises, bicycling or weight training.

Article selection and analysis

Potentially relevant studies included 462 records identified in CINAHL, 614 articles found in MEDLINE and 9452 records identified in PubMed. After duplicates were removed, 10,528 titles and abstracts were screened for relevance to inpatient mobilisation by the authors. This resulted in an initial selection of 171 articles. These 171 studies were entered into the full-text review stage and were independently analysed by the authors to determine whether they met the inclusion criteria. Of these, 148 studies did not meet the inclusion criteria and were eliminated. A total of 13 additional studies were added from hand searching of reference lists and citation tracking. After review of the full text and detailed evaluation by the three authors, 36 studies were selected for inclusion in this review (Fig. 1). Articles passing the full-text screening were placed in a data extraction form, and a list of included studies was created. To manage bias, all 36 studies were reviewed independently by the three authors. The reported outcomes of inpatient mobilisation that were aggregated into a data extraction form were categorised into themes. A summary of findings under the emergent themes is provided below.

Quality of studies

Thirty-six studies were evaluated by the three authors for methodological quality relative to study design, sample size,

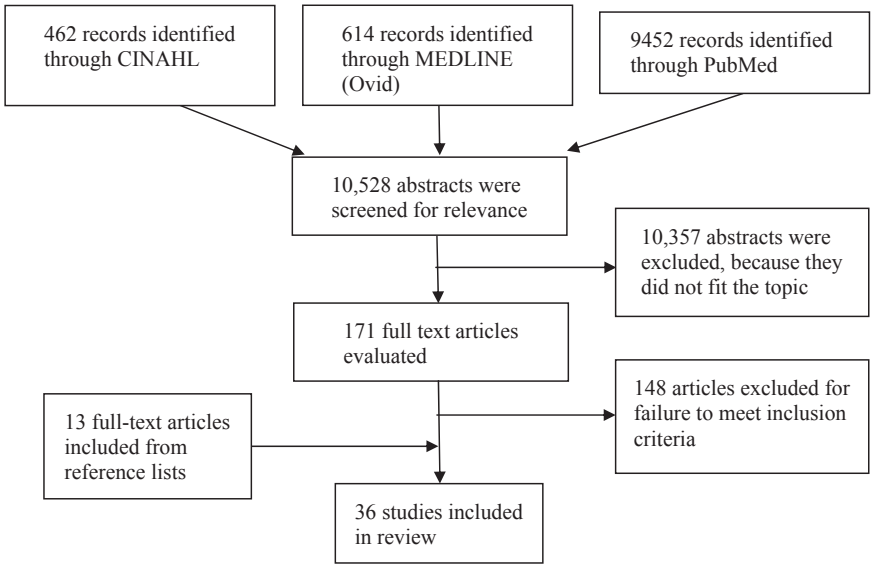

Figure 1 A flowchart of the search methods used in determining the articles used in this review.

measurement and statistical analysis. Criteria to guide scoring these four areas were developed by the three authors based on published criteria and their research experience (Estrabrooks 2003, Wong & Cummings 2007, De Cordova *et al.* 2012). A total of 12 possible points could be assigned. Study design was scored as 3 (randomised controlled trial), 2 (quasi-experimental study) or 1 (observational study). Sample size was scored as 3 (adequate sample sizes based on appropriate calculations), 2 (small sample size) or 1 (pilot study). Measurement was scored as 3 (adequate reliability and validity of measures), 2 (mixed reliability and validity of measures) or 1(no reliability and validity available). Statistical analysis was scored as 3 (completely adequate analysis), 2 (partially adequate analysis) or 1 (inadequate analysis).

Results

Quality of studies

Of the 36 studies evaluated, quality scores ranged from 7–11. Studies with scores of 1–4 were considered weak studies, 5–8 moderate, and 9 or higher strong. Of these, 27 studies received scores of 9–11 which we evaluated to be strong and nine studies showed moderate quality with scores of 7–8. None of the studies were categorised as weak. The lower-level studies shared nonexperimental designs or small sample sizes that limited generalisability of the findings; however, their results were promising and consistent with other studies and contributed to the findings of this review. Of the 36 studies, 27 studies tested interventions, of which 26 studies included control groups in their designs (Table 1).

Search results

Table 2 presents the summary of studies included in this review. The main outcomes were classified into four categories: physical outcomes, psychological outcomes, social outcomes and organisational outcomes (Table 3).

Physical outcomes

There were 21 studies that suggested physical benefits of hospital mobilisation, including pain relief (Partsch & Blattler 2000, Chair *et al.* 2007, Augustin *et al.* 2010), less deep vein thrombosis (DVT; Pearse *et al.* 2007, Chandrasekaran *et al.* 2009, García Guerrero *et al.* 2010, Langhorne *et al.* 2010, Nakao *et al.* 2010), less fatigue (Chang *et al.* 2008, Rezaei-Adaryani *et al.* 2009), incidence of new pneumonia (Kamel *et al.* 2003, Kurabe *et al.* 2010), less delirium (Kamel *et al.* 2003, Schweickert *et al.* 2009), more ventilator-free days (Schweickert *et al.* 2009), less urinary tract infection (Kurabe *et al.* 2010, Langhorne *et al.* 2010) and improved physical function (Killey & Watt 2006, Oldmeadow *et al.* 2006, Chang *et al.* 2008, Hirschhorn *et al.* 2008, Padula *et al.* 2009, Langhorne *et al.* 2010, Cumming *et al.* 2011, Zisberg *et al.* 2011).

Pain relief was found as the most frequently observed positive outcome of inpatient mobilisation. Partsch and Blattler (2000) conducted a randomised controlled trial of patients in the acute stage of DVT. Patients receiving compression stockings and ambulation had a significant reduction in pain after the second day as well as less swelling, compared to those on bed rest and no compression

Table 1 Summary of quality assessment

Author, date	Study design	Sample size	Measurement (reliability and validity)	Statistical analysis	Quality score
Augustin *et al.* (2010)	Quasi-experimental	347	Adequate	Completely adequate	10
Behnke *et al.* (2003)	Quasi-experimental	26	Mixed	Completely adequate	9
Brown *et al.* (2004)	Prospective observational	498	Mixed	Completely adequate	9
Browning *et al.* (2007)	Prospective observational	50	Mixed	Completely adequate	8
Chandrasekaran *et al.* (2009)	Quasi-experimental	100	Mixed	Inadequate	8
Chang *et al.* (2008)	Quasi-experimental	22	Mixed	Completely adequate	8
Chair *et al.* (2007)	Quasi-experimental	86	Mixed	Completely adequate	10
Craig *et al.* (2010)	Meta-synthesis	103	Mixed	Partially adequate	10
Cumming *et al.* (2008)	Quasi-experimental	71	Mixed	Completely adequate	10
Cumming *et al.* (2011)	Quasi-experimental	71	Mixed	Completely adequate	10
Delaney *et al.* (2003)	Quasi-experimental	64	Mixed	Completely adequate	10
Fisher *et al.* (2011)	Retrospective case control	10	Mixed	Completely adequate	7
Fisher *et al.* (2010)	Prospective cohort	162	Mixed	Completely adequate	9
Frenea *et al.* (2004)	Quasi-experimental	61	Mixed	Completely adequate	10
García Guerrero *et al.* (2010)	Quasi-experimental	47	Mixed	Inadequate	7
Hirschhorn *et al.* (2008)	Quasi-experimental	93	Mixed	Completely adequate	10
Indredavik *et al.* (1999)	Quasi-experimental	220	Mixed	Completely adequate	10
Kamel *et al.* (2003)	Retrospective cohort	131	Mixed	Completely adequate	9
Killey and Watt (2006)	Quasi-experimental	55	Mixed	Completely adequate	9
Kurabe *et al.* (2010)	Quasi-experimental	182	Mixed	Completely adequate	10
Langhorne *et al.* (2010)	Quasi-experimental	32	Mixed	Completely adequate	8
Larsen *et al.* (2009)	Quasi-experimental	87	Mixed	Partially adequate	9
Mundy *et al.* (2003)	Quasi-experimental	458	Mixed	Completely adequate	10
Nakao *et al.* (2010)	Comparative	37	Mixed	Completely adequate	8
Oldmeadow *et al.* (2006)	Quasi-experimental	60	Adequate	Completely adequate	11
Padula *et al.* (2009)	Quasi-experimental	50	Adequate	Partially adequate	9
Partsch and Blattler (2000)	Quasi-experimental	45	Mixed	Completely adequate	9
Pearse *et al.* (2007)	Quasi-experimental	195	Mixed	Completely adequate	10
Rath *et al.* (2010)	Quasi-experimental	23	Mixed		8
Rezaei-Adaryani *et al.*(2009)	Quasi-experimental	70	Mixed	Completely adequate	10
Schweickert *et al.*(2009)	Quasi-experimental	104	Mixed	Completely adequate	10
Shadmi and Zisberg (2011)	Prospective cohort	485	Mixed	Partially adequate	8
Siu *et al.* (2006)	Prospective cohort	532	Mixed	Completely adequate	9
Tay-Teo *et al.* (2008)	Quasi-experimental	71	Mixed	Partially adequate	9
Tyedin *et al.* (2010)	Quasi-experimental	71	Mixed	Completely adequate	11
Zisberg *et al.* (2011)	Prospective observational	525	Mixed	Completely adequate	9

stockings. Pain relief with ambulation has also been found in posttransfemoral cardiac catheterisation patients. Patients in the experimental group were ambulated four hours after bed rest, while the control group was mobilised at the usual care time of 12–24 hours postcardiac catheterisation. The experimental group experienced less back pain and less urinary discomfort than the control group (Chair *et al.* 2007). Augustin *et al.* (2010) studied postpercutaneous coronary intervention patients and found less pain in the intervention group which ambulated three hours after the procedure than in the control group which ambulated 10 hours after the procedure.

Deep vein thrombosis prevention was also a prevalent outcome of inpatient mobilisation. Chandrasekaran *et al.* (2009) explored early mobilisation of total knee replacement patients who began sitting out of bed or walking on the first postoperative day. Compared to the control group, the early mobilisation group had significantly less incidence of thromboembolic complications. Pearse *et al.* (2007) found that initiating walking within 24 hours of knee replacement surgery significantly decreased the incidence of DVT. Nakao *et al.* (2010) discovered that in patients with osteoarthritis or rheumatoid arthritis, ambulating early after total knee arthroplasty surgery significantly lowered D-dimer levels. García Guerrero *et al.* (2010) studied 47 consecutive patients receiving temporary pacemaker implantation and found that those who had a high or moderate amount of mobility did not experience a DVT, and

Table 2 Summary of studies that included mobilisation outcomes

Author, Date	Study design	Population	Sample size	Type of mobilisation activity	Outcomes of mobilisation
Physical outcomes					
Augustin *et al.* (2010)	Quasi-experimental	Percutaneous coronary intervention patients	347	EG (n = 172) ambulated after three hours of bed rest. CG (n = 175) ambulated after 10 hours of bed rest	The experimental group reported less lumbar pain (p = 0·001)
Brown *et al.* (2004)	Prospective observational	Hospitalised medical patients aged 70 and older	498	Mobility level scored from 0–12 including bed rest, transfer to chair and ambulation	The mobility level was inversely correlated with functional decline. Patients with low mobility were 5·6 times more likely than high-mobility patients to experience functional decline
Chandrasekaran *et al.* (2009)	Quasi-experimental	Total knee replacement patients	100	EG (n = 50) mobilised within 24 hours of surgery (sitting out of bed or walking for at least 15–30 minutes twice a day). CG (n = 50) mobilisation began POD 2	EG had reduced incidence of thromboembolic complications (p = 0·03)
Chang *et al.* (2008)	Quasi-experimental	Acute myelogenous leukaemia patients	22	EG (n = 11) walked in hospital hallways five days/week. CG (n = 11) received standard ward care	EG reported lower fatigue intensity and interference with daily life, increased walking distance (p = 0·001), decreased symptom distress [p = 0·001 (day 7), p = 0·04 (day 21)], decreased anxiety [p = 0·03 (day 7)], decreased depressive mood [p < 0·001 (day 7)], decreasing symptom distress after chemotherapy over time [p = 0·002 (day 7/day 1), p = 0·05 (day 14/day 1)]
Chair *et al.* (2007)	Quasi-experimental	Cardiac catherisation patients	86	EG (n = 43) ambulated after four hours of bed rest. CG (n = 43) ambulated the morning after procedure, 12–24 hours	EG reported less back pain (p < 0·001) and lower levels of urinary discomfort (p = 0·006)
Cumming *et al.* (2011)	Quasi-experimental	Stroke patients	71	EG (n = 38) 1st mobilisation within 24 hours of stroke and upright and OOB at least twice a day. CG (n = 33) standard care	(E) faster return to independent walking (p = 0·032)
Fisher *et al.* (2011)	Retrospective case control	Acute care medical/surgical unit patients 65 years of age and older	10	Steps per hospital day, minutes walking and engagement in episodes of activity were measured	No association was found between the fall outcome and the amount of walking
Frenea *et al.* (2004)	Quasi-experimental	Women in labour	61	EG (n = 31) were ambulating. CG (n = 31) recumbent	EG required smaller doses of bupivicain (p < 0·01) and oxytocin (p < 0·05), greater ability to void spontaneously (p < 0·01)
García Guerrero *et al.* (2010)	Quasi-experimental	Temporary pacemaker implantation patients	47	Level of mobility recorded	No DVTs in patients with moderate or high mobility
Hirschhorn *et al.* (2008)	Quasi-experimental	CABG patients	93	EG (n = 31) moderate intensity walking n = 30 walking with breathing exercises. CG (n = 32) standard care	EG had significantly higher six-minute walking distances at discharge from the hospital (p < 0·05)
Kamel *et al.* (2003)	Retrospective cohort	Hip fracture surgery patients	131	Time to ambulation was recorded	Time to ambulation predicted development of pneumonia (p < 0·001), new onset delirium (p < 0·001), and prolonged length of stay (p < 0·001)

Table 2 (Continued)

Author, Date	Study design	Population	Sample size	Type of mobilisation activity	Outcomes of mobilisation
Killey and Watt (2006)	Quasi-experimental	Older patients admitted to medical units	55	EG (n = 27) twice a day walking for a week. CG (n = 28) standard care	EG able to achieve greater walking distances ($p < 0{\cdot}05$), improved independence ($p = 0{\cdot}03$)
Kurabe *et al.* (2010)	Quasi-experimental	Older postoperative subdural haematoma patients	182	EG (n = 91) early mobilisation, walking beginning day of operation, upright position encouraged. CG (n = 91) delayed mobilisation	EG experienced fewer incidences of at least 1 complication ($p = 0{\cdot}015$)
Langhorne *et al.* (2010)	Quasi-experimental	Stroke patients	32	EG (n = 8) early mobilisation, (n = 8) early mobilisation and automated monitoring. CG (n = 8) standard stoke unit care, n = 8 automated monitoring	EG had fewer complications (chest infection, UTI and DVT) in 1st five days ($p = 0{\cdot}04$), more likely to achieve independent walking by day 5 ($p < 0{\cdot}03$)
Nakao *et al.* (2010)	Comparative	Total knee arthroplasty patients	37	Date of first ambulation recorded	Positive correlation with D-dimer ($r = 0{\cdot}71$, $p < 0{\cdot}001$) and a predictor ($p < 0{\cdot}001$) of D-dimer levels
Oldmeadow *et al.* (2006)	Quasi-experimental	Hip surgery patients	60	EG (n = 29) early ambulation. CG (n = 31) delayed ambulation	EG able to walk further ($p = 0{\cdot}03$), required less assistance with transfer ($p = 0{\cdot}009$)
Padula *et al.* (2009)	Quasi-experimental	Medical patients	50	EG (n = 25) encouraged mobility and ambulation 3–4×/day. CG (n = 25) standard care	EG ambulated in the hallway earlier ($p = 0{\cdot}007$) and had shorter LOS ($p < 0{\cdot}001$). CG had a decrease in function between pre-admission to discharge ($p = 0{\cdot}006$)
Partsch and Blattler (2000)	Quasi-experimental	Acute DVT patients	45	EG (n = 15) walking with inelastic Unna boot bandages. (n = 15) walking with elastic compressing stockings. CG (n = 15) bed rest and no compression	EG significant reduction in pain ($p < 0{\cdot}05$) and swelling ($p < 0{\cdot}01$)
Pearse *et al.* (2007)	Quasi-experimental	Total knee replacement patients	195	EG (n = 97) walking within 24 hours after surgery. CG (n = 98) walking on the 2nd postoperative day	EG significantly less incidence of DVTs 1% vs. 27·6% ($p < 0{\cdot}001$)
Rezaei-Adaryani *et al.* (2009)	Quasi-experimental	Cardiac catheterisation patients	70	EG (n = 35) BR for two hours, increasing HOB for two hours, right and left lateral positions for two hours, Fowler's position at 7th hour, ambulation at 8th hour. CG (n = 35) BR for 10–24 hours and sand bag on puncture site for at least eight hours	EG had higher comfort ($p \leq 0{\cdot}0001$–$<0{\cdot}001$) and satisfaction ($p \leq 0{\cdot}0001$), lower fatigue levels ($p \leq 0{\cdot}0001$–$0{\cdot}002$) at three, six and eight hour and the next morning after catheterisation, increased comfort and satisfaction after one, three, six, eight hours
Schweickert *et al.* (2009)	Quasi-experimental	Mechanically ventilated medical ICU patients	104	EG (n = 49) exercise and mobilisation programme. CG (n = 55) standard care	EG had shorter duration of delirium ($p = 0{\cdot}02$), more ventilator-free days ($p = 0{\cdot}05$), higher rate of returning to independent functional status ($p = 0{\cdot}02$)
Siu *et al.* (2006)	Prospective cohort	Hip fracture surgery patients	532	Time of immobility was recorded	Patients with less duration of immobility had better independence, total immobility was positively associated with mortality at six months ($p = 0{\cdot}01$)

Table 2 (Continued)

Author, Date	Study design	Population	Sample size	Type of mobilisation activity	Outcomes of mobilisation
Zisberg *et al.* (2011)	Prospective observational	Acute care medical patients aged >70, hospitalised for a non-disabling condition	525	Assessment of in-hospital mobility levels	Low vs. high in-hospital mobility was associated with worse basic functional status at discharge and at follow-up and worse IADLs at follow-up
Psychological outcomes					
Chang *et al.* (2008)*	Quasi-experimental	Acute myelogenous leukaemia patients	22	EG (n = 11) walked in hospital hallways five days/week. CG (n = 11) received standard ward care	EG reported lower fatigue intensity and interference with daily life, increased walking distance(p = 0·001), decreased symptom distress [p = 0·001 (day 7), p = 0·04 (day 21)], decreased anxiety [p = 0·03(day 7)], decreased depressive mood [p < 0·001(day 7)], decreasing symptom distress after chemotherapy over time [p = 0·002(day 7/day 1), p = 0·05 (day14/day 1]
Cumming *et al.* (2008)	Quasi-experimental	Stroke patients	71	EG (n = 38) VEM. CG (n = 33) standard care	(E) less depressed mood at 7 days (p = 0·012)
Rezaei-Adaryani *et al.* (2009)*	Quasi-experimental	Cardiac catheterisation patients	70	EG (n = 35) BR for two hours, increasing HOB for two hours, right and left lateral positions for two hours, Fowler's position at 7th hour, ambulation at 8th hour. CG (n = 35) BR for 10–24 hours and sand bag on puncture site for at least eight hours	EG had higher comfort ($p \leq$ 0·0001–<0·001) and satisfaction ($p \leq$ 0·0001), lower fatigue levels ($p \leq$ 0·0001–0·002) at three, six and eight hour and the next morning after catheterisation, increased comfort and satisfaction after one, three, six, eight hours
Social outcomes					
Behnke *et al.* (2003)	Quasi-experimental	COPD patients	26	EG (n = 14) walked for 10 days in the hospital followed by 18 months at home. CG (n = 12) had no ambulation training	The experimental group reported improvements in their quality of life at six, 12 and 18 months (p < 0·001)
Craig *et al.* (2010)	Meta-synthesis	Stroke patients	103	EG (n = 38) VEM for 14 days, (n = 16) VEM for seven days CG (n = 49) Standard care	Patients with VEM were three-times more likely to be independent at three months (adjusted odds ratio, 3·11)
Delaney *et al.* (2003)	Quasi-experimental	Laparotomy and intestinal or rectal resection patients	64	EG (n = 31) POD 1 encouraged to walk and sit out of bed. CG (n = 33) POD 1 encouraged to sit out of bed, POD 2 encouraged to walk	EG had less total time in the hospital after surgery (p = 0·022), reduction in the overall mental component score in quality of life at discharge (p = 0·01)
Killey and Watt (2006)*	Quasi-experimental	Older patients admitted to medical units	55	EG (n = 27) twice a day walking for a week. CG (n = 28) standard care	EG able to achieve greater walking distances (p < 0·05), improved independence (p = 0·03)
Larsen *et al.* (2009)	Quasi-experimental	Total hip arthroplasty patients	87	EG (n = 45) accelerated protocol, CG (n = 42) standard protocol	EG had decreased average total cost (p = 0·036), increased quality of life (p = 0·029)

Table 2 (Continued)

Author, Date	Study design	Population	Sample size	Type of mobilisation activity	Outcomes of mobilisation
Schweickert *et al.* (2009)*	Quasi-experimental	Mechanically ventilated medical ICU patients	104	EG (n = 49) exercise and mobilisation programme. CG (n = 55) standard care	EG had shorter duration of delirium (p = 0·02), more ventilator-free days (p = 0·05), higher rate of returning to independent functional status (p = 0·02)
Tyedin *et al.* (2010)	Quasi-experimental	Stroke patients	71	EG (n = 38) VEM. CG (n = 33) standard care.	(E) higher quality of life at the 75th percentile (p = 0·003)
Organisational outcomes					
Browning *et al.* (2007)	Prospective observational	Upper abdominal surgery patients	50	Time and distance of ambulation was measured over the first 4 postoperative days	More daily total time (p < 0·001) and mobilisation >5 m on day 1 (p = 0·03) were predictors of lower length of stay
Delaney *et al.* (2003)*	Quasi-experimental	Laparotomy and intestinal or rectal resection patients	64	EG (n = 31) POD 1 encouraged to walk and sit out of bed. CG (n = 33) POD 1 encouraged to sit out of bed, POD 2 encouraged to walk	EG had less total time in the hospital after surgery (p = 0·022), reduction in the overall mental component score in quality of life at discharge (p = 0·01)
Fisher *et al.* (2010)	Prospective cohort	65 Years or older patients	162	Distance walked measured	Patients who increased walking distance by 600 steps from the 1st to 2nd day were discharged 1·73 days earlier than those who did not
Indredavik *et al.* (1999)	Quasi-experimental	Stroke patients	220	EG (n = 110) early and intensive mobilisation: out of bed within 24 hours. CG (n = 110) mobilisation within 3–4 days after admission	EG discharge to home within 6 weeks
Kamel *et al.* (2003)*	Retrospective cohort	Hip fracture surgery patients	131	Time to ambulation was recorded	Time to ambulation predicted development of pneumonia (p < 0·001), new onset delirium (p < 0·001), and prolonged length of stay (p < 0·001)
Larsen *et al.* (2009)*	Quasi-experimental	Total hip arthroplasty patients	87	EG (n = 45) accelerated protocol, CG (n = 42) standard protocol	EG had decreased average total cost (p = 0·036), increased quality of life (p = 0·029)
Mundy *et al.* (2003)	Quasi-experimental	Community-acquired pneumonia patients	458	EG (n = 227) early mobilisation, CG (n = 231) usual care	(E) discharged 1 day earlier with no increase in adverse events (means, 5·8 days vs. 6·9 days), less adjusted mean hospital charges (p = 0·05)
Rath *et al.* (2010)	Quasi-experimental	Surgically corrected foot-drop patients	23	EG (n = 12) early mobilisation with active motion. CG (n = 11) postoperative immobilisation	EG had no tendon pull-out, reduced rehabilitation time by an average of 15 days (p < 0·001)
Shadmi and Zisberg (2011)	Prospective cohort	Older with acute non-disabling conditions	485	Frequency of ambulation and distance classified as inside or outside the patient's hospital room	Patients mobile at least once a day outside of their room had a 1·5 day shorter LOS than those mobile only inside their room after adjusting for pre-admission mobility (p < 0·003)
Siu *et al.* (2006)*	Prospective cohort	Hip fracture surgery patients	532	Time of immobility was recorded	Patients with less duration of immobility had better independence; total immobility was positively associated with mortality at six months (p = 0·01)

Table 2 (Continued)

Author, Date	Study design	Population	Sample size	Type of mobilisation activity	Outcomes of mobilisation
Tay-Teo *et al.* (2008)	Quasi-experimental	Ischaemic or haemorrhagic stroke patients	71	EG (n = 38) VEM. CG (n = 33) standard care	(E) less mean per patient total costs at three months ($p = 0{\cdot}02$) and at 12-months ($p = 0{\cdot}03$)

EG, experimental group; CG, control group; POD, postoperative day; COPD, chronic obstructive pulmonary disease; VEM, very early mobilization; OOB, out of bed; CABG, coronary artery bypass graft; EM, early mobilization; DVT, deep vein thrombosis; UTI, urinary tract infection; LOS, length of stay; BR, bed rest; HOB, head of bed; ICU, intensive care unit; IADLs, instrumental activities of daily living.

*Studies that are listed in more than one outcome.

6·4% of patients with a low amount of mobility did develop a DVT.

Fatigue was another outcome studied. Chang *et al.* (2008) explored the effects of walking on fatigue-related experiences of acute myelogenous leukaemia (AML) patients. Patients were randomised into an experimental group, which received a three-week walking exercise programme or a control group experiencing standard care. The walking group had lower levels of fatigue intensity and interference with daily life. The effects of position change and earlier ambulation on patient fatigue and comfort were examined in cardiac catheterisation patients (Rezaei-Adaryani *et al.* 2009). In this study, the experimental group received intermittent position change for the first six hours after cauterisation and ambulated seven hours after the procedure. The control group received routine care and was restricted to bed rest for 10–24 hours in a supine position. The experimental group reported less fatigue.

The review revealed additional effects of mobilisation on physical outcomes such as reduced incidence of new pneumonia, delirium, urinary tract infection and more ventilator-free days. Kamel *et al.* (2003) found that the longer the time to ambulation after hip fracture surgery, the greater the chance for development of pneumonia and new onset delirium. Schweickert *et al.* (2009) also evaluated effects of early exercise and mobilisation on critically ill intensive care unit mechanically ventilated patients and found that the intervention group experienced shorter duration of delirium and more ventilator-free days. Kurabe *et al.* (2010) evaluated the number of complications in older chronic subdural haematoma patients who underwent one burr-hole surgery. The early mobilisation group, who began walking on the day of the surgery, experienced fewer postoperative complications of pneumonia and urinary tract infections than the control group. Langhorne *et al.* (2010) found that in stroke patients, the early mobilisation group was less likely to develop complications of immobility such as chest infection, urinary tract infection and a DVT in the first five days.

Several studies showed improvement in physical function after inpatient mobilisation. Three studies exploring the impact of hospital ambulation on walking capacity indicated a positive effect (Killey & Watt 2006, Chang *et al.* 2008, Hirschhorn *et al.* 2008). Killey and Watt (2006) examined the impact of providing hospitalised older adults two extra walks per day. Compared to the control group, the intervention group demonstrated increased mobility measured by their ability to walk further distances. A study of hospitalised AML patients found that a three-week walking exercise programme increased 12-minute walking

Table 3 Main categories and outcomes of impatient mobilisation

Categories	Outcomes	
Physical outcomes	Less delirium	Kamel *et al.* (2003), Schweickert *et al.* (2009)
	Less pain	Partsch and Blattler (2000), Chair *et al.* (2007), Augustin *et al.* (2010)
	No relationship with inpatient falls	Fisher *et al.* (2011)
	Less urinary discomfort	Chair *et al.* (2007)
	Improved ability to void	Frenea *et al.* (2004), Augustin *et al.* (2010)
	Less urinary tract infection	Kurabe *et al.* (2010), Langhorne *et al.* (2010)
	Less fatigue	Chang *et al.* (2008), Rezaei-Adaryani *et al.* (2009)
	Less DVT	Pearse *et al.* (2007), Chandrasekaran *et al.* (2009), García Guerrero *et al.* (2010), Langhorne *et al.* (2010), Nakao *et al.* (2010)
	Less pneumonia	Kamel *et al.* (2003), Kurabe *et al.* (2010)
	More ventilator-free days	Schweickert *et al.* (2009)
	Increased walking distance	Killey and Watt (2006), Chang *et al.* (2008), Hirschhorn *et al.* (2008)
	Faster return to independent ambulation	Siu *et al.* (2006), Langhorne *et al.* (2010), Cumming *et al.* (2011)
	Improved physical function	Killey and Watt (2006), Oldmeadow *et al.* (2006), Chang *et al.* (2008), Hirschhorn *et al.* (2008), Padula *et al.* (2009), Langhorne *et al.* (2010), Cumming *et al.* (2011), Zisberg *et al.* (2011)
Psychological outcomes	Less depression	Chang *et al.* (2008), Cumming *et al.* (2008)
	Less anxiety	Chang *et al.* (2008)
	Increased comfort	Rezaei-Adaryani *et al.* (2009)
	More satisfaction	Rezaei-Adaryani *et al.* (2009)
	Less symptom distress	Chang *et al.* (2008)
Social outcomes	Improved quality of life	Behnke *et al.* (2003), Delaney *et al.* (2003), Larsen *et al.* (2009), Tyedin *et al.* (2010)
	More independence	Killey and Watt (2006), Schweickert *et al.* (2009), Craig *et al.* (2010)
Organisational outcomes	Decreased length of stay	Indredavik *et al.* (1999), Kamel *et al.* (2003), Delaney *et al.* (2003), Mundy *et al.* (2003), Browning *et al.* (2007), Fisher *et al.* (2010), Rath *et al.* (2010), Shadmi and Zisberg (2011)
	Less mortality	Mundy *et al.* (2003), Siu *et al.* (2006), Tay-Teo *et al.* (2008)
	Less cost	Mundy *et al.* (2003), Tay-Teo *et al.* (2008), Larsen *et al.* (2009)

DVT, deep vein thrombosis.

distance ability compared to standard inpatient care (Chang *et al.* 2008). Hirschhorn *et al.* (2008) studied coronary artery bypass graft patients. They found that patients in the walking and walking/breathing groups had significantly higher six-minute walking distances than the 'gentle mobilisation' group upon discharge from the hospital. Oldmeadow *et al.* (2006) studied the function of 60 hip surgery patients after early ambulation. Patients were randomised to either an early ambulation group, which began walking postoperative day 1 or 2, or a delayed ambulation group, which began walking postoperative day 3 or 4. They found that the early ambulation group had significantly better functional recovery at postoperative day 7 and were able to walk on average twice as far as the delayed ambulation group and required less assistance to transfer and ambulate. Padula *et al.* (2009) studied the effects of a nurse-driven mobility protocol on the functional status of inpatients. They found that the treatment group ambulated in the hallway earlier [2·7 days vs. 4·9 days ($p = 0{\cdot}007$)] and the control group had a statistically significant decrease in function between pre-admission and discharge ($p = 0{\cdot}006$). Zisberg *et al.* (2011) examined the mobility levels of 525 older adults and the association between mobility levels and functional outcomes. They found that low vs. high mobility to be associated with poorer basic functional status at discharge and also at follow-up. The low-mobility patients also had poorer instrumental activities of daily living at follow-up.

Inpatient ambulation has also been found to help patients' return to independent walking. Cumming *et al.* (2011) explored the use of early and more intense mobilisation on stroke patients. They found that patients who had their first mobilisation within 24 hours of the stroke and were out of bed at least twice a day returned to walking unassisted sooner than the standard care group. Langhorne *et al.* (2010) also studied stroke patients and found that early mobilisation patients were more likely to achieve walking by day 5 of their hospital admission and were less likely to develop complications of immobility. Examining the

association between the length of immobility and function in hip fracture patients found that those who were gotten out of bed earlier had better function at two months (Siu *et al.* 2006). However, no significant differences were found at six months, indicating an initial benefit of faster recovery.

A few studies found negative or inconclusive effects of mobilisation on physical outcomes. Augustin and colleagues (2010) revealed no significant improvement in the frequency of urinary retention among percutaneous coronary intervention patients in the early ambulation group, with urinary retention being the same in both groups. Using the pain visual analogue scale scores or the length of labour, Frenea *et al.* (2004) investigated the effects of ambulating women in labour on the duration of labour and pain and found no significant difference between the ambulation and the recumbent group. They did however find that the ambulatory group required smaller doses of bupivicain and oxytocin and had a greater ability to void spontaneously. Fisher *et al.* (2011) studied acute care patients aged 65 and older to explore the effects of inpatient mobilisation on falls. Examination of total patient steps per day, minutes walking and engagement of activity did not reveal an association between increased mobility and inpatient falls.

Psychological outcomes

Three articles suggested an effect of mobilisation on psychological outcomes such as anxiety and depressive mood (Chang *et al.* 2008, Cumming *et al.* 2008), symptom distress (Chang *et al.* 2008), and comfort and satisfaction (Rezaei-Adaryani *et al.* 2009).

Mobilisation had positive effects on anxiety, depressive mood and symptom distress. Chang *et al.* (2008) studied the effects of walking exercise programme on cancer patients and found improvement in mood and symptom distress. Even though the effect of walking on anxiety and depressive mood diminished over time, this study supports the positive psychological effect of ambulation on cancer patients undergoing chemotherapy. In addition, the results of the control group indicate that patients experience emotional distress during chemotherapy, especially during the initial period, emphasising the need of an intervention to decrease their emotional distress. Cumming *et al.* (2008) explored the effects of very early mobilisation (VEM) on depression and anxiety of stroke patients and found that the VEM group showed a less depressed mood at seven days after a stroke compared to the group with standard care, which entailed less ambulation. However, the VEM group had only marginally less anxiety than the control group, not strongly supporting the effect of ambulation on anxiety.

Comfort and satisfaction were studied as other psychological outcomes of patient mobilisation. Rezaei-Adaryani *et al.* (2009) investigated the effect of early ambulation after cardiac catheterisation on comfort and satisfaction of patients. The levels of comfort and satisfaction until the next morning after catheterisation increased in the experimental group but decreased in the control group. These differences between the two groups support the positive effect of early ambulation on patients' comfort and satisfaction.

Social outcomes

Five articles examined how ambulation helps patients in living after discharge by studying quality of life (Behnke *et al.* 2003, Delaney *et al.* 2003, Larsen *et al.* 2009, Tyedin *et al.* 2010) and independence (Killey & Watt 2006, Schweickert *et al.* 2009, Craig *et al.* 2010).

Inpatient mobilisation was found to positively influence the quality of life of patients. Tyedin *et al.* (2010) emphasised that patients tend to have a lower quality of life after stroke and suggested early mobilisation to recover it. The study found that the mobilisation group had significantly improved independent physical function, one subdomain of quality of life, as compared to the control group. Behnke *et al.* (2003) also supported the improvement in quality of life for patients with chronic obstructive pulmonary disease. In the study by Delaney *et al.* (2003), the mental component system, one subcategory of quality of life, resulted in improvement only at the time of discharge, but not at tenor 30 days after discharge. Larsen *et al.* (2009) identified that among total hip arthroplasty patients, the accelerated group had additional average gain in health-related quality of life compared to those who received the standard protocol.

Independence was another social outcome of inpatient mobilisation. Craig *et al.* (2010) conducted a meta-analysis of two trials: a very early rehabilitation trial and a very early rehabilitation contrasted with intensive telemetry after stroke (VERITAS). From individual data, it was concluded that stroke patients with early ambulation were three times more likely to be independent at three months. Exercise and mobilisation also have a positive effect on independence for critically ill patients. Schweickert *et al.* (2009) evaluated the performing activities of daily living at hospital discharge and found that patients under exercise intervention had a higher rate of returning to independent functional status. Killey and Watt (2006) applied extra walking to the intervention group in the medical unit and found that the level of independence in the walking group increased from admission day to after seven days while it decreased in the control group. The result showed the

significant role of a walking programme on improved independence of older patients.

Organisational outcomes

The effects of inpatient mobilisation on hospital organisational outcomes included issues such as length of stay at the hospital (Indredavik *et al.* 1999, Delaney *et al.* 2003, Kamel *et al.* 2003, Mundy *et al.* 2003, Browning *et al.* 2007, Fisher *et al.* 2010, Rath *et al.* 2010, Shadmi & Zisberg 2011), mortality (Mundy *et al.* 2003, Siu *et al.* 2006, Tay-Teo *et al.* 2008) and cost (Mundy *et al.* 2003, Tay-Teo *et al.* 2008, Larsen *et al.* 2009).

Mundy *et al.* (2003) applied early mobilisation on patients with community-acquired pneumonia and showed that patients receiving early mobilisation discharged one day earlier than the control group with no increase in adverse events. Delaney *et al.* (2003) compared two different types of postoperative care for patients after laparotomy and intestinal resection. One pathway was traditional care and other was controlled rehabilitation with early ambulation and diet (CREAD). Even though CREAD is a multimodal approach, early ambulation formed a greater part of the intervention. The result demonstrated a reduction in hospital stay in the CREAD group. Padula *et al.* (2009) also found in their study of a nurse-driven mobility protocol that patients in the treatment group had significantly shorter length of stays (4·96 days vs. 8·75 days, $p < 0·001$). Rath *et al.* (2010) compared mobilisation to immobilisation, which is a conventional management for patients after a tendon transfer. The early mobilisation group was applied a splint instead of a cast which was removed five days after surgery while the immobilised group was applied a cast which was removed 29 days after the procedure. Following the rehabilitation protocol for three weeks after removing the splint or cast, the patients in the mobilised group were discharged 15 days earlier than the immobilised group with no tendon insertion pull-out, the major complication of the surgery. This study supported the advantage of early ambulation after foot-drop correction.

Several researchers found that the amount of time of ambulation predicted or influenced length of stay. Fisher *et al.* (2010) calculated total steps of geriatric patients to measure ambulation and indicated that low or negative step change score from the first to second day were associated with longer lengths of stay. Browning *et al.* (2007) also investigated the quantity of ambulation and found that mobilisation >5 m on the first day and the amount of time of being upright were predictors of length of stay along with duration of anaesthesia and intensive care admission. Shadmi and Zisberg (2011) studied hospitalised adults aged 70 years and older with acute nondisabling conditions and found that those who ambulated outside of their room at least once a day had a 1·5 day shorter length of stay than those who only ambulated inside of their room. These results remained significant after adjusting for pre-admission mobility levels. Moreover, Indredavik *et al.* (1999) identified which aspects of the stroke unit contributed to the improved result in treatment. There were several important characteristics of stroke unit care, but shorter time to start systematic mobilisation was the most critical factor associated with 'discharge to home within six weeks'.

Regarding the issue of mortality, there were inconsistent findings. Siu *et al.* (2006) examined the effect of immobility of patients after hip fracture surgery on mortality at six months after discharge and showed that six-month survival was worse with delays in getting patients out of bed. However, Mundy *et al.* (2003) and Tay-Teo *et al.* (2008) did not find any significant difference in mortality rates between the early mobilisation group and control group.

Finally, the cost and efficiency outcomes of inpatient mobilisation were studied as outcomes of mobilisation. Tay-Teo *et al.* (2008) found that the VEM group incurred significantly less costs (determined from medical records and patient interviews) at three and 12 months and less demand of rehabilitation services. The cost difference at three months was largely attributable (84%) to lower inpatient rehabilitation costs among VEM patients. Cost was saved only at 12 months in the mobilisation group when productive loss was added, but it can be concluded that cost savings were attributable to the lesser amount of inpatient rehabilitation. Larsen *et al.* (2009) estimated average total cost, postoperative productivity loss and hospitalisation cost (preoperative and perioperative) and identified that among total hip arthroplasty patients, the accelerated group was less costly compared to those who received the standard protocol. In addition, Mundy *et al.* (2003) estimated $1000 per patient was saved under early mobilisation, showing the effect of ambulation on hospital charges.

Discussion

Findings from the literature review demonstrated various benefits of mobilising hospitalised adults. The majority of studies focused on the physical outcomes of inpatient mobilisation, followed by organisational, social and psychological outcomes, respectively. The physical benefits of inpatient mobilisation included less delirium, pain, urinary discomfort, urinary tract infection, fatigue, DVT, pneumonia, more ventilator-dependent days and improved ability to void. The physical function benefits also included

improved walking distance and shorten time to return of independent ambulation. This result provides insight into the impact of mobilisation for hospitalised adults: patients who experience less mobilisation and prolonged immobility often experience less optimal physical and psychosocial outcomes, slower recovery, more functional decline and longer length of stays, than patients with more mobility. The type of mobilisation activity and the timing of this mobilisation may vary dependent on patient characteristics, illness and procedures. However, based on the results of this review, most inpatients would benefit from inpatient mobilisation and would experience less than optimal outcomes if this activity is omitted.

There was evidence in this review that mobilisation affects not only patients' physical functioning, but also their emotional and social well-being. Mobilisation decreased depression, anxiety and symptom distress and enhanced more comfort and satisfaction. It also enhanced quality of life and independence. This review requires viewing the patient in a holistic manner. In addition to benefits to patients, organisational benefits were uncovered including cost reduction, decreased length of stays and lower mortality rates. This finding indicates that inpatient mobility is not only good for the patients, but also the organisations that care for them. Even though a few studies demonstrated negative or inconclusive findings, most studies found positive effects of inpatient mobilisation and emphasised the importance of mobilisation.

Limitations

Assessment of the quality of all studies found two weaknesses: (1) varied sample sizes which ranged from 22–458 in experimental design studies and from 35–532 in nonexperimental design studies and (2) heterogeneity of samples including patients from stroke, surgery or ICU units. These weaknesses may limit the generality of the findings. However, most studies used reliable and valid measurements and designed experimental studies, establishing causal relationships.

The process of reviewing the literature also has potential limitations. A publication bias may exist. The findings of this literature review were based on published literature and it is possible that important and relevant findings from key primary data articles were omitted as they were not included in the literature review. Moreover, a language bias may have been presented because we included only articles published in English-language journals. In addition, a variety of outcome measures (32 different ones in 36 studies) may limit the comparability of the findings.

Conclusion

Although immobility is known to cause functional decline or complications such as accelerated bone loss, muscle atrophy, malnutrition, delirium, sensory deprivation and incontinence (Creditor 1993, Convertino 1997, Markey & Brown 2002, Timmerman 2007), nurses have not consistently ensured that their patients are ambulated (Kalisch *et al.* 2011). Covinsky *et al.* (2003) found that hospitalised older adults are often discharged from acute care hospitals with activities of daily living functioning that is worse than their baseline functioning. It may be that the importance of ambulation has been overlooked by nurses or patient mobilisation is not fully implemented by nurses. The findings of this literature review have provided insight into the impact of inpatient mobilisation (physical, psychological, social and organisational outcomes). Given the positive impact of mobilisation uncovered in this review, the mobilisation of inpatients should become a higher priority for nurses practicing in the inpatient setting and should not be neglected.

Relevance to clinical practice

The findings of this review suggest directions for further research. Interventions and policies that increase inpatient mobilisation need to be developed, tested and put into practice. Larger studies with a variety of populations employing blinded trial methodology or using predictive designs are needed. In addition to formulating interventions and policies to increase patient mobility, steps must be taken to ensure that the required work environment (e.g. adequate staffing, levels, teamwork and equipment) is provided to facilitate patient mobility. Studies exploring the reasons nurses miss nursing care include too few staff, poor use of existing staff resources, the time required for the nursing intervention, poor teamwork or communication problems, ineffective delegation, habit and denial (Kalisch 2006, Kalisch *et al.* 2011). The factors related to not mobilising patients need to be addressed by hospital organisations, nursing management and practicing clinical nurses.

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Study design: BJK, SL, BWD; data collection and analysis: BJK, SL, BWD and manuscript preparation: BJK, SL, BWD.

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