Evidence-Based Quality Improvement: A recipe for improving medication safety and handover of care
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CHAPTER 7

Effectiveness of different nursing handover styles for ensuring continuity of information in hospitalized patients

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Cochrane Database of Systematic Reviews 2014;6:CD009979
ABSTRACT

Background
An accurate handover of clinical information is of great importance to continuity and safety of care. If clinically relevant information is not shared accurately and in a timely manner it may lead to adverse events, delays in treatment and diagnosis, inappropriate treatment and omission of care. During the last decade the call for interventions to improve handovers has increased. These interventions aim to reduce the risk of miscommunication, misunderstanding and the omission of critical information.

Objectives
To determine the effectiveness of interventions designed to improve hospital nursing handover, specifically to identify which nursing handover style(s) are associated with improved outcomes for patients in the hospital setting and which nursing handover style(s) are associated with improved nursing process outcomes.

Search methods
We searched the following electronic databases for primary studies: Cochrane EPOC Group specialized register (to 19 September 2012), Cochrane Central Register of Controlled Trials (CENTRAL) (to 1 March 2013), MEDLINE (1950 to 1 March 2013) OvidSP, EMBASE (1947 to 1 March 2013) OvidSP, CINAHL (Cumulative Index to Nursing and Allied Health Literature) (1980 to 1 March 2013) EbscoHost and ISI Web of Knowledge (Science Citation Index and Social Sciences Citation Index) (to 9 July 2012). The Database of Abstracts of Reviews (DARE) was searched for related reviews. We screened the reference lists of included studies and relevant reviews. We also searched the WHO International Clinical Trials Registry Platform (ICTRP) https://c-8pw-p-n-p3iewsec.amc.nl/ictrp/en/ and Current Controlled Trials www.controlled-trials.com/mrct and we conducted a search of grey literature web sites.

Selection criteria
Randomized controlled trials (RCTs or cluster-RCTs) evaluating any nursing handover style between nurses in a hospital setting with the aim of preventing adverse events or optimizing the transfer of accurate essential information required for continuity of care, or both.
DATA COLLECTION AND ANALYSIS
Two review authors independently assessed trial quality and extracted data.

MAIN RESULTS
The search identified 2178 citations, 28 of which were considered potentially relevant. After independent review of the full text of these studies, no eligible studies were identified for inclusion in this review due to the absence of studies with a randomized controlled study design.

AUTHOR’S CONCLUSIONS
There was no evidence available to support conclusions about the effectiveness of nursing handover styles for ensuring continuity of information in hospitalized patients because we found no studies that fulfilled the methodological criteria for this review. As a consequence, uncertainty about the most effective practice remains. Research efforts should focus on strengthening the evidence about the effectiveness of nursing handover styles using well designed, rigorous studies. According to current knowledge, the following guiding principles can be applied when redesigning the nursing handover process: face-to-face communication, structured documentation, patient involvement and use of IT technology to support the process.

Keywords: patient safety, handover, nursing care, systematic review

BACKGROUND
In its 2001 report, ‘Crossing the Quality Chasm’ the Institute of Medicine (IOM) stated that handovers provide an opportunity for error and that “in a safe system, information is not lost, inaccessible, or forgotten in transitions”¹. In a 2009 hospital survey on patient safety-culture, hospital staff respondents reported that “important patient care information is often lost during shift changes and patient transfers”.² Inadequate and ineffective interpersonal communication between healthcare professionals is an often-cited key factor contributing to errors and procedural mistakes, which may lead to adverse events (AEs). Breakdowns in communication were implicated as one of the main causes of AEs reported to the Joint Commission in the USA between 2004 and 2010.³ In an Australian study of more than 14,000 admis-
sions. 17% were associated with an AE; in 11% of these communication problems were found to be a contributing factor.4

Handovers of patient care thus introduce a ‘vulnerable gap’ that may result in AEs if clinically relevant information is not shared accurately and in a timely manner5-7 Other consequences of a poor handover might be delays in diagnosis or treatment8, inappropriate treatment and omission of care. However, inefficiency due to rework, redundant communications and activities, may result in lower satisfaction for both healthcare provider and patient, increased costs, increased length of hospital stay and more readmissions.9

As a result, it is now well recognized that an accurate handover of clinical information is of great importance to continuity and safety of care.

This review will focus on the nursing handover as an instrument for ensuring continuity of care for hospitalized patients. This specific scope is chosen as nurses are pivotal in ensuring continuity of care in a 24-hour seven-days-a-week environment, not only since they are present both day and night10, but also because they are seen as a communication partner for all healthcare professionals and are often the (in)formal coordinators of the increasingly complex care that is given within hospitals.11 To fulfil this role a complete and up to date picture of the patient’s care plan has to be handed over frequently - on average three times a day and two times during each nurse’s shift - and, due to frequent part-time working among nurses, handovers occur between many different nurses. Usually handovers are time-consuming, lack consistency and are varied in style12-14, and nursing handovers are no different. Furthermore, nurses, just like most healthcare professionals, may receive no formal training in the handover process other than by modelling from peers and superiors.15 As a consequence, the nursing handover is a vulnerable process with potential to result in AEs, unnecessary duplication of work or suboptimal care.

Although the literature so far has not provided a thorough or agreed definition of the concept of handover and its scope, continuity of patient care is its primary function16,17 The distinctive feature that distinguishes a handover from other (in)formal communication about patients is the transfer of professional responsibility for the patient.18 Responsibility deals with the transfer of accountability for the quality, safety and satisfaction of the patient. Within this review we define a handover as the exchange of specific information about a patient from one health professional to another, or from one team of health professionals to another, accompanied by the transfer of responsibility for that patient with the purpose of ensuring the conti-
nuity and safety of the patient’s care. The scope of this review covers the exchange of information about content (the ‘what’ aspect), as well as the way, or method, in which it is communicated (the ‘how’ aspect). Content can be structured (e.g., templates, mnemonics, checklists, or a combination of these) or unstructured. Method refers to the communication methods, e.g., verbal, written, or taped. In addition to the content and method, the location (the ‘where’ aspect) of the handover may also differ. Location can be either bedside or office-based. We define a handover style as any combination of the above-mentioned characteristics, that is, content (‘what’), method (‘how’), and location (‘where’).

Literature frequently identifies the following nursing handover styles: bedside, verbal, nonverbal, and taped.

- **Bedside**: located at the patient’s bedside, which promotes patient and nurse face-to-face interaction and encourages patients’ verbal participation, thus making the patient central to the information exchange process.

- **Verbal**: located in an office setting, the nurse responsible for a group of patients exchanges relevant documented information.

- **Non-verbal**: located in an office setting, nurses inform themselves by reading the patient health record, involving progress notes, medication charts, observation charts, and nursing care plans.

- **Taped**: located in an office setting, the nurse in charge collects the relevant information and records this onto an audiotape so that the oncoming shift can listen at a convenient time.

During the last decade, the call for interventions to improve handovers has increased. These interventions aim to reduce the risk of miscommunication, misunderstanding, and the omission of critical information, therefore, it is important to find out what constitutes an effective nursing handover style.

**Description of the condition**

As mentioned above, handovers of patient care may result in AEs if clinically relevant information is not shared accurately and in a timely manner. Other consequences of a less than perfect handover might be delays in treatment and diagnosis, inappropriate treatment, and omission of care. However, inefficiency due to rework, redundant communications, and redundant activities may also result in lower satisfaction for both healthcare providers and patients, increased costs, increased length of hospital stay, and more readmissions.
PART II - Safe handover of care

Description of the intervention
We considered any nursing handover style (‘what’, ‘how’ and ‘where’) between nurses in a hospital setting with the aim of preventing AEs or optimizing the transfer of accurate essential information required for continuity of care, or both. This includes:

- nurses’ shift changes on nursing wards providing different levels of care, such as: regular ward-based care, high-dependency care and intensive care unit (ICU);
- nurse-to-nurse transfers during a shift to balance workload;
- nurse-to-nurse interdepartmental transfers, such as between nursing wards, from the emergency department (ED) to the nursing ward, from the recovery unit to the nursing ward, from the ICU to the nursing ward or the other way round.

The review does not include:

- handover from a primary care setting to a hospital setting by a primary care physician or from the ambulance to the ED;
- handovers across different health professional groups, such as from a physician to a nurse;
- handovers from hospital to home or to another healthcare facility upon discharge.

How the intervention might work
Generally handover interventions aim to incorporate a tool or routine into practice that implements a standardized approach to the handover, including written information and standardized communication patterns allowing for questions or for information to be read back. Use of the tool or routine is intended to support the exchange or availability of information about the patient (or both) for the next caregiver, resulting in improved continuity of care through:

- improved recall of information provided;
- improved compliance with the plan of care;
- improved patient involvement;
- timely delivery of the care;
- a decrease in incongruent information (information given at handover that is different from the actual condition);
- a decrease in omissions (information that if left out of the handover that could increase inefficiency);
- a reduction of time spent resolving issues from incomplete communication at handover.
Therefore, an effective and efficient handover style may reduce the number of AEs and inefficiencies resulting from an ineffective handover, and also reduce the amount of time spent on handovers, thereby freeing-up time that can be spent in direct patient care.\textsuperscript{14}

**Why it is important to do this review**

Since handovers have been identified as a primary communication moment, many organizations, institutions and hospitals have initiated quality projects to improve handovers. In the ‘High 5s Project’, launched by the World Health Organization (WHO) in 2006, one of the five patient safety problems targeted was ‘Communication failures during patient handovers’.\textsuperscript{30} Literature on handovers is accumulating and thus it is important to understand the effectiveness of interventions aimed at improving nursing handovers and consequently ensuring continuity of care, as well as preventing AEs. Since the WHO and national government agencies are promoting handover interventions to improve patient safety\textsuperscript{32}, these policy decisions should be based on evidence of the effectiveness of these interventions. There are risks involved in implementing interventions for which evidence of effectiveness is lacking: valuable resources can be wasted and clinicians might become reluctant to implement other measures. The aim of this review is to synthesize the evidence from high-quality studies in order to determine the most effective nursing handover style.

**Objectives**

To determine the effectiveness of interventions designed to improve hospital nursing handover, specifically: to identify which nursing handover style(s) are associated with improved outcomes for patients in the hospital setting and which nursing handover style(s) are associated with improved nursing process outcomes.

**METHODS**

**Criteria for considering studies for this review**

**Types of studies**

We considered randomized controlled trials (RCTs or cluster-RCTs) to be eligible for inclusion (according to the definition of the Cochrane Effective Practice and Organization of Care (EPOC) Group). We considered published and unpublished studies to be eligible and we imposed no language restrictions.
Types of participants
All patients irrespective of age, gender or condition, and nurses in either general, teaching or university hospitals.

Types of interventions
Any intervention designed to improve nursing handover in a hospital setting compared with a previous or existing hospital nursing handover practice or an alternative intervention as defined by the study. Interventions could target a combination of the content (‘what’), communication method (‘how’) and location (‘where’) aspects of the handover. Content could be structured (e.g. including templates, mnemonics or checklists, or a combination of these) or unstructured. Communication method refers to verbal, written or taped handovers - used individually or in a combination - possibly combined with standardized communication patterns allowing for questions or for information to be read back. Written handovers can be facilitated by either paper-based or electronic systems. Location could be either bedside- or office-based.

If at least one of the above-mentioned characteristics constituted part of a handover style it could be included. We decided to include comparisons such as:
- non-verbal handover in an office setting versus a verbal handover in an office setting;
- non-verbal handover based on a structured summary versus non-verbal handover as in common practice;
- verbal handover at the bedside versus verbal handover in the office;
- verbal handover in an office setting based on a structured format versus verbal handover in an office setting based on an unstructured format;
- verbal handover at the bedside with a standardized communication approach versus verbal handover at the bedside without a standardized communication approach;
- verbal handover in an office setting using the read back communication principle versus verbal handover in an office setting as in common practice.

If different comparisons were found, these would be taken into account, as long as the intervention targeted one or more of the following characteristics: content (structured, semi-structured or unstructured), method (e.g. verbal, written and taped) or location of the handover (e.g. bedside or office-based).
Types of outcome measures

Primary outcomes
• Patient outcomes: any objective measure for preventable AE (patient safety) measured by, for example:
  – medication errors;
  – complications;
  – sentinel events, or
  – mortality.\(^9\)
• Process of care outcomes (nurse-related): any objective measure for the transfer of accurate essential information required for continuity of care\(^9\), such as:
  – improved recall of information provided (measured, for example, by number of data points: number correct, number omitted, number incorrect).
  – improved compliance with the plan of care (measured, for example, by adherence indicators).
  – timely delivery of the care (measured, for example, by time difference between planned delivery and actual delivery of care).
  – a decrease in incongruent information (information given at handover that is different from the actual condition).
  – a decrease in omissions (information that could increase inefficiency if left out of the handover).

Secondary outcomes
• Efficiency outcomes:
  – time required for handover (either increase or decrease) in relation to the effectiveness of the handover.
  – reduction of time spent resolving issues from incomplete communication at handover.
  – reduction of preventable nursing actions measured by, for example, double ordering or unnecessary telephone calls.

We included any study that reported data for either primary or secondary outcomes.

Search methods for identification of studies
Search strategies for CENTRAL, MEDLINE, EMBASE and CINAHL were developed by a clinical librarian, in consultation with the authors and under the supervision of the Information Specialist and Trials Search Coordinator for the EPOC group. The Database of Abstracts of Reviews (DARE)
was searched for related reviews. Searches of CENTRAL, MEDLINE, EMBASE and CINAHL were conducted initially in April 2012. Searches for the Cochrane EPOC Group Specialized Register and ISI web of Knowledge were developed and conducted in July and September 2012 by the Information Specialist and Trials Search Coordinator for the EPOC group. The searches of CENTRAL, MEDLINE, EMBASE and CINAHL were updated through a re-run in March 2013. All search strategies are provided in Appendix 1.

**Databases**

- Cochrane EPOC Group specialized register (to 19 September 2012)
- Cochrane Central Register of Controlled Trials (CENTRAL) (Issue 2, 2013) (to 1 March 2013) MEDLINE (1950 to 1 March 2013) OvidSP
- EMBASE (1947 to 1 March 2013) OvidSP
- CINAHL (Cumulative Index to Nursing and Allied Health Literature) (1980 to 1 March 2013) EbscoHost
- ISI Web of Knowledge (Science Citation Index and Social Sciences Citation Index) (to 9 July 2012)

The search strategies were comprised of keywords and, when available, controlled vocabulary such as MeSH (Medical Subject Headings). Keywords used included: handover, handoff, change of shift, sign out, and MeSH terms: patient transfer, patient care planning and patient care management. Neither date nor language restrictions were used. All databases were searched from their start dates forward.

Two methodological search filters were used to limit retrieval to appropriate study designs: namely, the Cochrane Highly Sensitive Search Strategy (sensitivity- and precision-maximizing version, 2008 revision) to identify randomized trials and an EPOC methodology filter to identify non-RCT designs.

**Searching other resources**

**Grey literature**

We conducted a search of the grey literature to identify studies that are not indexed in the databases listed above using the following sources:

- European handover initiative (www.handover.eur).
- International WHO Collaborating Centre for Patient Safety Solutions (www.who.int/patientsafety). The search terms used were: handover, handoff, sign out, shift change, inter shift, transfer

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This text is a continuous excerpt from a larger document, providing context on the methodology of searching for related reviews, databases used, and strategies employed in identifying relevant studies for the safe handover of care.
**Trial registries**

Current Controlled Trials http://www.controlled-trials.com/
The search terms used were: handover, handoff, sign out, shift change, inter shift, transfer.

We also reviewed reference lists of relevant systematic reviews (Appendix 2).

**Data collection and analysis**

**Selection of studies**

We downloaded all titles and abstracts retrieved by the electronic searching to the reference managing database Reference Manager12. Two review authors (MS and HV) independently screened all titles and abstracts identified through the search strategies to assess which studies met the inclusion criteria. We retrieved and assessed full-text copies of all papers that were potentially relevant for inclusion. Any disagreement was resolved through discussion between the review authors.

**Data extraction and management**

We had planned to have two authors independently extract appropriate information regarding the characteristics of each included study, using a data abstraction form based on the EPOC Group template. We intended to extract the following data:

- Study reference: author name, publication year
- Study design: RCT or cluster-RCT
- Participants: number of participating nurses, age, level of training and years in practice
- Setting: country, type of hospital, type of department/specialty
- Intervention: description of the nursing handover intervention, classified according to whether the intervention targets any or a combination of content, method and location of the handover
- Control: description of control group used
- Outcomes: measures used to assess patient outcome, process and efficiency outcomes
- Results: main results of all outcome(s)

Where needed, we planned to contact study authors (if possible) to obtain missing information.
Assessment of risk of bias in included studies
We had planned that eligible studies would be independently assessed on methodological quality using the Cochrane Risk of bias tool, the EPOC Group criteria for randomized controlled trials and the GRADE approach.33-35 These checklists assess the validity of study design (method of randomization, allocation concealment, imbalance of outcome measures at baseline, blinding of participants, personnel and outcome assessors, incomplete outcome data, method of data collection, appropriate statistical methods) and the effect and applicability of the results (magnitude of effect, imprecision, inconsistency, indirectness).

Measures of treatment effect
We planned to report pre- and post-intervention proportions (dichotomous outcomes) and means or medians (continuous outcomes) separately. For dichotomous outcomes, such as AEs, we intended to calculate the risk ratio (RR) and the risk difference (RD) together with their respective 95% confidence intervals (CI). For studies reporting continuous outcomes, such as time, we planned to calculate the mean difference (MD) together with a 95% CI. When necessary we intended to contact the first or corresponding author for clarification or additional information. Had authors not reported or supplied data in sufficient detail after we had contacted them, we would have reported the point estimates with 95% CI or a P value, as stated by the author. We would have annotated this with ‘as stated by the author’. Where studies reported more than one measure for each endpoint, we planned to abstract the primary measure (as defined in the methods section by the authors of the study) or the median measure identified.

Unit of analysis issues
Clustered studies, where clusters of individuals are randomized (cluster-RCTs) to intervention groups, but where inference is intended at the level of the individual, need to be analyzed appropriately to account for correlation of observations within clusters. Standard statistical methods assume independence of observations, and their use in these types of studies will generally result in artificially small P values and overly narrow 95% CI for the effect estimates.36 We planned to attempt to reanalyze studies with potential unit of analysis errors if information was available about the size/number of clusters and the value of the intra-cluster correlation coefficient (ICC). If a comparison had been reanalyzed, we would have quoted the P value and annotated it as ‘reanalyzed’. If the ICC was not available we
intended to attempt to obtain it by contacting trial authors, or by imputing it using external estimates from similar studies\textsuperscript{36}, or using general recommendations from empirical research\textsuperscript{37}. If this had not been possible we would have reported the effect estimate and annotated it with the phrase ‘unit of analysis error’.

**Dealing with missing data**

We intended to contact the authors of included studies for missing data and incorporate this information into the analysis. We would have annotated this information as ‘as provided after contact with the author’.

**Assessment of heterogeneity**

We expected to find both clinical and statistical heterogeneity due to differences in the types of intervention, types of setting, definition of outcome measures and study design. This made it unlikely that statistical pooling would be feasible, but if there appeared to be a body of studies amenable to meta-analysis, then we planned to display the results graphically to assess heterogeneity. We would have considered I\(^2\) statistic values of 50% or greater as indicative of significant heterogeneity. If this had been the case, we would have refrained from pooling and restricted the analysis to a qualitative overview. If there had been sufficient homogeneity in populations, study design and outcome measures (i.e., where I\(^2\) < 50%)\textsuperscript{38}, we would have pooled results.

**Assessment of reporting biases**

We had planned to construct a funnel plot analysis to assess publication bias if there were 10 or more studies included in an analysis. We would have judged that publication bias existed when we detected asymmetry in the funnel plot. We also intended to use the Egger test to assess funnel plot asymmetry\textsuperscript{39}. A thorough search for unpublished studies through searches of the grey literature and contact with known experts in the field would also have assisted in reducing the risk of publication bias. Finally, we would have assessed selective outcome reporting bias by comparing either the study protocol (if available) or the methods section (if a protocol was not available) to the reported results of the study.

**Data synthesis**

A meta-analysis would have been considered only if we had had two or more studies that were homogeneous regarding population, interventions, comparisons and outcomes. In instances where meta-analysis would not be
possible, we planned to report the results as a descriptive narrative only. For studies that were sufficiently clinically and statistically homogenous ($I^2 < 50\%$), we planned to use a random-effects model. Where possible, we would have included both relative and absolute measures of effect in the meta-analysis. We would have performed data synthesis using Review Manager.\textsuperscript{40} Furthermore, we intended to use GRADE-profiler software to assist in the preparation of the ‘Summary of findings’ tables.\textsuperscript{35}

**Subgroup analysis and investigation of heterogeneity**

Had sufficient data been available, we planned to perform subgroup analyses to compare outcomes for: shift to shift handover on nursing wards providing different levels of care, such as: regular ward-based care, high dependency care and ICU; interdepartmental handover: from one ward to another ward (same level of care), and between departments with different levels of care: for example from ICU to ward, from recovery to ward, from ward to ICU.

**Sensitivity analysis**

We planned to perform a sensitivity analysis to explore the impact of the following study characteristics: fixed-effect versus random-effects analysis, odds ratios versus risk ratios, and studies with imputed standard deviations versus without imputed standard deviations.

**RESULTS**

**Description of studies**

**Results of the search**

The search identified 2178 citations. Independent examination by the reviewers resulted in retrieval of 28 publications that were potentially eligible for inclusion in the review (Figure 1). After assessment of the full text of these studies, no study was found to meet the inclusion criteria.

**Included studies**

No eligible studies were found for inclusion in this review.

**Excluded studies**

Main reason for exclusion was that the studies did not meet the RCT study design. 18 studies used a simple before-and-after design\textsuperscript{41-58}; three studies were opinion papers\textsuperscript{59-61}; two studies used a qualitative design\textsuperscript{62,63}. 

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Figure 1. Flow diagram of search

- MEDLINE until 1 March 2013: 1246 publications
- EMBASE until 1 March 2013: 1788 publications
- Cochrane CENTRAL until 1 March 2013: 107 publications
- CINAHL until 1 March 2013: 742 publications
- ISI Web of Knowledge until 9 July 2012: 280 publications
- EPOC specialized register until 19 Sept 2012: 212 publications
- Other resources until 1 March 2013: 31 publications

4406 publications

- 2228 duplicates

2178 titles and abstracts screened for relevance

- 2150 excluded: not RCT, not handover, not nurses

28 Full text publications

- 28 excluded: 27 not RCT, 1 not a clinical study

0 publications
two studies were editorials\textsuperscript{64,65}, one study was a simulation study\textsuperscript{67}, one study performed post implementation evaluation only\textsuperscript{66} and one study was a project description\textsuperscript{67}. In addition four of the studies were not on nursing handover\textsuperscript{41,47,49,67}. The detailed description of retrieved studies and reasons for their exclusion are presented in Table 1.

**Risk of bias in included studies**

No eligible studies were found for inclusion in this review, so we made no assessment of risk of bias.

**Allocation**

No eligible studies were found for inclusion in this review, so we made no assessment of selection bias.

**Blinding**

No eligible studies were found for inclusion in this review, so we made no assessment of performance or detection bias.

**Incomplete outcome data**

No eligible studies were found for inclusion in this review, so we made no assessment of attrition bias.

**Selective reporting**

No eligible studies were found for inclusion in this review, so we made no assessment of reporting bias.

**Other potential sources of bias**

No eligible studies were found for inclusion in this review, so we made no assessment of other sources of bias.

**Effects of interventions**

No eligible studies were found for inclusion in this review, so we cannot report any effects of interventions.
### Table 1. Characteristics of excluded studies [ordered alphabetically]

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adams 2012⁶²</td>
<td>Qualitative interview study with 20 nurses to develop a model structure for a standardized nursing handover. Did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Aellig 2012⁶⁷</td>
<td>A quality improvement project on handover between institutions. Did not meet RCT study design criteria and in-hospital nursing handover criteria</td>
</tr>
<tr>
<td>Alvarado 2006⁶⁶</td>
<td>Development, implementation and evaluation of a combination of written and verbal nursing shift handover with a safety check at the bedside. Did not meet RCT study design criteria as performed only a post-implementation evaluation (of nurses’ experiences)</td>
</tr>
<tr>
<td>Antonoff 2013⁴¹</td>
<td>Development, implementation and evaluation of a combination of written and verbal shift handover for residents. Did not meet RCT study design criteria as only simple before-and-after comparison was performed (on satisfaction with sign-outs, perceptions of patient safety, adequacy of information provided in sign-out, and patient knowledge by on-call residents) and not on nursing handover</td>
</tr>
<tr>
<td>Athwal 2009⁴²</td>
<td>Development, implementation and evaluation of a combination of written and verbal nursing shift handover at the bedside. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on the amount of time spent for shift report, overtime expenses related to shift report, call lights, staff satisfaction, and patient falls)</td>
</tr>
<tr>
<td>Baldwin 1994⁴³</td>
<td>Development, implementation and evaluation of a computer-generated written nursing shift handover. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on overtime and staff satisfaction)</td>
</tr>
<tr>
<td>Benaglio 2006⁵⁹</td>
<td>Opinion paper on nursing shift handover, did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Benestante 2008⁴⁴</td>
<td>Implementation and evaluation of bedside nursing shift handover. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on nurses belief that bedside reporting improves patient safety)</td>
</tr>
<tr>
<td>Chung 2011⁴⁵</td>
<td>Development, implementation and evaluation of a standardized nursing shift report. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on staff opinions and overtime)</td>
</tr>
</tbody>
</table>
TABLE 1. Continued

<table>
<thead>
<tr>
<th>Study</th>
<th>Reason for exclusion</th>
</tr>
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<tbody>
<tr>
<td>Clair 1969</td>
<td>Qualitative study to find out what should be included in a nursing shift handover report and to determine the extent to which nurses acted upon their beliefs. Did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Craig 2012</td>
<td>Development, implementation and evaluation of multidisciplinary structured verbal, written bedside handover from cardiac operating room to pediatric intensive care. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on handover score, staff perception, duration and number of interruptions)</td>
</tr>
<tr>
<td>Dean 2012a</td>
<td>Development, implementation and evaluation of a standardized handover from ambulance to ED. Did not meet RCT study design criteria as performed only simple before-and-after comparison and did not meet in-hospital nursing handover criteria</td>
</tr>
<tr>
<td>Dean 2012b</td>
<td>Opinion paper on nursing handover: did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Dowding 2001</td>
<td>Simulation of the effect that manipulating the style and content of the nurse shift handover had on an individual’s ability to plan patient care, not in a clinical setting</td>
</tr>
<tr>
<td>Evans 2012</td>
<td>Development, implementation and evaluation of bedside nursing shift handover. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on nurses’ job satisfaction and time spent delivering report)</td>
</tr>
<tr>
<td>Hussain 2011</td>
<td>Development, implementation and evaluation of a weekend handover for residents. Did not meet RCT study design criteria as performed only simple before-and-after comparison and not on nursing handover</td>
</tr>
<tr>
<td>Joy 2011</td>
<td>Development, implementation and evaluation of a structured handover from cardiac operation room to ICU. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on technical errors, information omissions and realized errors)</td>
</tr>
<tr>
<td>Jukkala 2012</td>
<td>Development, implementation and evaluation of a structured written and verbal nursing shift report in a medical ICU. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on nurse’s perception of handoff communication during shift report)</td>
</tr>
<tr>
<td>Study</td>
<td>Reason for exclusion</td>
</tr>
<tr>
<td>--------------------</td>
<td>----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Moore 2012&lt;sup&gt;64&lt;/sup&gt;</td>
<td>Editorial, did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Rabol 2011&lt;sup&gt;65&lt;/sup&gt;</td>
<td>Editorial, did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Radtke 2013&lt;sup&gt;52&lt;/sup&gt;</td>
<td>Development, implementation and evaluation of a bedside nursing shift report on a medical/surgical intermediate care unit. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on patient satisfaction)</td>
</tr>
<tr>
<td>Raptis 2009&lt;sup&gt;53&lt;/sup&gt;</td>
<td>Comparison of a paper-based and electronic-based medical handover from day team to out-of-hours team consisting of specialist nurses, medical staff and surgical staff. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on patient location, primary diagnosis and current problem, plan of action and day team details)</td>
</tr>
<tr>
<td>Stahl 2009&lt;sup&gt;54&lt;/sup&gt;</td>
<td>Prospective cohort study of trauma and surgical ICU teams (interns, residents, and fellows) to determine whether a structured checklist for ICU handovers prevents information loss. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on data lost)</td>
</tr>
<tr>
<td>Streitenberger 2011&lt;sup&gt;55&lt;/sup&gt;</td>
<td>Proceedings abstract on development, implementation and evaluation of a standardized nursing shift handover in 3 pediatric ICUs. Did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Ten Cate 2012&lt;sup&gt;61&lt;/sup&gt;</td>
<td>Opinion paper; did not meet RCT study design criteria</td>
</tr>
<tr>
<td>Thomas 2012&lt;sup&gt;56&lt;/sup&gt;</td>
<td>Development, implementation and evaluation of a standardized bedside nursing shift handover on medical surgical units. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on nurse and patient satisfaction)</td>
</tr>
<tr>
<td>Tucker 2009&lt;sup&gt;57&lt;/sup&gt;</td>
<td>Development, implementation and evaluation of a bedside ‘reading’ nursing shift handover. Did not meet RCT study design criteria as performed only simple before-and-after comparison (the standard of record keeping)</td>
</tr>
<tr>
<td>Wentworth 2012&lt;sup&gt;58&lt;/sup&gt;</td>
<td>Development, implementation and evaluation of an electronic handover communication tool for transferring uncomplicated routine patients to and from a progressive care unit and cardiac laboratories. Did not meet RCT study design criteria as performed only simple before-and-after comparison (on implementation evaluation)</td>
</tr>
</tbody>
</table>

Abbreviations: ED = emergency department, ICU = intensive care unit, RCT = randomized controlled trial.
DISCUSSION

We did not find any randomized studies and could not include any studies that fulfilled our methodological criteria for this review. Therefore, we are unable to draw any conclusions about the effectiveness of different nursing handover styles for ensuring continuity of information in hospitalized patients. This is disappointing in view of the important role of the nursing handover in continuity of care and the widespread attention the topic receives in light of patient safety. Within the field of physician handover we identified three publications from two randomized studies comparing usual care to an intervention, which indicates that it is possible to apply this design for evaluation of handover styles. One study used a randomized crossover design and the other study used randomization of members to a team. Unfortunately one study was a small study (n = 19) and both studies had a short time frame (three and five months respectively). The outcomes measured were efficiency (workflow and time), continuity of care, safety (adverse events) and self-reported assessment of the new procedure. Although no reliable evidence exists yet, there are many examples of researchers attempting to evaluate effectiveness of nursing handover styles in order to improve patient safety and quality of care (listed within the Characteristics of excluded studies). Most of these studies (18 out of 28 studies) were limited to simple before- and-after designs of local experiences with quality improvement (QI) initiatives in which the handover practice and how it was performed was described to a varying degree, making reproduction difficult. The handover practice was often evaluated at the level of self-reported satisfaction (six studies on nurse satisfaction and two on patient satisfaction) and not at the level of effectiveness.

The topic of nursing handover has received considerable attention lately, but the studies designed so far are at a high risk of bias, generate only local knowledge or have not been designed to generate effectiveness data. There is an urgent need for high-quality studies to provide hospital management with appropriate evidence to guide decisions about the most effective nursing handover style.

Summary of main results
No eligible studies were found for inclusion in this review.

Overall completeness and applicability of evidence
This review is complete, based on the evidence currently available.
Quality of the evidence
No randomized controlled trials were available for inclusion in this review. The majority of the excluded studies were simple before-and-after evaluations of local experiences with QI initiatives. The major drawback of this design is a high risk of bias, since there is no control available and changes over time in patient populations, or changes in practice, that are unrelated to the QI intervention may produce the desired improvements.75

Potential biases in the review process
The extensive search strategy was carefully designed and adapted to existing terminology by experienced clinical librarians. We searched a large number of databases and relevant websites. Two review authors independently assessed all potentially eligible titles and abstracts against the eligibility criteria to ensure that no important references were missed. Additionally, we searched reference lists of systematic reviews that were identified in the search.

Agreements and disagreements with other studies or reviews
During the inclusion process for primary studies on nursing handover we also identified 27 potential systematic reviews on handover (Appendix 2), six of which could be classified as systematic reviews31,76-80, according to the DARE criteria. These reviews had wider inclusion criteria than this review regarding methodology, consisting of QI studies using primarily simple before-and-after designs and a wider scope that also included physician or interdisciplinary handover. Searching the references of these reviews revealed no high quality studies we might have missed in our search. Also a recent review by Scott revealed no RCTs, interrupted time series (ITS) or controlled before-and-after studies (CBA)82 All the reviews also concluded that the existing literature on patient handovers does not yet support definitive research conclusions, and all addressed the need for high quality studies.

AUTHORS’ CONCLUSIONS
Implications for practice
We found no eligible studies for inclusion in the review and therefore the review question remains unanswered. As a consequence, uncertainty remains about the most effective nursing handover practice and, as previously noted, one can only rely on insights obtained from systematic reviews of studies with simple before-and-after designs. Breakdowns in commu-
cation are one of the main causes of adverse events (AEs) and an accurate handover of clinical information is of great importance to continuity and safety of care. According to current knowledge, the following guiding principles can be applied when redesigning the nursing handover process: face-to-face communication, structured documentation, patient involvement and use of information technology to support the process. When designing and implementing a quality improvement (QI) initiative to improve nursing handover one should consider conducting an evaluation using a robust design, e.g. an interrupted time series (ITS) or a controlled before-and-after (CBA) study) to strengthen the evidence about this topic.

Implications for research

At present, high quality evidence on the effectiveness nursing handover styles for ensuring continuity of information in hospitalized patients is lacking. Researchers wishing to evaluate the effectiveness of different nursing handover styles in hospitalized patients should use well designed rigorous studies. Experimental methods such as (cluster) randomized controlled trials (RCTs) are recommended because they offer protection from the effects of background variation. However, their use in QI research may be beyond the capacity of many clinicians and researchers because of difficulty in blinding and concealment of allocation. Another feasible rigorous study design that can correct for the drawbacks of simple before-and-after designs is an ITS with at least three data points before and three data points after the intervention and at least two intervention sites. This design conveys the extent of background variation and also indicates the extent to which any trend toward improvement may have been present prior to the intervention. When multiple time points before and after an intervention are not feasible, a reasonable alternative to a time-series analysis is a CBA study, in which the same before-and-after measurements occur in one or more hospitals that did not implement the change of interest but are otherwise comparable. Within these designs interventions to improve nursing handovers, such as bedside handover or structured formats for handover can be compared against usual care (i.e. unstructured handover in the office). Also it appears that there is no one single handover format that is applicable everywhere, the context and local situation are important factors to consider when designing a handover process and structure.

Ideally, when evaluating the effectiveness of nursing handover styles objective outcome measures should be used. Nurse-sensitive indicators are being proposed as a means of measuring the impact of nursing care.
quality on patient outcomes. These include preventable AEs such as medication errors and patient falls, or complications such as pressure ulcers and nosocomial infections, as well as length of hospital stay and patient satisfaction.\textsuperscript{86} Process outcomes that can be used include recall of information, compliance with the plan of care, time and interruptions. Since the incidence of AEs is not high, a sufficient number of participants (for RCT designs) or sufficient time interval (for ITS and CBA designs), or both, should be applied.

**Acknowledgements**

We thank Arnold Leenders, clinical librarian at the Medical Library of the University of Amsterdam, for developing the search strategy. We thank Michelle Fiander, Information Specialist and Trials Search Coordinator for the EPOC group, for supervising and reviewing the search strategy.

**Authors’ contributions**

HV, study design; MS, HV, literature selection, data extraction and interpretation; MS, drafting the manuscript; all authors, revising the manuscript for intellectual content and final approval.

**Competing interest**

The authors declare that they have no competing interests.

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Dowding D. Examining the effects that manipulating information given in the change of shift report has on nurses’ care planning ability. J Adv Nurs 2001;33:836–46.


WHO High 5s project. Available at: https://www.high5s.org/bin/view/Main/WebHome Accessed May 2012.


PART II - Safe handover of care


PART II - Safe handover of care


81. National Institute for Health Research. DARE, Database of Abstracts of Reviews of Effects. Available at: http://www.crd.york.ac.uk/NIHRCRDWEB/AboutDare.asp.


APPENDIX 1

Search strategies

EPOC Specialised Register search strategy

All Non-Indexed fields (continuity of care) AND {communicat\*} AND {nurse} OR
All Non-Indexed fields (handover) OR {hand\* over} OR {hand\* off} OR {handoff} OR
All Non-Indexed fields (bedside report\*) OR {bed side report\*} OR {changing shift\*} OR
{changing shift\*} OR (shift chang\*) OR {shift report\*} OR {sign out} report\* OR {sign out system} OR {transfer report} OR (intershift) OR {inter- shift\*} OR
5 All Non-Indexed fields {patient\*} AND {transfer\*} AND {nurse} OR
6 All Non-Indexed fields (patient\* care) AND (communicat\*) OR
All Non-Indexed fields {patient\* care} AND {communicat\*} OR
All Non-Indexed fields {discharge planning} AND {nurse} OR 9 All Non-Indexed fields (patient
8 All {patient\* discharge planning}) AND {nurse} OR 10 Title, primary {patient} AND {transfer\*} OR
11 All Non-Indexed fields {care transition} OR {transition of care} OR
12 All Non-Indexed fields {interfacility} AND (transfer) OR
13 All Non-Indexed fields {inter-facility} AND {transfer} OR 14 Keywords patient transfer* OR
15 All Non-Indexed fields {care transition} OR {transition\*} OR {transition of care}

Cochrane Central Register of Controlled Trials (CENTRAL) search strategy

#1 (Interfacility or inter-facility or intra-hospital or intrahospital) ti.ab.kw
#2 (interprofessional or inter-professional or interdepartment* or inter-department*) ti.ab.kw
#3 (#1 OR #2)
#4 (patient* near/3 transfer*)
#5 (sign-over* or service change* ) ti.ab.kw
#6 (care near/2 transition*) ti.ab.kw
#7 MeSH descriptor Patient Transfer, this term only
#8 (#4 OR #5 OR #6 OR #7)
#9 (#3 AND #8)
#10 (#3 AND #8)
#11 (interprofessional or inter-professional or interdepartment* or inter-department*) ti.ab.kw
#12 (Interfacility or inter-facility or intra-hospital or intrahospital) ti.ab.kw
#13 (#1 OR #2)
#14 MeSH descriptor Patient Care Planning explode all trees
#15 MeSH descriptor Patient Care Management, this term only
#16 MeSH descriptor Patient-Centered Care, this term only
#17 MeSH descriptor Continuity of Patient Care, this term only
#18 MeSH descriptor Progressive Patient Care, this term only
#19 MeSH descriptor Critical Pathways, this term only
PART II - Safe handover of care

#10 (#4 OR #5 OR #6 OR #7 OR #8 OR #9)
#11 (#10 AND #3)
#1 `change-of-shift` or `bedside report` or `bed-side report` ti,ab,kw
#2 (transfer and report*) ti
#3 (#1 OR #2)
#1 `shift report` or `sign-out report`
#2 `sign` out* ti,ab,kw
#3 `hand over` or `handing over` or handover* or `hand off` or `handing off` or `hand off` ti,ab,kw
#4 (#1 OR #2 OR #3)

MEDLINE search strategy
(hand over? or handing over or handover?) ti,ab
`shift report`* ti,ab
(handoff? or handing off or hand off?) ti
(handoff? or handing off or hand off?) ab
(shift adj3 chang*) ti,ab and (patient? or care) ti,hw
`sign-out report`* ti,ab
(sign out adj2 (report* or system? or patient?)) ti,ab
(sign out adj2 (report* or system?)) ti,ab
(sign* out adj4 (nurse? or physician? or doctor? or resident? or patient?)) ti,ab 10 or/1-9
(change-of-shift or (bedside report$ or bed-side report$)) ti,ab
transfer report ti or (transfer report? adj3 (nurse? or doctor? or physician? or patient?)) ab
((intershift? or inter-shift? or shift?) adj2 report$) ti,ab 14 or/11-13
Patient transfer/
(patient? and (transfer? or transport*)) ti
(patient? adj3 (transfer$ or transport*)) ab
((interprofessional or inter-professional or interdepartment$ or inter-department$) adj2 transfer$) ti,ab
sign-over? ti,ab
service change? ti,ab
(care adj2 transition$) ti,ab
((Interfacility or inter-facility or intra-hospital or intrahospital) adj3 transfer$) ti,ab
(patient care management/ or exp patient care planning/ or patient-centered care/ or `conti-
uity of patient care`/ or progressive patient care/ or critical pathways/) and ((patient adj2 transfer?) or shift chang$ or shift-to-shift) ti,ab 24 or/15-23
exp Nursing/
exp nurses/ or nurse administrators/ or nurse anesthetists/ or nurse clinicians/ or nurse
midwives/ or nurse practitioners/ or nurses. male/
nursing staff/ or nursing staff. hospital/
exp Nursing Care/
(patient care/ or exp critical care/ or ‘episode of care’/ or exp hospitalization/ or exp life
support care/ or exp long-term care/ or exp night care/ or palliative care/ or perinatal care/ or
exp perioperative care/ or postnatal care/ or prenatal care/ or preoperative care/ or subacute
care/ or exp terminal care/) and ((nurse? or nursing).ti. or (or/25-27))
(nurse? or nursing).ti.ab.hw. 31 or/25-30
32. 10 and 31
33. 14 and 31
34. 24 and 31
intervention?ti. or (intervention? adj6 (clinician? or collaborat$ or community or complex or
design$ or doctor? or educational or family doctor? or family physician? or family practi-
tioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individu-
ali?e? or individuali?ng or interdisciplin$ or multicomponent or multi-component or multidis-
ciplin$ or multi-disciplin$ or multifacet$ or multi-facet$ or multimodal$ or multi-modal$ or
personali?e? or personali?ng or pharmacists or pharmacist? or pharmacy or physician? or prac-
titioner? or prescrib$ or prescription? or primary care or profession$ or provider? or regulat-
ory or regulatory or tailore? or target$ or team$ or usual care).ab
(collaborativ$ or collaboration? or tailored or personali?ed).ti.ab
(exp hospitals/ or exp Hospitalization/ or exp Patients/ or exp Nurses/ or exp Nursing/) and
(study:ti. or evaluation studies as topic/)
demonstration project?ti.ab
(pre-post or ‘pre test$’ or pretest$ or posttest$ or ‘post test$’ or (pre adj5 post)).ti.ab
(pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti.ab
trial:ti. or ((study adj3 aim?) or ‘our study’).ab
(before adj10 (after or during)).ti.ab.
(‘quasi-experiment$’ or quasiexperiment$ or ‘quasi random$’ or quasirandom$ or ‘quasi
control$’ or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or
design$))).ti.ab.hw
(‘time series’ adj2 interrupt$).ti.ab.hw
(time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten
or eleven or twelve or month$ or hour? or day? or ‘more than’)).ab.
pilot:ti.
Pilot projects/
(clinical trial or multicenter study) pt
(multicentre or multicenter or multi-centre or multi-center).ti
random$.ti.ab or controlled:ti.
(control adj3 (area or cohort? or compar? or condition or group? or intervention? or partici-
PART II - Safe handover of care

(handover? or study)) ab not (controlled clinical trial or randomized controlled trial).pt
comment on cm or systematic review ti or literature review ti or editorial pt or letter pt or
meta-analysis pt or news pt or review pt
exp animals/ not humans.sh 54 (or/35-51) not (or/52-53)
(randomized controlled trial or controlled clinical trial).pt or randomi?ed ab or clinical trials as
topic sh or randomly ab or trial ti.
exp animals/ not humans/
(rat or rats or mouse or horse or equine or cow or bovine or pig or porcin*).ti,hw
comment on cm or systematic review ti or literature review ti or editorial pt or meta-analysis pt
or news pt or review pt 59 55 not (or/56-58)
60 54 not 59
32 and 60 [epoc hand-over]
33 and 60 [epoc shift]
34 and 60 [epoc transfer]
32 and 59 [rct hand-over]
33 and 59 [rct shift]
34 and 59 [rct transfer]
(handover? or `hand over?' or hand* over?).ti,ab and (nurse or nurses or nursing).ti,hw
((nurse or nursing or nurses) adj3 (handover? or `hand over?' or hand* over?)).ti,ab
((patient? or inpatient? or outpatient?) adj3 (handover? or `hand over?' or hand* over?)).ti,ab
or/67-69 [handover-ruim]

EMBASE search strategy
(hand over? or handing over or handover?).ti,ab
'shift report*'.ti,ab
(handoff? or handing off or hand off?).ti.
(handoff? or handing off or hand off?).ab
(shift adj3 chang*).ti,ab and (patient? or care).ti,hw
'sign-out report*'.ti,ab
(sign out adj2 (report* or system? or patient?)).ti,ab
(sign out adj2 (report* or system?)).ti,ab
(sign* out adj4 (nurse? or physician? or doctor? or resident? or patient?)).ti,ab 10 or/1-9
(change-of-shift or (bedside report$ or bed-side report$)).ti,ab
transfer report ti or (transfer report? adj3 (nurse? or doctor? or physician? or patient?)).ab
((intershift? or inter-shift? or shift?) adj2 report$).ti,ab 14 or/11-13
Patient transfer/
(patient? and (transfer? or transport*)).ti
(patient? adj3 (transfer$ or transport*)).ab
((interprofessional or inter-professional or interdepartment$ or inter-department$) adj2
transfer$).ti,ab
sign-over?.ti,ab
service change?.ti,ab
(care adj2 transition$).ti,ab
((Interfacility or inter-facility or intra-hospital or intrahospital) adj3 transfer$).ti,ab
(patient care management/ or exp patient care planning/ or patient-centered care/ or “continuity of patient care/ or progressive patient care/ or critical pathways/ and ((patient adj2 transfer?) or shift chang$ or shift-to-shift)).ti,ab.
24 or/15-23
exp Nursing/
exp nurses/ or nurse administrators/ or nurse anesthetists/ or nurse clinicians/ or nurse midwives/ or nurse practitioners/ or nurses, male/
nursing staff/ or nursing staff, hospital/
exp Nursing Care/
(patient care/ or exp critical care/ or “episode of care/ or exp hospitalization/ or exp life support care/ or exp long-term care/ or exp night care/ or palliative care/ or perinatal care/ or exp perioperative care/ or postnatal care/ or prenatal care/ or preoperative care/ or subacute care/ or exp terminal care/) and ((nurse? or nursing).ti. or (or/25-27))
32. 10 and 31
33. 14 and 31
34. 24 and 31
intervention?.ti. or (intervention? adj6 (clinician? or collaborat$ or community or complex or design$ or doctor? or educational or family doctor? or family physician? or family practitioner? or financial or GP or general practice? or hospital? or impact? or improv$ or individuali?e? or individuali?ing or interdisciplin$ or multicomponent or multi-component or multi-disciplin$ or multi-disciplin$ or multifacet$ or multi-facet$ or multimodal$ or multi-modal$ or personali?e? or personali?ing or pharmacies or pharmacist? or pharmacy or physician? or practitioner? or prescrib$ or prescription? or primary care or professional$ or provider? or regulatory or regulatory or tailors or target$ or team$ or usual care)).ab
(collaborativ$ or collaboration? or tailored or personali?ed).ti,ab
(exp hospitals/ or exp Hospitalization/ or exp Patients/ or exp Nurses/ or exp Nursing/) and
(study ti or evaluation studies as topic/)
demonstration project?ti,ab
(pre-post or “pre test$” or pretest$ or posttest$ or “post test$” or (pre adj5 post)).ti,ab
(pre-workshop or post-workshop or (before adj3 workshop) or (after adj3 workshop)).ti,ab
trial ti or ((study adj3 aim?) or “our study”).ab
(before adj10 (after or during)).ti,ab
“experimental design/ or “pilot study/ or quasi experimental study/
PART II - Safe handover of care

(‘quasi-experiment$’ or quasiexperiment$ or ‘quasi random$’ or quasirandom$ or ‘quasi control$’ or quasicontrol$ or ((quasi$ or experimental) adj3 (method$ or study or trial or design$)))ti,ab
(‘time series’ adj2 interrupt$)ti,ab
(time points adj3 (over or multiple or three or four or five or six or seven or eight or nine or ten or eleven or twelve or month$ or hour? or day? or ‘more than’))ab
pilot ti
(multicentre or multicenter or multi-centre or multi-center)ti
random$ ti,ab or controlled ti
‘comment on’ cm or systematic review ti, or literature review ti, or editorial pt, or letter pt, or meta-analysis pt, or news pt, or review pt
(animal/ or animal hw) not ((animal/ or animal? kw, hw) and (human/ or human? hw, kw)) S2
(or/35-49) not (or/50-51)
randomized controlled trials/ or controlled clinical trials/ or randomized ab, or clinical trials as topic sh, or randomly ab, or trial ti,
exp animals/ not humans/
(rat or rats or mice or mouse or horse or equine or cow or bovine or pig or porcin*) ti, hw
(comment on or systematic review or literature review) ti, or editorial pt, or meta-analysis/ or news ti, or review pt S7 S3 not (or/54-56)
58 S2 not 57
32 and 58 [epoc handover]
33 and 58 [epoc shift]
34 and 58 [epoc transfer]
32 and 57 [rct handover]
33 and 57 [rct shift]
34 and 57 [rct transfer]
(handover? or ‘hand over?’ or hand* over?) ti, ab, and (nurse or nurses or nursing) ti, hw
((nurse or nursing or nurses) adj3 (handover? or ‘hand over?’ or hand* over?)) ti, ab
((patient? or inpatient? or outpatient?) adj3 (handover? or ‘hand over?’ or hand* over?)) ti, ab
or/65-67 [handover ruim]

CINAHL search strategy
S84 s33 and s41 and s81 S83 s18 and s81
S82 s11 and s81 S81 s66 not s77
S80 S33 and S41 and S77 S79 S18 and S77
S78 S11 and S77
S77 S71 or S72 or S73 or S74 or S75 or S76 S76 (MM ‘Clinical Trials+’)
S75 TI (‘control’ NI clinical’ or ‘control’ NI group’ or ‘control’ NI trial’ or ‘control’ NI study’ or ‘control’ NI studies’ or ‘control’ NI design’ or ‘control’ NI method’) or AB (‘control’ NI clinical’
or "control* N1 group*" or "control* N1 trial*" or "control* N1 study" or "control* N1 studies" or "control* N1 design*" or "control* N1 method*"

S74 TI controlled or AB controlled S73 TI random* or AB random*

S72 TI ("clinical study" or "clinical studies") or AB ("clinical study" or "clinical studies")

S71 TI (multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*) or AB ((multicent* n2 design*) or (multicent* n2 study) or (multicent* n2 studies) or (multicent* n2 trial*))

S70 S33 and S41 and S66 S69 S18 and S66

S68 S11 and S66

S67 (S42 or S43 or S44 or S45 or S46 or S47 or S48 or S49 or S50 or S51 or S52 or S53 or S54 or S55 or S56 or S57 or S58 or S59 or S60 or S61 or S62 or S63 or S64 or S65) and (S11 and S66) S66 S42 or S43 or S44 or S45 or S46 or S47 or S48 or S49 or S50 or S51 or S52 or S53 or S54 or S55 or S56 or S57 or S58 or S59 or S60 or S61 or S62 or S63 or S64 or S65

S65 TI (time points n3 over) or (time points n3 multiple) or (time points n3 three) or (time points n3 four) or (time points n3 five) or (time points n3 six) or (time points n3 seven) or (time points n3 eight) or (time points n3 nine) or (time points n3 ten) or (time points n3 eleven) or (time points n3 twelve) or (time points n3 month*) or (time points n3 hour*) or (time points n3 day*) or (time points n3 more than) or AB ((time points n3 over) or (time points n3 multiple) or (time points n3 three) or (time points n3 four) or (time points n3 five) or (time points n3 six) or (time points n3 seven) or (time points n3 eight) or (time points n3 nine) or (time points n3 ten) or (time points n3 eleven) or (time points n3 twelve) or (time points n3 month*) or (time points n3 day*) or (time points n3 more than))

S64 TI (control w3 area) or (control w3 cohort*) or (control w3 compar*) or (control w3 condition) or (control w3 group*) or (control w3 intervention*) or (control w3 participant*) or (control w3 study) or AB ((control w3 area) or (control w3 cohort*) or (control w3 compar*) or (control w3 condition) or (control w3 group*) or (control w3 intervention*) or (control w3 participant*) or (control w3 study))

S63 TI (multicentre or multicenter or multi-centre or multi-center) or AB random* S62 TI random* OR controlled

S61 TI (trial or (study n3 aim) or "our study") or AB ((study n3 aim) or "our study")

S60 TI (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop) or AB (pre-workshop or preworkshop or post-workshop or postworkshop or (before n3 workshop) or (after n3 workshop))

S59 TI (demonstration project OR demonstration projects OR preimplement* OR pre-implement* OR post-implement* OR postimplement*) or AB (demonstration project OR demonstration projects OR preimplement* OR pre-implement* OR post-implement* OR postimplement*)

S58 TX (intervention n6 clinician*) or (intervention n6 community) or (intervention n6 complex) or (intervention n6 design*) or (intervention n6 doctor*) or (intervention n6 educa-
PART II - Safe handover of care

(tional) or (intervention n6 family doctor*) or (intervention n6 family physician*) or (intervention n6 family practitioner*) or (intervention n6 financial) or (intervention n6 GP) or (intervention n6 general practice*) or (intervention n6 hospital*) or (intervention n6 impact*) or (intervention n6 improv*) or (intervention n6 individualize*) or (intervention n6 individualising) or (intervention n6 individualising) or (intervention n6 interdisciplinary) or (intervention n6 multidisciplinary) or (intervention n6 multi-component) or (intervention n6 multi-component) or (intervention n6 multicomponent) or (intervention n6 multi-component) or (intervention n6 multifaceted) or (intervention n6 multimodal) or (intervention n6 multi-modal) or (intervention n6 personalise*) or (intervention n6 personalise*) or (intervention n6 personalizing) or (intervention n6 personalising) or (intervention n6 pharmacist*) or (intervention n6 pharmacy) or (intervention n6 physician*) or (intervention n6 practitioner*) or (intervention n6 prescrib*) or (intervention n6 prescription*) or (intervention n6 primary care) or (intervention n6 professional*) or (intervention n6 provider*) or (intervention n6 regulator) or (intervention n6 regulatory) or (intervention n6 tailor*) or (intervention n6 target*) or (intervention n6 team*) or (intervention n6 usual care)

S57 TI ( collaborativ* or collaboration* or tailored or personalised or personalized ) or AB ( collaborativ* or collaboration* or tailored or personalised or personalized )
S56 TI pilot
S55 (MH “Pilot Studies”) S54 AB “before-and-after” S53 AB time series
S52 TI ( (time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 time) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*) ) or AB ( (time point*) or (period* n4 interrupted) or (period* n4 multiple) or (period* n4 various) or (period* n4 varying) or (period* n4 week*) or (period* n4 month*) or (period* n4 year*) )
S49 TI ( ( quasi-experiment* or quasiexperiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or quasi* W3 method* or quasi* W3 study or quasi* W3 studies or quasi* W3 trial or quasi* W3 design* or experimental W3 method* or experimental W3 study or experimental W3 studies or experimental W3 trial or experimental W3 design* ) ) or AB ( ( quasi-experiment* or quasiexperiment* or quasi-random* or quasirandom* or quasi control* or quasicontrol* or quasi* W3 method* or quasi* W3 study or quasi* W3 studies or quasi* W3 trial or quasi* W3 design* or experimental W3 method* or experimental W3 study or experimental W3 studies or experimental W3 trial or experimental W3 design* )
S48 TI pre w7 post or AB pre w7 post
S47 MH “Multiple Time Series” or MH “Time Series”
S46 TI ( (comparative N2 study) or (comparative N2 studies) or evaluation study or evaluation studies ) or AB ( (comparative N2 study) or (comparative N2 studies) or evaluation study or evaluation studies )
S45 MH Experimental Studies or Community Trials or Community Trials or Pretest-Posttest Design + or Quasi-Experimental Studies + Pilot Studies or Policy Studies + Multicenter Studies

S44 TI (pre-test* or pretest* or posttest* or post-test*) or AB (pre-test* or pretest* or posttest* or post test*) OR TI (preimplement* or pre-implement*) or AB (pre-implement* or preimplement*)

S43 TI (intervention* or multi-intervention* or postintervention* or pre-intervention* or preintervention* or post-intervention* or pre-intervention* or pre-intervention*)

S42 (MH ‘Quasi-Experimental Studies’) 
S41 S34 or S35 or S36 or S37 or S38 or S39 or S40

S40 AB interprofessional or inter-professional or interdepartment* or inter-department* S39 TI interprofessional or inter-professional or interdepartment* or inter-department* S38 AB Interfacility or inter-facility or intra-hospital or intrahospital

S37 TI Interfacility or inter-facility or intra-hospital or intrahospital S36 TX patient unit*

S35 (MH ‘Interprofessional Relations+’) S34 (MH ‘Transfer Intrahospital’) 
S33 S19 or S20 or S21 or S22 or S23 or S24 or S25 or S26 or S27 or S32 S32 S28 and S31 S31 S29 or S30

S30 AB patient N2 transfer* or shift chang* or shift-to-shift S29 TI patient N2 transfer* or shift chang* or shift-to-shift

S28 (MH ‘Patient Care Plans+’) OR (MH ‘Patient Centered Care’) OR (MH ‘Continuity of Patient Care+’) OR (MH ‘Progressive Patient Care’) OR (MH ‘Critical Path’)

S27 AB care N2 transition* S26 TI care N2 transition* S25 AB ‘service change’ S24 TI ‘service change’ S23 AB sign over

S22 TI sign over

S21 AB patient N3 transfer* or patient N3 transport* S20 TI patient and transfer?

S19 (MH ‘Discharge Planning+’)

S18 S12 or S13 or S14 or S15 or S16 or S17

S17 TI intershift? / N3 report* or inter-shift? N3 report* or shift* N3 report* S16 AB intershift?/N3 report* or shift* N3 report* or inter-shift? N3 report* or shift* N3 report* S15 AB transfer N3 report* S14 TI transfer N3 report*

S13 TI change-of-shift or ‘bedside report’ or ‘bed-side report’ S12 AB change-of-shift or ‘bedside report’ or ‘bed-side report’ S11 S1 or S2 or S3 or S4 or S5 or S6 or S7 or S8 or S9 or S10 S10 AB hand over? or handing over or handover?

S9 TI hand over? or handing over or handover? S8 AB ‘shift report’ or ‘sign-out report’

S7 AB (shift N3 chang*) and (patient? or care) S6 AB sign out

S5 TI sign out

S4 TI (shift N3 chang*) and (patient? or care)
PART II - Safe handover of care

S3 TI "shift report*" or "sign-out report*" S2 AB handoff? or handing off or hand off? S1 TI handoff? or handing off or hand off?

ISI Web of Knowledge search strategy
Topic=(handover*) AND Topic=(patient or patients or nurse or nurses or hospital* or healthcare or 'health care') NOT Title= ('Nursing Home*')
(TI=handover* AND (TI=patient* or TI=hospital* or TI=nurse or TI=nurses or TI=healthcare or TI=care)) NOT ti="nursing home*"
Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH Timespan=All Years Lemmatization=On
((TI=HANDOFF* OR ts=HANDOFF*) and (ti=NURSE OR TI=NURSES OR TI=HOSPITAL* OR TI=CARE OR TI=PA- TIENT* OR TI=INPATIENT* OR TS=NURSE OR TS=NURSES OR TS=HOS- PITAL* OR TS=CARE OR TS=PATIENT* OR TS=INPATIENT) NOT (TI=NURSING HOME* OR TS=NURSING HOME*)
Databases=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH Timespan=All Years Lemmatization=On

APPENDIX 2

Systematic reviews for which the authors searched the references lists

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<th>Authors</th>
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Systematic review Nursing handover