**Effectiveness of nurse-led clinics in the early discharge period after percutaneous coronary intervention: a systematic review**

**Abstract**

**Background:** Readmission after percutaneous coronary intervention is common in the early post-discharge period, often linked to limited opportunity for education and preparation for self-care. Attending a nurse-led clinic within 30 days after discharge has the potential to enhance health outcomes.

**Objective:** To synthesise the available literature on the effectiveness of nurse-led clinics, during early discharge (up to 30 days), for patients who have undergone percutaneous coronary intervention.

**Review method used:** A systematic review was undertaken of randomised and quasi-randomised controlled trials.

**Data sources:** The databases PubMed, OVID, CINAHL, EMBASE, the Cochrane Library, SCOPUS and ProQuest.

**Review methods:** Databases were searched up to November 2018. Two independent reviewers assessed studies using the Cochrane risk of bias tool.

**Results:** Of 2970 articles screened, only four studies, representing 244 participants, met the review inclusion criteria. Three of these studies had low to moderate risk of bias, with the other study unclear. Interventions comprised of physical assessments and individualised education. Reported outcomes included quality of life, medication adherence, cardiac rehabilitation attendance and psychological symptoms. Statistical pooling was not feasible due to heterogeneity across interventions, outcome measures and study reporting. Small improvements in quality of life and some self-management behaviours were reported but these changes were not sustained over time.

**Conclusions:** This review has identified an important gap in the research examining the effectiveness of early-discharge percutaneous coronary intervention nurse-led clinics on outcomes for patients and health services. More robust research with sufficiently-powered sample sizes and clearly-

defined interventions, comparison groups and outcomes is recommended to determine effectiveness of nurse-led clinics in the early discharge period.

**Key words:** Nurse-led clinic, early discharge, percutaneous coronary intervention, systematic review.

**Registration**: The review protocol was registered with PROSPERO (CRD42017071797)

**Introduction**

Coronary heart disease (CHD) is a major cause of death globally.[1] Percutaneous coronary intervention (PCI) is a treatment option for severe CHD and may be undertaken as a primary or elective procedure.[2] The procedure restores blood flow to the myocardium through introduction of a balloon catheter into the occluded coronary artery that compresses plaque within the affected artery.[3] Compared with traditional coronary artery bypass graft surgery (CABG), PCI offers lower associated risks, symptom relief and faster recovery for eligible patients.[4] Hospitalisation for PCI is typically brief, ranging between 1 and 4 days[5,6], however readmission within 30 days is common.[7]

Effective patient education has been found to result in optimal outcomes for early and/or same day discharge post-PCI in uncomplicated patients.[5] However, it should also be noted that short length of stay (LOS) limits opportunities for effective post-operative patient education regarding self-management.[8-10] Patients are often discharged from hospital without receiving adequate education for, and comprehension of, their chronic condition.[11] Importantly, insufficient patient education has been associated with deficiencies in self-management, negative psychological symptoms (i.e., anxiety and depression) and adverse cardiovascular events post-PCI.[3,12-15] Onset of negative psychological symptoms has been reported between hospital discharge up until cardiologist review and/or commencement of cardiac rehabilitation, which can range from 7 to 64 days following the procedure.[16] Early, nurse-led, post-discharge follow-up, support and reiteration of patient education has the potential to reduce negative psychological symptoms, enhance self-management[17] and may be effective in reducing adverse outcomes.

A recent systematic review of 25 studies on nurse-led clinics within ambulatory care settings for a variety of patient conditions[18] supported feasibility of nurse-led clinics as a safe and, in some cases, superior model of care for patients compared to physician-led care for condition-specific clinical outcomes as well as health related quality of life, self-management behaviours and symptom burden.[18] Additional research was recommended in order to confidently ascertain economic effectiveness, and considerations such as expertise of the nurse delivering the clinic and availability

of resources were highlighted.[18] Further, nurse-led clinics for patients' post-acute cardiovascular events have been identified as a favourable intervention for reducing all-cause mortality and improving medication adherence.[19] The aim of this review was to synthesise evidence on the effectiveness of nurse-led clinics delivered in the early discharge period post-PCI (up to 30 days) on patient and health service outcomes.

## Methods

### *Review question*

What is the effectiveness of nurse-led clinics in the early discharge period on patient and service related outcomes after undergoing PCI?

### *Inclusion criteria*

This review included randomised and quasi-randomised controlled trials (RCTs) of patients over 18 years of age, who had been discharged from hospital and seen by a nurse in the early discharge period, after undergoing PCI. The intervention for this review was any pre-procedure care or discharge follow-up led by a nurse of any qualification (e.g., Registered Nurse (RN), Nurse Practitioner (NP), or Advanced Practice Nurse (APN), in an acute care or outpatient clinic setting within 30 days of discharge from hospital. Interventions were compared against usual care or no clinic attendance. Comparison to other interventions was also considered (e.g., medical practitioner follow-up). Primary outcomes included patient factors such as psychological distress or self-management behaviours or service outcomes such as waiting times and satisfaction.

### *Search strategy*

A health librarian was consulted to assist in developing a comprehensive search strategy for searching the following databases: PubMed, OVID, CINAHL, EMBASE, Cochrane Library (CENTRAL), Cochrane Clinical Trials, SCOPUS, ProQuest Theses and Dissertations. Boolean operators ("AND" and/or "OR") were used to join search strings and MeSH terms were included along with major subject headings and/or text words according to database search requirements (see Table 1).

Reference lists of selected studies were examined for eligibility and inclusion in the review. Studies in the English language only were included due to lack of translation resources. No date restriction was applied to the search. Two reviewers initially checked titles and abstracts of studies and full-text copies of those thought to meet review criteria were retrieved. The search was initially conducted in September/October 2017 and updated in November 2018. Recommended guidelines were followed for reporting the search and selection process according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) Statement.[20]

***Assessment of risk of bias***

Methods for the review were specified in a protocol published on the PROSPERO database (CRD42017071797). All team members were involved in the study selection and appraisal processes. Two reviewers independently assessed included studies for risk of bias using the Cochrane risk of bias tool.[21] The tool comprises six categories for evaluating risk of bias and a grading of high, low or unclear risk can be applied to each category.[21] Any disagreements in appraisal scores were resolved through discussion; a third reviewer was not required.

***Data extraction, analysis and synthesis***

Data were extracted in two stages. Firstly, data pertaining to the participants, intervention, study methods, geographical location of the study and outcome measures, were extracted. Extraction of numerical data, where available, pertaining to the effectiveness of the intervention was then undertaken. Data were checked by two reviewers. Due to insufficient data for meta-analysis, a narrative synthesis is presented.

**Results**

***Description of search process and study selection***

After duplicates were removed (977), 2970 articles had title and abstract screened. Thirty articles were selected for closer examination to ascertain if they met the inclusion criteria. Four studies were included in the review.[22-25] The study search and selection process is outlined in Figure 1. Three

studies were reported as trials – one as an RCT[23] and two as pilot studies to test feasibility of the intervention for larger trials[22,25] and one as a quasi-experimental study with pre-test/post-test measures.[24] One study was conducted in Australia,[25] two in Canada[22,23] and one in South Korea.[24] One of the included studies was a publication from a study authored by one of the review team. This paper was verified and appraised by two independent team members with no prior involvement in the doctoral study.

The four studies comprised a total of 244 patients with a mean age of 55.7 years (range 45-81years). The quasi-experimental study[24] reported mean length of hospital stay as 6.23 ± 2.92 days for the intervention groups and 6.43 ± 3.39 days for the control group. The RCT[23] used the Zwolle Primary PCI index[26] to screen participants and only patients with the score of ≤ 3 were eligible for inclusion in their trial. Eligibility for the other three studies specified that patients were undergoing primary PCI. The RCT[23] reported a median duration of hospital admission for patients in the intervention group was 55 hours, while length of stay was not specified in the two pilot studies. Further details of included studies are shown in Table 2.

Each intervention group was compared to a control group receiving standard care from their organization. The quasi-experimental study and one of the pilot studies reported on interventions led by an APN[24,25] and the RCT and other pilot study reported the intervention being led by an experienced cardiovascular RN.[22,23] Initial follow up by the nurse for each study ranged from discharge to 3-months post-procedure. Further details regarding the interventions for each included study are shown in Table 3.

***Methodological quality/risk of bias***

Three of the four included studies were assessed as having low to moderate risk of bias (Table 4). The randomisation processes were mostly well detailed in the RCTs; however, there was a moderate risk of performance and detection bias across the studies. Furthermore, outcomes in one study were measured by the nurse who also delivered the intervention.[25] Intention-to-treat analyses were reported in two studies,[23,25] with loss to follow-up clearly documented in all studies. The fourth study

had unclear risk of bias overall; however, this was a quasi-experimental study with subsequent inherent risk of bias in study methods due to the nature of the design.[24]

***Review findings***

Statistical synthesis of results was not possible in this review. Many of the outcomes of interest were assessed after the two-week follow-up period. Heterogeneity within interventions and in the way in which outcome measures were reported also limited synthesis of results.

***Quality of Life***

Three studies reported quality of life following intervention delivery.[22-24] One of the pilot studies [22] reported statistically significant improvements for quality of life overall in the intervention group at six weeks, six months and one year following PCI, as measured with the Quality of Life Index QLI-CVIII.[27] The RCT[23] reported no significant difference between control and intervention groups at six weeks using the Short-Form (SF)-36 questionnaire.[28] The quasi-experimental study[24] measured health-related quality of life at three time-points - on discharge; at three to five months post-procedure; and at 10-12 months post-procedure - using the SF-36 and found that though there were significantly higher scores in the intervention group on short-term follow up compared to the control group, there was no significant difference over time.

***Medication adherence***

Two studies reported medication adherence,[23,25] though at different time points, with only the RCT[23] measuring this within 14 days. Both studies reported no significant difference in medication adherence between five to seven days and at one month between groups,[25] and at six weeks following discharge respectively.[23]

***Cardiac rehabilitation attendance***

Two studies reported cardiac rehabilitation attendance. The RCT[23] found no difference between groups; the other study[25] found that 74% (n=23) of participants declined rehabilitation referral.

***Psychological symptoms***

Two studies reported psychological symptoms. [22,25] One pilot study[22] reported patients' psychological

symptoms at two weeks and identified that most patients had self-reported levels of emotional distress requiring support and reassurance; however, reporting was unclear, limiting confidence in this finding. The other study[25] reported moderate reductions in trait anxiety, as measured with the State-Trait Anxiety Inventory,[29] in the intervention group (*d*=0.50), and in depressive symptoms, as measured with the Cardiac Depression Scale,[30] though not statistically significantly different.

***Other***

The RCT[23] reported readmission rates at six weeks' post-discharge, with no significant differences between intervention and control groups (8% vs. 4%; *p*=0.56). Two studies[22,25] reported smoking cessation rates in the intervention groups although sample sizes were small. The quasi-experimental study[24] measured self-care compliance and self-efficacy using locally developed instruments and found significant differences in self-care compliance over the follow-up period between control and intervention groups. In both groups, self-efficacy scores improved at three-months but not beyond that. None of the included studies reported on cost-effectiveness outcomes.

**Discussion**

This systematic review aimed to synthesise studies on the effectiveness of nurse-led clinics on patient and service outcomes following PCI. The paucity of studies found to meet our inclusion criteria has identified a significant gap in the research regarding early post-discharge support following PCI. With a trend for decreasing length of stay for patients following PCI, nurse-led clinics have the potential to fill a gap in patient needs (i.e. self- management, psychosocial and physical well-being). However, our review was unable to determine the impact of such an intervention on patient and/or health service outcomes. It has, however, highlighted a need for more well-designed studies to address this gap.

Although two of the four studies were pilot studies,[22,23] they clearly specified their intention was to determine feasibility for a larger trial, which is appropriate for these designs.[31] Specific guidance for inclusion of pilot studies in systematic reviews is limited, though such studies are imperative to the

design of larger trials as they form a basis for identifying the feasibility of a proposed intervention as well as a method for assessing study procedures such as, but not limited to, recruitment, reasons for attrition and implementation strategies.[32,33] While the included pilot studies support a need for further research, we acknowledge that the overall small number of studies, participants and events impact significantly on the consistency and precision of results.

We also acknowledge that one of the included studies was written by an author of the present review and this may be a source of bias. The paper was found after conducting a thorough and transparent search process and it was made clear at the outset within the review team that it would be screened for eligibility and appraised by two independent reviewers. It was thought that the study contributes to the current state of research around the topic and excluding it would have had no impact on overall findings due to limitations found within the other included studies. This situation highlights not only the importance of transparency of review processes but also where a body of research continues to be explored in-depth.

Anxiety and depressive symptoms may be experienced by 70-80% of people after a cardiovascular event.[16,34] The management of negative psychological symptoms post-cardiovascular event has been explored in another systematic review.[35] Patients are particularly vulnerable during the early post-discharge period following an acute cardiac event and procedure.[36] Negative psychological symptoms may be experienced and overlooked, subsequently increasing the risk of cardiac mortality.[8,37,38] Despite the mixed results in this review, there seems a pragmatic need to support patients in the early post-discharge period following PCI. Nurse-led clinics have been demonstrated as effective in managing patients with chronic conditions,[39-43] in particular in terms of improving psychosocial and physiological outcomes. Two of the studies in this review included qualitative analyses of patient perspectives of the interventions provided. As the protocol for our systematic review was aimed at quantitative outcomes, these findings have not been fully explored. However, a synthesis of qualitative and mixed method studies would be useful to identify patient experiences in this context and to also identity possible effects on outcomes, such as cardiac rehabilitation

attendance.

***Limitations***

There are several limitations to this review. As identified, despite a thorough and widespread search process, the small number of included studies and the small sample sizes within each study are major limitations to knowing the overall effect of the nurse-led clinic on patient and service outcomes. Our search strategy was developed with assistance of a health librarian and the process followed recommended guidelines; however, other relevant studies may have been missed. As previously discussed, two of the included studies were pilot studies and therefore the overall results of the review should be considered cautiously.

The short-term follow-up as outlined in our protocol was thought sufficient to identify effects of the intervention. However, due to the way in which results were presented across the studies, analysis was limited. We included one study that had an extended follow up as per our protocol; however, extending the follow-up period in future reviews would provide greater detail on any sustained impact of the interventions.

**Conclusions**

The findings of this systematic review highlight the paucity of published studies pertaining to nurse-led clinics during early discharge post-PCI and the limited quality of them. It has identified an important gap in the research examining the effectiveness of these clinics on outcomes for patients and health services. More robust research with sufficiently-powered sample sizes and clearly-defined interventions, comparison groups and outcomes is recommended to determine effectiveness of nurse-led clinics in the early discharge period.

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**Table 1: Search strategy**

| PubMed |
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| S1<br>(nurse-led clinic[Title/Abstract]) OR nurse led clinic[Title/Abstract]) OR nurse managed center[Title/Abstract]) OR nurse managed centre[Title/Abstract]) OR nurse-managed centre[Title/Abstract]) OR nurse-managed centre[Title/Abstract]) OR Advanced Practice Nurse[MeSH Terms]) OR Nurse Practitioner[MeSH Terms]) OR Nurse specialist[Title/Abstract]) OR specialist nurse[Title/Abstract])) OR ((patient discharge[MeSH Terms]) OR patient discharge education[MeSH Terms]))))) OR practice patterns, nurses [MeSH Terms]) |
| S2<br>("myocardial revascularization"[MeSH Terms] OR "angioplasty, balloon, coronary"[MeSH Terms]) OR "coronary angioplasty"[Title/Abstract]) OR "cardiac catheterization"[Title/Abstract] OR "cardiac catheterisation"[Title/Abstract]) OR "percutaneous coronary intervention"[Title/Abstract]) OR PCI[Title/Abstract]) OR "balloon angioplasty"[Title/Abstract]) OR PTCA[Title/Abstract]) OR "coronary stent"[Title/Abstract]) OR "angioplasty, balloon, coronary"[MeSH Terms] |
| S1 AND S2 |
| Filter English only |

**Table 2: Details of included studies**

| Citation | Design | Participants | Setting | Outcome measures and tools | Main Results |
|---|---|---|---|---|---|
| Lindsay et al. (2000) [22] | RCT | All patients had first-time PTCA; over 18 years; spoke English or French; cognitively oriented Intervention = 45; control = 50 | Canada | Quality of Life (QoL) - QLI-CVIII[27]; Lifestyle changes: Modified LCQ[47] Patient issues and concerns Patient medical record, text comments from LCQ Demographics - Demographic profile All tools were available in French and English | - Qol: no significant difference between groups at baseline or 1 year - significant difference between groups at 6 weeks (p = 0.05) and 6 months (p = 0.04) for QLI-CVIII scores.<br>- Lifestyle change: 4 out of 5 participants who smoked had either quit or were actively trying to stop smoking at 6 months<br>- Significant increase in exercise participation in treatment group at 6 weeks (p = 0.04) and 6 months (p = 0.05) |

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|---|---|---|---|---|---|
| | | | | | - Greater adherence to healthy heart diet in treatment group at 6 weeks ( p =0.044) and 6 months (p = 0.037)<br>- One-year results not reported for these outcomes<br>- Patient concerns: by one year 92% of participants had actively overcome issues and concerns compared to 38% (control group) |
| Kotowycz et al. (2010) [23] | Pilot RCT | Patients presenting to hospital with STEMI for primary or rescue PCI with Zwolle score[26] | Canada | Quality of life (QoL) measured at 6 weeks by research assistant using SF-36.[28]<br>Hospital data (including mortality and readmission) collected from health record and patients' self-report. | - No significant difference between groups for mortality, ED presentations or admissions.<br>- No significant difference between groups for rate of medication compliance, cessation of smoking or cardiac rehab attendance. |

| | | | | | |
|---|---|---|---|---|---|
| | | <3; Intervention group - n = 27; control group - n = 27 | | | - No significant difference in QoL scores between groups although the intervention group did report higher scores in most categories. |
| Shim & Hwang (2017) [24] | Quasi-experimental | Newly diagnosed ACS and had PCI | South Korea | Self-efficacy – scale based on American Heart Association Cardiovascular Risk Factor Assessment Tool[52]<br>Health Related Quality of Life (HRQoL) – SF-36[53]<br>Self-care compliance – 23-item scale[29,30] | - No sustained significant difference in self-efficacy over time, between control and intervention groups;<br>- No interaction between groups<br>- Significant differences noted in HRQoL and self-care compliance with improvements greater in intervention group |
| Corones-Watkins et al. (2018)[25] | Pilot three-arm RCT | Patients who have had a PCI; 18 yrs or older; | Australia | Demographics – own data collection form<br>CSE scale[48] | - A moderate reduction in CSE in intervention group (*d* = 0.60) at day 5-7 and 1 month. Increased slightly at 3 months |

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|---|---|---|---|
| | can speak or understand English, be able to be contacted for follow up | STAI[49]<br>CDS[50]<br>Serum cortisol salivary level<br>MMAS-8[51]<br>Wound assessment<br>Neurovascular assessment<br>Cardiac rehab referral and attendance | - Mean trait anxiety scores showed greater decrease in intervention group than control group at Time 2 (days 5-7) and Time 3 (1 month); Greater total change in score in intervention group (*d* = 0.50) from baseline compared to control group (*d* = 0.16)<br>- small reduction in depressive symptoms in both intervention (*d* = 0.26) and control groups (*d* = 0.37)<br>- Of those who reported history of smoking at discharge (n =17), all reported smoking cessation at all time points (Days 5-7; 1 month; 3 months) |

| | | | | | |
|---|---|---|---|---|---|
| Shim & Hwang (2017) [24] | Quasi-experimental | Newly diagnosed ACS and had PCI | South Korea | Self-efficacy – scale based on American Heart Association Cardiovascular Risk Factor Assessment Tool[52]<br>Health Related Quality of Life (HRQoL) – SF-36[53]<br>Self-care compliance – 23-item scale[29,30] | - No sustained significant difference in self-efficacy over time, between control and intervention groups;<br>- No interaction between groups<br>- Significant differences noted in HRQoL and self-care compliance with improvements greater in intervention group |

Abbreviations: acute coronary syndrome (ACS); advanced practice nurse (APN); cardiac depression scale (CDS); cardiac self-efficacy (CSE); emergency department (ED); health related quality of life – short form survey (HRQoL) SF-36; lifestyle change questionnaire (LCQ); morisky medication adherence scale (MMAS), percutaneous coronary intervention (PCI); percutaneous transluminal coronary angioplasty (PTCA); quality of life index-cardiac version lll (QLI-CVlll); quality of life (QOL); randomised controlled trial (RCT); state-trait anxiety inventory (STAI); ST-elevated myocardial infarction (STEMI).

**Table 3: Intervention delivery details of included studies**

| Author | Delivered by | Method of delivery | Follow up | Aims/Activities/Content |
|---|---|---|---|---|
| Lindsay et al. (2000)[22] | APN | Outpatient clinic (face-to-face) | 2, 6 weeks then 6, 9, 12 months following procedure (four times within the first year: 9-month visit optional) | Physical assessment (e.g., BMI, BP, heart rate, risk factor identification) Counselling, education, referrals to other health professionals (e.g., dietician, cardiologist); to discuss concerns and anxieties |
| Kotowcyz et al. (2010)[23] | APN | Face-to face and telephone | Outpatient (or phone if deemed appropriate by APN) follow up within 3 days of discharge and two more follow-ups within 30 days either face-to-face or telephone. | Education about disease and management, medications; to facilitate discharge planning |
| Shim & Hwang (2017) [24] | Cardio-vascular Nurse | Face-to-face with telephone follow-up | At discharge, 3-5 months, then 10-12 months post procedure | Individualised education on exercise, diet, medication, stress management, smoking management, health behaviour strategies, support strategies |

| | | | | |
|---|---|---|---|---|
| Corones-Watkins et al. (2018) [25] | Cardio-vascular RN | Face-to-face with telephone follow up at 1 & 3 months | Day 5-7 post discharge, 1-month post intervention and 3 months post discharge | Tailored education and support; physical examination (e.g., weight, BP, heart rate, ECG); psychological assessment |

**Table 4: Risk of bias appraisal for included studies[21]**

| Domain | Kotowycz et al. 2010 | Lyndsay et al.2000 | Corones-Watkins et al. 2018 | Shim & Hwang, 2017 |
|---|---|---|---|---|
| Selection bias: *Random sequence generation* | Unclear | Low | Low | Unclear |
| Selection bias: *Allocation concealment* | Low | Unclear | Low | Unclear |
| Reporting bias: *Selective reporting* | Low | Unclear | Low | Unclear |
| Performance bias: B*linding of participants and personnel* | Low | Unclear | High | Unclear |
| Detection bias: *Blinding of outcome assessment* | Low | Unclear | High | Unclear |
| Attrition bias: *Incomplete outcome data* | Low | Low | Low | Unclear |

Figure 1: PRISMA flowchart of search and selection process[20]