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The development and testing of a nurse practitioner secondary prevention intervention for patients after acute myocardial infarction: A prospective cohort study

Patricia Harbman NP-PHC, PhD[a,b,c,*]

[a] Health Interventions Research Centre, Ryerson University, Toronto, Canada
[b] Trillium Health Partners, Mississauga, Ontario, Canada
[c] Canadian Centre for Advanced Practice Nursing Research, McMaster University, Hamilton, Ontario, Canada

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ABSTRACT

Background: Patients with acute myocardial infarction (AMI) are at high risk for reinfarction and death. Therapies that have been shown to reduce these risks (secondary prevention) continue to be underutilized. Nurse practitioners are well positioned to provide secondary prevention during and following hospitalization.
Objectives: The purpose of this study was to evaluate the effects of NP care on the rate of provider implementation and patient achievement of evidence-based secondary prevention target goals.
Design: A prospective cohort design was used, which compared achievement of target goals between patients who received secondary prevention care from an NP to those who received usual care.
Participants: The sample consisted of 65 patients with AMI, admitted to a large community hospital. Patients meeting eligibility criteria were recruited consecutively.
Methods: The intervention was delivered by the NP before discharge from hospital and one week, two weeks, six weeks and 3 months after discharge. Data on patients' achievement of goals were obtained before discharge from hospital and 3 months after discharge from both groups.
Results: This study's results provide preliminary evidence that an NP delivered secondary prevention intervention can significantly improve achievement of the following target goals when compared to usual care: smoking cessation (OR 5), blood pressure (OR 15), attendance at cardiac rehabilitation (OR 7), physical activity five days a week (OR 17), physical activity $\geq$ five days a week (OR 34), achieving a glycated haemoglobin $< 7\%$ in those with diabetes (OR 10), triglyceride levels ($p = .02$), statin use at follow-up ($p = .05$), and number of weeks to cardiac rehabilitation ($p = .05$).
Conclusion: NP-led interventions such as this warrant duplication to evaluate reproducibility of the intervention and to determine if short-term improvements in secondary prevention goals translate into morbidity and mortality benefits.

What is already known about the topic?

- Therapies that have been shown to reduce future risk in those with coronary heart disease (secondary prevention) continue to be underutilized.

* Correspondence to: Health Interventions Research Centre, Ryerson University, Toronto, Canada. Tel.: +1-289-259-1171.
E-mail addresses: pharbman@sympatico.ca, harbmapr@mcmaster.ca

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- Secondary prevention programmes, with and without exercise components, improve outcomes in patients following acute myocardial infarction (Clark et al., 2005).
- Cardiac rehabilitation programmes, the most typical form of secondary prevention programme, are utilized by less than 30% of those eligible.

What this paper adds

- The results of this study demonstrate that a nurse practitioner can safely and effectively deliver a comprehensive secondary prevention intervention.
- A nurse practitioner delivered secondary prevention intervention is well received by patients and significantly improves the implementation of guideline based secondary prevention treatments and risk factor reduction strategies, and improves treatment goals achieved by patients.
- Diabetes and activity levels, risk factors that have been challenging to improve in most secondary preventions programmes, were significantly improved with this nurse practitioner intervention.

1. Introduction

Patients with coronary heart disease are at high risk for reinfarction and death. Secondary prevention entailing strategies aimed at decreasing these risks in patients with established coronary heart disease has been shown effective in achieving its goal. In Canada and the United States, risk factor control outperformed improvements in medical and surgical treatments as the source of the decline in age-adjusted mortality associated with coronary heart disease over the past two decades (Ford et al., 2007; Wijeysundera et al., 2010). In spite of conclusive evidence that secondary prevention strategies significantly reduce morbidity and mortality in coronary heart disease survivors, a significant proportion of patients in whom these therapies are indicated are not receiving secondary prevention strategies, or are receiving them in suboptimal doses (Anderson et al., 2007; Jackevicius et al., 2008; Kotseva et al., 2009; Lee et al., 2008; Smith et al., 2011; Yusuf et al., 2011).

Based on our ageing population and the growing need to reduce cardiovascular risks internationally, innovative ways to improve the uptake and implementation of secondary prevention strategies are required. In this study, the nurse practitioner, whose nursing background is strengthened through advanced training in health assessment, diagnosis, treatment and counselling, is proposed as an ideal healthcare provider for delivering preventive care for patients with coronary heart disease.

2. Background

Coronary heart disease is a leading cause of death in Canada, the United States, and Europe, and the most common cause of death worldwide reported by the World Health Organization (Kochanek et al., 2011; Mathers et al., 2009; Statistics Canada, 2008). Acute myocardial infarction is an acute presentation of coronary heart disease, which plays a central role in assessing the burden of heart disease (Roger, 2007). Despite the dramatic fall in coronary heart disease mortality rates over the last three decades (Cooper et al., 2000; Every et al., 2000), the burden of coronary heart disease and acute myocardial infarction has been increasing, and is projected to continue to do so into the next century due to the ageing population. The decline in coronary heart disease related mortality is thought to be largely due to improvements in treatment and secondary prevention (Lenfant, 2003; Roger, 2007).

Secondary prevention incorporates identifying, treating, and rehabilitating patients with coronary heart disease or acute myocardial infarction to reduce their risk of recurrence, decrease their need for interventional procedures such as coronary artery bypass surgery, improve quality of life, and extend overall survival (Cooper et al., 2000). Secondary prevention strategies include smoking cessation, blood pressure control, lipid management, physical activity promotion, weight management, diabetes management, antiplatelet agent/anticoagulant use, and long-term use of angiotensin-converting enzyme inhibitors and beta-adrenoceptor blockers (Antman et al., 2008; Graham et al., 2007; Smith et al., 2011). These risk reduction strategies are based on compelling evidence from clinical trials and are the foundation for the American Heart Association/American College of Cardiology Foundation guidelines for secondary prevention reduction therapy for patients with coronary and other vascular disease (Antman et al., 2008; Smith et al., 2011) and the European guidelines on cardiovascular disease prevention in clinical practice (Graham et al., 2007).

Although utilization rates of evidence-based strategies have improved significantly over time, target levels have not yet been achieved in each category of secondary prevention strategy. Specifically, there is still much room for improvement in the initiation of and adherence to non-pharmacological therapies, such as smoking cessation, physical activity and referral to cardiac rehabilitation (Teo et al., 2013), and the long-term adherence to medications (Kotseva et al., 2009; Yusuf et al., 2011).

Evidence indicates that structured secondary prevention programmes, with and without exercise components, significantly improve outcomes in patients with coronary heart disease (Clark et al., 2005; McAlister et al., 2001b). Secondary prevention cardiac programmes which are exercise-based are widely available in most urban and suburban communities, but are utilized by less than 20–30% of the patients who are eligible (Gravely-Witte et al., 2010; Suaya et al., 2007). In a recent synthesis of the literature examining strategies to increase patient enrolment in cardiac rehabilitation, Grace et al. (2011) reported that on average only 34% of those eligible are referred to cardiac rehabilitation. Similar rates of referral have been reported in a multinational survey conducted in 15 countries in Europe (Kotseva et al., 2004). In most, if not all, studies nurses were the most frequently reported professionals to lead or manage the programmes.

To date, the level of training that nurses possess in secondary prevention practice settings is not well defined. However, the level of training that the nurse possesses

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dictates the extent to which secondary prevention strategies, both pharmacological and non-pharmacological, can be implemented in settings where a physician is not immediately available. For example, clinical settings that do not have a provider with the authority to titrate medications to target levels, order smoking cessation pharmacotherapy, make referrals to cardiac rehabilitation, or order diagnostic tests (such as cholesterol levels, liver function and renal function tests necessary in monitoring progress and response to secondary prevention medications) will be limited to exercise supervision, education and counselling, and thereby miss the opportunity for delivering comprehensive secondary prevention in one setting, at the most opportune time.

Nurse practitioners who participate in expanded clinical practice, including some prescriptive, diagnostic and treatment authority, are potentially well suited to deliver comprehensive secondary prevention, as their responsibilities can span the traditional medical and nursing domains of practice described in these programmes. For example, nurse practitioners in many countries have the authority to diagnose and treat hyperlipidemia, hypertension and angina; and can refer patients to cardiac rehabilitation and psychiatric services in most jurisdictions. Nurse practitioners are described as having the advanced knowledge and skills to deliver comprehensive preventive care, which includes assessment, diagnosis and treatment of chronic diseases (Canadian Nurses Association, 2010; Royal College of Nursing, 2012; Thomas et al., 2012).

Although the nurse practitioner role has not been specifically evaluated in secondary prevention, results of many studies have demonstrated improvements in outcomes (patient health, quality of life, coordination and continuity of care, use of health services, access times, wait times, patient and family satisfaction with care and health care costs) when advanced practice nursing roles that include nurse practitioners complement existing care provider roles and are designed to address gaps in the delivery of health care services (Bredin et al., 1999; Brooten et al., 2002) or focus on chronic disease management (Litaker et al., 2003; Schuttelaar et al., 2010). Evidence shows that: (1) nurse practitioners are more effective than physicians in areas related to patient compliance with treatment recommendations (Horrocks et al., 2002); (2) nurse practitioner-run lipid management programmes have been associated with significant reductions in low density lipoprotein cholesterol levels (Allen et al., 2002; DeBusk et al., 1994; Mason, 2005); (3) transitional care provided by advanced practice nurses improves outcomes such as readmission rates in cardiac patients (Naylor et al., 2004); (4) nurse practitioners contributed to high quality chronic disease management (Russell et al., 2009); and (5) nurse-led secondary prevention clinics have been shown to improve adherence to secondary prevention strategies when compared to usual care (Murchie et al., 2003). The role of nurse practitioners in the implementation of secondary prevention post acute myocardial infarction and their success in achieving beneficial outcomes have not been investigated.

3. The Study

3.1. Aims

The purpose of this study was to evaluate the effects of nurse practitioner care on the rate of provider implementation and patient achievement of evidence-based secondary prevention target goals.

3.2. Conceptual framework

The conceptual framework that guided the study was adapted from a framework developed by Sidani and Irvine (1999). These authors identified several factors that influence the nurse practitioners' delivery of care and subsequent patient outcomes, as well as the key elements of nurse practitioner practices or processes of care associated with the expected outcomes.

The adaptation of the framework involved identifying structure, process, and outcome variables that were most relevant to the evaluation of the nurse practitioners contribution in secondary prevention (Fig. 1). Of the structure variables listed in Fig. 1, only patient characteristics were assessed and controlled for statistically in this study. The nurse practitioner professional qualities and organizational variables were excluded because the secondary prevention nurse practitioner intervention was delivered by one nurse practitioner in one setting. The processes of care were operationalized with the activities of which the nurse practitioner's intervention was comprised and with the practice patterns in which the nurse practitioner engaged to facilitate delivery of secondary prevention. The nurse practitioner activities involve the implementation of secondary prevention strategies recommended by the American Heart Association/American College of Cardiology Foundation and European guidelines on cardiovascular disease prevention (Antman et al., 2008; Graham et al., 2007; Smith et al., 2011). The outcome variables represented the treatment goals achieved by the patient and expected as a result of the secondary prevention strategies implemented by the nurse practitioner.

3.3. Methodology

A prospective cohort design was used to address the study purpose. Fig. 2 presents a flow diagram of the study design. A group of patients with acute myocardial infarction receiving nurse practitioner care was compared to a group of acute myocardial infarction patients not receiving nurse practitioner care. All patients admitted to the coronary care unit over the study period at the selected setting were screened for eligibility, using the same inclusion and exclusion criteria. Group allocation was determined by the composition of the healthcare team to which patients were assigned upon admission to the cardiac unit. Nurse practitioners in this facility work Monday through Friday; patients admitted during weekdays formed the intervention group (i.e., exposed to the nurse practitioner care). The healthcare team for patients admitted with acute myocardial infarction over the

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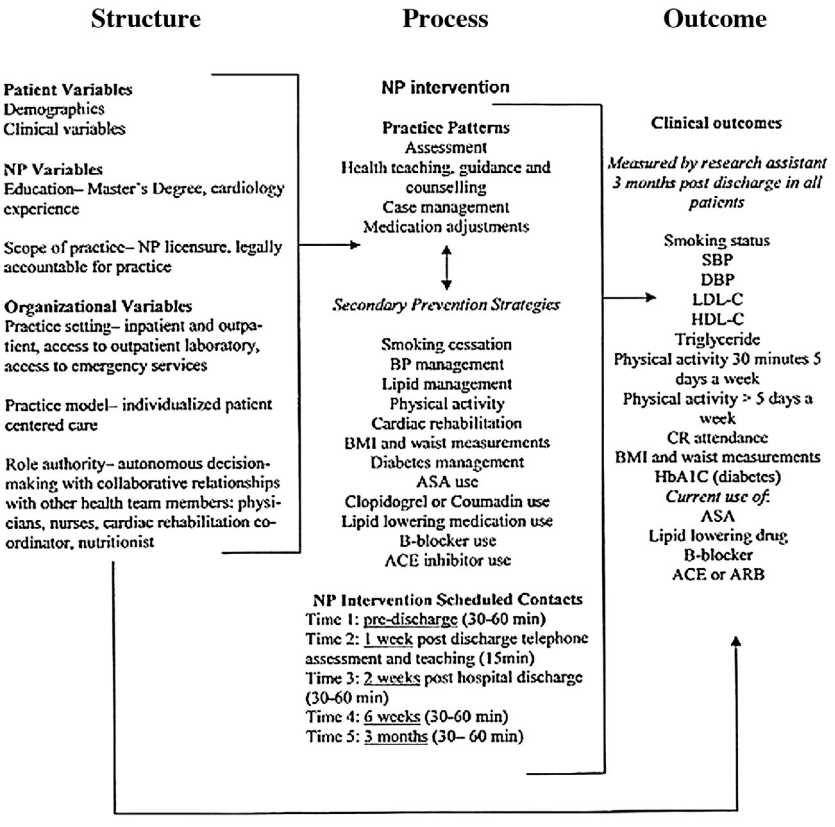

Fig. 1. Conceptual framework for evaluating NP care in delivering secondary prevention post AMI.

weekend does not include a nurse practitioner; patients admitted on the weekend comprised the control group (i.e., not exposed to the nurse practitioner).

All patients received usual care. Patients in the nurse practitioner care group were given the secondary prevention intervention. The intervention included comprehensive cardiovascular assessments and education, counselling and treatment recommendations related to heart attack recovery and secondary prevention care. A detailed description of the intervention follows.

There is no evidence that the two cohorts of patients differ on characteristics that could influence outcomes. However, an examination of baseline comparability of the two cohorts was completed, and variables showing significant between-group differences were controlled for statistically to minimize their potential confounding influence on outcomes.

Data on the fidelity of the intervention implementation was obtained during each session with individual participants through the use of a clinical log completed by the nurse practitioner. Outcome data were collected at baseline (time 1) and three months after discharge from hospital (time 5) for both patient groups.

3.4. Setting

The study was conducted in a large tertiary care community hospital with full cardiac services (coronary angiography, coronary artery bypass surgery, cardiac exercise rehabilitation programme). The hospital is within a multicultural community with a population of 500,000. The study was conducted over a one year period (2008–2009).

3.5. Ethical approval

Ethical approval for conducting clinical research was obtained from the Research Ethics Board at the University of Toronto and participating hospital. All participants provided written, informed consent.

3.6. Usual care

Usual care in this facility consisted of services by a team of cardiologists, registered nurses, and nurse practitioners (weekdays). Services available for all acute myocardial infarction patients included nutritional counselling and

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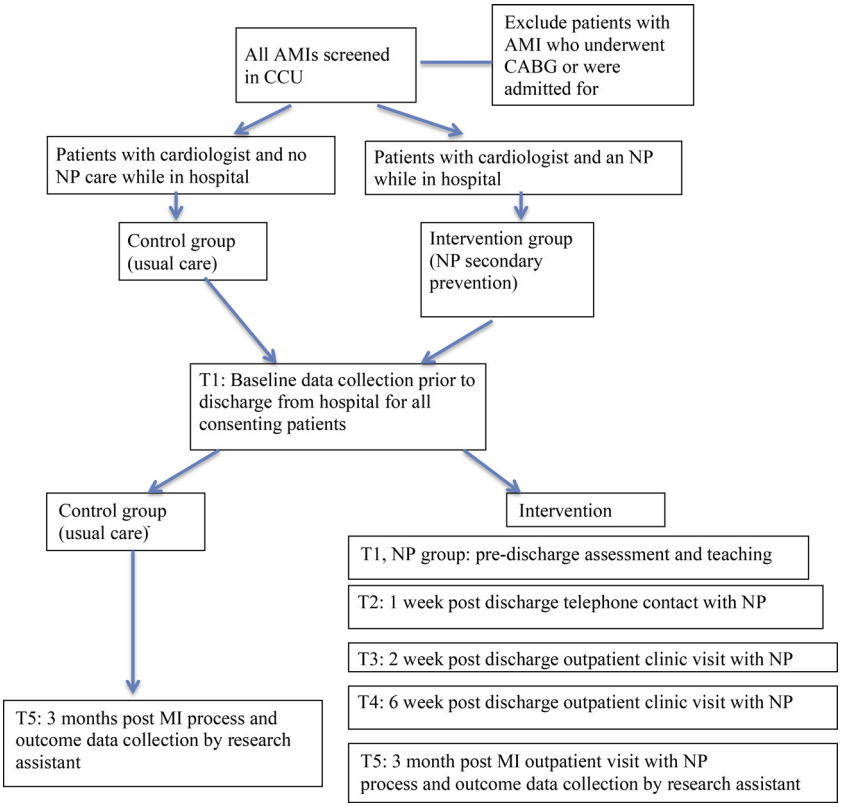

Fig. 2. Study flow diagram.

access to a psychologist, social worker, or home care (with referral). Usual care included discharge teaching by registered nurses and access to an outpatient group teaching session on heart attack recovery. The most responsible physician and/or a family physician determined timing of post discharge follow-up appointments. All participants in the control group received usual care.

3.7. Intervention

The nurse practitioner delivered the secondary prevention intervention in inpatient and outpatient settings. A patient centred approach was utilized by the nurse practitioner in delivering the intervention, whereby the patients' priorities and preferences are a priority and a therapeutic alliance is sought. The application of this approach is expected to yield favourable outcomes including increased patient satisfaction with care, sense of empowerment, adherence to treatment, and improved physical functioning and emotional well-being (Hobbs, 2009; Hudon et al., 2011). The content of the intervention was developed using the American Heart Association/American College of Cardiology Foundation guidelines for secondary prevention for patients with coronary and vascular disease (Antman et al., 2008; Smith et al., 2011). All risk reduction strategies were included in the intervention. These were: delivery of or referral to smoking cessation counselling; initiation or titration of blood pressure medications if blood pressure not at target goal; initiation or titration of lipid lowering therapy if lipid levels not at target goals; delivery of physical activity counselling or referral to cardiac rehabilitation programme; measurement of weight, body mass index, waist circumference, and dietary counselling; measurement of blood glucose and diabetes risk factor counselling for diabetic patients; initiation of acetylsalicylic acid, if not contraindicated, and clopidogrel or warfarin if clinically indicated; initiation or titration of angiotensin-converting inhibitors towards treatment goals unless contraindicated; and initiation or titration of beta-adrenergic blocking agents towards treatment goal unless contraindicated. Each secondary prevention strategy included in the guidelines that was applicable to an individual patient was addressed at each visit. The protocol for the NP intervention can be found in Table 1.

The intervention was delivered in five sessions at the following points in time: time 1, prior to discharge from hospital; time 2, one week following hospital discharge; time 3, two weeks after discharge from hospital; time 4, six weeks after discharge, and time 5, three months after hospital discharge. The intervention was provided by the nurse practitioner via face-to-face contact prior to discharge from hospital, a telephone call to the patient one week following discharge from hospital, and outpatient clinic appointments with the nurse practitioner at 2 weeks, 6 weeks and 3 months after discharge from hospital.

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Table 1
Nurse practitioner intervention protocol.

Nurse practitioner intervention protocol	T1: pre-discharge	T2: telephone contact one week post discharge	T3: clinic visit two weeks post discharge	T4: clinic visit six weeks post discharge	T5: outpatient clinic visit three months post discharge
Clinical history and assessment	✓		✓	✓	✓
Focused CV assessment	✓		✓	✓	✓
Counselling and guidance on Risk factors:		Reinforce pre-discharge			
Smoking	✓	counselling	✓	✓	✓
BP	✓	and education	✓	✓	✓
Lipid	✓		✓	✓	✓
Physical activity	✓		✓	✓	✓
Weight	✓		✓	✓	✓
Diabetes	✓		✓	✓	✓
Antiplatelet	✓		✓	✓	✓
B-blocker	✓		✓	✓	✓
ACE-inhibitor	✓		✓	✓	✓
Review of signs and symptoms to report (nitroglycerin use review)	✓	✓	✓	✓	✓
Antiplatelet	✓	✓	✓	✓	✓
B-blocker	✓	✓	✓	✓	✓
ACE-inhibitor adjustment(s) to target goal (in consultation with most responsible physician as needed)	✓	✓	✓	✓	✓
Lipid measurement	Obtain baseline		✓	✓	✓
BP measurement	measures from		✓	✓	✓
HbA1c	health record or		✓		✓
Weight/BMI calculation	arrange with		✓	✓	✓
Waist circumference	most responsible				✓
Liver function and renal function tests (for monitoring lipid and/or ACE medications)	physician			✓	✓
Referral to cardiac rehabilitation	✓		✓	Check on enrolment	Check on enrolment
Referral for smoking cessation	✓		✓	Check on enrolment	Check on enrolment
Referral for dietary counselling	✓		✓		
Schedule outpatient clinic appointments	✓		✓	✓	

Although optimal timing of secondary prevention interventions has not been established, the time intervals were selected to maximize the potential of reaching secondary prevention goals during the period of time in which the patient is at highest risk for reinfarction and death (Anderson et al., 2007; Kornowski et al., 1993). For example, a large study using U.S. Medicare data reported that in the month following acute myocardial infarction, the likelihood of death is 21 times higher and the risk of hospitalization is 12 times higher than the general population over the age of 65 (Dharmarajan et al., 2013).

The number of contacts and the amount of time allotted for each contact were flexible, based on individual patient needs, which is a fundamental characteristic of patient-centred care (Robinson et al., 2008). One hour was allocated for each participant before discharge from hospital, while 30–60 min were allocated for the outpatient contacts, delivered in an ambulatory care setting. Repeated contacts were planned to assist patients in applying the secondary prevention recommendations and in addressing potential barriers. The number of contacts was similar to those reported in other studies of secondary prevention (Goessens et al., 2006; Redfern et al., 2009).

3.8. Sample

The target population consisted of patients admitted for the medical management of acute myocardial infarction. The eligibility criteria were: confirmed diagnosis of acute myocardial infarction (2 out of 3 criteria: presence of troponin/creatine kinase, chest pain > 30 min; electrocardiogram changes consistent with myocardial infarction), and scheduled for discharge from the cardiac care unit. Patients with a previous myocardial infarction were included and pertinent data recorded. Exclusion criteria were: acute myocardial infarction patients with coronary artery bypass graft surgery on target admission or those transferred from another hospital for the purpose of coronary procedures

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(coronary angiogram or angioplasty); significant co-morbidity which was expected to effect one year survival (i.e., metastatic cancer, end stage heart or renal disease) as reported in the patients' health record; language barrier, dementia or cognitive impairment which would affect ability to understand instructions regarding treatment recommendations, or ability to read and sign consent; and geographic/transportation obstacles which would prohibit follow-up appointments.

A sample size of 60 patients was estimated to be adequate to detect moderate to large effect sizes for the intended outcomes at $\beta = .80$ and $\alpha = .05$ (Cohen, 1992). Moderate to large effect sizes have been reported in studies that investigated secondary prevention strategies included in the nurse practitioner intervention, such as guideline-based care and nurse case management on lipids, diet and exercise (e.g., Allen et al., 2002; DeBusk et al., 1994; Goessens et al., 2006; Murchie et al., 2003). To account for an anticipated 10% attrition rate 6 additional participants (3 in each group) were recruited, for a total of 66 (33 in each group).

3.9. Measures

Data were collected on the following variables:

3.9.1. Patient characteristics

Data on patient age, gender, marital status, employment status, living arrangements, complications of acute myocardial infarction (heart failure, unstable angina), medical history (diabetes, hypertension, hyperlipidemia, prior acute myocardial infarction, congestive heart failure, previous coronary artery bypass grafting surgery, percutaneous coronary intervention, and stroke), and smoking status were obtained from participants' medical records.

3.9.2. Secondary prevention strategies

To evaluate the fidelity of the intervention, implementation of secondary prevention strategies by the nurse practitioner was assessed using a clinical log completed by the nurse practitioner during each contact with each participant. The nurse practitioner recorded on the clinical log whether or not she carried out each secondary prevention strategy (listed in intervention section).

3.9.3. Outcomes

The outcome variables included treatment goals achieved by the patient. These were: smoking status; systolic blood pressure (mmHg), diastolic blood pressure (mmHg); low density lipoprotein cholesterol (mmol/L), high density lipoprotein cholesterol (mmol/L), triglycerides (mmol/L); involvement in physical activity; attendance at cardiac rehabilitation programme; glycated haemoglobin; and current use of acetylsalicylic acid, beta-adrenergic blocking agent and angiotensin-converting inhibitor as recommended. For each patient contact, a data collection tool was used to record whether or not the target goal for each secondary prevention strategy was achieved based on information available in his/her medical record.

3.9.4. Feasibility and acceptability of the nurse practitioner-delivered intervention

Feasibility was evaluated with the rate at which the nurse practitioner implemented the secondary prevention strategies. Acceptability of the intervention was inferred from the rates of participants' enrolment and attrition.

3.10. Statistical analysis

Descriptive statistics (frequency distributions, measures of central tendency and dispersion) were used to describe the baseline characteristics of the sample, outcomes measured at each time point, and to test for the assumption of normality underlying the planned statistical tests used for data analysis. Independent-samples *t*-tests (for continuous variables) and chi-square tests (for dichotomous variables) were conducted to examine the comparability of the intervention and control groups on all baseline variables. The Levene's test examined the equality of variance assumption, and if not met, the appropriate formula for the *t*-test was reported.

Rates of nurse practitioner implementation of evidence-based secondary prevention strategies were analyzed descriptively to describe the percentage of participants who achieved treatment goals.

Analysis of covariance was conducted to compare the intervention and control groups on post-test outcomes while controlling for confounding variables. The covariates included variables showing significant between-group differences at baseline and correlation with the post-test outcomes, as recommended by Norman and Streiner (2008). Outcome data were analyzed by use of an intention-to-treat analysis on the basis of all selected patients. Data for all patients lost to follow-up or those who dropped out of the NP care group were analyzed in the groups to which they were originally assigned.

A multiple regression or logistic regression analysis, based on the level of measurement of the dependent variable, was used to examine the outcome variables while controlling for the same confounding variables included in the analysis of covariance. For each dependent variable, the first set of predictors included the demographic and clinical variables showing baseline differences between groups (age and marital status). The second set consisted of the number of family physician visits since discharge from hospital, the number of cardiologist visits since discharge, and attendance at a cardiac rehabilitation programme. These variables were included to control for their potential influence on outcomes. The third set of predictors was the group to which participants were assigned (intervention or control). Lastly, for the intervention group, the number of contacts and total time spent with the nurse practitioner were examined as predictors of outcome achievement.

4. Results

4.1. Enrolment and attrition

Of the 75 eligible patients, 65 enrolled and10 refused, yielding an 87% participation rate. Reasons for non-enrolment were: admission and discharge timing restricting

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nurse practitioner participation on the healthcare team, surgical intervention (such as coronary artery bypass surgery or valve replacement), and being too ill (ascertained with a Charlson Comorbidity Index score greater than 2, as documented in the patient's chart) (Hall et al., 2005).

The number of participants in the intervention ($n = 32$) and the control ($n = 33$) group was comparable. A total number of 4 participants dropped out, yielding an attrition rate of 6.1%; 3 were assigned to the control group (9% attrition rate for this group) and 1 was assigned to the intervention group (3% attrition rate for this group). All withdrawals occurred after the first contact.

4.2. Characteristics of participants

The mean age of participants was 58 years. The majority of participants were men (83%), married (75%), employed (61%), with high school education or above (65%). As shown in Table 2, the intervention and control groups were similar in gender, employment and education. The mean age of participants in the intervention group was significantly higher than the control group. More participants in the control group were married, whereas more participants in the intervention group were widowed. Therefore, age and marital status were controlled for in the analyses comparing the post-test outcomes.

In the total sample, the mean number of days in hospital was 4.7. Smoking at baseline was reported by 42% of participants. Participants had a history of hypertension (52.3%), hyperlipidemia (56.9%), diabetes (24.6%) and family history of cardiovascular disease (60%). Most had percutaneous transluminal coronary angioplasty and stent, with just over one-third (37%) receiving drug-eluting stent. Only two participants experienced complications (Table 3). The rates of interventional treatment of percutaneous angioplasty and use of stents were different between groups. The variable stent was significantly correlated with age; however it is not known to have clinically meaningful association with the outcome variables; therefore it was not controlled for in subsequent analyses. Similarly, there were no statistically significant between-group differences in the outcomes measured at baseline (Table 4).

In the total sample, the mean number of family physician visits during the time period between discharge from hospital and the three-month follow-up study visit was 2.51. The mean number of visits to a cardiologist for the total sample was one visit (range = 0–2). Participants in the control group (mean = 1.14) visited a cardiologist more frequently than participants in the intervention group (mean = .81), $p = .003$. There were no significant differences between the two groups on the number of family physician, nutritionist or diabetic clinic visits in the study period.

4.3. Implementation of the intervention

The nurse practitioner intervention was delivered in 5–11 contacts, with the majority (74.2%) of the 31 patients assigned to this group made 5–6 contacts with the nurse

Table 2
Demographic characteristics.

Characteristic	Total sample ($n = 65$)	NP group ($n = 32$)	Control group ($n = 33$)	*P*-value
Mean age (SD)	58.3 (9.87)	61.87 (10.88)	54.9 (7.44)	.004
Male, *n* (%)	54 (83.1)	25 (78.1)	29 (87.9)	.29
Married, *n* (%)	49 (75)	20 (62.5)	29 (87.9)	.02
Employed, *n* (%)	40 (61.5)	17 (53.1)	23 (69.7)	.20
Education, *n* (%) high school	16 (24.6)	8 (25)	8 (24.2)	.17
Education, *n* (%) post secondary	26 (40)	11 (34)	15 (45.45)	.17

Table 3
Clinical characteristics.

Characteristic	Total sample ($n = 65$)	NP group ($n = 32$)	Control group ($n = 33$)	*P*-value
Days in hospital, mean (SD)	4.7 (3.96)	5.0 (5.47)	4.48 (1.46)	.60
Risk factors, *n* (%)				
Smoker	27 (41.5)	13 (40.6)	14 (42.4)	.12
Former smoker	14 (21.5)	10 (31.3)	4 (12.1)	
Never smoked	24 (36.9)	9 (28.1)	15 (45.5)	
Hypertension	34 (52.3)	18 (56.3)	16 (48.5)	.53
Lipids	37 (56.9)	17 (53.1)	20 (60.6)	.54
Diabetes	16 (24.6)	8 (25.0)	8 (24.2)	.94
Family history	35 (60)	16 (50)	19 (57.6)	.54
Prior MI, *n* (%)	8 (12.3)	5 (15.6)	3 (9.1)	.42
PTCA, *n* (%)	58 (89.2)	26 (81.3)	32 (97)	.03
Stent, *n* (%)	58 (89.2)	26 (81.3)	32 (97)	.03
DES, *n* (%)	24 (36.9)	7 (21.9)	17 (51.5)	.01
Troponin, mean (SD)	38.50 (38.42)	33.37 (39.52)	43.46 (37.23)	.29
Complications, *n* (%)				
CHF	2 (3.1)	1 (3.1)	1 (3.0)	.98
Unstable angina	2 (3.1)	1 (3.1)	1 (3.0)	.98

Note: MI = myocardial infarction; PTCA = percutaneous transluminal coronary angioplasty; DES = drug eluting stent; CHF = congestive heart failure.

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Table 4
Outcome variables at baseline.

Variable	Total sample ($n = 65$)	NP group ($n = 32$)	Control group ($n = 33$)	*P*-value
Medications on admission, *n* (%)				
ASA	18 (27.7)	7 (21.9)	11 (33.3)	.30
Plavix	4 (6.2)	3 (9.4)	1 (3.0)	.35
Statin	23 (35.4)	14 (43.8)	9 (27.3)	.16
β-blocker	11 (16.9)	8 (25.0)	3 (9.1)	.08
ACE inhibitor	15 (23.1)	8 (25.0)	7 (21.2)	.71
ARB	5 (7.7)	4 (12.5)	1 (3)	.18
LDL-C on admission, mean (SD)[a]	2.44 (1.39)	2.46 (1.76)	2.42 (.88)	.91
HDL-C, mean (SD)[a]	.94 (.27)	.98 (.31)	.89 (.21	.18
Triglycerides, mean (SD)[a]	1.75 (1.10)	1.50 (.77)	1.99 (1.33)	.08
Blood glucose in hospital, mean (SD) [b]	6.19 (2.39)	5.8 (1.25)	6.59 (3.11)	.18
SBP prior to discharge, mean (SD)[c]	116 (13.59)	115.96 (14.52)	114.96 (11.51)	.78
DBP prior to discharge, mean (SD)[c]	68.30 (9.71)	66.76 (8.92)	68.11 (9.07)	.59
BMI, mean (SD)[d]	27.86 (4.5)	26.4 (4.95)	29.0 (3.85)	.07
Waist, mean (SD)[d]	40.56 (4.27)	39.78 (4.23)	41.05 (4.32)	.41

Note: LDL-C = low density lipoprotein cholesterol; HDL-C = high density lipoprotein cholesterol; SBP = systolic blood pressure; DBP = diastolic blood pressure; BMI = body mass index.
[a] Measured within 24 h of admission (fasting).
[b] Measured at least 24 h after admission.
[c] Last recorded BP prior to discharge, some unavailable (NP group, $n = 5$; Control group $n = 6$).
[d] Baseline BMI unavailable on 12 in NP group, 8 in control group; waist unavailable on 19 in NP group, 13 in control group.

practitioner, and about a fourth (25.8%) had 7–11 contacts. The mean number of minutes the NP spent with each participant across all visits was 3.64 h (SD 31.00 min), with a range of 2.67–4.75 h. The number of contacts and the amount of time the NP spent with patients were not significantly associated with successful achievement of measured outcomes.

Smoking cessation counselling was provided to 92% of the intervention group participants who were current smokers at baseline ($n = 12$). Referral and attendance to a smoking cessation clinic occurred in 25% ($n = 3$) of smokers in the intervention group. All participants in the intervention group who were smokers were offered smoking cessation clinic referral before discharge from hospital.

Rates of referral to cardiac rehabilitation were 81% in the intervention group, the remainder declined referral.

Physical activity counselling and measurement of weight and body mass index calculation were done for 100% of participants. Diabetic teaching was completed with all participants, and 100% of participants with diabetes had a glycated haemoglobin measured.

4.4. Effects of the intervention

The intervention and control groups were compared to examine differences in outcome achievements for each secondary prevention goal at the three month follow-up visit, assessed by a research assistant (Table 5). Results of the analysis of covariance indicated significant between-group differences in triglyceride level and on weeks to cardiac rehabilitation. The intervention group had lower triglyceride levels and had a shorter number of weeks from hospital discharge to cardiac rehabilitation intake than the control group.

In Table 6, the percentages of achievement for the dichotomous outcome variables are presented. A larger percent of participants in the intervention than control group achieved the following targets: physical activity for 30 min greater than 5 days a week, glycated haemoglobin < 7 for those with diabetes, and statin use at 3-month follow-up.

Results of the multiple regression analysis showed that group membership did not significantly predict outcomes measured at the continuous level. Findings of the logistic regression indicated that intervention group membership was a significant predictor of smoking cessation, achievement of blood pressure less than 130/80 mmHg, achieving the *minimum* physical activity goal of 5 days a week, engagement in 30 min of physical activity *more than* five days a week, attendance at cardiac rehabilitation, and achievement of a glycated haemoglobin level less than 7% in patients with diabetes (Table 7).

Table 5
Achievement of secondary prevention goals at 3-month follow-up, continuous variables, controlling for covariates (adjusted means/SE).

Variable	Total ($n = 65$)	NP group ($n = 32$)	Control group ($n = 33$)	*F*(df)	*P*-value
SBP	60	114.11 (2.31)	116.50 (2.40)	.47 (56)	.50
DBP	60	68.12 (1.52)	70.28 (1.58)	0.86 (56)	.35
LDL-C	59	1.70 (0.10)	1.52 (0.10)	1.34 (55)	.25
HDL-C	60	0.98 (0.06)	1.08 (0.06)	1.15 (56)	.29
Triglycerides	58	1.07 (0.14)	1.61 (0.16)	5.48 (54)	.02
BMI	55	27.47 (0.89)	28.57 (0.95)	0.64 (51)	.42
Waist	55	39.67 (0.87)	41.91 (0.92)	2.84 (51)	.10
Weeks to CR	41	8.15 (0.71)	10.50 (0.86)	3.83 (37)	.05

Note: SBP = systolic blood pressure; DBP = diastolic blood pressure; LDL-C = low density lipoprotein cholesterol; HDL-C = high density lipoprotein cholesterol; BMI = body mass index; CR = cardiac rehabilitation.

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Table 6
Achievements of secondary prevention goals, dichotomous variables.

Variable	*N* by group intervention/control	Intervention group, *n* (%)	Control group, *n* (%)	Likelihood Ratio	*P*-value
Smoking cessation	12/13*	7 (58)	3 (23)	3.30	.11
Attended smoking cessation clinic	12/13*	3 (25)	0	4.85	.09
BP < 140/90	31/30	4 (12.9)	5 (16.7)	.17	.73
BP < 130/80	31/30	28 (90)	24 (80)	1.31	.30
BP < 130/80 (diabetes)	7/6	5 (71.4)	3 (50)	.63	.59
LDL-C < 2.6	31/28	9 (29)	9 (32.1)	.07	.79
LDL-C < 1.79	31/28	20 (64.5)	19 (67.9)	.07	.78
Physical activity >5 days per week	31/30	21 (67.7)	4 (13.3)	20.02	<0.0
Physical activity 5 days per week	31/30	23 (74.2)	18 (60.0)	1.4	.24
Attended cardiac rehabilitation	32/33	24 (75)	19 (57.6)	2.22	.14
Return to work at 3 month follow-up	16/20	7 (43.8)	14 (70)	2.54	.11
Diabetic management (HbA1C < 7 for diabetics)	7/6	7 (100)	2 (33.3)	8.41	.02
ASA at discharge	32/33	32 (100)	31 (93.9)	2.77	.49
ASA at 3 month follow-up	31/30	30 (96.8)	29 (96.7)	.001	1.00
Clopidogrel at discharge	32/33	31 (96.9)	32 (97)	.00	1.00
Clopidogrel at follow-up	31/30	28 (90.3)	27(90.0)	.002	1.0
Statin at discharge	32/33	31 (96.9)	31 (93.9)	.324	1.0
Statin at 3 month follow-up	31/30	31 (100)	26 (86.7)	5.97	.05
B-blocker at discharge	32/31	28 (87.5)	28 (84.8)	.10	1.0
B-blocker at follow-up	31/30	27 (87.1)	25 (83.3)	.17	.73
ACE inhibitor at discharge	32/33	27 (84.4)	28 (84.8)	.003	1.0
ACE inhibitor at follow-up	31/30	28 (90.3)	25 (83.3)	.66	.47

Note: BP = blood pressure; LDL-C = low-density lipoprotein cholesterol; HbA1C = glycosylated haemoglobin; ASA = aspirin; β-blocker = beta blocker; ACE inhibitor = angiotensin- converting enzyme inhibitor.
* Current smokers at baseline *n* = 27 (data on 2 participant drop outs missing).

Table 7
Regression analysis: predictors of outcome achievement.

Variable	Exp (B) odds ratio	95% CI for low	Odds ratio high
Smoking cessation	4.84	.98	23.88
BP < 130/80	14.78	1.19	183.50
Physical activity > 5 days a week	34.33	5.51	213.97
Physical activity 5 days a week	17.05	1.82	159.68
Attendance at cardiac rehabilitation	7.43	1.61	34.22
HbA1C < 7% with diabetes	9.63	1.83	50.47

5. Discussion

5.1. Acceptability and feasibility of the intervention

The implementation of the secondary prevention intervention was considered acceptable, as inferred from a high participants' enrolment rate (87%) and low attrition rate (3%). Lower rates of recruitment were reported in studies targeting participants who were completing cardiac rehabilitation (Lear et al., 2003) and higher rates in those offering comprehensive lifestyle interventions delivered by nurses and/or dieticians (Vale et al., 2003; Vesthold Heartcare Study Group, 2003). Two other comparable nurse-led secondary prevention studies have reported recruitment rates in the 70% range (Campbell et al., 1998; Goessens et al., 2006).

Attrition rates of 10–18% (Goessens et al., 2006; Lichtman et al., 2004; Masley et al., 2001; Vesthold Heartcare Study Group, 2003) are common in secondary prevention studies, with few reporting less than 10% (Lear et al., 2003; Redfern et al., 2009). The low attrition rate observed in this study could be related to the short follow-up period. This is consistent with findings of a systematic review examining predictors of referral, entry and long-term behaviour change related to cardiac rehabilitation. Factors that influenced each phase of cardiac rehabilitation differed, indicating that tailoring rehabilitation interventions to individual patients' preferences and needs would maximize adherence (Jackson et al., 2005). The high enrolment and low attrition rates in this study suggest that the nurse practitioner secondary prevention intervention is a desired option, acceptable to patients with acute myocardial infarction.

5.2. Characteristics of Participants

The profile of participants is comparable to that reported in two systematic reviews examining the benefits of cardiac secondary prevention programmes. The results of the reviews described participants as mid-aged men (McAlister et al., 2001a,b; Clark et al., 2005). The similarity of participants' characteristics across studies supports the representativeness of this study sample of the target population defined as acute myocardial infarction survivors. Therefore the study findings are applicable to middle age men with acute myocardial infarction.

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5.3. Feasibility of the intervention

In the context of the current study, the nurse practitioner spent a longer time (mean 36 min) with the patient at each visit as compared to the time spent by physicians reported in the literature and observed in clinical practice (Ogden et al., 2004). Accordingly, the nurse practitioner had ample opportunity to provide, clarify, and reinforce information about secondary prevention. This finding supports the use of appointment times that exceed the 10-min usually allotted for each patient, for delivering the nurse practitioner secondary prevention intervention with fidelity.

There is evidence that improvement in implementation and adherence to clinical practice guidelines by healthcare professionals caring for patients with acute myocardial infarction population are associated with lower mortality rates. Quality indicators have been developed to measure adherence to key clinical practice guidelines (Tu et al., 2008). The target benchmark for these quality indicators is 90% in ideal patients, that is, patients without contraindications to treatment recommendation (e.g., allergy to ASA) (Tu et al., 2008). These quality indicators serve as a benchmark and a means for quality improvement.

The nurse practitioner's implementation of guideline-based secondary prevention strategies exceeded 90% (assessed by a research assistant 3 months post acute myocardial infarction) for: smoking cessation counselling, physical activity counselling, measurement of weight and body mass index, dietary counselling, diabetic teaching, measurement of glycated haemoglobin in patients with diabetes, and medication prescribed at discharge and three month follow-up. Only two secondary prevention strategy categories were below the ideal target: cardiac rehabilitation referral (81%) and angiotensin-converting enzyme inhibitor prescribed at discharge (87%, including 3% contraindicated). In the case of the cardiac rehabilitation referral rate, 100% of patients were offered referral, whereas 19% declined. The percentage of those on an angiotensin-converting enzyme inhibitor at discharge was slightly under the ideal target, which in the absence of contraindications could be related to the nurse practitioner having less influence in an inpatient environment with multiple providers, as the 3 month follow-up exceeded 90%.

The observed high nurse practitioner performance on these quality indicators may be reflective of the dedicated focus of the intervention on secondary prevention, the timing of the intervention within the patient's recovery, the adequacy of the time the nurse practitioner spent implementing prevention activities, the discharge and follow-up checklists used by the nurse practitioner, and the awareness that implementation rates would be recorded and examined in relation to a comparison group. This is consistent with what is already known about a variety of methods for increasing adherence to guidelines; for example, the get with the guidelines programme, the largest hospital-based national performance initiative for coronary artery disease (USA), has been successful in improving guideline adherence in a large number of hospitals. This programme's stated focus is to improve adherence to prevention guidelines (Lewis et al., 2008). Key features of this programme include using a patient management tool for data collection, clinical decision support and feedback, as was done in the nurse practitioner secondary prevention study.

The timing of the nurse practitioner secondary prevention intervention, spanning the period before discharge and continuing for 3 months, could have contributed to the high implementation rates for the secondary prevention strategies. It has been reported that patients are more motivated to begin and maintain interventions that lower risks while they are still in hospital (Fonarow and Ballantyne, 2001). This is likely due to a heightened awareness of their current health, and strengthened perception of the link between treatments and the importance of decreasing future risks (Fonarow and Ballantyne, 2001).

5.4. Effects of the intervention

The findings indicated that after three months, acute myocardial infarction patients who received the secondary prevention intervention delivered by a nurse practitioner demonstrated significant improvements in multiple treatment goals when compared to patients who received usual care. The improvements related to the achievement of lower triglyceride levels, glycated haemoglobin blood measurements $<7\%$ in those with diabetes, smoking cessation, achieving a blood pressure $< 130/80$, attending cardiac rehabilitation, having shorter number of weeks from hospital discharge to cardiac rehabilitation intake, achieving the *minimum* physical activity goal of 5 days a week, engagement in 30 min of physical activity *more than* five days a week, and remaining on statin medications three months after discharge from hospital. Overall, the nurse practitioner's implementation of the evidence-based secondary prevention treatment strategies with high fidelity may have contributed to the clinically relevant improvements in treatment goals.

The potential impact of this magnitude of improvement in these risk factors is clinically important. A nurse practitioner led secondary prevention intervention guided by well-established guidelines is easy to administer and effective in decreasing cardiovascular risk. Improvement of secondary prevention goals, such as those seen in the intervention group, are known to be associated with improved outcomes in patients with acute myocardial infarction. Every percentage increase in guideline adherence has the potential of an equivalent decrease in death (Peterson et al., 2006). In addition to improvements in most treatment goals, the intervention was strongly associated with improvements in risk factors that have been particularly challenging to improve in other secondary prevention programmes: physical activity and diabetes. Diabetes and obesity have recently been identified as the last two risk factors cutting into the survival gains made from declines in smoking, hyperlipidemia and hypertension (Wijeysundera et al., 2010)

In contrast to findings on nurse dose reported in previous studies examining advanced practice nurses (Brooten et al., 2002), the amount of time or number of

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contacts the NP spent with patients in this study were not associated with successful achievement of outcomes. This may be related to both the type of outcomes measured and the difference in the operationalization of dose. In this study, the number and duration of contacts with the nurse practitioner were responsive to individual patients' needs. Future research should investigate the appropriateness of different ways to quantify nurse practitioner dose.

The results of this study are consistent with evidence that short-term secondary prevention programmes can be effective in improving multiple cardiovascular risk factors and uptake of guideline based recommendations for patients with established cardiovascular disease (Clark et al., 2005). The CHOICE (Choice of Health Options In prevention of Cardiovascular Events) randomized controlled trial evaluated a 3-month secondary prevention intervention for acute coronary syndrome survivors who were not accessing cardiac rehabilitation. The intervention group had significant improvements in the risk factor levels for total cholesterol, blood pressure, physical activity, smoking cessation and statin use at 3 months, similar to those observed in the nurse practitioner secondary prevention study. However, the Choice of Health Options In prevention of Cardiovascular Events study did not specify who delivered the intervention; rather, the intervention was described as an individualized, structured case management approach overseen by treating physicians (Redfern et al., 2009), which was comparable to the approach the nurse practitioner followed in delivering the secondary prevention strategies. These findings suggest that an individualized short-term approach to secondary prevention, which does not include a structured exercise component, may have comparable results to standard cardiac rehabilitation.

The choice of health options in prevention of cardiovascular events study findings also highlight what is well known about cardiac rehabilitation, that the majority of eligible patients do not access these programmes, and that those who opt out may have greater need for risk factor modification and support (e.g., more risk factors, higher mean levels of low density lipoprotein, more depression and lower physical activity in those opting out) (Redfern et al., 2009).

In the nurse practitioner study, the mean length of time from hospital discharge to cardiac rehabilitation programme participation was 9 weeks (SD 3.30), with the nurse practitioner secondary prevention intervention beginning before discharge from hospital. This highlights again that secondary prevention programmes, with and without exercise components, are effective in improving risk factor profiles in patients with acute myocardial infarction and established cardiovascular disease (Clark et al., 2005; McAlister et al., 2001a,b), with timing of the start of a programme as an additional factor to be considered. Given that the majority of eligible patients do not attend structured cardiac rehabilitation programmes, and those who do, start in the range of 6–12 weeks after the event, secondary prevention programmes outside of traditional cardiac rehabilitation, beginning as early as possible, such as done in the nurse practitioner study, appears to be a feasible and effective alternative. Secondary prevention programmes may be a desired option for patients who do not have immediate access to a cardiac rehabilitation programme and may serve to motivate patients and/or facilitate their engagement in cardiac rehabilitation programmes.

5.5. Strengths and limitations

The strengths of this study are related to its design and implementation, which were guided by a clear conceptual framework. The use of a prospective cohort design with the application of the same eligibility criteria for selecting consecutive acute myocardial infarction patients contributed to comparability between groups on most baseline characteristics. Variables showing differences at baseline and significant correlation with post-test outcomes were controlled for statistically. The nurse practitioner intervention was carefully designed to integrate clearly defined nurse practitioner activities, derived from the nurse practitioner scope of practice and previous research, relative to the most recent and effective secondary prevention strategies. The intervention activities were operationalized in a log that guided its appropriate delivery and accurate documentation of the activities carried out with each participant. This resulted in high fidelity and standardization of the intervention implementation and contributed to the achievement of intended outcomes. The intervention was delivered by one interventionist to a small sample, in one setting. Single centre studies, as well as a limited number of interventionists provide less heterogeneity in the delivery of the intervention and less chance of undetected co-interventions (e.g., multiple hospitals would have varying discharge or cardiac follow-up practices). Homogeneity in treatment delivery and patient characteristics limits external validity or applicability of the findings to other contexts. The intervention was implemented by one nurse practitioner. The nurse practitioner may have professional qualities and an interactional style that may not be reflective of those characterizing other nurse practitioners.

This study involved a small number of patients, characterized as middle-aged, married, employed men. Although representative of the patient population served in the setting and of the acute myocardial infarction population taking part in research studies, it may not be representative of two subgroups of cardiac patients that is, women and older adults.

The sample size in both groups was powered to detect moderate to large differences between groups, a conservative target for the purposes of examining the feasibility and acceptability of the intervention. However, small but clinically significant differences in outcomes between the intervention and comparison groups likely have gone undetected. The wide confidence intervals reported in the regression analysis are related to the small sample size.

The data for this study were collected in 2008 and 2009. Based on the current guidelines for secondary prevention of cardiovascular disease the intervention as described and implemented here is still relevant to current practice recommendations (Antman et al., 2008; Graham et al., 2007; Smith et al., 2011).

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5.6. Implications

The study findings support the ability of the nurse practitioner to deliver secondary prevention interventions within the full scope of practice. Future research needs to include different nurse practitioners in different contexts to determine the extent to which the nurse practitioner and setting characteristics influence implementation of the intervention and achievement of outcomes, as proposed by the conceptual framework that guided the study. In settings where nurse practitioner care is being delivered in hospital as usual care, consideration should be given for comparing three groups in a future study: usual inpatient nurse practitioner care and outpatient usual care (which does not include a nurse practitioner), inpatient nurse practitioner intervention care and nurse practitioner intervention outpatient care, and inpatient care and outpatient care which does not include a nurse practitioner. This would make it possible to make comparisons on the effects of inpatient and outpatient nurse practitioner care on outcomes separately, which would help further delineate the influence of setting on fidelity of intervention implementation and on the measured outcomes.

The cost-effectiveness of this type of nurse practitioner secondary prevention intervention should be investigated in future research. In addition to replicating this research with a larger sample, an examination of the impact of financial factors limiting secondary prevention medication use and entry into cardiac rehabilitation programmes – circumstances which can be potentially improved with a nurse practitioner intervention would be helpful in fully understanding the potential contribution of the nurse practitioner in this type of practice setting.

This study demonstrates that the nurse practitioner secondary prevention intervention potentially has broad appeal for acute myocardial infarction patients in this type of practice setting. The high enrolment and low attrition rates may represent a desire for cardiac follow-up in the time period extending from hospital stay to three months post acute myocardial infarction. This study highlights the potential advantages of providing care that spans the inpatient and outpatient settings, with frequent follow-ups at a time when patients' motivation for change is heightened. Secondary prevention programmes that incorporate pre- and post-discharge secondary prevention teaching, and early outpatient follow-up could serve as a bridge to entry into cardiac rehabilitation.

Additionally, secondary prevention programmes such as the one studied here may appeal to patients who desire an alternative to traditional cardiac rehabilitation, or to those who could benefit from assistance in overcoming barriers to cardiac rehabilitation. This could also potentially translate into reaching those who have been shown to attend cardiac rehabilitation the least (women and the elderly). Further research is needed on programme preferences, especially for those less likely to attend traditional cardiac rehabilitation. Providers delivering secondary prevention should build time in their practices to allow adequate time for health teaching, discussing treatment options, and the opportunity for individual barriers and concerns to be expressed.

6. Conclusion

The results of this study demonstrate that a nurse practitioner can safely and effectively deliver a comprehensive secondary prevention intervention. This study found that a nurse practitioner delivered secondary prevention intervention is well received by patients and significantly improves the implementation of guideline based secondary prevention treatments and risk factor reduction strategies. Every percentage increase in guideline adherence has the potential of an equivalent decrease in death (Peterson et al., 2006). In addition to improvements in most secondary prevention treatment goals, the nurse practitioner secondary prevention intervention was strongly associated with improvements in secondary prevention goals and risk factors that have been particularly challenging to improve in other secondary prevention programmes: physical activity and diabetes. Interventions such as this, which successfully address those risk factors, and multiple others, warrant replication with two or more nurse practitioners and a larger sample of subjects to validate the results.

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