# Remote Cardiac Rehabilitation for Secondary Prevention of Coronary Heart Disease: A Meta-Analysis Comparing Remote Based Programs versus Usual Care and Center Based Programs

By

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**Abstract**

*Background:* The effectiveness of cardiac rehabilitation (CR) programs for coronary heart disease (CHD) is well established; it is associated with improved quality of life, risk factor reduction and, over the long term, a reduction in all cause and cardiac mortality. Despite this effectiveness, program uptake is poor, with as few as 20% of eligible patients participating. Remote CR programs have been developed as an alternative to center-based cardiac rehabilitation delivery and/or usual care. An up-to-date meta-analysis is needed to determine the effectiveness of remote CR compared to center based programs and usual care

*Purpose:* To determine the effectiveness of remote CR programs for CHD compared to usual care or center-based CR programming

*Method:* Systematic review of existing literature and meta-analysis of extracted data.

*Data Sources:* MEDLINE (1992–2014), the EBM Cochrane Central Register of Controlled Trials, EMBASE, CINAHL, PsycINFO, and Scopus were searched. Google Scholar and National Library of Medicine clinical trial registry (NLMCTR) were also hand searched as were the reference lists of applicable papers. An updated search was completed in November 2015.

*Study Selection:* Randomized control trials published in a peer-reviewed journal after the year 1995 were eligible for inclusion. 21 trials were identified for inclusion representing 5273 patients with CHD. *Data Extraction:* Two reviewers identified trials and extracted data independently; a random effects model was utilized to conduct statistical analysis.

*Limitations:* Interpretations were limited by the variable quality and heterogeneity of included trials. Poor description of the included CR programs also limited interpretation.

*Conclusions:* There is no statistically significant difference between remote CR and usual care (17 trials, N=4793 P=0.84, CI= 0.60-1.88) and remote CR and center based programing (3 Trials, N=720, P=0.71, CI: 0.42-3.54). However, remote CR programs are a superior option compared to usual care and a comparable option to center based delivery in relation to modifiable cardiac risk factors. Compared to

usual care, remote programs had a statistically significant impact on SBP (Trials= 9, N= 2516, P= 0.002, CI= -9.64-2.22), DBP (Trials= 6, N= 1836,p=0.005, CI -3.26—0.57), BMI (Trials=10, N=2761,

P=0.0009, CI: -1.25-0.32), TC Trials=10, N= 2709, p=0.0002, CI:-0.39-0.12 ), LDL (Trials=7, N=2007, P=0.0001, CI-0.34-0.11), smoking cessation (Trials=9, N=1492, P=0.005, CI: 0.21,0.76). Remote interventions were equally as effective as center based programing on SBP (Trails= 3, N= 611, P=0.88, CI =-3.28-2.81), DBP (Trials=3, N=603, p= 0.17. CI=-0.05-0.27), Total cholesterol (Trials=3, N=575, p=0.65, CI: -0.32-0.20), LDL (Trials=2, N=139, P=0.34, CI:-0.09,0.27), smoking cessation (Trials=2, N= 207, P= 0.97, CI: 0.21-0.76). The findings of this review indicate that remote CR programs are a more cost effective and scalable method of delivering CR programing to a broader group of participants.

## Preface

(Mandatory due to collaborative work)

A portion of the research conducted for this thesis is part of a CIHR-funded interdisciplinary collaboration for knowledge translation, led by Dr. Clark at the University of Alberta in collaboration with Professor. H. M. Arthur at McMaster University and co-investigators Oh, P., Stone, J., Briffa, T., Chambers, T., Choby, A., Neubeck, L., Redfern, J., Shiri, A. and Thirsk, L. (Clark, 2013b). The systematic review protocol outlined this manuscript was developed by myself, with the assistance of Dr. Dr. Clark. The literature review, data collection, synthesis and concluding analysis are my original work.

The data and synthesis of this thesis project are being developed for publication; this manuscript is not yet complete. I was responsible for the data collection, synthesis and analysis as well as drafting a manuscript. Dr. Clark assisted data synthesis, analysis and interpretation, and contributed to the development of this manuscript.

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## Chapter One: Introduction, Background and Purpose in the Context of the Literature

### 1.1 Coronary Heart Disease and Cardiac Rehabilitation Programs

The landscape of coronary heart disease (CHD) has change in recent decades. In the 1940's CHD related mortality accounted for half of all deaths in developed countries. At that time, prevention and treatment of CHD was so poorly understood that most people accepted an "early death from heart disease as unavoidable" (Mahmood, Levy, Vascan, & Wong, 2014). Over recent decades, longitudinal epidemiological studies such as the Framingham Heart Study have elucidated a greater understanding of the physiology and risk factors associated with the development of CHD (Kannel & McGee, 1979). Increased understanding of CHD has led to treatment advances such as coronary angiography, percutaneous coronary interventions, pharmacological therapies and risk factor modification. These developments have transformed the prevention and management of CHD and significantly decreased the occurrence of sudden CHD related mortality (Nabel, & Braunwald, 2012).

CHD has become a continuum that begins with the presence of cardiovascular risk factors and proceeds via progressive vascular disease to target organ damage, end-organ failure and eventual death (Daholf, 2010). An estimated 1.3 million Canadians currently live with CHD as a chronic condition (Heart and Stroke, 2014). An aging population, increasingly sedentary lifestyles and the rise of obesity all contribute to the incidence and prevalence of CHD and it is estimated that CHD will continue to be the primary cause of disability and hospitalization in the future (Mozaffarian et al., 2016). Consequently, health organizations and governments are increasingly prioritizing the implementation of both primary and secondary prevention strategies to reduce individuals' risk of future cardiac events.

Cardiac rehabilitation (CR) is secondary prevention programing for individuals with CHD (Dalal, Zawada, Jolly, Moxham, & Taylor, 2010). CR programs are "coordinated, multifaceted interventions designed to optimize cardiac patient's physical, psychological, and social functioning, in addition to stabilizing, slowing or even reversing the progression of the underlying atherosclerotic processes" (Leon, Franklin, Costa et al., 2005). CR programs typically include a combination of exercise, education, behaviour change, counselling and strategies that target modifiable CHD risk factor reduction (Briffa, Chow, Clark, & Redfern, 2013). Main modifiable CHD risk factors include: blood pressure, cholesterol panel, smoking behaviours, body weight composition and diabetes management (Canto, et al., 2011). CR programs are commonly delivered by a multidisciplinary team, which may include nurses, physicians, physiotherapists, occupational therapists, pharmacists, dieticians, psychologists, and social workers (Bethell, Lewin, & Dalal, 2008). CR programs are effective; participation reduces all-cause mortality by

20% and cardiac mortality by 26% over three years (Bethell, Lewin, & Dalal, 2008). Improved quality of life, functional status, reduced hospitalization and re-current myocardial infarction are also associated with participation (Wenger, 2008).

Despite the seeming effectiveness of CR, referral and participation rates are poor; only 10-25% of eligible participants attend (Zutz, Ignaszewski, Bates, & Lear, 2007). Barriers to participation include: lack of referrals, lack of access, distance to the program, other time commitments (Clark, Redfern, & Briffa, 2013) and not being aware of the importance of CR participation (Grace, Bennett, Arden, & Clark, 2013). Dislike of hospitals or group settings has also been cited as a deterrent to participation in traditional center based programs (Thompson & Clar, 2009).

While CR participation rates are generally low, it is alarmingly underutilized within certain populations; older adults, women, ethnic minorities, those of low socio-economic status or who live in rural areas are least likely to participate (Clark, Redfern, & Briffa, 2014). Despite being the least likely to attend, these people often carry the highest disease burden and risk for future CHD events (McSweeney, et al., 2016). Not only do these groups have a high CHD risk and disease burden, they also experience the most significant barriers to CR participation as they may not be able to take time off work, afford transportation or have family support to attend center based CR (O'Connor, & Willenius, 2012). Remote delivery of CR program content has the potential to increase participation and uptake in groups of people who are least likely to participate, yet would experience significant benefits.

### 1.2 Remote Cardiac Rehabilitation Programs

Remote healthcare interventions, which use technology platforms to deliver care to patients in their homes, are increasingly being utilized by healthcare systems to improve access and reduce costs (Moore, 2002). Remote CR programs have the potential to transform the delivery of CR programs in Canada, overcoming the barriers associated with participation. The cost of transportation, poor weather/road conditions, being away from family and feeling isolated in an urban setting all contribute to an under representation of rural citizens in CR programs (Sevean, Dampier, Spadoni, Strickland, & Pilatzke, 2009). Currently, despite Canada's relatively large and widely dispersed rural population, CR program delivery is concentrated in larger cities with 70% of all CR programs being supervised programs which take place in a center or hospital setting (Grace, et al., 2013; Polyzotis et al., 2012). Yukon, Northwest Territories and Iqaluit have no documented CR programs (Grace, Bennet, Ardern, & Clark, 2014). CR programs situated in urban centers makes it difficult for individuals living in rural and remote areas to access programming (Keating, Swindle, & Fletcher, 2011). The implementation of remote CR programs

has the potential to reach patients who would otherwise be unable to participate. The development and deployment of remote CR is becoming increasingly feasible as access to the internet and other technologies has become more common, advanced and affordable (Zutz, Ignaszewski, Bates, & Lear, 2007).

Remote CR programs also have the potential to benefit CHD patients who live in urban areas well (van de den Berg, Schumann, Kraft, & Hoffman, 2012). Urban dwelling CHD patients may not be able to participate in traditional center based CR programs due to decreased mobility, being a primary caregiver to a family member or work commitments. One of the potential benefits of remote CR programs is that they provide an alternative to center-based programing; the ability for patients to choose a program based on personal choice and preferences may improve participation for both rural and urban patients living with CHD.

### 1.3 Remote Cardiac Rehabilitation and Cost of Healthcare Delivery

CHD is the healthcare system's single most fiscally burdensome disease process, costing the Canadian economy approximately 20.9 billion dollars annually due to physician fees, hospital expenses, individuals' lost wages and decreased productivity (Tarride, et al., 2014; Heart and Stroke, 2014). Prevention programs which reduce individuals' risk of experiencing a future CHD event is a rational investment for healthcare organizations and governments to make. However, center based programs are costly to deliver as they have significant overhead costs due to acquiring and maintaining a physical space as well as paying staff salaries. Remote CR programs have the potential to be considerably more cost efficient method of delivering CR program compared to center based programs as they have lower overhead costs (Southard, 2008). Despite the high cost of center based programing, currently only 1025% of the eligible population benefit from programming due to poor program participation. Not only do remote programs have the potential to be a less costly method of delivering CR programing, they also have the potential of benefiting a greater number of eligible participants as they have the ability to overcome barriers associated with traveling, occupational and fiscal constraints preventing individuals from participating.

### 1.4 The Existing Literature

In 2011, a meta-analysis comparing the findings of 11 RCTs found that remote interventions had a nonstatistically significant effect on all-cause mortality (relative risk = 0.70, 95% confidence interval (CI) = 0.45–1.1; P = 0.12]) (Neubeck, et al, 2011). This analysis also determined that remote interventions had a favourable impact on BMI, BP, and a decrease in the number of participants who smoked cigarettes.

Since 2011, more RCTs investigating remote CR interventions have been added to the literature and an updated meta-analysis is now required.

In 2015, a meta-analysis comparing 9 trials was published, this study found that there was no statistically significant difference between remote interventions and center based interventions on exercise capacity, weight, SBP, DBP, lipid profile, smoking status, mortality, quality of life and psychosocial status (Haung, et al, 2015). However, this trial included studies that utilized out-dated technology platforms that do not reflect the technology that is available today to delivery remote healthcare interventions (McLean, & Clark, 2015). Further, this meta-analysis utilized a fixed effects statistical analysis opposed to a random effects model. Using a fixed effects statistical model does not account for the considerable methodological, clinical and statistical heterogeneity of the included studies and can produce varying results compared to a random effects model which would have been more appropriate considering the heterogeneity of the included studies (McLean, & Clark, 2015). Therefore, despite this recently published analysis, there continues to be a need for an up to date high quality meta-analysis that utilizes a random effects model of statistical analysis to compare remote interventions with usual care and center-based programs.

### 1.4 Problem Statement

While remote CR programs hold promise, their effectiveness needs to be confirmed by investigating their impact on patient outcomes and program uptake using recently published studies. Many RCTs have been completed comparing remote CR programs with usual care and traditional center based programing. The methodology and results of these trials vary widely. Conducting a meta-analysis and combining the results of these studies using a random effects statistical model will provide a more reliable and precise estimate of remote CR programing's effectiveness than one study alone (CRD, 2008).

### 1.5 Hypothesis

The hypothesis of this study is as follows:

*Null Hypothesis*: Meta-analysis will identify no differences between remote CR programs and center based CR programs and/or usual care in terms of their effect on outcomes including: all-cause mortality and modifiable cardiac risk factors.

*Alternative Hypothesis:* Meta-analysis will identify a difference between remote CR programs and center based CR programs and/or usual care in terms of their effect on outcomes including: all-cause mortality and modifiable cardiac risk factors.

### 1.6 Conclusion

In the last fifty years prevention and treatment of CHD has dramatically improved, causing CHD to evolve into a chronic illness, generating the need for effective secondary prevention programs to reduce the risk of future CHD events and further disability or death. Currently, secondary prevention programs for CHD are offered predominantly through center based programs that people must attend in person. While effective, the delivery of care in this way is costly and only 10-25% of eligible participations attend. The evolution of technology has made the delivery of CR remotely an increasingly feasible alternative. While multiple trials comparing remote CR and traditional CR and usual care have been conducted, there has been great heterogeneity between the trials; which has generated the need for a metaanalysis to determine the effectiveness of remotely delivered CR content.

## Chapter 2: Methodology

### 2.1 Research Question

The research question for this study was developed using the PICOS tool, a well-established format for developing research questions for systematic reviews (CRD, 2009). This tool frames the question in terms of **p**opulation, **i**ntervention, **c**omparator, **o**utcome and **s**tudy design; using this tool the following research question was developed:

How do remote CR programs compare to usual care or center based CR programs in CHD patient outcomes including re-hospitalization, recurrent MI, all-cause mortality, cardiovascular mortality and modifiable CHD risk factors.

### 2.2 Inclusion Criteria

Only RCTs were included; qualitative and pre-test post-test studies were excluded. Choosing to only include RCTs minimizes bias and increases the reliability of information included in the analysis (Taylor, 2001). Trials must have included participants over the age of 18 with a CHD diagnosis. The diagnosis of CHD included: patients with acute coronary syndromes (ACS), including ST elevation MI, Non-ST elevation MI, or angina (stable or unstable) or recently undergone coronary artery bypass grafting surgery (CABG) or percutaneous coronary intervention (PCI). Trials that included or were predominantly designed for heart failure patients were excluded due to the palliative nature of heart failure as well as the different medical management needs of heart failure patients compared to ACS patients (Manlucu, & Tang, 2014).

Trials that were published prior to the year 1995 were excluded. This is because of the rapid expansion and changes in CR, the evolution of technology as well as the changes that have occurred in ACS management over the past two decades. Single modality programs, such as exercise only or smoking cessation only programs were also excluded.

Trials in the review must have described a remote intervention compared to a center based program or usual care. A study was considered to have a remote intervention if greater than 50% of the program content was delivered remotely. Remote delivery methods included paper based, text message, email, web, telephone or other technological modalities to delivery content to patients in their homes (Neubeck,

2009). Language was not a formal limit, and if applicable trials published in other languages were identified, a translator was to be accessed and utilized; however, we accepted the possibility that such trials may have to be excluded at that time for feasibility issues.

Measured outcomes included all-cause mortality, re-current myocardial infarction, as well as modifiable cardiac risk factors (lipids, blood pressure, body weight), psychosocial outcomes including quality of life and depression scores were also included. Data comparing the cost of program delivery was also collected.

**2.3 Search methods**

A systematic search was performed to identify published RCTs of CR interventions comparing remote programs to center based programs or usual care. The search was developed in conjunction with Dr. Clark and a health librarian (Refer to Appendix A).The search included the following data bases: MEDLINE (1992–2014), the EBM Cochrane Central Register of Controlled Trials, EMBASE, CINAHL, PsycINFO, and Scopus were searched. Google Scholar and National Library of Medicine clinical trial registry (NLMCTR) were searched for unpublished dissertations and theses in the grey literature. Meta-analyses that exclude grey literature may increase the risk of exaggerating intervention effects, over-representing studies with statistically significant findings, potentially inflating effect size estimates and may provide less precise effect size estimates (Petticrew & Roberts, 2006). Conference abstracts were not included due to a lack of peer review. A hand search was also conducted in prominent cardiology journals, including: Circulation, European Journal of Preventive Cardiology. An updates search was conducted in November, 2015 and January 2016.

**2.4 Study Selection**

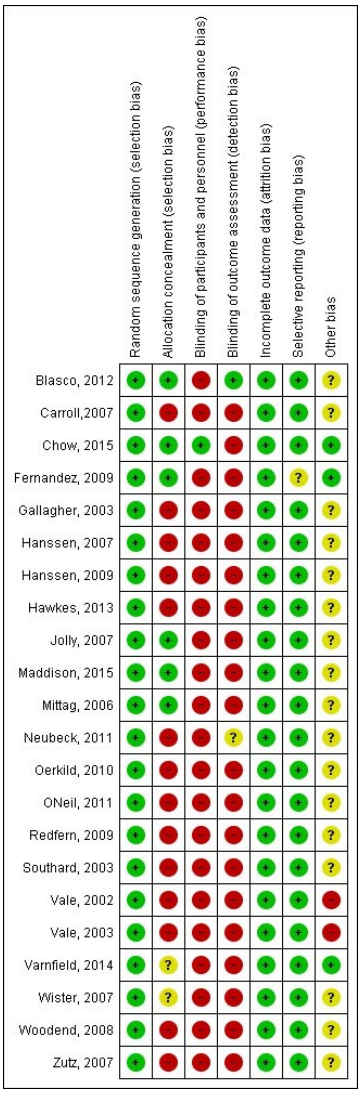
After the initial search was completed references were compiled into a reference manager (RefWorks). First, duplicate references were removed. The titles and abstracts of all citations were then screened to identify articles for potential inclusion. For each of the potential articles, the full text was obtained and reviewed against the inclusion/exclusion criteria. The primary author, L. McLean and fellow graduate student R. Ellis assessed titles and abstracts for inclusion and read potential manuscripts in their entirety. Disagreements were resolved by consensus or through consultation with A. Clark. Microsoft Excel was used to document all decisions regarding inclusion and exclusion of potential papers.

**2.5 Quality Assessment**

The Cochrane Collaboration Quality Assessment Tool was used to assess study quality. Selection bias

(sequence generation, allocation concealment), performance bias (blinding and other threats to validity), attrition bias (incomplete data and blinding of research staff), detection bias (blinding of outcome assessor) and reporting bias (selective reporting including intention to treat analysis) were evaluated according to CRD guidelines (CRD, 2009); see Table 2. While all included trials randomly assigned patients to the intervention group, there was limited blinding of the participants or assessors. While this is largely due to the nature of the trials, Chow did demonstrate some innovation when they blinded the providers and assessors to the participant's group allocation. This was possible because of the use of technology to deliver the intervention, an option that is not possible if care providers are actually delivering the intervention.

Table 2: Quality Assessment




## 2.6 Data Extraction and Analysis

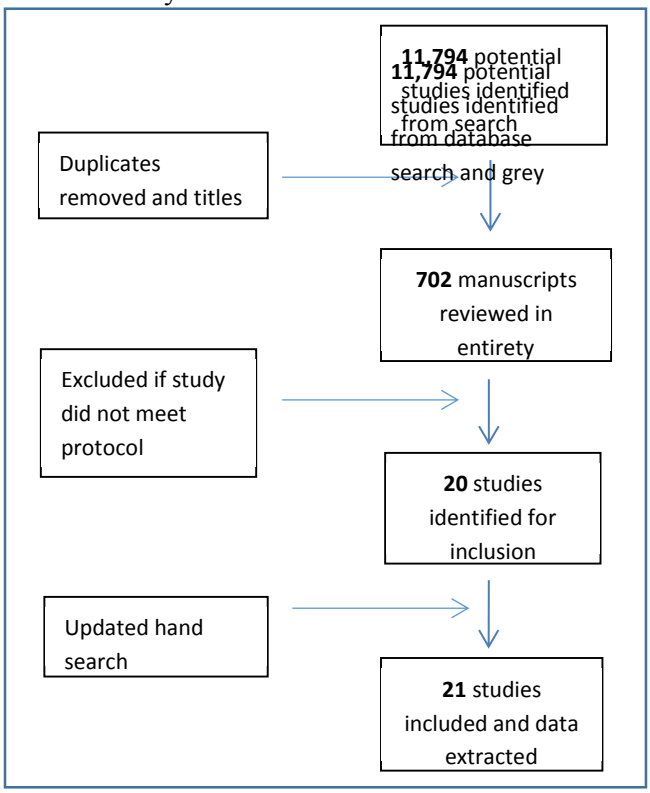
Data was extracted and analyzed using RevMan software. Data was extracted by L.McLean and the accuracy of the data extraction was verified by R. Ellis. Due to the statistical heterogeneity of the included studies, a random effects model of statistical analysis was used.

## Chapter 3: Results

### 3.1: Results

Initially, 11,794 citations were identified for potential inclusion through the literature search. After the initial screening, 702 manuscripts were reviewed in entirety. No significant disagreement regarding exclusion occurred between the two reviewers (L McLean and R Ellis). Any hesitancy between the two reviewers were resolved by consulting A Clark. Initially, 20 trials were identified for inclusions. An updated hand search using Google Scholar and the reference list of recent publications pertaining to CR was conducted in November 2015 and 1 additional trial was identified for inclusion. Data was then extracted for all 21 included trials.

Table 2: Study Selection




Data was extracted and analyzed for the following outcomes: all-cause mortality, SBP, DBP, cholesterol values, BMI, smoking rates. While other outcomes were included in our initial proposal, we were unable

to gather data regarding V02 max, METs score, because only one or no papers reported data on these outcomes.

### 3.2 Characteristics of the population

The 21 included trials represent data of a combined 5723 CHD patients with the average age of 60.9 years. Only 25% of the included trial participants were women. The underrepresentation of women in CHD trials has been previously identified as a shortcoming of CHD research and is particularly alarming as CHD is the number of cause of death and disability for women (Melloni, et al., 2010; Mozaffarian, et al., 2016). A wide range of ACS, post- MI, post-PCI and post-CABG patients were represented in the population.

Table 3: Population and Intervention Description

| **Remote Cardiac Rehabilitation Programs versus Usual Care** | | | | | | | |
|---|---|---|---|---|---|---|---|
| Author | N | Age | % Female | Study Population | Intervention | Usual Care | Follow Up |
| Blasco, 2012 | 203 | 60.8 | 20 | ACS | Text messages, counselling and remote telemonitoring | Cardiac rehabilitation referral, lifestyle counselling | 12 months |
| Carroll, 2007 | 247 | 76.3 | 66 | MI or CABG | Home visit within 72 hours, telephone calls at 2,6,10 week, 12 weekly calls from peer advisor | Usual care | 12 months |
| Chow, 2015 | 710 | 57.6 | 8 | post MI/PCI | Text messages that offered lifestyle support | Usual care including physician follow up | 6 months |
| Fernandez, 2009 | 51 | 57 | 2 | ACS | Telephone calls, selfhelp resource book, personalized letters | Information about heart disease, contact information for CR program | 8 weeks |
| Hanssen, 2007 | 288 | 60.2 | 24 | post MI | Telephone, individualized risk factor counseling | Follow up with specialist and GP | 6 months |
| Hanssen, 2009 | 288 | 60.2 | 24 | post MI | Telephone, individualized risk factor counseling | Follow up with specialist and GP | 18 months |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Hawkes, 2013 | 430 | 60.6 | 25 | post MI | 30 minute scripted telephone health coaching sessions | Written educational resources | 6 months |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Maddison, 2015 | 171 | 60.2 | 19 | Angina, MI or PCI | Text messages and a website with video messages | Usual care; encouragement to be active | 24 weeks |
| Mittag, 2006 | 343 | 59.85 | 18 | post MI, CABG, PCI | Monthly telephone calls; risk factor counseling, including exercise and nutrition | Written information mailed to them | 12 months |
| Neubeck, 2011 | 144 | 54.5 | 25 | ACS | Clinic visit plus telephone support | Usual care | 48 months |
| O'Neil, 2014 | 430 | 60.8 | 21 | post MI | Scripted telephone health coaching sessions | Written information | 6 months |
| Redfern, 2009 | 144 | 54.5 | 25 | ACS | Clinic visit plus telephone support | Usual care | 12 months |
| Southard, 2003 | 104 | 62 | 25 | CAD diagnosis | Online platform including education and online discussion | Usual care | 6 months |
| Vale, 2002 | 245 | 61.05 | 25 | PCI or CABG | Telephone coaching plus written information | Usual care | 6 months |
| Vale, 2003 | 792 | 58.45 | 23 | CAD diagnosis | Telephone coaching plus written information | Usual care | 6 months |
| Wister, 2007 | 296 | 56.9 | 32 | CAD diagnosis | Telephone coaching plus health report card | Usual care | 12 months |
| Woodend, 2008 | 128 | 64 | 18 | Angina | video conferencing and phone line transmission of weight BP, BP, ECGs | Usual care | 12 months |
| Zutz, 2007 | 15 | 58.5 | 20 | MI, PCI, CABG | Internet platform to deliver interactive CR content | Usual care | 12 weeks |
| **Remote Interventions versus Center Based Programing** | | | | | | | |
| Author | N | Age | % Female | Study Population | Intervention | Control | Follow Up |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Jolly, 2009 | 525 | 61.05 | 24 | Post MI/PCI | home visits, telephone follow up and the Heart Manual | CR program | 12 months |
| Oerkild, 2011 | 75 | 74.55 | 40 | MI/PCI/CABG | Home visits and telephone calls | CR program | 12 months |
| Varnfield, 2014 | 94 | 55.5 | 13 | post MI | Smartphone used to for health and exercise monitoring, | CR program | 6 months |
| | | | | | and delivery of motivational and educational materials and pre-installed audio and video files. | | |

### 3.3 Characteristics of the included trials

Significant heterogeneity exists between the encompassed trials in regards to the included population, characteristics of the intervention and characteristics of the center based programs and usual care. Intervention lengths and time to follow up also varied considerably between programs with follow up ranging 8 weeks to 18 months with the majority of follow up taking place between 12 weeks and 12 months. Unfortunately, most control groups programs were poorly described and did not provide pertinent information relating to the length, type and content of the control intervention or usual care.

Many trials utilized more than one method of delivering content. For example, Carroll (2007), included home visits as well as telephone calls. Telephone interventions that provided counseling to patients was the most common method of delivering CR content, however, text messaging has become increasingly popular in more recently published trials.

Table 4: Predominant Mode of Content Delivery

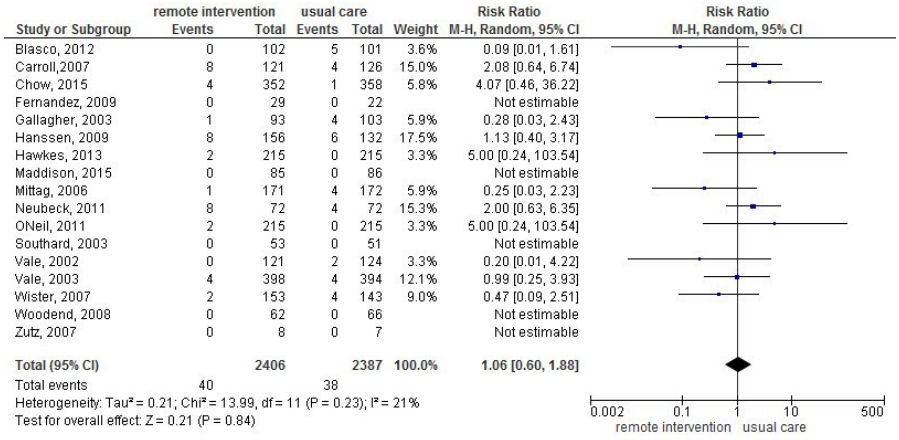
| Predominant Mode of CR Content Delivery | Number of Trials |
|---|---|
| Text Messages | 2 |
| Web based delivery | 4 |
| Telephone | 14 |
| Video conferencing | 1 |

### 3.4 All- Cause Mortality

3.4: A: All-cause mortality remote versus usual care

If studies did not report mortality data, the corresponding author was contacted and the missing data were obtained. Redfern et al. (2009) and Hanssen et al. (2007) were not included in this forest plot as Neubeck et al. (2011) and Hanssen et al. (2009) were long term follow up studies of the same patients, respectively. The incidence of mortality across the trials was low, likely due to the short follow up periods utilized in a majority of the trials. There was no statistically significant difference between remote interventions and usual care on the outcome of all-cause mortality (17 trials, N=4793 P=0.84, CI= 0.60-1.88).

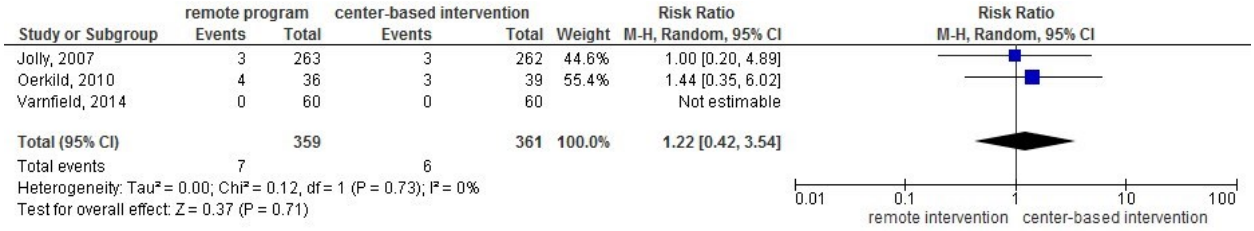
All-cause mortality: remote intervention versus usual care




3.4: B: All-cause mortality remote versus center based programs.

The three trials that compared remote interventions with center based interventions reported mortality data (Jolly, et al. 2007; Oerkild et al., 2010; Varnfield, et al., 2014). As in the remote versus usual care analysis there was no statistically significant difference between remote and center based programs on allcause mortality (3 Trials, N=720, P=0.71, CI: 0.42-3.54).

All-cause mortality remote versus center-based program

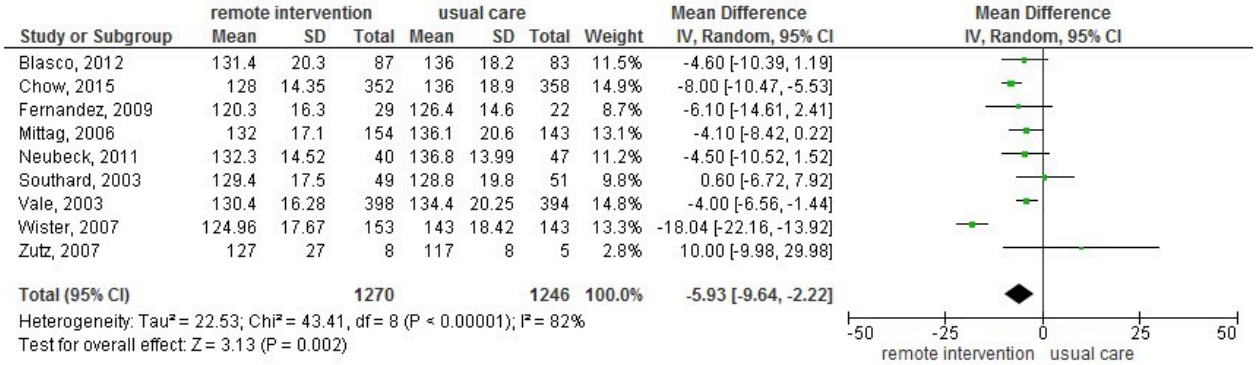



### 3.5: Systolic Blood Pressure

A: Systolic Blood Pressure Remote versus Usual care

Nine of the included trials comparing remote interventions with usual care reported systolic blood pressure data (Blasco et al.,2009; Chow et al., 2009; Fernandez et al., 2009; Mittag et al., 2006;, Neubeck et al., 2011; Southard et al., 2003; Vale et al.,2003; Wister et al., 2007; Zutz et al., 2007). Remote programs compared to usual care had a statistically significant impact on systolic blood pressure reduction (Trials= 9, N= 2516, P= 0.002, CI= -9.64-2.22).

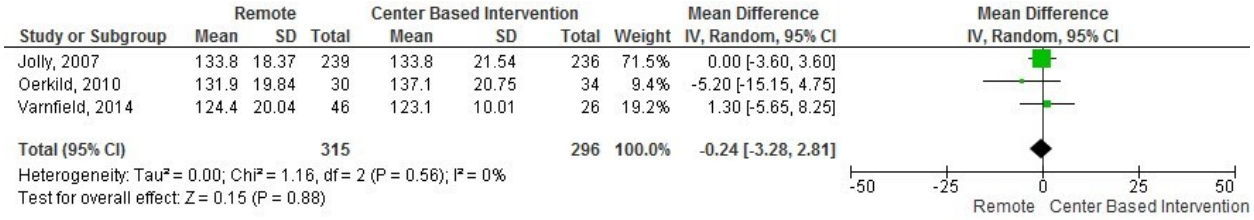
Systolic Blood Pressure Remote versus Usual Care




B: Systolic Blood Pressure Remote versus Center- Based

All three trials comparing remote interventions to center based interventions reported systolic blood pressure data (Jollyet al, 2007; Oerkild,et al, 2010; Varnfield et al., 2014). There is not statistically significant difference between remote programs and center based programs in regards to systolic blood pressure (Trails= 3, N= 611, P=0.88, CI =-3.28-2.81)

Systolic Blood Pressure Remote versus Center Based Program

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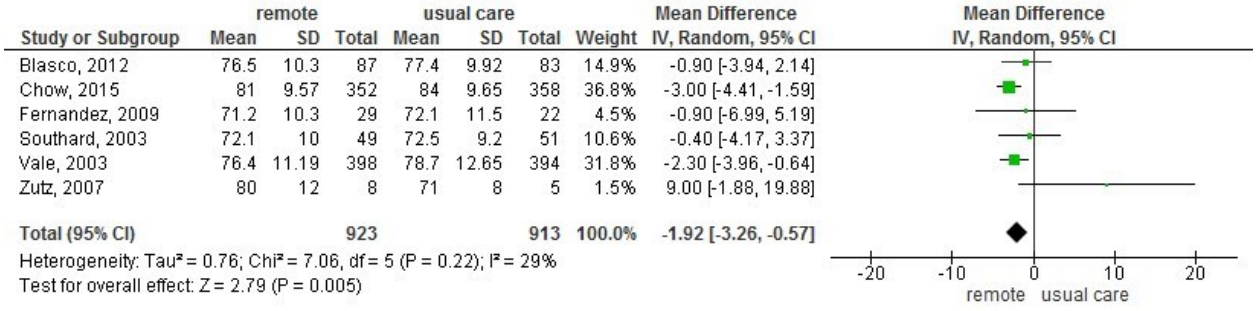
### 3.6 Diastolic Blood pressure

A: Diastolic blood Pressure Remote versus Usual Care

Six trials comparing remote to usual care reported diastolic blood pressure follow up data (Blasco 2012, Chow 2015, Fernandez 2009, Southard 2003, Vale 2003, Zutz 2007). Just as with systolic blood pressure, remote versus usual care is statistically significant (Trials= 6, N= 1836,p=0.005, CI -3.26—0.57).

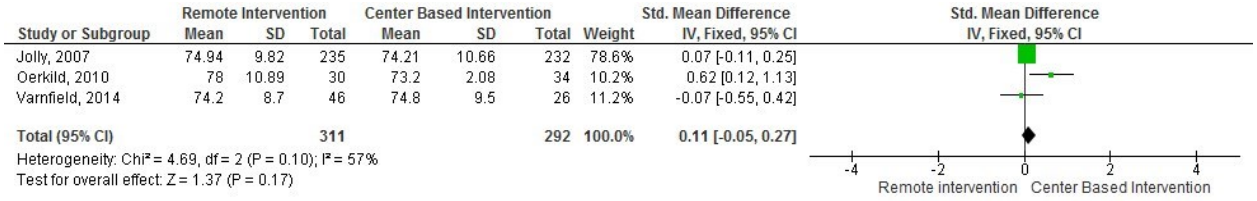
Diastolic Blood Pressure Remote versus Usual Care




B: Diastolic blood pressure remote versus center based

All three trials in this comparison group reported diastolic blood pressure data (Jolly 2007, Oerkild 2010, Varnfield 2014). There was no statistically significant difference between remote and center based programs (Trials=3, N=603, p= 0.17. CI=-0.05-0.27).

Diastolic Blood Pressure Remote versus Center Based

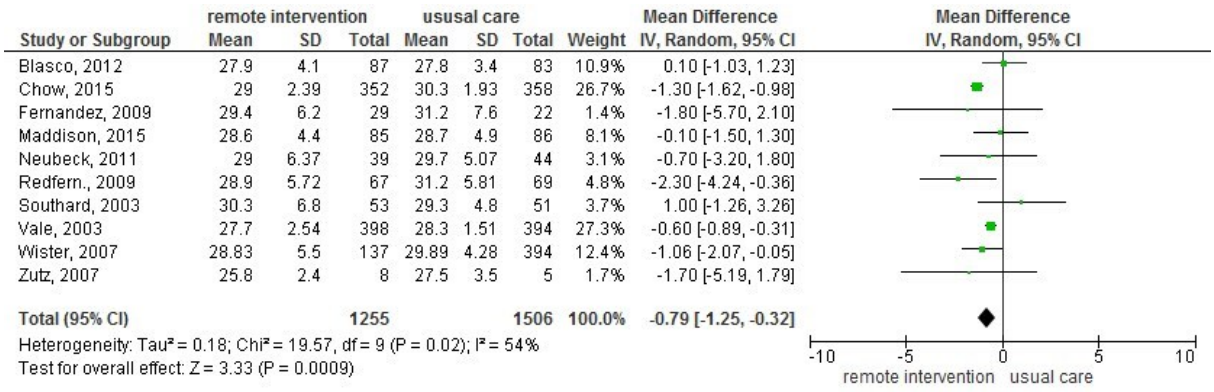



**3.7: BMI**

A: Remote intervention versus usual care

Ten trials reported BMI data. A statistically significant difference, favoring remote interventions was found. (Trials=10, N=2761, P=0.0009, CI: -1.25-0.32).

BMI Remote versus Usual Care




B: Remote intervention versus center based program

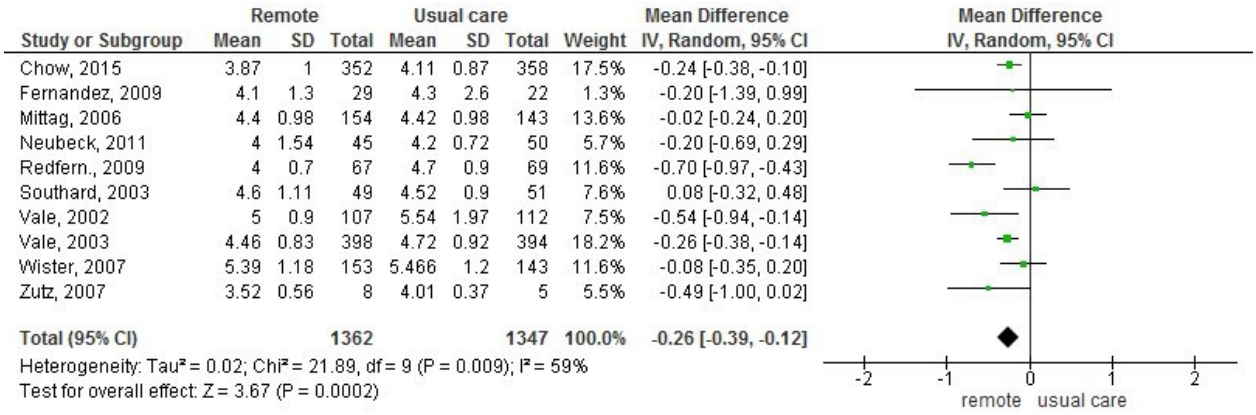
Only one trial (Oerkild) reported data regarding BMI. Consequently, results could not be pooled.

### 3.8: Total Cholesterol

A: Total cholesterol remote versus usual care:

Ten trials reported data on total cholesterol levels. A statistically significant difference, favouring remote interventions exists. (Trials=10, N= 2709, p=0.0002, CI:-0.39-0.12).

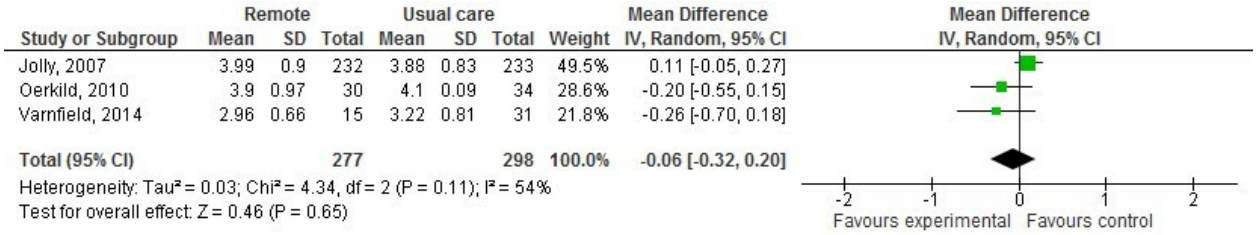
Total Cholesterol Remote versus Usual Care




B: Total Cholesterol remote versus center based

All three trials comparing remote interventions with center based interventions reported total cholesterol data. However, a statistically significant difference between the two programs does not exist (Trials=3, N=575, p=0.65, CI: -0.32-0.20).

Total Cholesterol Remote versus Usual Care

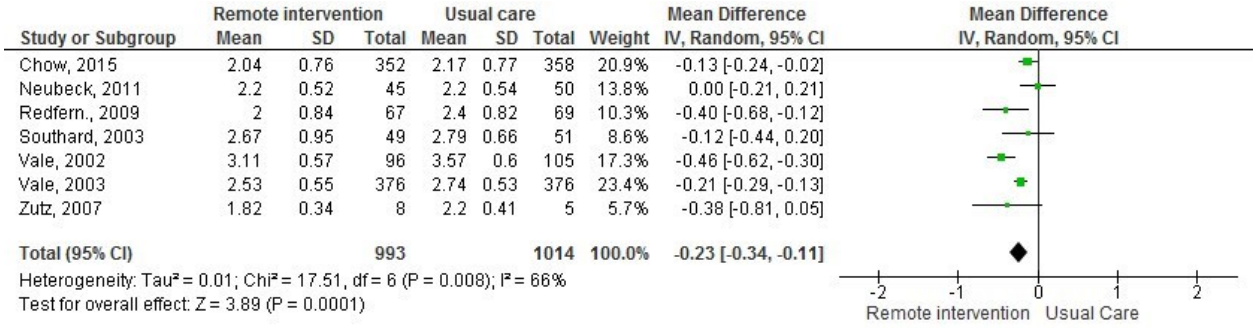



### 3.9: Low Density Lipoproteins

A: LDL Remote versus usual care

Seven trials reported data on Low density lipoproteins (LDL). There was a statistically significant difference, favoring remote interventions (Trials=7, N=2007, P=0.0001, CI-0.34-0.11).

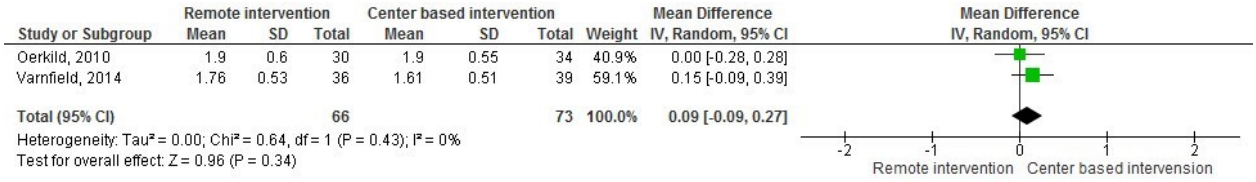
LDL Remote versus Usual Care




B: LDL remote versus center based program

Only two trials reported data comparing LDL data (Oerkild and Varnfield). (Trials=2, N=139, P=0.34, CI:-0.09,0.27).

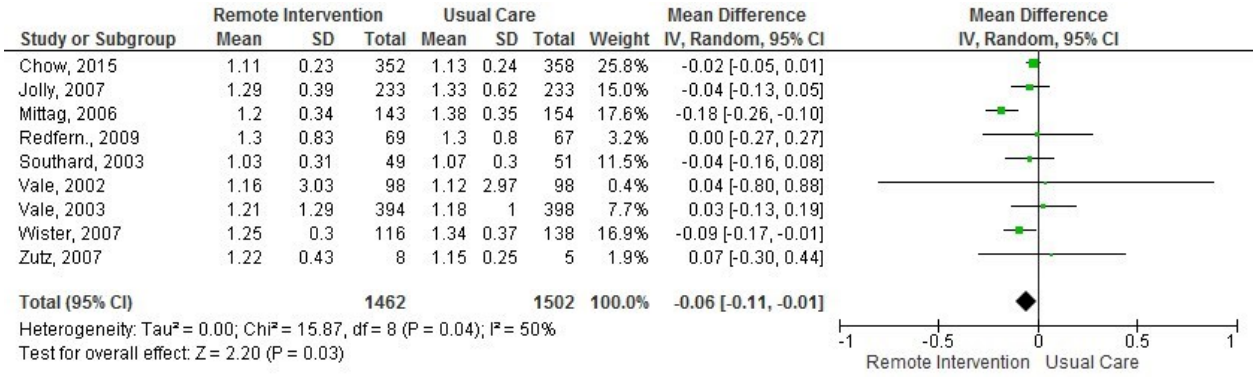
LDL Remote versus Center Based



### 3.10: High Density Lipoproteins

A: HDL remote intervention versus usual care

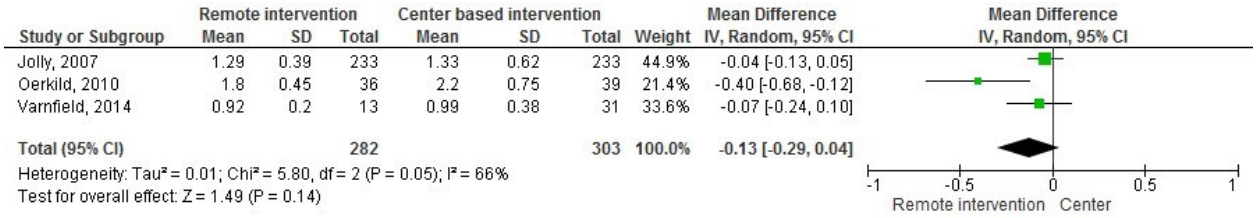
Nine trials reported data on HDL (Chow 2015, Jolly 2007, Mittag 2006, Redfern 2009, Southard 2003, Vale 2002, Vale 2003, Wister 2007, Zutz 2007). The remote intervention had a statistically significant effect on HDL compare to usual care (Trials= 9, N= 2964, p= 0.03, CI: -0.11,-0.01). HDL Remote versus Usual Care




B: HDL Remote intervention versus center based

All three of the included trials included data on HDL (Jolly, 2007, Oerkild, 2010, Varnfield 2014). There was no statistically significant difference between program delivery and HDL (Trials=3, N= 585, p = 0.14, CI: -0.29,0.04).

HDL Remote versus Center Based

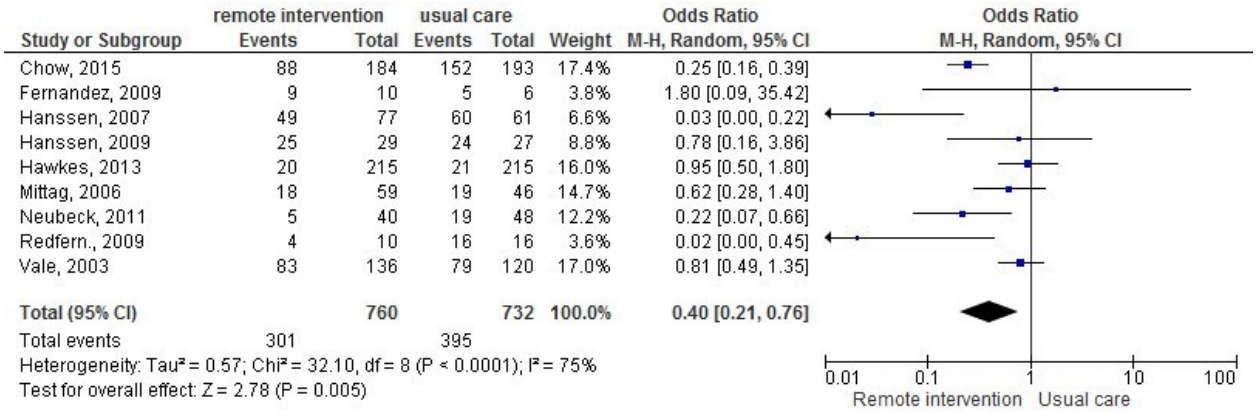


### 3.11: Smoking cessation

A: Smoking cessation remote intervention versus usual care

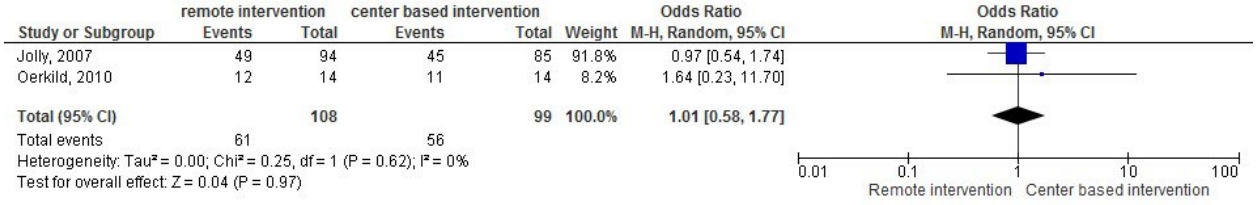
Nine trials reported data on smoking cessation. A statistically significant difference, favoring remote interventions was found (Trials=9, N=1492, P=0.005, CI: 0.21,0.76). Please note that this is the number of individuals that were smoking at the time that final outcomes were collected, it does not reflect a change from the beginning to the end of the trial.

Table:




B: Smoking cessation remote versus centre based program:

Only two studies comparing remote interventions with center based programs reported smoking cessation data. There was not statistically significant different outcomes between the two interventions. (Trials=2, N= 207, P= 0.97, CI: 0.21-0.76).




### 3.12: Psychosocial Outcomes

Fifteen different tools were utilized by included trials to collect psychosocial outcomes, making it impossible to statistically compare these outcomes. The following tools were used to collect psychosocial outcomes: PAIS scale, symptom checklist, SF-36, HRQOL, HADS, Beck Depression Scale, Cardiac

Depression Scale, Perceived Stress health confidence, SF-36, Seattle Angina Questionnaire, Psychological Distress Scale, Depression, Anxiety and Stress Scale, DASS, EQ5D- Index.

### 3.13 Economic costs

Only three trials (Southard, Maddison, Chow) examined the economic implications of a remotely delivered CR program. The internet program delivered over the course of six months by Southard cost $453.00/per participants while Maddison's program cost 239.00/per participant. Most striking, however, was Chow's study which was remarkably cost effective to deliver. The program which delivered text messages directly to participant's cell phone cost only $10.00 for 96 text messages. This indicates that remote interventions have the potential to be cost effective and scalable at a low cost. This is a particularly relevant insight as most people, from all economic backgrounds, have cell phones (Chow et al., 2015).

## Chapter #4 Discussion and Recommendations

### 4.1. Discussion

This meta-analysis presents the largest, most comprehensive and up to date comparison of remote CR programs with traditional, center based CR programs and usual care. There is no statistically significant impact on mortality between remote interventions and usual care or center based CR programs. This finding is likely in part due to the short follow up periods utilized in the included studies; previous metaanalysis has indicated that mortality effects are not fully realized until the three year follow up point (Clark, Hartling, & Vandermeer, 2005).

In comparison to usual care, remote interventions consistently demonstrate a statistically significant benefit on modifiable CHD risk factors, including: SBP, DBP, TC, LDL, TC, HDL and smoking cessation. The benefit remote programs have on multiple cardiac risk factors is striking, as risk factors rarely occur in isolation and instead tend to cluster in individuals (Weycker, Nichols, O'Keefe-Rosetti, Edelsberg, Khan, Kuara, & Oster, 2007). For example, individuals who are obese, typically have multiple cardiac risk factors and a modest weight reduction of just 5-10% has a positive effect on reducing blood pressure, cholesterol and blood glucose levels (Wing, et al., 2011). Clustering of risk factors is an important phenomenon to consider as these factors interact synergistically, together magnifying individual's total risk of CHD. Individuals with a single risk factor have a fourfold risk of having a cardiac event compared to an individual with no risk factors while an individual with five risk factors have a 60 fold risk of having a CHD event (Kannel, 1976; Wilson, Kannel, Silbershatz, & Agostino, 1999).

While there was no overall significant reduction in mortality, our findings that remote CR can reduce CHD risk factors is a key in the development of cardiac services and care. In particular, our findings are interesting considering remote CR is frequently posited as a fall back option to center based programing. Remote CR is often used when center based CR is not available or when patients are unwilling or unable to participate in traditional CR (Wakefield, Drwal, Scerubel, Klobucar, Johnson, & Kaboli, 2014). If not explicitly stated that remote CR is a second rate option, it is at least underdeveloped and underutilized in comparison to center based CR (Dalal, Zwada, Jolly, Moxham, & Taylor, 2010). Our analysis of the most up to date studies indicates that remote CR is an equal alternative to center based programing and has the potential to be an even more cost effective one. This was particularly evident in Chow et al (2015)'s intervention which delivered a remote program via text messaging for just 10 dollars per participant. Participation in this remote intervention reduced BMI, SBP, LDL, and increased physical activity and smoking cessation rates.

In light of the poor uptake of CR, remote interventions are particularly promising in terms of expanding the number of people who have access to CR. Previous studies have identified barriers to participation, highlighting patients' knowledge of services, patient identity, perceptions of heart disease and financial or occupational constraints (Clark, et al., 2012). Remote intervention have the potential to overcome at least some of these barriers, including financial and occupational constraints relating to traditional CR uptake. They also have the potential to serve locations such as Yukon, Northwest Territories and Iqaluit which currently have no documented CR programs (Grace, Bennet, Ardern, & Clark, 2014). While our analysis has identified that remote interventions are an effective alternative to a center based program and superior to usual care, further research is required to explore the actual uptake of remote programs.

### 4.2 Limitations

The conclusions of this analysis is limited by the quality of trials currently available in the literature. Overall, the RCTs utilized short follow up periods and demonstrated significant methodological heterogeneity in regards to program delivery, content, and follow up. This study reflects our previous observation that the literature requires strengthening (Clark, & McLean, 2015). There is also significant differences in what "usual care" means, ranging from a referral to center based cardiac rehabilitation to follow up with a general practitioner or cardiologist. Overall, future studies should attempt to describe usual care in a more comprehensive manner as this will allows for more accurate comparisons in future analysis.

Favorable effects were also seen in quality of life, psychosocial factors and cost delivery, however these were difficult to quantify given the diversity of methodologies that were utilized. As mentioned above, fifteen different tools were used to collect data on psychosocial and quality of life outcomes, rendering if impossible to pool them statistically.

### 4.3 Implications

Our analysis included the most up to date trials, reflecting current technology platforms and CR program designs. The finding that remote program is equally effective as center based and more effective than usual care is an important finding for administrators and CR stakeholders.

Despite the benefit of CR, the fact that it only benefits 10-25% of the eligible population is of significant concern. Remote programs provide flexibility and the ability to overcome barriers to participation associated with traditional, center based CR participation. Our analysis indicates that organizations should continue to value the development and implementation of remote programs. Given the value of both

traditional and remote CR, the choice of which program individuals access should reflect personal choice and preference of the participant.

CHD remains the most costly disease process in developed countries, far outpacing the cost of cancer care (Mozaffarian, 2016). In 2011, CHD cost the Canadian healthcare system an estimated 20.9 billion dollars (Heart & Stroke, 2014). Improved participation in CR reduces future healthcare costs. However, the delivery of center based CR is itself expensive for healthcare systems to sustain. Center based programs incur significant overhead costs associated with paying for healthcare provider and administrator salaries and a physical space to deliver the program  Our analysis suggests that remote CR has the potential to be a cost effective method of delivering CR content. For example, the Chow et al. (2015) intervention delivered an effective program at the cost of just 10 dollars per participant. Little research exists regarding the cost effectiveness of delivering traditional center based CR in comparison to remote programs and this is a need for future research to help guide organizations.

Our analysis has also identified future opportunities for research. Trails that include long term follow up points and explore the effectiveness of different times, content and length of program delivery are needed. The underrepresentation of female participants is a significant challenge in the current literature. Not only are women represented, outcomes for men and women are almost always pooled together. Future trials should present the findings for each sex separately in order for sex based differences to be observed. Furthermore, additional comparisons of the cost effectiveness of program delivery and an investigation on the impact of quality of life and psychosocial outcomes may assist in the development of efficient and responsive programing.

### 4.4 Conclusion

Our analysis found that remote CR program are equally effective to center based programs and superior to usual care in terms of modifiable risk factor modification; there was no statistically significant difference between program delivery and mortality. Healthcare organizations and policy makers must consider these findings when planning for future care delivery and program participation should reflect participant choice and preference. We have also identified clear gaps in the literature and opportunities for future investigations.

## CHAPTER #5: Conclusion

### 5.1 Implications for Nursing

The presence of technology in healthcare delivery is becoming inevitable as organizations look to contain the rapidly escalating costs of delivering healthcare (Kvedar, Coye & Everett, 2014). While the utilization of technology is an opportunity to potentially contain healthcare costs and improve access and quality of care, it also has significant implications for patients, providers and organizations. Nurses, who are uniquely positioned at the intersection between technology, individuals, clinical environments and communities are both affected and have an opportunity to influence and interpret the relationship between technology, health care and human experience (Barnard, 2002). The nursing profession has a rich history of championing innovative solutions to healthcare's complex challenges (Hughes, 2006). Healthcare research, clinical practice, business, technology and health policy have all benefited from the profession's innovations. Using technology to provide care is not new to the profession as nurses have long used tools and technologies to achieve needed ends (Barnard, 2002). However, the use of technology to deliver care from a distance does shift the meta-physical relationship that has historically been a significant attribute of the nursing-patient relationship (Nagel, Pomerleau, & Penner, 2013).

There is a need for further philosophical and empirical enquiry into the impact on both nurses and patients. However, technology is less likely to produce desired outcomes without appropriate understanding of the relationship between technology and healthcare, adequate education and enhancement of knowledge and skills- of which, nurses are an integral part (Pacey, 1983). As much as the increased utilization of technology in healthcare delivery will change the landscape of nursing and what it means to provide nursing care, this challenge is also an opportunity for nurses to continue to be leaders in innovating care and optimizing the well being of patients and populations.

### 5.2 Final Conclusion

Our analysis evaluated twenty-one trials that measured the effectiveness of remote CR programs with usual care or center based programs. The included trials did demonstrate significant heterogeneity between programs, measured outcomes and comparison control groups. However, by accounting for this heterogeneity in our statistical approach, and the utilization of a random effects statistical model, we were able to conclude that remote interventions are superior to usual care and equally effective to center based programs in regards to modifiable risk factor modification. There was no effect between programs on mortality. Due to the stated heterogeneity, we were not able to draw conclusions pertaining to the optimal design of the study such as how long the intervention should be or the optimal content. We were also

unable to draw conclusions regarding the effectiveness of programs on quality of life or psychosocial outcomes or make a direct comparison of the cost of delivering different programs. Newer trials such as Chow, et al. (2015) who delivered an effective program for just ten dollars per person, does indicate that remote interventions could be a cost effective method of delivering CR content and indicates a need for future investigation in this area.

To date, remote CR programs have been posited as a fall back to center based CR when center based programing is not available or patients are not willing to participate in center based programing. Our analysis indicates that remote interventions are superior to usual care and equally as effective as center based programing. Considering that CR programing is effective, yet significantly underutilized, remote CR programs are emerging as an opportunity for improving CR participation as remote programs are not associated with some of the barriers typically associated with CR participation. Remote programs have the potential to be available to people who live in rural communities who may only have usual care available to them and as an option to people who do not wish/cannot participate in traditional programs; which program individuals participate in should reflect personal choice and preference. As the prevalence of CHD and the cost of healthcare delivery continue to increase in the future, there will continue to be pressure to deliver healthcare through modalities that contain costs and remotely delivered CR has the potential to do this.

While the findings of this analysis are limited due to the heterogeneity and poor quality of studies available in the literature at this time. Our findings found significant gap in the existing literature, further reinforcing the need for a large RCT trial with an extended follow up point to further develop an understanding of the benefits of remotely delivered CR; further investigation is also needed to explore the cost effectiveness.

It is anticipated that the burden of CHD will continue to grow in the future. It is already one of the most costly and disabling disease processes of our time. CR can contribute to combating the burden of CHD as it is effective at reducing future events and improves quality of life. That being said, there is significant work to be done as only 20-25% of participants are currently reached and there are substantial barriers to participation. Our analysis indicates that remote intervention is an effective method of delivery that has the potential to overcome barriers associated with traditional, center based delivery. We have also identified needs for future investigation to further enhance CR in the future.

References

Barnard, A. (2002). Philosophy of technology and nursing. *Nursing Philosophy*, *3*(1), 15-26.

Bethell, H. J., Lewin, R. J., & Dalal, H. M. (2008). Cardiac rehabilitation: It works so why isn't it done? *British Journal of General Practice, 58*(555), 677-679.

Blasco, A., Carmona, M., Fernández-Lozano, I., Salvador, C. H., Pascual, M., Sagredo, P. G.,.... & Alonso-Pulpón, L. (2012). Evaluation of a telemedicine service for the secondary prevention of coronary artery disease. *Journal of cardiopulmonary rehabilitation and prevention*, *32*(1), 25-31.

Briffa, T. G., Hobbs, M. S., Tonkin, A., Sanfilippo, F. M., Hickling, S., Ridout, S. C., et al. (2011). Population trends of recurrent coronary heart disease event rates remain high. *Circulation. Cardiovascular Quality and Outcomes, 4*(1), 107-113.

CRD's Guidance for undertaking reviews in health care. Centre for Review and Dissemination, New York, 2008.

Canto, J. G., Kiefe, C. I., Rogers, W. J., Peterson, E. D., Fredrick, P. D., French, W. J.,… & NRMI Investigators. (2011). Number of coronary heart disease risk factors and mortality in patients with first myocardial infarction. *JAMA, 306* (19), 2120-2127.

Carroll, D. L., Rankin, S. H., & Cooper, B. A. (2007). The effects of a collaborative peer advisor/advanced practice nurse intervention: cardiac rehabilitation participation and rehospitalization in older adults after a cardiac event. *Journal of Cardiovascular Nursing*, *22*(4), 313-319.

Chow, C. K., Redfern, J., Hillis, G. S., Thakkar, J., Santo, K., Hackett, M. L., ... & Thiagalingam, A.(2015). Effect of lifestyle-focused text messaging on risk factor modification in patients with coronary heart disease: a randomized clinical trial. *JAMA*, *314*(12), 1255-1263.

Clark, A. M., Hartling, L., Vandermeer, B., & McAlister, F. A. (2005). Meta-analysis: secondary prevention programs for patients with coronary artery disease. *Annals of internal medicine*, *143*(9), 659-672.

Clark, A. M., King-Shier, K. M., Thompson, D. R., Spaling, M. A., Duncan, A. S., Stone, J. A., ... & Angus, J. E. (2012). A qualitative systematic review of influences on attendance at cardiac rehabilitation programs after referral. *American heart journal*, *164*(6), 835-845.

Clark, A. M., Arthur, H. M., Briffa, T., Refern, J., Neubeck, L., & Shiri, A. (2013) What components matter most in secondary prevention interventions for coronary heart disease?: Better data for better knowledge usage. *CIHR grant proposal*.

Clark, A. M., Redfern, J., & Briffa, T. (2013). Cardiac rehabilitation: Fit to face the future? *Heart,100* (5), 355-356.

Dahlöf, B. (2010). Cardiovascular disease risk factors: epidemiology and risk assessment. *The American Journal of Cardiology*, *105*(1), 3A-9A

Dalal, H. M., Zawada, A., Jolly, K., Moxham, T., & Taylor, R. S. (2010). Home based versus centre based cardiac rehabilitation: Cochrane systematic review and meta-analysis. *BMJ, 340,* b5631.

Fernandez, R. S., Davidson, P., Griffiths, R., Juergens, C., Stafford, B., & Salamonson, Y. (2009). A pilot randomised controlled trial comparing a health-related lifestyle self-management intervention with standard cardiac rehabilitation following an acute cardiac event: Implications for a larger clinical trial. *Australian Critical Care*, *22*(1), 17-27.

Grace, S. L., Bennett, S., Ardern, C. I., & Clark, A. M. (2013). Cardiac rehabilitation series: Canada. *Progress in Cardiovascular Diseases, 53* (5), 530-535.

Huang, K., Liu, W., He, D., Huang, B., Xiao, D., Peng, Y., ... & Huang, D. (2015). Telehealth interventions versus center-based cardiac rehabilitation of coronary artery disease: A systematic review and meta-analysis. *European journal of preventive cardiology*, *22*(8), 959-971.

Hanssen, T. A., Nordrehaug, J. E., Eide, G. E., & Hanestad, B. R. (2007). Improving outcomes after myocardial infarction: a randomized controlled trial evaluating effects of a telephone follow-up intervention. *European Journal of Cardiovascular Prevention & Rehabilitation*, *14*(3), 429-437.

Hanssen, T. A., Nordrehaug, J. E., Eide, G. E., & Hanestad, B. R. (2009). Does a telephone follow-up intervention for patients discharged with acute myocardial infarction have long-term effects on

health-related quality of life? A randomised controlled trial. *Journal of Clinical Nursing*, *18*(9), 1334-1345.

Hawkes, A. L., Patrao, T. A., Atherton, J., Ware, R. S., Taylor, C. B., O'Neil, A., ... & Oldenburg, B. F. (2013). Effect of a Telephone-Delivered Coronary Heart Disease Secondary Prevention Program (ProActive Heart) on quality of life and health behaviours: primary outcomes of a randomised controlled trial. *International Journal of Behavioral Medicine*, *20*(3), 413-424.

Kannel, W. B. (1976). Some lessons in cardiovascular epidemiology from Framingham. *The American Journal of Cardiology*, *37*(2), 269-282.

Keating, N., Swindle, J., & Fletcher, S. (2011). Aging in rural Canada: A retrospective and review. *Canadian Journal on Aging/La Revue canadienne du vieillissement*, *30*(03), 323-338.

Heart and Stroke Foundation. (2014). Statistics. Retrieved from http://www.heartandstroke.com/site/c.ikIQLcMWJtE/b.3483991/k.34A8/Statistics.htm

Hughes, F. (2006). Nurses at the forefront of innovation. *International Nursing Review*, *53*(2), 94-101.

Jolly, K., Lip, G. Y., Taylor, R. S., Raftery, J., Mant, J., Lane, D., ... & Stevens, A. (2009). The Birmingham Rehabilitation Uptake Maximisation study (BRUM): a randomised controlled trial comparing home-based with centre-based cardiac rehabilitation. *Heart*, *95*(1), 36-42.

Kvedar, J., Coye, M.J., & Everett, W. (2014). Connected health: A review of technologies and strategies to improve patient care with telemedicine and telehealth. Health Affaire, 33 (2), 194-199.

Leon, A. S., Franklin, B. A., Costa, F., Balady, G. J., Berra, K. A., Stewart, K. J., et al. (2005). Cardiac rehabilitation and secondary prevention of coronary heart disease: An American Heart Association scientific statement from the council on clinical cardiology (subcommittee on exercise, cardiac rehabilitation, and prevention) and the council on nutrition, physical activity, and metabolism (subcommittee on physical activity), in collaboration with the American Association of Cardiovascular and Pulmonary Rehabilitation. *Circulation, 111*(3), 369-376.

Maddison, R., Pfaeffli, L., Whittaker, R., Stewart, R., Kerr, A., Jiang, Y., ... & Rawstorn, J. (2014). A mobile phone intervention increases physical activity in people with cardiovascular disease: Results from the HEART randomized controlled trial. *European Journal of Preventive Cardiology*, heartjnl-2014.

Mahmood, S. S., Levy, D., Vasan, R. S., & Wang, T. J. (2014). The Framingham Heart Study and the epidemiology of cardiovascular disease: a historical perspective. *The Lancet*, *383*(9921), 9991008.

Manlucu, J., & Tang, A. S. (2014). Whom should I refer in 2014 for cardiac resynchronization?. *Canadian Journal of Cardiology*, *30*(6), 675-678.

McLean, L. D., & Clark, A. M. (2015). Telehealth interventions versus center-based cardiac rehabilitation: It's time to strengthen the evidence. *European Journal of Preventive Cardiology*, 2047487315604834.

McSweeney, J. C., Rosenfeld, A. G., Abel, W. M., Braun, L. T., Burke, L. E., Daugherty, S. L., ... & Reckelhoff, J. F. (2016). Preventing and Experiencing Ischemic Heart Disease as a Woman: State of the Science A Scientific Statement From the American Heart Association. *Circulation*, *133*(13), 1302-1331.

Melloni, C., Berger, J. S., Wang, T. Y., Gunes, F., Stebbins, A., Pieper, K. S., ... & Newby, L. K. (2010). Representation of women in randomized clinical trials of cardiovascular disease prevention. *Circulation: Cardiovascular Quality and Outcomes*, *3*(2), 135-142.

Mittag, O., China, C., Hoberg, E., Juers, E., Kolenda, K. D., Richardt, G., ... & Raspe, H. (2006). Outcomes of cardiac rehabilitation with versus without a follow-up intervention rendered by telephone (Luebeck follow-up trial): overall and gender-specific effects. *International Journal of Rehabilitation Research*,*29*(4), 295-302.

Moore, S. K. (2002). Extending healthcare's reach. *Spectrum, IEEE*, *39*(1), 66-71.

Mozaffarian, D., Benjamin, E. J., Go, A. S., Arnett, D. K., Blaha, M. J., Cushman, M., ... & Howard, V. J. (2016). Executive Summary: Heart Disease and Stroke Statistics—2016 Update A Report From the American Heart Association. *Circulation*, *133*(4), 447-454.

Nabel, E. G., & Braunwald, E. (2012). A tale of coronary artery disease and myocardial infarction. *New England Journal of Medicine*, *366*(1), 54-63.

Nagel, D. A., Pomerleau, S. G., & Penner, J. L. (2013). Knowing, caring, and telehealth technology "Going the Distance" in nursing practice. *Journal of Holistic Nursing*, *31*(2), 104-112.

Neubeck, L., ulie Redfern, J., Fernandez, R., Briffa, T., Bauman, A., & Freedman, S. B. (2009). Telehealth interventions for the secondary prevention of coronary heart disease: a systematic review. *European Journal of Cardiovascular Prevention & Rehabilitation*, *16*(3), 281-289.

Neubeck, L., Freedman, S. B., Briffa, T., Bauman, A., & Redfern, J. (2011). Four-year follow-up of the Choice of Health Options In prevention of Cardiovascular Events randomized controlled trial. *European Journal of Cardiovascular Prevention & Rehabilitation*, *18*(2), 278-286.

O'Connor, A., & Wellenius, G. (2012). Rural–urban disparities in the prevalence of diabetes and coronary heart disease. *Public health*, *126*(10), 813-820.

Oerkild, B., Frederiksen, M., Hansen, J. F., Simonsen, L., Skovgaard, L. T., & Prescott, E. (2011). Home based cardiac rehabilitation is as effective as centre-based cardiac rehabilitation among elderly with coronary heart disease: results from a randomised clinical trial. *Age and ageing*, *40*(1), 78-85.

O'Neil, A., Hawkes, A. L., Atherton, J. J., Patrao, T. A., Sanderson, K., Wolfe, R., ... & Oldenburg, B. (2014). Telephone-delivered health coaching improves anxiety outcomes after myocardial infarction: the 'ProActive Heart'trial. *European journal of preventive cardiology*, *21*(1), 30-38.

Pacey, A. (1983). The Culture of Technology. MIT Pres, Massachusetts.

Papadakis, S., Reid, R. D., Coyle, D., Beaton, L., Angus, D., & Oldridge, N. (2008). Cost-effectiveness of cardiac rehabilitation program delivery models in patients at varying cardiac risk, reason for referral, and sex. *European Journal of Cardiovascular Prevention and Rehabilitation : Official Journal of the European Society of Cardiology, Working Groups on Epidemiology & Prevention and Cardiac Rehabilitation and Exercise Physiology, 15*(3), 347-353.

Petticrew, M., & Roberts, H. (2006). How to appraise the studies: an introduction to assessing study quality. *Systematic reviews in the social sciences: A practical guide*, 125-163.

Polyzotis, P. A., Tan, Y., Prior, P. L., Oh, P., Fair, T., & Grace, S. L. (2012). Cardiac rehabilitation services in Ontario: Components, models and underserved groups. *Journal of Cardiovascular Medicine (Hagerstown, Md.), 13*(11), 727-734. doi:10.2459/JCM.0b013e32835794c1

Redfern, J., Briffa, T., Ellis, E., & Freedman, S. B. (2009). Choice of secondary prevention improves risk factors after acute coronary syndrome: 1-year follow-up of the CHOICE (Choice of Health Options In prevention of Cardiovascular Events) randomised controlled trial. *Heart*, *95*(6), 468-475.

Sevean, P., Dampier, S., Spadoni, M., Strickland, S., & Pilatzke, S. (2009). Patients and families experiences with video telehealth in rural/remote communities in northern Canada. *Journal of Clinical Nursing, 18* (18), 2573-2579.

Southard, B. H., Southard, D. R., & Nuckolls, J. (2003). Clinical trial of an Internet-based case management system for secondary prevention of heart disease. *Journal of Cardiopulmonary Rehabilitation and Prevention*, *23*(5), 341-348.

Tarride, J. E., Hopkins, R., Blackhouse, G., Bowen, J. M., Bischof, M., Von Keyserlingk, C., et al. (2010). A review of methods used in long-term cost-effectiveness models of diabetes mellitus treatment. *Pharmacoeconomics, 28*, 255-277.

Taylor, R. (2001). Cardiac rehabilitation: What more evidence do we need? *Coronary Health Care, 5*(2), 59-60.

Thompson, D. R., & Clark, A. M. (2009). Cardiac rehabilitation: into the future. *Heart*, *95*(23), 18971900.

Vale, M. J., Jelinek, M. V., Best, J. D., Dart, A. M., Grigg, L. E., Hare, D. L., ... & McNeil, J. J. (2003). Coaching patients On Achieving Cardiovascular Health (COACH): a multicenter randomized trial in patients with coronary heart disease. *Archives of Internal Medicine*, *163*(22), 2775-2783.

Vale, M. J. (2002). Coaching patients on achieving cardiovascular health: the COACH program a patient targeted strategy for the secondary prevention of coronary heart disease. *Journal of Clinical Epidemiology, (55); 245-252.*

van den Berg, N., Schumann, M., Kraft, K., & Hoffmann, W. (2012). Telemedicine and telecare for older patients—a systematic review. *Maturitas*,*73*(2), 94-114.

Varnfield, M., Karunanithi, M., Lee, C. K., Honeyman, E., Arnold, D., Ding, H., ... & Walters, D. L. (2014). Smartphone-based home care model improved use of cardiac rehabilitation in postmyocardial infarction patients: results from a randomised controlled trial. *Heart*, heartjnl-2014.

Weycker, D., Nichols, G. A., O'Keeffe-Rosetti, M., Edelsberg, J., Khan, Z. M., Kaura, S., & Oster, G. (2007). Risk-Factor Clustering and Cardiovascular Disease Risk in Hypertensive Patients*. *American journal of hypertension*,*20*(6), 599-607.

Wakefield, B., Drwal, K., Scherubel, M., Klobucar, T., Johnson, S., & Kaboli, P. (2014). Feasibility and effectiveness of remote, telephone-based delivery of cardiac rehabilitation. *Telemedicine and eHealth*, *20*(1), 32-38.

Wing, R. R., Lang, W., Wadden, T. A., Safford, M., Knowler, W. C., Bertoni, A. G., ... & Look AHEAD Research Group. (2011). Benefits of modest weight loss in improving cardiovascular risk factors in overweight and obese individuals with type 2 diabetes. *Diabetes care*, *34*(7), 1481-1486.

Wister, A., Loewen, N., Kennedy-Symonds, H., McGowan, B., McCoy, B., & Singer, J. (2007). One-year follow-up of a therapeutic lifestyle intervention targeting cardiovascular disease risk. *Canadian Medical Association Journal*,*177*(8), 859-865.

Woodend, A. K., Sherrard, H., Fraser, M., Stuewe, L., Cheung, T., & Struthers, C. (2008). Telehome monitoring in patients with cardiac disease who are at high risk of readmission. *Heart & Lung: The Journal of Acute and Critical Care*,*37*(1), 36-45.

Zutz, A., Ignaszewski, A., Bates, J., & Lear, S. A. (2007). Utilization of the Internet to deliver cardiac rehabilitation at a distance: A pilot study. *Telemedicine and e-Health, 13* (3), 323-33

**Appendix A:**

| Platform | Database | Date of Search | # of Citations Retrieved |
|---|---|---|---|
| Ovid | MEDLINE 1946- | February 4, 2014 | 1646 |
| | MEDLINE In-Process & Other Non-Indexed Citations | February 4, 2014 | 56 |
| | Embase 1988- | February 4, 2014 | 2379 |
| | PsycINFO 1987- | February 4, 2014 | 671 |
| | EBM Reviews – Cochrane Central Register of Controlled Trials | February 5, 2014 | 955 |
| EBSCOhost | CINAHL | February 5, 2014 | 1634 |
| Web of Knowledge | Web of Science<br>Science Citation Index Expanded (SCIEXPANDED) --1900-present<br>Social Sciences Citation Index (SSCI) -1900-present<br>Conference Proceedings Citation Index-Science (CPCI-S) --1990-present<br>Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH) -1990-present<br>Book Citation Index– Science (BKCI-S) -2005-present<br>Book Citation Index– Social Sciences & Humanities (BKCI-SSH) --2005-present | February 5, 2014 | 2645 |
| | Scopus | February 10, 2014 | 1808 |
| | | Sub-Total | 11 794 |
| | | Duplicates<br>Total | |

# Medline & Medline in process

1. heart diseases/ or myocardial ischemia/ or acute coronary syndrome/ or angina pectoris/ or exp angina, unstable/ or coronary disease/ or coronary aneurysm/ or coronary artery disease/ or coronary occlusion/ or coronary stenosis/ or coronary thrombosis/ or myocardial infarction/
2. (coronary artery disease* or atherosclerotic heart disease* or Arteriosclerotic heart disease*).ti,ab.
3. (Acute coronary syndrome* or angina or heart attack or myocardial infarct* or heart infarct*).ti,ab.
4. ((Ischem* or ischaem*) adj3 (heart or cardio* or myocard* or coronary)).ti,ab.
5. ((coronary or heart) adj3 (aneurysm* or occlusion* or stenosis or thrombosis)).ti,ab.
6. or/1-5
7. Secondary Prevention/
8. secondary prevent*.ti,ab.
9. recurrence/pc or (recur* adj3 prevent*).ti,ab.
10. (manag* adj2 (illness or disease)).ti,ab.
11. (dh or rh).fs.
12. or/7-11
13. (program* or clinic$1 or session* or educat* or class* or service).mp.
14. 6 and 12 and 13
15. risk reduction behavior/ or disease management/
16. exp Patient Education as Topic/
17. exp health education/
18. ((educat* or rehabilit* or prevent* or manag*) adj3 (program* or clinic$1)).ti,ab.
19. (cardiac rehabilitation or cardiopulmonary rehabilitation).ti,ab.
20. (nurs* adj (intervention* or manage*)).tw.
21. or/15-20
22. 6 and 21
23. diet/
24. Exercise/
25. Smoking Cessation/ or "tobacco use cessation"/
26. Medication Adherence/
27. 23 and 24
28. 23 and 25
29. 23 and 26
30. 24 and 25
31. 24 and 26
32. 25 and 26
33. or/27-32
34. 6 and 33
35. cognitive therapy/ or "acceptance and commitment therapy"/ or mindfulness/
36. (cognitive behavioral therapy or behavior therapy or cognitive therapy).mp.
37. heart manual.mp.
38. or/35-37
39. 6 and 38
40. exp Home Care Services/ or Telemedicine/
41. (home care or homecare or (remote adj3 monitor*) or (tele-health or telehealth or tele-medicine or telemedicine or tele-nurs* or telenurs* or telemonitor* or tele-monitor*)).ti,ab.
42. 40 or 41
43. 6 and 42
44. 14 or 22 or 34 or 39 or 43 45. randomized controlled trial.pt.

46. clinical trial.pt.
47. randomi?ed.ti,ab.
48. placebo.ti,ab.
49. randomly.ti,ab.
50. trial.ti,ab.
51. or/45-50
52. animals/
53. 51 not 52
54. 44 and 53
55. limit 54 to (english language and yr="1995 -Current")
56. remove duplicates from 55
57. 39 and 53
58. limit 57 to (english language and yr="1995 -Current")
59. remove duplicates from 58
60. 43 and 53
61. limit 60 to (english language and yr="1995 -Current")
62. remove duplicates from 61

# Embase

1. *heart disease/ or exp *heart aneurysm/ or exp *heart arrhythmia/ or exp *intracardiac thrombosis/ or exp *ischemic heart disease/ or exp *myocardial disease/ or exp *pericardial disease/ or exp *valvular heart disease/
2. (coronary artery disease* or atherosclerotic heart disease* or Arteriosclerotic heart disease*).ti,ab.
3. (Acute coronary syndrome* or angina or heart attack or myocardial infarct* or heart infarct*).ti,ab.
4. ((Ischem* or ischaem*) adj3 (heart or cardio* or myocard* or coronary)).ti,ab.
5. ((coronary or heart) adj3 (aneurysm* or occlusion* or stenosis or thrombosis)).ti,ab.
6. or/1-5
7. *secondary prevention/
8. secondary prevent*.ti,ab.
9. (recur* adj3 prevent*).ti,ab.
10. (manag* adj2 (illness or disease)).ti,ab.
11. or/7-10
12. (program* or clinic$1 or session* or educat* or class* or service).mp.
13. 6 and 11 and 12
14. *risk reduction/
15. *disease management/
16. exp *health education/
17. heart rehabilitation/
18. ((educat* or rehabilit* or prevent* or manag*) adj3 (program* or clinic$1)).ti,ab.
19. (cardiac rehabilitation or cardiopulmonary rehabilitation).ti,ab.
20. (nurs* adj (intervention* or manage*)).tw.
21. or/14-20
22. 6 and 21
23. exp diet/
24. exp exercise/
25. smoking cessation/ or smoking cessation program/
26. medication compliance/

27. 23 and 24
28. 23 and 25
29. 23 and 26
30. 24 and 25
31. 24 and 26
32. 25 and 26
33. or/27-32
34. 6 and 33
35. cognitive therapy/
36. (cognitive behavioral therapy or behavior therapy or cognitive therapy).mp.
37. heart manual.mp.
38. or/35-37
39. 6 and 38
40. home care/
41. exp telemedicine/
42. (home care or homecare or (remote adj3 monitor*) or (tele-health or telehealth or tele-medicine or telemedicine or tele-nurs* or telenurs* or telemonitor* or tele-monitor*)).ti,ab.
43. 40 or 42
44. 6 and 43
45. 13 or 22 or 34 or 39 or 44
46. exp clinical trial/ 47. randomi?ed.ti,ab.
48. placebo.ti,ab.
49. randomly.ti,ab.
50. trial.ti,ab.
51. or/46-50
52. animal/
53. 51 not 52
54. 45 and 53
55. limit 54 to (english language and yr="1995 -Current")
56. remove duplicates from 55
57. 39 and 54
58. limit 57 to (english language and yr="1995 -Current")
59. 44 and 53
60. limit 59 to (english language and yr="1995 -Current")

# PsycINFO

1. exp cardiovascular disorders/
2. (coronary artery disease* or atherosclerotic heart disease* or Arteriosclerotic heart disease*).mp.
3. (Acute coronary syndrome* or angina or heart attack or myocardial infarct* or heart infarct*).mp.
4. ((Ischem* or ischaem*) adj3 (heartor cardio* or myocard* or coronary)).mp.
5. ((coronary or heart) adj3 (aneurysm* or occlusion* or stenosis or thrombosis)).mp.
6. or/1-5
7. secondary prevent*.mp.
8. (recur* adj3 prevent*).mp.
9. disease management/
10. (manag* adj2 (illness or disease)).mp.

11. health behavior/ or preventive medicine/
12. client education/
13. health education/
14. ((educat* or rehabilit* or prevent* or manag*) adj3 (program* or clinic$1)).mp.
15. (cardiac rehabilitation or cardiopulmonary rehabilitation).mp.
16. (nurs* adj (intervention* or manage*)).mp.
17. or/7-16
18. 6 and 17
19. diets/
20. exp physical activity/
21. smoking cessation/
22. treatment compliance/
23. 19 and 20
24. 19 and 21
25. 19 and 22
26. 20 and 21
27. 20 and 22
28. 21 and 22
29. or/23-28
30. 6 and 29
31. cognitive behavior therapy/ or exp behavior modification/ or exp behavior therapy/ or cognitive restructuring/ or cognitive therapy/
32. (cognitive behavioral therapy or behavior therapy or cognitive therapy).mp.
33. heart manual.mp.
34. 31 or 32 or 33
35. 6 and 34
36. telemedicine/
37. home care/
38. (home care or homecare or (remote adj3 monitor*) or (tele-health or telehealth or tele-medicine or telemedicine or tele-nurs* or telenurs* or telemonitor* or tele-monitor*)).mp.
39. or/36-38
40. 6 and 39
41. 18 or 30 or 35 or 40
42. clinical trials/
43. randomi?ed.ti,ab.
44. placebo.ti,ab.
45. randomly.ti,ab.
46. trial.ti,ab.
47. or/42-46
48. 41 and 47
49. limit 48 to (english language and yr="1995 -Current")

# EBMR Central

1. heart diseases/ or myocardial ischemia/ or acute coronary syndrome/ or angina pectoris/ or exp angina, unstable/ or coronary disease/ or coronary aneurysm/ or coronary artery disease/ or coronary occlusion/ or coronary stenosis/ or coronary thrombosis/ or myocardial infarction/
2. (coronary artery disease* or atherosclerotic heart disease* or Arteriosclerotic heart disease*).ti,ab.
3. (Acute coronary syndrome* or angina or heart attack or myocardial infarct* or heart infarct*).ti,ab.

4. ((Ischem* or ischaem*) adj3 (heart or cardio* or myocard* or coronary)).ti,ab.
5. ((coronary or heart) adj3 (aneurysm* or occlusion* or stenosis or thrombosis)).ti,ab.
6. or/1-5
7. Secondary Prevention/
8. secondary prevent*.ti,ab.
9. recurrence/pc or (recur* adj3 prevent*).ti,ab.
10. (manag* adj2 (illness or disease)).ti,ab.
11. (dh or rh).fs.
12. or/7-11
13. (program* or clinic$1 or session* or educat* or class* or service).mp.
14. 6 and 12 and 13
15. risk reduction behavior/ or disease management/
16. exp Patient Education as Topic/
17. exp health education/
18. ((educat* or rehabilit* or prevent* or manag*) adj3 (program* or clinic$1)).ti,ab.
19. (cardiac rehabilitation or cardiopulmonary rehabilitation).ti,ab.
20. (nurs* adj (intervention* or manage*)).tw.
21. or/15-20
22. 6 and 21
23. diet/
24. Exercise/
25. Smoking Cessation/ or "tobacco use cessation"/
26. Medication Adherence/
27. 23 and 24
28. 23 and 25
29. 23 and 26
30. 24 and 25
31. 24 and 26
32. 25 and 26
33. or/27-32
34. 6 and 33
35. cognitive therapy/ or "acceptance and commitment therapy"/ or mindfulness/
36. (cognitive behavioral therapy or behavior therapy or cognitive therapy).mp.
37. heart manual.mp.
38. or/35-37
39. 6 and 38
40. exp Home Care Services/ or Telemedicine/
41. (home care or homecare or (remote adj3 monitor*) or (tele-health or telehealth or tele-medicine or telemedicine or tele-nurs* or telenurs* or telemonitor* or tele-monitor*)).ti,ab.
42. 40 or 41
43. 6 and 42
44. 14 or 22 or 34 or 39 or 43 45. randomized controlled trial.pt.
46. clinical trial.pt.
47. randomi?ed.ti,ab.

48. placebo.ti,ab.
49. randomly.ti,ab.
50. trial.ti,ab.
51. or/45-50
52. animals/
53. 51 not 52
54. 44 and 53
55. limit 54 to yr="1995 - Current"
56. 43 and 53
57. limit 56 to yr="1995 - Current"
58. 39 and 53
59. limit 58 to yr="1995 - Current"

# CINAHL

| # | Query | |
|---|---|---|
| S1 | (MH "Heart Diseases") OR (MH "Arrhythmia+") OR (MH "Heart Arrest+") OR (MH "Myocardial Diseases+") OR (MH "Myocardial Ischemia+") OR (MH "Aneurysm+") OR (MH "Ischemia+") OR (MH "Hypertension+") OR (MH "Vascular Diseases") | |
| S2 | ( "coronary artery disease*" or "atherosclerotic heart disease*" or "Arteriosclerotic heart disease*" ) OR ( "Acute coronary syndrome*" or angina or "heart attack" or "myocardial infarct*" or "heart infarct*" ) OR ( (ischaem*) N3 (heart or cardio* or myocard* or coronary) ) OR ( (ischem*) N3 (heart or cardio* or myocard* or coronary) ) | |

**Limiters/Expanders**

Search modes - Find all my search terms

| | | |
|---|---|---|
| | | Search modes - Find all my search terms |
| S3 | ( (heart) N3 (aneurysm* or occlusion* or stenosis or thrombosis) ) OR ( (coronary) N3 (aneurysm* or occlusion* or stenosis or thrombosis) ) | Search modes - Find all my search terms |

| | | |
|---|---|---|
| | | Search modes - Find all my search terms |
| | | - |
| S4 | S1 OR S2 OR S3 | |
| | | - |
| S5 | (MH "Recurrence") | Search modes Find all my search terms |
| S6 | "secondary prevention" OR ( manag* N2 (illness or disease) ) | Search modes Find all my search terms |
| S7 | S5 OR S6 | Search modes - Find all my search terms |
| S8 | program* or clinic or session* or educat* or class* or service | Search modes - Find all my search terms |
| S9 | S7 AND S8 | Search modes - Find all my search terms |
| S10 | S4 AND S9 | Search modes - Find all my search terms |
| S11 | (MH "Disease Management") OR (MH "Patient Education+") OR (MH "Health Education+") OR (MH "Rehabilitation, Cardiac+") | Search modes - Find all my search terms |
| S12 | ( educat* N3 (program* or clinic) ) OR ( rehabilit* N3 (program* or clinic) ) OR ( prevent* N3 (program* or clinic) ) OR ( manag* N3 (program* or clinic) ) | Search modes - Find all my search terms |
| S13 | "cardiac rehabilitation" or "cardiopulmonary rehabilitation" | Search modes - Find all my search terms |
| S14 | "nurs* intervention" OR "nurse manag*" | Search modes - Find all my search terms |

Search modes - Find all my search terms

-

-

S15 S11 OR S12 OR S13 OR S14

Search modes - Find all my search terms

S16 S4 AND S15

Search modes Find all my search terms

S17 (MH "Diet+")

Search modes Find all my search terms

S18 (MH "Exercise+")

(MH "Smoking Cessation") OR (MH "Smoking Cessation S19 Programs")

Search modes - Find all my search terms

Search modes - Find all my search terms

S20 (MH "Medication Compliance")

Search modes - Find all my search terms

S21 S17 AND S18

Search modes - Find all my search terms

S22 S17 AND S19

Search modes - Find all my search terms

S23 S17 AND S20

Search modes - Find all my search terms

S24 S18 AND S19

Search modes - Find all my search terms

S25 S18 AND S20

| | |
|---|---|
| | Search modes - Find all my search terms |
| | - |
| | - |
| | Search modes - Find all my search terms |
| S26 S19 AND S20 | |
| | Search modes - Find all my search terms |
| S27 S21 OR S22 OR S23 OR S24 OR S25 OR S26 | |
| | Search modes - Find all my search terms |
| S28 S4 AND S27 | |
| S29 (MH "Cognitive Therapy+") | |

Search modes - Find all my search terms

-

-

"cognitive behavioral therapy" or "behavior therapy" or
S30 "cognitive therapy"
Search modes Find all my search terms

S31 "heart manual" Search modes Find all my search terms

S32 S29 OR S30 Search modes - Find all my search terms

S33 S4 AND S32 Search modes - Find all my search terms

S34 S31 OR S33 Search modes - Find all my search terms

S35 (MH "Home Health Care+") OR (MH "Telehealth+") Search modes - Find all my search terms

( "home care" or homecare or "tele-health" or telehealth or "telemedicine" or telemedicine or "tele-nurs*" or telenurs* or
S36 telemonitor* or "tele-monitor" ) OR remote N3 monitor* Search modes - Find all my search terms

S37 S35 OR S36 Search modes - Find all my search terms

S38 S4 AND S37 Search modes - Find all my search terms

S39 S10 OR S16 OR S28 OR S34 OR S38 Search modes - Find all my search terms

S40 (MH "Clinical Trials+") Search modes - Find all my search terms
S41 PT Clinical trial Search modes - Find all my search terms

| | |
|---|---|
| | Search modes - Find all my search terms |
| S42 TX clinic* n1 trial* | |
| TX ( (singl* n1 blind*) or (singl* n1 mask*) ) or TX ( (doubl* n1 blind*) or (doubl* n1 mask*) ) or TX ( (tripl* n1 blind*) or (tripl* n1 mask*) ) or TX ( (trebl* n1 blind*) or (trebl* n1 S43 mask*) ) Search modes - Find all my search terms | |
| S44 TX "randomi* control* trial*" | Search modes - Find all my search terms |
| S45 (MH "Random Assignment") | Search modes - Find all my search terms |
| S46 TX random* allocat* | Search modes - Find all my search terms |
| S47 TX placebo* | Search modes - Find all my search terms |
| S48 (MH "Placebos") | Search modes - Find all my search terms |
| S49 S40 OR S41 OR S42 OR S43 OR S44 OR S45 OR S46 OR S47 OR S48 | Search modes - Find all my search terms |
| S50 S39 AND S49 | Search modes - Find all my search terms |
| S51 S39 AND S49 | Limiters - English Language; Published Date: 1995010120141231; Research Article Search modes - Find all my search terms |
| S52 S38 AND S49 | Search modes - Find all my search terms |
| S53 S38 AND S49 | Limiters - English Language; Published Date: 1995010120141231; Research |

| | |
|---|---|
| | Article Search modes - Find all my search terms |
| S54 S34 AND S49 | Search modes - Find all my search terms<br>Limiters - English Language; Published Date: 1995010120141231; Research Article Search modes - Find all my search terms |
| S55 S34 AND S49 | |

## Web of Science

Science Citation Index Expanded (SCI-EXPANDED) --1900-present
Social Sciences Citation Index (SSCI) --1900-present
Conference Proceedings Citation Index- Science (CPCI-S) --1990-present
Conference Proceedings Citation Index- Social Science & Humanities (CPCI-SSH) --1990-present
Book Citation Index– Science (BKCI-S) --2005-present
Book Citation Index– Social Sciences & Humanities (BKCI-SSH) --2005-present

| | |
|---|---|
| #1 | TS=("coronary artery disease*" or "atherosclerotic heart disease*" or "Arteriosclerotic heart disease*" or "Acute coronary syndrome*" or angina or "heart attack" or "myocardial infarct*" or "heart infarct*") |
| #2 | TS=(ischaem* NEAR/3 heart) OR TS=(ischaem* NEAR/3 cardio*) OR TS=(ischaem* NEAR/3 myocard*) OR TS=(ischaem* NEAR/3 coronary) |
| #3 | TS=(ischem* NEAR/3 heart) OR TS=(ischem* NEAR/3 cardio*) OR TS=(ischem* NEAR/3 myocard*) OR TS=(ischem* NEAR/3 coronary) |
| #4 | TS=(heart NEAR/3 aneurysm*) OR TS=(heart NEAR/3 occlusion*) OR TS=(heart NEAR/3 stenosis) OR TS=(heart NEAR/3 thrombosis) |
| #5 | TS=(coronary NEAR/3 aneurysm*) OR TS=(coronary NEAR/3 occlusion*) OR TS=(coronary NEAR/3 stenosis) OR TS=(coronary NEAR/3 thrombosis) |
| #6 | #5 OR #4 OR #3 OR #2 OR #1 |
| #7 | TS=("secondary prevention" OR recurrence) |
| #8 | TS=(manag* NEAR/2 illness) OR TS=(manag* NEAR/2 disease) |

| | |
|---|---|
| #9 | TS=(program* or clinic or session* or educat* or class* or service) |
| #10 | #8 OR #7 |
| #11 | #10 AND #9 |
| #12 | #11 AND #6 |
| #13 | TS=("disease management" OR "patient education" OR "health education" OR "cardiac rehabilitation" OR "cardiopulmonary rehabilitation") |
| #14 | TS=(educat* NEAR/3 program*) OR TS=(educat* NEAR/3 clinic) OR TS=(educat* NEAR/3 rehabilit*) OR TS=(educat* NEAR/3 program*) OR TS=(educat* NEAR/3 clinic) OR TS=(prevent* NEAR/3 program*) OR TS=(prevent* NEAR/3 clinic) OR TS=(manag* NEAR/3 program*) OR TS=(manag* NEAR/3 clinic) |
| #15 | TS=("nurs* intervention" OR "nurs* manag*") |
| #16 | #15 OR #14 OR #13 |
| #17 | #16 AND #6 |
| #18 | TS=("home care" or homecare or "tele-health" or telehealth or "tele-medicine" or telemedicine or "tele-nurs*" or telenurs* or telemonitor* or "tele-monitor") |
| #19 | TS=(remote NEAR/3 monitor*) |
| #20 | #19 OR #18 |
| #21 | #20 AND #6 |
| #22 | TS=("cognitive behavioral therapy" or "behavior therapy" or "cognitive therapy") |
| #23 | #22 AND #6 |
| #24 | #23 OR #21 OR #17 OR #12 |
| #25 | (TS=("clinical trial" OR random* OR trial* OR placebo or "control trial")) *AND* **LANGUAGE:** (English) |
| #26 | (#25 AND #24) *AND* **LANGUAGE:** (English) |
| #27 | #25 AND #21 |
| #28 | #25 AND #23 |

## Scopus

(((((TITLE-ABS-KEY(**"heart disease"** OR **"coronary disease"** OR **"Acute coronary syndrome*"** OR **angina** OR **"heart attack"** OR **"myocardial infarct*"** OR **"heart infarct*"**) OR TITLE-ABS-KEY(**ischaem***) OR TITLE-ABS-

KEY(**ischem***)) AND PUBYEAR > **1994**) AND ((TITLE-ABS-KEY(**"secondary prevention"**) AND TITLE-ABS-KEY(**program*** OR **clinic** OR **session*** OR **educat*** OR **class*** OR **service**)))) OR (((TITLE-ABS-KEY(**"heart disease"** OR**"coronary disease"** OR **"Acute coronary syndrome*"** OR **angina** OR **"heart attack"** OR **"myocardial infarct*"** OR **"heart infarct*"**) OR TITLE-ABS-KEY(**ischaem***) OR TITLE-ABS-KEY(**ischem***)) AND PUBYEAR > **1994**) AND((TITLE-ABS-KEY(**"cardiac rehabilitation"** OR **"cardiopulmonary rehabilitation"** OR **"nurs* intervention"** OR **"nurs* manag*"**) OR TITLE-ABS-KEY(**education** W/3 **program**) OR TITLE-ABS-KEY(**education** W/3 **clinic**) OR TITLE-ABS-KEY(**rehabilit*** W/3 **pogram**) OR TITLEABS-KEY(**rehabilit*** W/3 **clinic**))))) OR (((TITLE-ABS-KEY(**"heart disease"** OR **"coronary disease"** OR **"Acute coronary syndrome*"** OR **angina** OR **"heart attack"** OR **"myocardial infarct*"**OR **"heart infarct*"**) OR TITLE-ABS-KEY(**ischaem***) OR TITLE-ABS-KEY(**ischem***)) AND PUBYEAR > **1994**) AND (TITLE-ABS-KEY(**"cognitive behavioral therapy"** OR **"behavior therapy"** OR **"cognitive therapy"**))) OR (((TITLE-ABS-KEY(**"heart disease"** OR **"coronary disease"** OR **"Acute coronary syndrome*"** OR **angina** OR **"heart attack"** OR **"myocardial infarct*"** OR **"heart infarct*"**) OR TITLE-ABS-KEY(**ischaem***) OR TITLE-ABS-KEY(**ischem***)) ANDPUBYEAR > **1994**) AND ((TITLE-ABS-KEY(**"home care"** OR **homecare** OR **"tele-health"** OR **telehealth** OR **"tele-medicine"** OR **telemedicine** OR **"telenurs*"** OR **telenurs*** OR **telemonitor*** OR **"tele-monitor"**) OR TITLE-ABS-KEY(**remote** W/3 **monitor***))))) AND (TITLE-ABS-KEY(**"clinical trial"** OR **"controlled trial"** OR **random*** OR **"single blind*"** OR **"double blind*"** OR **"triple blind*"** OR **placebo**)) AND (LIMIT-TO(DOCTYPE, **"ar"**) OR LIMIT-TO(DOCTYPE,**"cp"**)) AND