

A Systematic Review and Content-Analysis of Service Quality Indicators Provided to Patients with Cardiovascular Disease Using Donabedian Model

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ABSTRACT

AIM: There is a large gap between healthcare quality provided to patients with cardiovascular disease and appropriate standards in this field. The aim of this study was to systematic review and content analysis of service quality indicators provided to patients with cardiovascular disease using Donabedian model.

METHODS: We conducted a systematic review and Content-Analysis of service quality indicators provided to patients with cardiovascular disease using Donabedian model. Manual search, reference of references and gray literature were employed in this study as well as different database searching methods using the search words like “quality”, “Cardiovascular diseases”, “indicator*”, “Cardiac care” and “heart diseases”) in the following databases: Iranmedex, Science Direct, Google Scholar, Ovid Medline, Ovid Embase, Cochrane Library, PubMed, Magiran and

SID. After identifying and extracting service indicators from the cardiovascular literature, we utilized content analysis approach. Then the indicators were analyzed and categorized Donabedian Model.

RESULTS: Out of 2,342 articles, 15 articles met the inclusion criteria and entered study consisting of 463 indicators. Collected indicators divided into 7 categories and the most frequent indicators were belonged to MI and AMI category by 215 frequent. The extracted indicators were broken down into input, process and output categories using of Donabedian model and then each of these categories were again divided to hospital interior and hospital exterior indicators. Most indicator formulation methods which were applied in prior studies were included literature review (8 studies), Delphi method (7 studies) and expert panel (6 studies).

CONCLUSION: In this study, service quality indicators provided to patients with cardiovascular disease were systematically collected and categorized using Donabedian model to introduce the formulation methods for these indicators. Thus these results can be beneficial to health policy makers and managers in planning, providing, measurement and promotion of services provided to patients with cardiovascular disease by.

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Key words: Indicator; Healthcare Quality; Cardiovascular diseases; Systematic review; Content-Analysis; Donabedian Model

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INTRODUCTION

Cardio-Vascular Diseases (CVD) are the main causes of morbidity

and mortality in many High Income Countries (HICs) and Low and Middle Income Countries (LMICs). Despite the availability of novel advanced treatments and complex interventional and surgical methods, the fatality rate from these diseases is still too high^[1-4]. In spite of much attention to CVD during past years, evidences reveal that services provided to such patients is yet poor quality and too far from ideal standards^[5-7].

Recently, different methods have been utilized for promoting service quality^[8,9] and the most important of which is measurement and promotion of service quality by using the indicators of provided service quality^[10-13]. Nowadays measurement of indicators of service quality provided to patients is widely used in different countries for their health system^[14]. The first effort of indicator formulation was made in United States (US) when Research And Development (RAND) Corporation, college of Heart and America Heart Association (AHA) Committed to formulate measurement indicators of service quality provided to patients with cardiovascular disease^[10]. Project of care quality improvement for CVD and Joint Commission on Accreditation of Healthcare Organizations (JCAHO) subsequently started to formulate the indicators of quality assessment and to measure them for the first hand data which was existed^[15].

Considering the variety of prior studies on CVD, we need a proper given framework to use their findings. Therefore, the aim of this study was to systematic review and content analysis of service quality indicators provided to patients with cardiovascular disease using Donabedian model.

METHODS

In this systematic review and Content-Analysis study the required data for systematic review was collected by searching Iranmedex, Science Direct, Google Scholar, Ovid Medline, Ovid Embase, Cochrane Library, PubMed, Magiran and SID. The following keywords were used to identify eligible studies: quality indicator, cardiovascular diseases, cardiac care and heart diseases.

Besides manual search, checking reference lists (reference of references) and grey literature were applied in the current study. After identifying and extracting service indicators from the cardiovascular literature, we utilized content analysis approach. Then the indicators were analyzed and categorized using Donabedian Model. A topic expert as well as an experienced librarian helped us to design PubMed search strategy as follows. This search strategy was edited in different steps of searching according to the characteristics of various data bases.

{[(quality indicator*) AND Cardiovascular diseases) OR Cardia* care} OR heart diseases.

There was no time limitation for paper searching and this search included published articles in the English and the Persian.

The following inclusion criteria was applied: (1) the study should be on the field of provided care to patients with cardiovascular disease; (2) studies should formulate or report indicators of service quality provided to patients with cardiovascular disease. We excluded studies such as editorials, case reports and Interventional studies.

To select articles, an initial screening of titles and abstracts was performed to identify potentially relevant papers after that the full papers were screened to identify possibly relevant articles. The total search showed 2,342 articles. However after removing the irrelevant and duplicate papers or those not eligible, 15 articles entered this study (Figure 1). The selected articles were entirely reviewed and studied to extract the required data by using a designed extraction table. The author's name, the place and time of the studies in CVD

which reported service quality indicators, the methods of indicator formulation as well as the number and name of final reported indicators were included in this table. To organize and identify duplicate references, reference management software of Endnote X5 was used^[16].

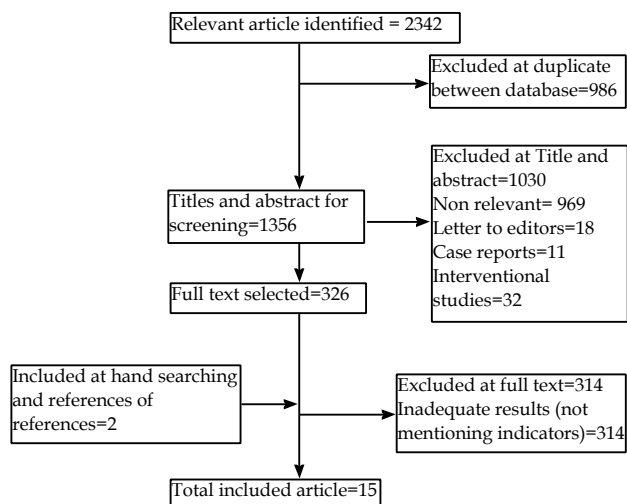


Figure 1 Flow diagram of the searches and inclusion process.

After identifying and extracting service indicators from the cardiovascular literature, we utilized content analysis approach using Donabedian model. Donabedian model is the most popular assessment model of healthcare (Figure 2) which was introduced in 1966. This model contains three groups: input (including appropriate facilities and equipments, adequate and skilled human resources, and anything relevant to primary structure and facilities), process (indicating the state and quality of provided services) and output or outcome (involving outcomes and effects of healthcare)^[17-19].

In this study, all three components of Donabedian Model were subdivided to hospital interior and exterior indicators.

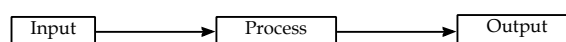


Figure 2 Donabedian Model.

RESULTS

The final results of literature review in the current study showed 15 papers which included 436 indicators presented in Appendix 1^[6,14,20-31].

Extracted indicators were divided into 7 groups and the most frequent indicators are illustrated in figure 3.

As presented in figure 3, the most frequent indicators were belonged to the category of acute myocardial infarction (AMI). Indicators of myocardial infarction (MI) also were inserted into this category. The methods in formulating indicators were mostly literature review, Delphi method, expert panel, using recorded data and focus group. Such methods used in prior studies are arranged by their frequency in figure 4

As it is shown, the most frequent method in formulating indicator was literature review including simple and systematic review.

The extracted indicators in this study were divided into three groups: input, process and output. These groups also were subdivided to hospital interior and exterior indicators (Figure 5).

DISCUSSION

Nowadays there is a large gap between healthcare quality provided to patients with cardiovascular disease and proper standards which exist in this field^[32,33]. Therefore, recently much attention is given to using indicators of service quality in order to measure and promote service quality provided to patients with cardiovascular disease^[34]. So in the current study to present a model for designing, formulating and applying indicators, we applied a systematic review and Content-Analysis of service quality indicators provided to patients with cardiovascular disease using Donabedian model. In total, 463 indicators in 7 fields were eligible to be reported. Hence, these

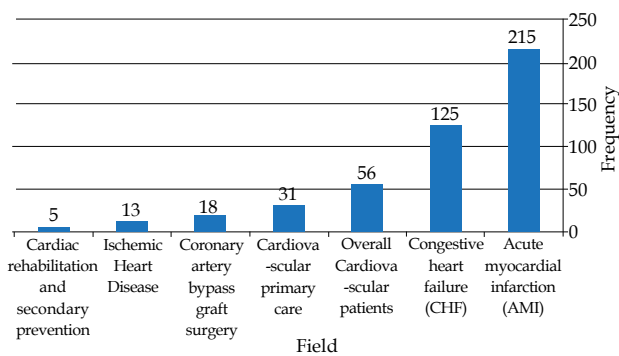


Figure 3 The frequency of indicator groups in this study orderly (total number of indicators=463).

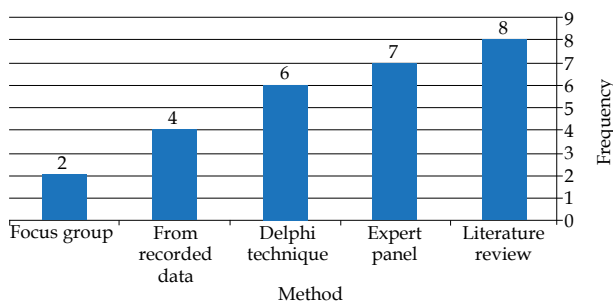


Figure 4 The methods in formulating indicators of service quality provided to patients with cardiovascular disease (number of studies=15).

indicators model were categorized in three groups: input, process and output using Donabedian model and then they were broken down into hospital interior and exterior indicators. Besides, our findings showed that systematic review is the most frequent method in formulating indicators. The findings also demonstrated that the indicators of MI and AMI in had the most frequency indicating the importance of CVD. In the recent years, lots of studies have applied these indicators to increase service quality. showing improvement and promotion in service quality provided to these patients^[35-38]. Thus using available indicators or formulating, developing and using new indicators in this field may have a positive effect on service quality provided to these patients.

In the current study we conducted Content-Analysis of indicators using Donabedian model. This model is the most popular and significant model of quality assessment in healthcare^[39,40]. Recently many studies have formulated and developed indicators of service quality provided to patients with cardiovascular disease using Donabedian model^[20,21,26]. Therefore, this model can be considered as a suitable model in formulating and measuring indicators. In the current study, the utilized indicators in each three groups of Donabedian model (input, process and output) were categorized into hospital interior and exterior indicators. This categorizing can be effective in identifying weaknesses and needed interventions. Furthermore, literature review of indicators revealed that most studies focused on formulation and measurement of hospital interior indicators but little attention is given to hospital exterior indicators, especially in regard of input compared with two others^[41]. The results of Khalid study is in line with this study^[29]. Thus developing and implementing incorporating care managers' models, such as "Project Leonardo" that introduced by Ciccone and colleagues (2010) into the primary healthcare system are necessary to improve CVD patients health outcomes out of hospitals^[42].

The methods of reviewing indicator formulation showed that literature review, expert panel and Delphi method were the most frequent methods in formulating indicators. The findings of Sadeghi-Bazargani *et al* on the types and formulation process of clinical indicators also revealed that literature review, expert panel and Delphi method were the most popular methods in formulating indicators. These findings are consistent with the results of the current study^[43]. Thus, the mentioned methods can be applicable in formulating indicators for future studies.

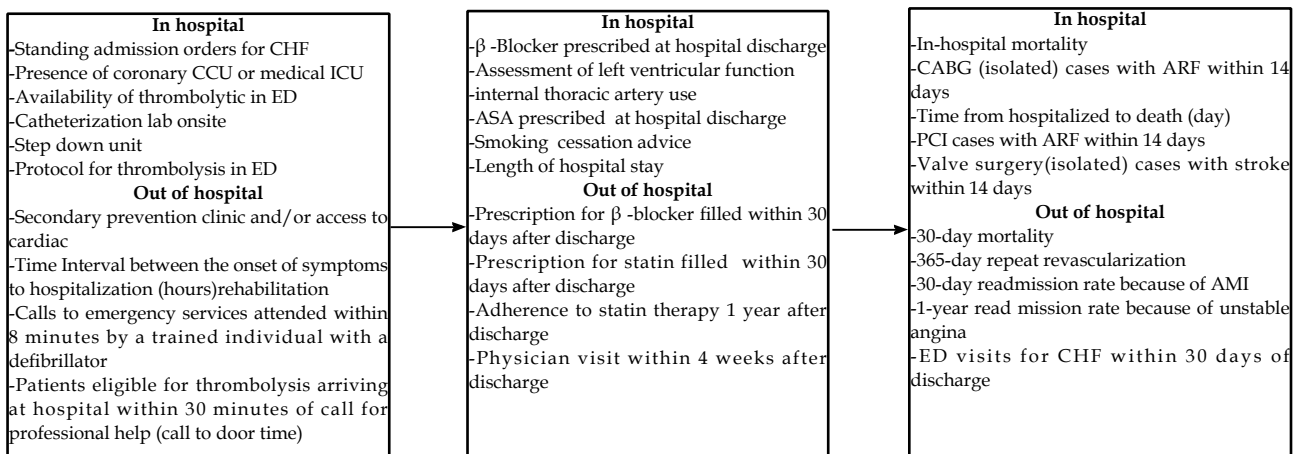


Figure 5 Content analysis of service quality indicators provided to patients with cardiovascular disease using Donabedian model.

During literature review we noticed that most of these studies have been conducted in HICs. Out of 15 reviewed papers only one was done in LMIC^[24] which may be due to some issues as follows: publishing LMIC studies in their language rather than English, limited of valid journals, lack of attention paid to the importance of using service quality indicators. The probability of the last is more. Therefore, the present study used Donabedian model for formulating indicators of service quality in LMIC.

This study was limited to relevant literature in the English and the Persian language which bounded accessibility to studies published in other languages.

CONCLUSION

In this study, indicators of service quality provided to patients with CVD were systematically collected and categorized using Donabedian model to introduce methods of formulating such indicators. Thus the results of the current study will help health policy makers and managements in planning, providing and measuring services delivered to patients with CVD by. Moreover findings of the current study showed that the main focus of studies on formulating and using indicators of service quality provided to patients with cardiovascular disease is on hospital interior indicators but poor attention is given to hospital exterior indicators, especially input indicators. In formulating indicators, literature review, expert panel and Delphi technique are recommended.

CONFLICT OF INTERESTS

There are no conflicts of interest with regard to the present study.

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Appendix Quality Indicators Provided to Patients With Cardiovascular Disease.

Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
1. Guru <i>et al</i> , Canada, 2005	Coronary artery bypass graft surgery	Quality improvement organizations, literature review, 2-step Delphi-17 expert	149	18	<p>Structure:</p> <ol style="list-style-type: none"> 1. Participation in a cardiac surgery database <p>Processes of care:</p> <ol style="list-style-type: none"> 2. Waiting time to surgery 3. Completion of surgery within a Recommended waiting time according to patient's symptoms 4. internal thoracic artery use <p>Outcomes:</p> <ol style="list-style-type: none"> 5. 30-day mortality 6. In-hospital mortality 7. Ventilation time 8. ICU length of stay 9. Chest reopening 10. ICU readmission 11. Postoperative stroke 12. Postoperative ECG myocardial infarction 13. Deep sternal wound infection 14. Postoperative dialysis 15. Total packed red blood cells transfused 16. Total units of blood products transfused 17. 365-day repeat operation with CPB 18. 365-day repeat revascularization
2. Jack <i>et al</i> , Canada, 2008	Acute myocardial infarction	12-member expert panel, literature review, 2-step Delphi	-	39	<p>In-hospital process-of-care, outcome and system indicators:</p> <p>Pharmacologic process-of-care indicators:</p> <ol style="list-style-type: none"> 1. Acetyl-Salicylic Acid (ASA) within 24 hours before hospital arrival or within 3 hours after hospital arrival 2. ASA prescribed at hospital discharge 3. β-Blocker prescribed at hospital discharge 4. Angiotensin-Converting Enzyme (ACE) inhibitor or angiotensin-receptor blocker prescribed at hospital discharge 5. Statin prescribed at hospital discharge 6. Fibrinolysis therapy within 30 minutes after hospital arrival <p>Nonpharmacologic process-of-care indicators:</p> <ol style="list-style-type: none"> 7. Electrocardiogram (ECG) within 10 minutes after hospital arrival 8. Primary percutaneous coronary intervention within 90 minutes after hospital arrival 9. Reperfusion therapy in eligible patients with ST-segment elevation myocardial infarction 10. Risk stratification (i.e., cardiac catheterization exercise stress testing perfusion imaging or stressechoc radiography) 11. Assessment of left ventricular function 12. Smoking cessation advice 13. counseling or therapy during hospital stay <p>14. Referral to cardiac rehabilitation</p> <p>Outcome indicator:</p> <ol style="list-style-type: none"> 15. In-hospital mortality <p>System indicators :</p> <ol style="list-style-type: none"> 16. Fibrinolysis therapy within 60 minutes after call for emergency medical services 17. Primary percutaneous coronary intervention within 120 minutes after call for emergency medical services 18. Pre hospital 12-lead ECG <p>Out-of-hospital process-of-care and outcome indicators</p> <p>Pharmacologic process-of-care indicators:</p> <ol style="list-style-type: none"> 19. Prescription for β-blocker filled within 30 days after discharge 20. Prescription for β-blocker filled within 90 days after discharge 21. Adherence to β-blocker therapy 1 year after discharge 22. Prescription for ACE inhibitor or angiotensin-receptor blocker filled within 30 days after discharge 23. Prescription for ACE inhibitor or angiotensin-receptor blocker filled within 90 days after discharge 24. Adherence to ACE inhibitor or angiotensin-receptor blocker therapy 1 year after discharge 25. Prescription for statin filled within 30 days after discharge 26. Prescription for statin filled within 90 days after discharge 27. Adherence to statin therapy 1 year after discharge <p>Nonpharmacologic process-of-care indicators:</p> <ol style="list-style-type: none"> 28. Physician visit within 4 weeks after discharge 29. Median wait time (in days) for cardiac catheterization after myocardial infarction 30. Median wait time (in days) for percutaneous coronary intervention after myocardial infarction 31. Median wait time (in days) for coronary artery bypass graft surgery after myocardial infarction

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2. Jack <i>et al</i> , Canada, 2008	Acute myocardial infarction	12-member expert panel, literature review, 2-step Delphi	-	39	<p>Outcome indicators:</p> <ol style="list-style-type: none"> 32. 30-day mortality 33. 1-year mortality 34. 30-day readmission rate because of acute myocardial infarction 35. 1-year read mission rate because of acute myocardial infarction 36. 30-day readmission rate because of congestive heart failure 37. 1-year read mission rate because of congestive heart failure 38. 30-day readmission rate because of unstable angina 39. 1-year read mission rate because of unstable angina <p>Structure</p> <ol style="list-style-type: none"> 1. Coordinated program of ambulatory CHF care 2. Coding accuracy of heart failure discharge abstracts Care by specialist 3. Standing admission orders for CHF <p>Process</p> <ol style="list-style-type: none"> 4. ACE inhibitor prescription at hospital discharge 5. Beta-blocker at hospital discharge 6. Warfarin at hospital discharge for atrial fibrillation 7. LV function evaluation before or during admission 8. Weights measured/recorded $\geq 50\%$ of in hospital days 9. Discharge instructions regarding discharge medications 10. Discharge instructions regarding salt/fluid restriction 11. Discharge instructions regarding daily weight monitoring 12. Discharge instructions regarding symptoms of worsening heart failure 13. Discharge instructions regarding follow-up appointment 14. Length of hospital stay 15. ACE inhibitor prescription within 90 days of discharge 16. One-year ACE inhibitor adherence after discharge 17. Beta-blocker prescription within 90 days of discharge 18. One-year beta-blocker adherence after discharge 19. One-year spironolactone adherence after discharge 20. Warfarin for atrial fibrillation within 90 days of discharge 21. One-year adherence with warfarin after discharge 22. LV function evaluation within one month of discharge in those not assessed before or during admission 23. Follow-up provider visit within four weeks of discharge <p>Outcomes:</p> <ol style="list-style-type: none"> 24. In hospital mortality 25. 30-day mortality 26. One-year mortality 27. All-cause readmission rate within 30 days of discharge 28. CHF readmission rate within 30 days of discharge 29. CHF readmission rate within one year of discharge 30. ED visits for CHF within 30 days of discharge 31. ED visits for CHF within one year of discharge 32. Any cardiovascular ED visit within 30 days of discharge 33. Any cardiovascular ED visit within one year of discharge
3. Lee <i>et al</i> , Canada, 2008	Congestive heart failure (CHF)	11-member expert panel, literature review, 2-step Delphi	60	33	<ol style="list-style-type: none"> 1. proportion of patients receiving ECG within 10 minutes of hospital removal 2. proportion of highly eligible patients receiving thrombolysis 3. Time to lysis: proportion of highly eligible patients receiving thrombolysis within 60 and 30 minutes of hospital arrival 4. Cardiac counselling: proportion of highly eligible patients receiving in-hospital cardiac counselling 5. Assessment of serum lipids: proportion of patients undergoing testing of serum lipids 6. Discharge status: β-blocker: proportion of highly eligible patients prescribed β-blocker 7. Anti-platelet agents: proportion of highly eligible patients prescribed anti-platelet agents (aspirin or clopidogrel) 8. ACE inhibitors: proportion of highly eligible patients prescribed ACE inhibitors 9. Lipid-lowering agents: proportion of highly eligible patients prescribed lipid-lowering agents 10. Cardiac rehabilitation: proportion of highly eligible patients referred to outpatient cardiac rehabilitation programme 11. Coronary angiography: proportion of highly eligible patients undergoing early coronary angiography (during index admission or scheduled within 30 days of discharge) 12. Non-invasive risk stratification: proportion of highly eligible patients undergoing noninvasive risk assessment (during index admission or within 30 days of discharge) 13. Recording underlying causes: proportion of patients for whom underlying causes for heart failure were recorded in hospital notes 14. Recording acute precipitants: proportion of patients for whom acute precipitants were recorded in hospital notes 15. Fluid regimens: proportion of patients for whom a fluid management regimen was explicitly recorded in hospital notes 16. Daily weigh: proportion of patients undergoing daily weighing in assessing effectiveness of diuresis
4. Hickey, 200. Australia	Acute coronary syndromes - Congestive heart failure	Expert panel, Data collected from hospital records and general practice heart-check forms were used to calculate process and outcome indicators for each condition.		29	

Appendix Quality Indicators Provided to Patients With Cardiovascular Disease.

Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
4. Hickey, 200. Australia	Acute coronary syndromes - Congestive heart failure	Expert panel , Data collected from hospital records and general practice heart-check forms were used to calculate process and outcome indicators for each condition.		29	17. DVT prophylaxis: proportion of patients receiving DVT prophylaxis 18. Dietitian review: proportion of patients receiving dietitian review re: salt and fluid intake 19. Testing of thyroid function: proportion of patients undergoing thyroid function testing 20. Assessment left ventricular function: proportion of patients who have undergone left ventricular imaging either during index admission or within previous 12 months 21. Clinical pharmacist review: proportion of patients receiving review by clinical 22. Pharmacist 23. Discharge status ACE inhibitors: proportion of highly eligible patients 24. prescribed ACE inhibitor at discharge 25. ACE inhibitor dose: proportion of highly eligible patients prescribed ACE inhibitors at discharge who receive target dose 26. β -blockers: proportion of highly eligible patients prescribed β -blockers at discharge 27. Warfarin: proportion of highly eligible patients prescribed warfarin at discharge 28. Deleterious agents: proportion of patients who did not receive deleterious agents (class I ant arrhythmic agents, verapamil, diltiazem, NSAIDs, tricyclic antidepressants) 29. Clinic follow-up: proportion of patients scheduled for outpatient clinic review within 4 weeks of discharge 1. Number of discharged patients with AMI those prescribed aspirin at discharge in last month 2. Number of discharged patients with AMI those prescribed β - blocker at discharge in last month 3. Number of discharged patients with left ventricular systolic dysfunction in last month 4. Number of discharged patients with left ventricular systolic dysfunction in last month those prescribed ACE inhibitor at discharge 5. Number of discharged patients with left ventricular systolic dysfunction in last month those prescribed statin at discharge 6. Number of minutes from time of arrival at hospital to time of administration of the thrombolytic 7. Hospitalized AMI patients without aspirin contraindications 8. Number who received aspirin within 24hours before or after hospital arrival 9. Number of deaths in any setting that occurred within 1 year of hospital admission for a primary (principal) diagnosis of AMI 10. Number of unique individuals undergoing CABG re-operations within 6 months of discharge Measure proposed by panel members 11. Number of PTCA performed in last year 12. Number of unique individuals having a second PTCA performed within 30 days of discharge in last year 13. Number of individual patients discharged with a principal diagnosis of CHF 14. Number of individual patients with a principal diagnosis of CHF who are prescribed an ACE inhibitor at discharge 15. Number of individual patients with a diagnosis of CHF who are prescribed a β -blocker at discharge 16. Number of deaths in discharges with principal diagnosis code for CHF 17. Hospitalized CHF patients in last year 18. Total number of death from Arrhythmia in the last year 19. Total number of admission ACS primary diagnoses in CCU in the last year, 20. Average length of stay ACS patients in CCU in the last year 21. Average length of stay Arrhythmia patients in CCU in the last year 22. Time Interval between the onset of symptoms to hospitalization (hours) 23. Time from hospitalized to death (day) 24. Time Interval between the onset of symptoms to Thrombolytic therapy (hours)
5. Azami. Aghdash <i>et al</i> , 2013, Iran	Cardiovascular patients Hospitalized	Systematic review, Interview, 2 rounds of Delphi technique, experts panel	48	24	Outcome indicators ARF 1. PCI cases with ARF within 14 days 2. CABG(isolated) cases with ARF within 14 days 3. CABG+valve surgery cases with ARF within 14 days 4. valve surgery(isolated) cases with ARF within 14 days Stroke 5. cardiac catheterization cases with stroke within same Episode of care 6. PCI cases with stroke within 14 days 7. CABG(isolated) cases with stroke within 14 days 8. CABG+valve surgery cases with stroke within 14 days 9. valve surgery(isolated) cases with stroke within 14 days Mortality 10. 30 days in-hospital mortality for PCI cases 11. 30 days in-hospital mortality for CABG(isolated) cases 12. 30 days in-hospital mortality for CABG+ valve surgery cases 13. 30 days in-hospital mortality for valve surgery (isolated) cases CABG+PCI 14. PCI cases with CABG within 2 days
6. vanita Gorzkiewicz <i>et al</i> , 2009-2010, Canada	Improvement initiative for cardiac care	Collaboratively with partner, expert clinical panel, pilot phase, providing outreach and client support, engaging hospitals in the validation		15	

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Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
7. K McMartin, <i>et al</i> , 2012, Ontario (Canada)	Heart failure management	Literature search, Assessment of Multiple Systematic Reviews (AMSTAR), GRADE Working Group criteria,		17	<p>Therapeutics</p> <ol style="list-style-type: none"> 1. ACEi and/or ARB if LV systolic dysfunction in eligible patients 2. Use of beta blockers in eligible patients 3. Use of statins in eligible patients if underlying CAD, PVD, CVD, or diabetes 4. Aldosterone antagonists for eligible patients 5. Anticoagulants for atrial fibrillation 6. Use of ICD in eligible patients 7. Avoid 1st and 2nd generation CCBs if LV systolic dysfunction 8. Avoid type 1 antiarrhythmic agents if LV systolic dysfunction (unless ICD in place) <p>Investigations</p> <ol style="list-style-type: none"> 9. Outpatient assessment including one or more of regular volume 10. assessment, weight, blood pressure, activity level 11. Appropriate baseline blood/urine tests, ECG, CXR 12. Appropriate biochemical monitoring of renal function and electrolytes 13. Assessment of LV function 14. Measure digoxin levels if toxicity suspected <p>Education and follow-up</p> <ol style="list-style-type: none"> 15. HF patient education/discharge instructions 16. Outpatient follow-up within 4 weeks 17. Advice on smoking cessation
8. Ulla M, <i>et al</i> , 2006, Organization for Economic Co-operation and Development countries	Quality of cardiac care	Literature search, review of national measurement systems, nomination from countries participating in the project, modified Delphi process (developed originally by the RAND Corporation)	61	17	<p>Indicators on secondary prevention of coronary heart disease</p> <ol style="list-style-type: none"> 1. Aspirin on discharge after acute MI 2. ACE inhibitors at discharge after AMI 3. β-Blockers at discharge after AMI 4. Statin treatment after a cardiac event <p>Indicators on acute coronary syndromes</p> <ol style="list-style-type: none"> 5. Timing of thrombolytics for patients with AMI 6. Timing of emergent PTCA for patients with AMI 7. Aspirin at admission to hospital for AMI 8. One-year mortality following AMI <p>Indicators on cardiac interventions</p> <ol style="list-style-type: none"> 9. CABG in-hospital mortality rate 10. One-year mortality rate following CABG 11. CABG re-operation within 6 months of discharge 12. PTCA in-hospital mortality 13. Same-day CABG surgery rate after PTCA 14. Repeat PTCA within 30 days of discharge <p>Indicators on congestive heart failure (CHF)</p> <ol style="list-style-type: none"> 15. Proportion of patients with CHF receiving ACE inhibitor on discharge 16. Rate of β-blocker prescription at hospital discharge for CHF 17. CHF in-hospital mortality rate
9. Wayne Putnam, <i>et al</i> , 2006, Canada	Care of acute myocardial infarction and congestive heart failure	focus groups		81	<p>Acute myocardial infarction quality indicators</p> <p>Process (inpatient)</p> <ol style="list-style-type: none"> 1. _ Aspirin prescribed within six hours of hospital arrival 2. _ Aspirin prescribed at hospital discharge 3. _ Reperfusion with thrombolytics during hospitalization 4. _ Median 'door-to-needle' time for thrombolysis 5. _ Beta-blockers at hospital discharge 6. _ ACE inhibitors prescribed at hospital discharge 7. _ Lipid sample obtained within 24 h of admission 8. _ Statins prescribed at hospital discharge 9. _ Reperfusion using primary PCI 10. _ Beta-blockers within 12 h of admission 11. _ Median time from door to first balloon inflation in primary PCI 12. _ Coronary angiography in-hospital or referral for angiography (test indicator) 13. _ Median length of CCU/ICU stay 14. _ Median length of in-hospital stay 15. _ Median length of stay in ED <p>Process (outpatient)</p> <ol style="list-style-type: none"> 16. _ Physician visit within four weeks post-discharge 17. _ Median waiting time (in days) for catheterization post-MI 18. _ Median waiting time (in days) for PCI post-MI 19. _ Median waiting time (in days) for CABG post-MI 20. _ Beta-blocker prescription filled within 30 days post-discharge 21. _ Beta-blocker prescription filled within 90 days post-discharge 22. _ Beta-blocker one year adherence post-discharge 23. _ ACE inhibitor prescription filled within 30 days post-discharge 24. _ ACE inhibitor prescription filled within 90 days post-discharge 25. _ ACE inhibitor one year adherence post-discharge 26. _ Statin prescription filled within 30 days post-discharge 27. _ Statin prescription filled within 90 days post-discharge 28. _ Statin one year adherence post-discharge

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Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
					Outcomes 29. _ In-hospital mortality 30. _ 30-day mortality 31. _ One-year mortality 32. _ AMI readmission rate at 30 days post-discharge 33. _ AMI readmission rate at one year post-discharge 34. _ CHF readmission rate at 30 days post-discharge 35. _ CHF readmission rate at one year post-discharge 36. _ Unstable angina readmission rate at 30 days post-discharge 37. _ Unstable angina readmission rate at one year post-discharge Structure 38. _ Secondary prevention clinic and/or access to cardiac rehabilitation 39. _ Standard admitting orders for CCU/ICU 40. _ Presence of coronary CCU or medical ICU 41. _ Step down unit 42. _ Protocol for thrombolysis in ED 43. _ Availability of thrombolytics in ED 44. _ Specialist consult not required for thrombolytic administration 45. _ Presence of dedicated clinical pharmacist in CCU/ICU 46. _ Catheterization lab onsite 47. _ PCI capability Congestive heart failure quality indicators Process (inpatient) 48. ACE inhibitor prescription at hospital discharge 49. Warfarin at hospital discharge for atrial fibrillation 50. LV function evaluation before or during admission 51. Weights measured/recorded Z50% of in-hospital days 52. Beta-blocker at hospital discharge 53. Discharge instructions - re: discharge medications 54. Discharge instructions - re: salt/fluid restriction 55. Discharge instructions - re: daily weight monitoring 56. Discharge instructions - re: symptoms of worsening heart failure 57. Discharge instructions - re: follow-up appointment 58. Length of hospital stay Process (outpatient) 59. Warfarin for atrial fibrillation within 90 days of discharge 60. One-year adherence with warfarin after discharge 61. Follow-up provider visit within four weeks of discharge 62. ACE inhibitor prescription within 90 days of discharge 63. One-year ACE inhibitor adherence after discharge 64. Beta-blocker prescription within 90 days of discharge 65. One-year beta-blocker adherence after discharge 66. One-year spironolactone adherence after discharge 67. LV function evaluation within 1 month of discharge in those not assessed in before or during admission (test) Outcomes 68. In-hospital mortality 69. 30-day mortality 70. One-year mortality 71. All-cause readmission rate within 30 days of discharge 72. CHF readmission rate within 30 days of discharge 73. CHF readmission rate within one year of discharge 74. ED visits for CHF within 30 days of discharge (test) 75. ED visits for CHF within one year of discharge (test) 76. Any cardiovascular ED visit within 30 days of discharge 77. Any cardiovascular ED visit within one year of discharge Structure 78. Coordinated program of ambulatory CHF care 79. Coding accuracy of heart failure discharge abstracts 80. Care by specialist (test) 81. Standing admission orders for CHF (test)
9. Wayne Putnam, <i>et al</i> , 2006, Canada	Care of acute myocardial infarction and congestive heart failure	focus groups		81	

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Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
					Congestive heart failure quality indicators
					Process (inpatient)
					48. _ ACE inhibitor prescription at hospital discharge
					49. _ Warfarin at hospital discharge for atrial fibrillation
					50. _ LV function evaluation before or during admission
					51. _ Weights measured/recorded Z50% of in-hospital days
					52. _ Beta-blocker at hospital discharge
					53. _ Discharge instructions - re: discharge medications
					54. _ Discharge instructions - re: salt/fluid restriction
					55. _ Discharge instructions - re: daily weight monitoring
					56. _ Discharge instructions - re: symptoms of worsening heart failure
					57. _ Discharge instructions - re: follow-up appointment
					58. _ Length of hospital stay
					Process (outpatient)
					59. _ Warfarin for atrial fibrillation within 90 days of discharge
					60. _ One-year adherence with warfarin after discharge
					61. _ Follow-up provider visit within four weeks of discharge
					62. _ ACE inhibitor prescription within 90 days of discharge
					63. _ One-year ACE inhibitor adherence after discharge
					64. _ Beta-blocker prescription within 90 days of discharge
					65. _ One-year beta-blocker adherence after discharge
					66. _ One-year spironolactone adherence after discharge
					67. _ LV function evaluation within 1 month of discharge in those not assessed in before or during admission (test)
					Outcomes
					68. _ In-hospital mortality
					69. _ 30-day mortality
					70. _ One-year mortality
					71. _ All-cause readmission rate within 30 days of discharge
					72. _ CHF readmission rate within 30 days of discharge
					73. _ CHF readmission rate within one year of discharge
					74. _ ED visits for CHF within 30 days of discharge (test)
					75. _ ED visits for CHF within one year of discharge (test)
					76. _ Any cardiovascular ED visit within 30 days of discharge
					77. _ Any cardiovascular ED visit within one year of discharge
					Structure
					78. _ Coordinated program of ambulatory CHF care
					79. _ Coding accuracy of heart failure discharge abstracts
					80. _ Care by specialist (test)
					81. _ Standing admission orders for CHF (test)
					Quality indicators applicable to all patients
					1. Percentage of adult patients who have weight and height or waist Circumference recorded on the chart.
					2. Percentage of adult patients who have alcohol consumption recorded on the chart.
					3. Percentage of adult patients who have smoking status recorded on the chart.
					4. Percentage of patients who are current smokers and have smoking cessation counselling or a referral for counselling recorded on the chart.
					5. Percentage of patients 40 years and older with no risk factors, or any adults with cardiovascular risk factors (eg, hyperlipidemia, hypertension, ischemic heart disease, etc), who have had a fasting plasma glucose level recorded on the chart in the past three years.
					6. Percentage of healthy patients (no previous cardiovascular risk) 40 to 80 years of age (men) or 50 to 80 years of age (women) who have lipid testing at least every five years recorded on the chart.
					7. Percentage of adult patients who have had a visit to their usual primary care provider's office in the previous three years whose blood pressure was recorded on the chart.
					8. Percentage of patients older than 40 years of age (men) and older than 50 years of age (women) for whom a global risk assessment (eg, Framingham model) has been recorded on the chart.
					9. Percentage of patients with a systolic blood pressure of 140 mmHg to 159 mmHg or diastolic blood pressure of 90 mmHg to 99 mmHg who have a follow-up visit in a six-month period recorded on the chart.
					Quality indicators for hypertension
					10. Percentage of patients with an average systolic blood pressure of greater than 160 mmHg and/or a diastolic blood pressure greater than 100 mmHg, as determined on at least three separate visits, who have a diagnosis of hypertension recorded on the chart.
10. Frederick I Burge, <i>et al</i> 2007, Canada	Cardiovascular primary care	Modified Delphi based on the RAND Corporation (had four stages: In-depth literature review on previous indicators-Circulation of the survey tool- In-person meeting and Recirculation of survey tool)	80	31	

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Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
10. Frederick I Burge, <i>et al</i> 2007, Canada	Cardiovascular primary care	Modified Delphi based on the RAND Corporation (had four stages: In-depth literature review on previous indicators- Circulation of the survey tool- In-person meeting and Recirculation of survey tool)	80	31	<p>11-Percentage of adult patients whose blood pressure is 180/110 mmHg or greater, or 140/90 mmHg or greater and who have diabetes, chronic renal disease or target organ damage, who have a record on the chart of a second visit for blood pressure within two months of the first elevated blood pressure visit.</p> <p>12. Percentage of adult patients whose blood pressure is 180/110 mmHg or greater, or 140/90 mmHg or greater and who have diabetes, chronic renal disease or target organ damage on a second visit, who were labelled as hypertensive on the chart.</p> <p>13. Percentage of patients with an average systolic blood pressure of 160 mmHg or greater, or a diastolic blood pressure of 100 mmHg or greater with a recommendation for drug therapies recorded on the chart.</p> <p>14. Percentage of patients with an average diastolic blood pressure of 90 mmHg or greater with a recommendation for drug therapies recorded on the chart if target organ damage is present or if they have independent cardiovascular risk factors</p> <p>15. Percentage of patient visits (for blood pressure follow-up) for those with hypertension whose blood pressure is above target (140/90 mmHg, or 130/80 mmHg for patients with diabetes or renal disease) with a plan of care for hypertension recorded on the chart that includes a change in dose or regimen of medications, and/or repeated education regarding lifestyle modification and/or planned reassessment.</p> <p>16. Percentage of patients identified as hypertensive, but who are at target blood pressure levels and who have had blood pressure recorded in the chart in the past six months</p> <p>17. Percentage of adult patients with hypertension and diabetes who have a measure of urinary protein excretion (eg, 24 h urine, dipstick for microalbuminuria, etc) on the chart.</p> <p>18. Percentage of patients identified as hypertensive for longer than 12 months whose most recent blood pressure was at target</p> <p>Quality indicators for chronic, stable ischemic heart disease</p> <p>19. The percentage of patients with ischemic heart disease who are taking acetylsalicylic acid or have a contraindication to, or side effects from, acetylsalicylic acid</p> <p>20. The percentage of patients with ischemic heart disease who have had a myocardial infarction and are taking a beta-blocker or have a contraindication to, or side effects from, a beta-blocker</p> <p>21. The percentage of patients with ischemic heart disease who are on an angiotensin-converting enzyme inhibitor, or have a contraindication to, or side effects from, an angiotensin-converting enzyme inhibitor.</p> <p>22. The percentage of patients with ischemic heart disease who have had a fasting blood sugar level recorded on chart at least once since diagnosis.</p> <p>23. Percentage of patients with a diagnosis of congestive heart failure who have had an ejection fraction value recorded in the chart at least once</p> <p>24. Percentage of patients with left ventricular systolic dysfunction (ejection fraction of less than 40%), whether symptomatic or asymptomatic, who are taking an angiotensin-converting enzyme inhibitor or an angiotensin receptor II blocker, or have a contraindication to, or side effects from, both an angiotensin-converting enzyme inhibitor and an angiotensin receptor II blocker</p> <p>Quality indicators for congestive heart failure</p> <p>25. Percentage of patients with left ventricular systolic dysfunction (ejection fraction of less than 40%) who are taking a beta-blocker or have a contraindication to, or side effects from, beta-blockers.</p> <p>26. Percentage of patients with congestive heart failure on an angiotensin-converting enzyme inhibitor or an angiotensin receptor II blocker who have had potassium and creatinine levels recorded on the chart in the past year.</p> <p>27. Percentage of patient visits for congestive heart failure during which weight was recorded in the chart</p> <p>Quality indicators for hyperlipidemia</p> <p>28. Percentage of adult patients with one or more of the following who have lipid testing recorded on the chart every two years: diabetes mellitus; hypertension and/or risk factors, such as smoking or abdominal obesity and/or strong family history of premature ischemic heart disease; or evidence of symptomatic or asymptomatic coronary artery or vascular disease.</p> <p>29. Percentage of patients with hyperlipidemia for whom a therapeutic target, based on their global risk assessment and lipid profile, has been recorded on the chart.</p> <p>30. Percentage of patients with hyperlipidemia who are at high risk for ischemic heart disease, for whom it has been recorded on the chart that pharmacological treatment was recommended immediately, concomitant with dietary and lifestyle changes</p> <p>31. Percentage of hyperlipidemia patients (who have been diagnosed for longer than 12 months) at risk for ischemic heart disease who are at target levels for low-density lipoprotein cholesterol (LDL-C) and total cholesterol to high-density lipoprotein cholesterol (HDL-C) ratios</p>

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Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
11. Paul A. Heidenreich, Gregg C. Fonarow.	Heart failure	Web search and reference Mining, literature, expert panel		21	<ol style="list-style-type: none"> 1. ACE Inhibitor Therapy 2. Medical History and Documentation 3. Physical Examination 4. Diagnostic Testing 5. Evaluation of LVEF 6. Biochemical Monitoring During Hospitalization 7. Beta-Blockers 8. Calcium Channel Blockers 9. Type I Antiarrhythmic Agents 10. Digoxin Monitoring 11. Patient Counseling 12. Outpatient Visit: Volume Status
12. Laila Khalid.2007. Canada	AMI	Literature search	17	79	<p style="text-align: center;">Pre-Hospital Indicators</p> <ol style="list-style-type: none"> 1. Calls to emergency services attended within 8 minutes by a trained individual with a defibrillator 2. Patients eligible for thrombolysis arriving at hospital within 30 minutes of call for professional help (call to door time) <p style="text-align: center;">In-hospital Indicators</p> <ol style="list-style-type: none"> 3. ECG within 10 minutes of hospital arrival 4. ECG interpretation time on admission 5. Aspirin prescribed within 6 hours or 24 hours of hospital Arrival 6. Beta-blockers within 12 hours of admission or arrival 7. Reperfusion with thrombolytics during hospitalization 8. Median 'door to needle' time for thrombolysis 9. Thrombolytics received within 30 min of hospital arrival 10. Thrombolytics received within 60 min of hospital arrival 11. Number and proportion of patients eligible for thrombolysis receiving it within 20 minutes of arrival at hospital (door to needle time) 12. Number and proportion of patients eligible for thrombolysis receiving it within 60 minutes of call for professional help (call to needle time) 13. GP IIb/IIIa inhibitor use during hospital stay 14. Cardiac catheterization within 48 hours of arrival 15. Coronary angiography performed during hospital stay 16. Coronary angiography in-hospital or referral for angiography (test indicator) 17. Heparin or LMWH use during hospitalization 18. Clopidogrel use during hospital stay 19. Non-invasive risk stratification 20. Glycoprotein IIb/IIIa inhibitor before PCI 21. Reperfusion using PCI 22. Median time from door to first balloon inflation in primary PCI 23. PCI received within 120 min of hospital arrival 24. PCI received within 90 min of hospital arrival 25. Reperfusion therapy 26. STEMI patients meeting criteria for reperfusion and receiving it 27. Lipid sample obtained within 24 hours of admission or in Hospital 28. Statins within 24 hours 29. Aspirin prescribed at hospital discharge 30. Beta-blockers at hospital discharge 31. ACE inhibitors/ARB for LVSD 32. ACE inhibitors prescribed at hospital discharge 33. Statins/lipid-lowering prescribed at hospital discharge 34. Calcium channel blockers held at discharge 35. Clopidogrel prescribed at discharge _ _ _ _ 36. Smoking cessation counseling 37. Blood pressure < 140/90 at discharge 38. In-hospital cardiac counseling 39. Dietary modification counseling 40. Referral for cardiac rehabilitation 41. Median length of stay in emergency department 42. Median length of coronary care unit/intensive care unit stay 43. Median/mean length of in-hospital stay <p style="text-align: center;">Outpatient Indicators</p> <ol style="list-style-type: none"> 44. Aspirin use at 30 days 45. Aspirin use at 90 days of post discharge 46. Aspirin six month adherence post discharge 47. Aspirin one year adherence post discharge 48. Beta-blocker prescription filled within 7 days 49. Beta-blocker prescription filled within 30 days post discharge 50. Beta-blocker prescription filled within 90 days post discharge 51. Beta-blocker six month adherence post discharge 52. Beta-blocker one year adherence post discharge 53. Use of beta-blocker use after MI 54. Clopidogrel use at 30 days

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Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
12. Laila Khalid.2007. Canada	Heart failure	Web search and reference Mining, literature, expert panel	17	21	55. Clopidogrel use at 6 months 56. Clopidogrel use at one year 57. ACE inhibitor prescription filled within 30 days post Discharge 58. ACE inhibitor prescription filled within 90 days post Discharge 59. ACE inhibitor six month adherence post discharge 60. ACE inhibitor one year adherence post discharge 61. Statin prescription filled within 30 days post discharge 62. Statin prescription filled within 90 days post discharge 63. Statin six month adherence post discharge 64. Statin one year adherence post discharge 65. Physician visit within four weeks of post discharge 66. Median waiting time (in days) for catheterization postmyocardial infarction 67. Median waiting time (in days) for PCI postmyocardial Infarction 68. Median waiting time (in days) for coronary artery bypass graft postmyocardial infarction
					69. In-hospital mortality 70. 30 day mortality 71. One year mortality 72. AMI readmission rate at 30 days post discharge 73. Same cause readmission in 30 days 74. AMI readmission rate of one year post discharge 75. Reinfarction rate 76. CHF readmission rate at 30 days post discharge 77. CHF readmission rate at one year post discharge 78. Unstable angina readmission rate at 30 days post discharge 79. Unstable angina readmission rate at one year post discharge
13. Matthew J. Budoff <i>et al.</i> 2004. UA	AMI	Literature search	18	13	Outcome Indicators 1. Assessment of Left Ventricular Function Following Acute Myocardial Infarction 2. Non-Invasive Stress Testing 3. Early Aspirin Therapy 4. Early Beta-Blocker Therapy 5. Reperfusion Therapy 6. Early Coronary Catheterization 7. Coronary Artery Bypass Surgery 8 and 9. Cholesterol-Lowering Medications 10. Antiplatelet Therapy 11. Counseling on Smoking Cessation 12. Cardiac Rehabilitation 13. Beta-Blocker Therapy
					1. in-patients referred to a cardiac rehabilitation program 2. cardiac rehabilitation wait time from referral to enrollment 3. patient self-management education 4. increase in exercise capacity 5.emergency response strategy
14. Canadian Cardiovascular Society, 2013. Canada	Management of Ischemic Heart Disease	Literature review, expert panel		5	1. Reperfusion using primary PCI 2. Median time from door to 1st balloon inflation in primary PCI 3. Coronary angiography in-hospital or referral for angiography (test indicator*) 4. Median length of stay in ED 5. Median length of CCU/ICU stay 6. Median length of in-hospital stay
15. Tran <i>et al.</i> , 2003: Canada	AMI			50	1. Aspirin prescribed within six hours of hospital arrival 2. Aspirin prescribed at hospital discharge 3. Reperfusion with thrombolytics during hospitalization 4. Median "door to needle" time for thrombolysis 5. Beta-blocker within 12 hours of admission 6. Beta-blocker at hospital discharge 7. ACEI prescribed at hospital discharge 8. Lipid sample obtained within 24 hours of admission 9. Statin prescribed at hospital discharge
					1. Beta-blocker prescription filled within 30 days post-discharge 2. Beta-blocker prescription within 90 days post-discharge 3. Beta-blocker 1 year adherence post-discharge 4. ACEI prescription filled within 30 days post-discharge 5. ACEI prescription filled within 90 days post-discharge 6. ACEI 1 year adherence post-discharge 7. Statin prescription filled within 30 days post-discharge 8. Statin prescription filled within 90 days post-discharge 9. Statin 1 year adherence post-discharge
					outpatient process of care (non-pharmacological) indicators 1. Physician visit within 4 weeks post-discharge

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Reference	Field	Methods	Initial indicators Number	Final indicators Number	Indicators
15. Tran et al, 2003: Canada	AMI			50	<ul style="list-style-type: none"> 2. Median waiting time (days) for catheterization post-MI 3. Median waiting time (days) for PCI post-MI 4. Median waiting time (days) for CABG post-MI <p style="text-align: center;">Outcome indicators</p> <ul style="list-style-type: none"> 1. In-hospital mortality 2. 30 day mortality 3. 1 year mortality 4. AMI readmissions rate at 30 days post-discharge 5. AMI readmission rate at 1 year post-discharge 6. CHF readmission rate at 30 days post-discharge 7. CHF readmission rate at 1 year post-discharge 8. Unstable angina readmission rate at 30 days post-discharge 9. Unstable angina readmission rate at 1 year post-discharge <p style="text-align: center;">Structural / organizational indicators general</p> <ul style="list-style-type: none"> 1. Secondary prevention clinic and/or access to rehabilitation 2. Standard admitting orders for CCU/ICU 3. Presence of dedicated clinical pharmacist in CCU/ICU 4. Presence of coronary CCU or medical ICU 5. Step down unit 6. Catheterization lab onsite 7. PCI capability <p style="text-align: center;">Thrombolysis</p> <ul style="list-style-type: none"> 1. Protocol for thrombolysis in ED 2. Availability of thrombolytics in ED 3. Specialist consult not required for thrombolytic administration