Quality-Based Procedures Clinical Handbook for Coronary Artery Disease

Cardiac Care Network of Ontario &
Ministry of Health and Long-Term Care

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Table of Contents

1.0 Purpose 3

2.0 Introduction 4

3.0 Description of Coronary Artery Disease 9

4.0 Best Practices Guiding the Implementation of CAD QBP 19

5.0 Implementation of Best Practices 41

6.0 What Does It Mean for Interprofessional Teams? 43

7.0 Service Capacity Planning 44

8.0 Performance Evaluation and Feedback 45

9.0 Support for Change 49

10.0 Frequently Asked Questions 50

11.0 Membership 51

12.0 References 53

Appendix A – List of Abbreviations 58

Appendix B – CCN Cardiac Registry Code Definition 59

Quality-Based Procedures Clinical Handbook: Coronary Artery Disease

1.0 Purpose

This Clinical Handbook has been created to serve as a compendium of the evidence-based rationale and clinical consensus driving the development of the policy framework and implementation approach for the coronary artery disease (CAD) Quality-Based Procedure (QBP).

The diagnosis and revascularization of CAD are accomplished through non-surgical approaches such as coronary catheterization, percutaneous coronary intervention (PCI), and the surgical isolated coronary artery bypass graft (CABG) surgery. For the purposes of this handbook, these procedures will be collectively referred to as advanced cardiac procedures.

The Cardiac Care Network of Ontario (CCN) serves as a system support to the Ministry of Health and Long-Term Care (the Ministry), Local Health Integration Networks, hospitals, and care providers dedicated to improving quality, efficiency, access, and equity in the delivery of the continuum of cardiac services in Ontario. CCN's priority is to ensure the highest quality of cardiovascular care based on evidence, standards, and guidelines, and actively monitors access, volumes, and outcomes of advanced cardiac procedures in Ontario. In addition, CCN works collaboratively with provincial and national organizations to share ideas and resources and to co-develop strategies that enhance and support the continuum of cardiovascular care, including prevention, rehabilitation, and end-of-life care.

Working with key stakeholders, CCN helps to plan, coordinate, implement, and evaluate cardiovascular care and is responsible for the Ontario Cardiac Registry. The information collected in the Cardiac Registry includes wait times information as well as specific clinical parameters required to evaluate key components of care and determine risk-adjusted outcomes. Through scientific evidence, expert panels and working groups, CCN uses evidence and consensus driven methods to identify best practices and strategies to effectively deliver cardiovascular services across the continuum of care.

The Cardiac Care Network, in collaboration with a working group composed of physicians, technical- and health data- experts, and other stakeholders, have played an integral role in the planning and development of this QBP.

This document has been prepared for informational purposes only. This document does not mandate health care providers to provide services in accordance with the recommendations included herein. The recommendations included in this document are not intended to take the place of the professional skill and judgment of health care providers.

2.0 Introduction

The Ministry of Health and Long-Term Care (Ministry) established Health System Funding Reform (HSFR) in Ontario in 2012 with a goal to develop and implement a strategic funding system that promotes the delivery of quality health care services across the continuum of care, and is driven by evidence and efficiency. HSFR is based on the key principles of quality, sustainability, access, and integration, and aligns with the four core principles of the ***Excellent Care for All Act*** (ECFAA):

- Care is organized around the person to support their health;
- Quality and its continuous improvement is a critical goal across the health system;
- Quality of care is supported by the best evidence and standards of care; and
- Payment, policy, and planning support quality and efficient use of resources.

Since its inception in April 2012, the Ministry has shifted much of Ontario's health care system funding away from the current global funding allocation (currently representing a large portion of funding) towards a funding model that is founded on payments for health care based on best clinical evidence-informed practices.

Principles of ECFAA have been further reinforced first by Ontario's Action Plan for Healthcare in January 2012, and recently with Patients First: Action Plan for Healthcare in February 2015, which signals positive transformational activity which will require adaptive responses across sectors and organizational levels at a time of accelerated change. The Ministry's commitment is to make Ontario the best healthcare system in the world.

The 2012 Action Plan identified HSFR as a lever to advance quality and ensure that the right care gets provided at the right place and at the right time. HSFR focuses on delivering better quality care and maintaining the sustainability of Ontario's universal public health care system. Ontario is shifting the focus of its health care system away from one that has primarily been health care provider-focused, to one that is patient-centred. The 2015 Action Plan continues to put patients at the heart of the health care system by being more transparent and more accountable to provide health care in a way that maximizes both quality and value.

HSFR comprises 2 key components:

1. Organizational-level funding, which will be allocated as base funding using the Health-Based Allocation Model (HBAM); and
2. Quality-Based Procedure (QBP) funding, which will be allocated for targeted activities based on a "(price x volume) + quality" approach premised on evidence-based practices and clinical and administrative data.

2.1 'Money follows the patient'

Prior to the introduction of HSFR, a significant proportion of hospital funding was allocated through a global funding approach, with specific funding for select provincial programs, wait times services and other targeted activities. However, a global funding approach may not account for complexity of patients, service levels and costs, and may reduce incentives to adopt clinical best practices that result in improved patient outcomes in a cost-effective manner. These variations in patient care evident in the global funding approach warranted the move towards a system where 'money follows the patient'.

Under HSFR, provider funding is based on: the types and quantities of patients providers treat, the services they deliver, the quality of care delivered, and patient experience/outcomes. Specifically, QBPs incent the

health care providers to become more efficient and effective in their patient management by accepting and adopting clinical best practices that ensure Ontarians get the right care, at the right time and in the right place.

QBPs were initially implemented in the acute care sector, but as implementation evolves, they are being expanded across the continuum of care, including into the community home care sector, in order to address the varying needs of different patient populations.

Internationally, similar models have been implemented since 1983. While Ontario is one of the last leading jurisdictions to move down this path, this positions the province uniquely to learn from international best practices and pitfalls, in order to create a sustainable, efficient, and effective funding model that is best suited for the province and the people of Ontario.

2.2 What are Quality-Based Procedures?

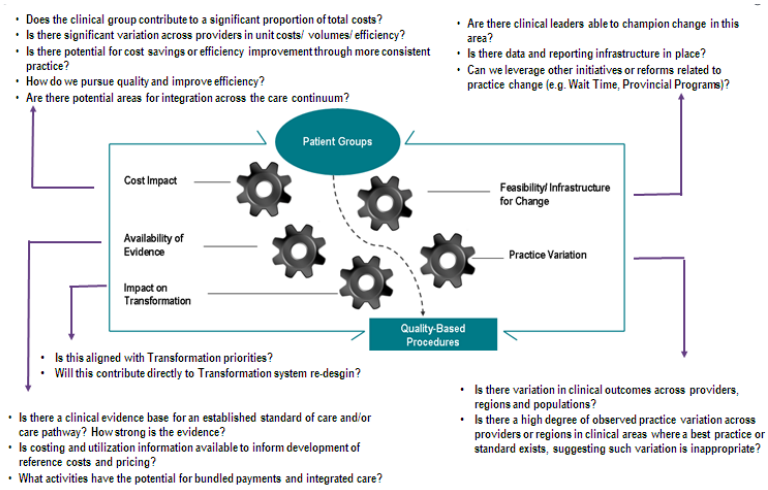
QBPs are clusters of patients with clinically related diagnoses or treatments that have been identified using an evidence-based framework as providing opportunity for process improvements, clinical re-design, improved patient outcomes, enhanced patient experience, and potential health system cost savings.

Initially developed in the acute (hospital) sector, QBPs were defined as “procedures.” However, as implementation evolved since the introduction of QBPs in 2012, so too has the approach. Currently, the expanded focus is on care provided in other parts of the health care sector with a focus on a more functional/programmatic/population-based approach. As a result, the definition of QBPs is expanding to include Quality-Based Procedures, Programs and Populations.

QBPs have been selected using an evidence-based framework. The framework uses data from various sources such as, but not limited to: the Discharge Abstract Database (DAD) and National Ambulatory Care Reporting System (NACRS) adapted by the Ministry for its HBAM repository. The HBAM Inpatient Grouper (HIG) groups inpatients based on the diagnosis or treatment responsible for the majority of their patient stay. Additional data has been used from the Ontario Case Costing Initiative (OCCI), and Ontario Cost Distribution Methodology (OCDM). Evidence published in literature from Canada and international jurisdictions, as well as World Health Organization reports, have also assisted with the definition of patient clusters and the assessment of potential opportunities (e.g. reducing variation, improving patient outcomes, sustainability).

The evidence-based framework assesses patients using five perspectives, as presented in Figure 1. It is this evidence-based framework that has identified QBPs that have the potential to improve quality of care, standardize care delivery across the province and show increased cost efficiency.

Figure 1: Evidence-Based Framework



2.2.1 Practice Variation

Practice variation is the cornerstone of the QBP evidence-based framework. A demonstrated large practice or outcome variance across providers or regions in clinical areas, where a best practice or standard exists, represents a significant opportunity to improve patient outcomes through focusing on the delivery of standardized, evidence-informed practices. A large number of 'Beyond Expected Length of Stay' and a large standard deviation for length of stay and costs were flags to such variation.

2.2.2 Availability of Evidence

A significant amount of research has been conducted and collected, both nationally and internationally, to help develop and guide clinical practice. Working with clinical experts, best practice guidelines and clinical pathways can be developed for QBPs and establish appropriate evidence-informed indicators. These indicators can be used to measure the quality of care and help identify areas for improvement at the provider level, and to monitor and evaluate the impact of QBP implementation.

2.2.3 Feasibility/ Infrastructure for Change

Clinical leaders play an integral role in this process. Their knowledge of the identified patient populations, and the care currently provided and/or required for these patients, represents an invaluable element in the assessment of much needed clinical delivery and clinical process improvements. Many groups of clinicians have already developed care pathways to create evidence-informed practice. There is now an opportunity for this knowledge to be transferred provincially.

2.2.4 Cost Impact

The provincial footprint from a financial perspective also impacts the selection of the QBP. This may include QBPs that are high volume and low-cost, as well as those that are low-volume and high costs (i.e. specialized procedures that demonstrate opportunity for improvement).

A selected QBP should have, as a guide, no less than 1,000 cases per year in Ontario and represent at least one percent of the provincial direct cost budget. For patient cohorts that fall below these thresholds, the resource requirements to implement a QBP can be restrictive. Even where the patient cohorts

represent an opportunity for improvement, it may not be feasible, even if there are some cost efficiencies, to create a QBP.

2.2.5 Impact on Transformation

The ***Action Plan for Health Care*** was launched in January 2012 and is already making a difference to Ontarians and our health care system:

- We've bent the cost curve since 2011/12
- We're improving the health of Ontarians
- We're enhancing the experience of Ontarians when they use the health system
- We're working with our health sector partners to improve the quality of health care

The next phase of Transformation will build on and deepen implementation of the Action Plan. HSFR is a key element of the Health System Transformation Agenda by ensuring sustainability and quality.

Selected QBPs should, where possible, align with the government's transformational priorities. In addition, the impact on transformation of certain patient populations hitherto not prioritized by the framework can be included as QBPs. This will ensure that QBPs are wide ranging in their scope e.g. paediatric patient populations or patients requiring community care. QBPs with a lesser cost impact but a large impact on the provincial health care system may still be a high priority for creation and implementation.

2.3 How will QBPs encourage the delivery of high quality, evidence-based care and innovation in health care delivery?

The QBP methodology is driven by clinical evidence and best practice recommendations from the Clinical Expert Advisory Groups (Advisory Groups). Advisory Groups are comprised of cross-sectoral, multi-geographic and multi-disciplinary membership, including representation from patients. Members leverage their clinical experience and knowledge to define the patient populations and recommend best practices.

Once defined, these best practice recommendations are used to understand required resource utilization for QBPs and will further assist in the development of evidence-informed prices. The development of evidence-informed pricing for the QBPs is intended to incent health care providers to adopt best practices in their care delivery models, maximize their efficiency and effectiveness, and engage in process improvements and/or clinical re-design to improve patient outcomes.

Best practice development for QBPs is intended to promote standardization of care by reducing inappropriate or unexplained variation and ensuring that patients get the right care, at the right place and at the right time. Best practice standards will encourage health service providers to ensure that appropriate resources are focused on the most clinically and cost-effective approaches.

QBPs create opportunities for health system transformation where evidence-informed prices can be used as a financial lever to incent providers to:

- Adopt best practice standards;
- Re-engineer their clinical processes to improve patient outcomes;
- Improve coding and costing practices; and
- Develop innovative care delivery models to enhance the experience of patients.

An integral part of the enhanced focus on quality patient care is the development of indicators to allow for the evaluation and monitoring of actual practice and support on-going quality improvement.

In addition, the introduction of additional QBPs such as outpatient and community-based QBPs will further help integrate care across sectors and encourage evidence-based care across the continuum.

3.0 Description of Coronary Artery Disease

CAD or ischemic heart disease is the result of progressive narrowing and obstruction of the lumen of coronary arteries secondary to atherosclerosis (i.e. build-up of plaque) and related disorders. Ischemic heart disease is the most common form of cardiac disease. Atherosclerotic plaque in the coronary arteries can reduce the flow of blood to the heart muscle resulting in a lack of oxygen which can lead to symptoms of angina (chest pain) or myocardial infarction (heart attack). Heart attacks occur most commonly when a plaque ruptures and a blood clot forms inside the coronary artery, suddenly stopping the blood flow through the artery. Generally, ischemic heart disease most commonly occurs in men between the ages of 50 and 75. In women, the onset occurs slightly later in life in part due to the protective effects of estrogen.[1]

CAD includes stable angina (also known as stable CAD) and acute coronary syndrome (ACS). ACS is an acute event where the plaque in the artery may become less stable and/or may rupture resulting in unstable angina (UA) or myocardial infarction (MI) i.e. ST elevation MI (STEMI) or non-ST elevation MI (NSTEMI). ACS requires immediate medical attention. STEMI is a severe form of heart attack that can cause death if not treated quickly. The incidence of STEMI in Ontario is approximately 68 for every 100,000 adult residents, or approximately 7,000 STEMIs per year.[2]

Major risk factors for heart disease include: diabetes, high-blood pressure, obesity, smoking, inactivity, and an unhealthy diet. These risk factors are increasing among all age groups. Between 1994 and 2005, rates of high blood pressure among Canadians rose by 77%, diabetes by 45% and obesity by 18%.[3] For younger age groups, specifically those aged 35-39, the prevalence of high blood pressure increased by 127%, diabetes by 64%, and obesity by 20%.[4] In 2012, over 50% of adults aged 35 and above were considered overweight or obese and over 20% were smokers.[5] In Ontario, 27% of youth are overweight or obese.[6] In 2010, one in five adults 50-65 years of age in Ontario has two or more of the following major cardiovascular disease risks: hypertension, diabetes, obesity, and smoking.[7]

CCN Cardiac Registry data from fiscal year 2012-13 demonstrates that the majority of patients who underwent advanced cardiac procedures in Ontario have major cardiovascular (CV) risk factors. Data shows that the majority of these patients were in the 45-64 age cohort (see Table 1). Furthermore, CCN data shows that over 60% had hypertension or hyperlipidemia, about 50% were either current or former smokers, and 40-60% were either obese or overweight.

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[1] (Harvard Medical School, 2014)

[2] (Cardiac Care Network of Ontario (CCN), June 2013)

[3] (Heart and Stroke Foundation, 2010)

[4] (Heart and Stroke Foundation, 2010)

[5] (Statistics Canada, 2010)

[6] (Ministry of Health and Long Term Care (MOHLTC), 2013)

[7] (Heart and Stroke Foundation, 2010)

Table 1: Characteristics of CAD Patients who underwent Advanced Cardiac Procedures in Ontario (FY 12/13)

Characteristics of CAD Patients			
Variables	**Cath Only**	**PCI**	**Isolated CABG**
Volume	44,828	23,095	6,510
Average Age (mean)	65.3	65.0	65.9
Age Cohort (%)			
a) 20 - 44	4.5	4.0	2.2
b) 45 - 64	41.3	45.2	40.4
c) 65 - 74	29.5	26.7	35.7
d) 75+	24.6	24.1	21.8
Clinical Baseline Characteristics (%)			
a) Dialysis: (Missing : No : Yes)	1.4 : 96.8 : 1.7	2.3 : 96.2 : 1.5	0.3 : 98.3 : 1.4
b) Diabetes Mellitus: (Missing : No : Yes)	1.7 : 68.7 : 29.6	2.4 : 69.8 : 27.8	0.3 : 61.1 : 38.6
c) Hypertension: (Missing : No : Yes)	2 : 30.8 : 67.3	2.7 : 33.5 : 63.8	2.5 : 23.5 : 74
d) Hyperlipidemia: (Missing : No : Yes)	2.4 : 32.4 : 65.2	2.9 : 35 : 62.1	2.8 : 24.7 : 72.5
e) History of Myocardial Infarction: (Missing : No : Yes)	1.2 : 77.3 : 21.5	1.7 : 72.9 : 25.4	2 : 75 : 23
f) Recent Myocardial Infarction: (Missing : No : Yes)	1.2 : 81.9 : 16.8	2.2 : 56.1 : 41.7	0.3 : 64.5 : 35.2
g) History of Smoking:			
i) Current	19.6	25.7	20.9
ii) Former	27.9	25.5	36.1
iii) Missing	2.0	2.7	2.4
iv) Never	48.7	44.1	39.9
v) Unknown	1.8	2.0	0.6
h) Congestive Heart Failure (CHF):			
i) Missing	4.4	4.4	0.3
ii) No	86.2	89.8	90.6
iii) Unknown		0.0	0.1
iv) Yes	9.5	5.7	8.9
i) Creatinine:			
i) 0 - 120 µmol/L	76.0	71.9	82.2
ii) 120-180 µmol/L	6.8	7.0	8.3
iii) >180 µmol/L	2.9	2.8	2.8
iv) Missing	14.2	18.3	6.7
j) Body Mass Index (BMI):			
i) Underweight	0.8	0.6	0.6
ii) Normal weight	17.2	14.6	23.1
iii) Overweight	21.6	22.0	37.6
iv) Obesity	21.8	20.3	31.8
v) Missing	38.6	42.5	6.9

Data source: CCN Cardiac Registry.

Note: Volumes include cases that fall within and outside clinical pathways, as well as stable angina inpatient cases with cath only procedure. Cases that fall outside of the clinical pathways are excluded from the CAD QBP.

The diagnosis of CAD involves the use of non-invasive and/or invasive cardiac testing. Cardiac catheterization or coronary angiogram (or angiogram) is a catheter-based diagnostic procedure that utilizes contrast media and x-ray to visualize the lumen of coronary arteries. Angiogram is considered a definitive study in determining the presence of atherosclerosis or making the diagnosis of CAD. Diagnostic tools such as fractional flow reserve (FFR), intravascular ultrasound (IVUS), and optical coherence tomography (OCT) are sometimes used in conjunction with angiogram. ACS and stable angina patients with significant lesions (or blockage) may be treated by PCI or CABG surgery.

Similar to an angiogram, a PCI (also called angioplasty) involves inserting a wire through a catheter into the blocked coronary artery. A balloon (with or without a metal scaffold (referred to as a "stent")) is then inflated and flattens the blockage against the wall of the artery. Stents are currently available in a bare metal (BMS) or drug eluting (DES) format. The inflation of balloon with stent facilitates the flow of blood through the vessel by opening up the artery and allowing the stent to remain in place. A CABG is an open heart procedure involving the grafting of arterial (i.e. internal mammary or radial) or venous (i.e. saphenous) conduits (or channel) to bypass the blocked coronary artery thus restoring blood flow. An isolated CABG means that the surgery is performed without any concomitant procedure (e.g. valve surgery).

3.1 CAD QBP Definition

This QBP is for the provision of invasive diagnostic and revascularization procedures for CAD patients presenting with ACS or stable angina. Access to PCI and cardiac surgery services and the acuity of the patient at the time of presentation determine the type of treatment the patient will receive. Hemodynamically compromised ACS patients are assessed and treated as inpatients, while stabilized ACS patients and stable angina patients may be treated as elective or ambulatory care patients in an outpatient setting. ACS inpatients that are discharged home with arrangements for a scheduled or staged procedure should be referred to as stable angina patients.

To accurately classify patients into a clinical pathway, it is important for hospitals to enter the most appropriate primary referral reason information.

Limitations of Using CIHI Definitions

Two versions of the Cardiac QBP definitions were developed: one utilizes the CCN Cardiac Registry as the data source, and the other uses the CIHI DAD and NACRS. Both sets of definitions were considered for QBP implementation; however, there are fundamental differences between the CIHI and CCN definitions that do not accommodate direct comparisons and lead to discrepancies in volumes. Based on detailed analytic work, CCN identified that CIHI as a data source does not align with the clinical pathways and does not accurately account for case volumes. For instance, there are no fields in CIHI to accurately capture a patient's clinical presentation e.g., stable angina, STEMI, non-STEMI or unstable angina.

Additionally, referral reasons for a diagnostic procedure such as cardiac catheterization (cath) are not captured in CIHI. Non-CAD patients with diverse clinical conditions or medical diagnoses may undergo a cath for the identification and definitive diagnosis of CAD. These patients are captured in the CCN Cardiac Registry as "rule-out CAD" cases and are included in the CAD QBP cohort. This patient cohort would not be coded with a CAD diagnosis in CIHI; therefore, when the revised CIHI definition is applied, patients without a clinical pathway coded will be excluded, leaving out the majority of ***cath only*** patients that should be included in the CAD patient cohort. The CAD population is better represented by using the CCN Cardiac Registry definition.

The CCN definitions have been refined to better reflect homogenous patient cohorts for the Cardiac QBPs to ensure the ability to identify a greater proportion of patients with CAD. These revised definitions are a more accurate representation of the general CAD patient population. Based on the analyses, the Cardiac QBP Advisory Panel recommends that the CCN Cardiac Registry data be used to define procedure volumes.

3.1.1 Overlap with Other QBPs

There is potential for CAD QBP to overlap with other QBPs. Review of the data indicates that majority of the overlap occurs within the CHF and COPD QBP; however, it is only a small proportion of cases. It was found that majority of the overlap between these QBPs occurs within the CAD inpatient cath-only subgroup. To capture the overlap between the CAD QBP and other QBPs, the definitions for each QBP (*Cohort Inclusion/Exclusion Criteria for Funding Purposes*) were identified. By applying the definitions to CCN Cardiac Registry data linked to CIHI DAD and NACRS data, cases that fall within more than one QBP may be identified for exclusion from the CAD QBP.

The overlapping cases have already been carved out during the first year of implementation of these QBPs; thus, to avoid over-carving, they are to be excluded from the CAD QBP. This is reflected in the *CAD Exclusion Criteria* section below.

Overlap with Congestive Heart Failure (CHF) QBP

There is minimal (<1% of CAD QBP cases) overlap between the CAD and CHF QBPs.

The vast majority of the overlap is within NSTEMI/UA and STEMI *cath only* cases. All other CAD cases (PCI or CABG) should have a major clinical category (MCC) partition of "I", which would exclude them from the CHF QBP cohort.

CHF Cohort Inclusion/Exclusion Criteria

1. **Age**: Age greater than or equal to 20 years at time of admission.

2. **Diagnosis codes**: The ICD-10-CA most responsible diagnosis codes are listed below.

    - I50.x Heart failure, left ventricular dysfunction, etc.
    - I40.x, I41.x Myocarditis
    - I25.5 Ischemic cardiomyopathy
    - I42.x, I43.x Cardiomyopathies
    - I11.x plus I50.x (secondary Dx) Hypertensive heart disease plus heart failure, left ventricular dysfunction
    - I13.x plus I50.x (secondary Dx) Hypertensive heart disease and renal disease plus heart failure, left ventricular dysfunction)

3. **Intervention**: Patients are not assigned to an intervention-based HIG cell, given the current methodology. (i.e., MCC partition variable is not "I")

Overlap with Chronic Obstructive Pulmonary Disease (COPD) QBP

There is minimal (<0.1% of CAD QBP cases) overlap between the CAD and COPD QBPs.

The overlap is only found within *cath only* cases. All other CAD cases (*PCI* or *CABG*) should have an MCC partition of "I", which would exclude them from the COPD QBP cohort.

COPD Cohort Inclusion/Exclusion Criteria

1. **Age:** Age greater than or equal to 35 at time of admission
2. **Diagnoses:** Most responsible diagnosis in the range of J41-J44, excluding "J43.1" "J43.2" "J43.0"
3. **Intervention:** Is not assigned to an intervention based HIG cell based on the current methodology. (i.e., MCC partition variable is not "I")
4. **Inpatients Only:** Cases from DAD only; NACRS cases are excluded.

3.1.2 CAD Inclusion Criteria:

- Patients ≥20 years of age on the date of procedure;
- Ontario-funded cases;
- Patients whose *cath only*, *PCI*, or isolated *CABG* procedure started; and
- Cases that fall within a CAD clinical pathway.

3.1.3 CAD Exclusion Criteria:

- Cases with an invalid discharge date;
- Outpatient isolated CABG cases;
- NSTEMI and STEMI PCI or Cath Only cases with a wait location of home;
- Stable angina *cath only* inpatient cases;
- Cases that overlap with CHF or COPD QBP cases; and
- Cases with an AVD QBP procedure within the same admission.

When there are two or more procedures within a single admission, the case will only fall under only one procedure group, according to the following hierarchy. Cases with an AVD QBP procedure within the same admission are excluded from the CAD QBP.

For example, if a patient had a PCI and then later an isolated CABG surgery within the same admission, only the isolated CABG will be included.

See *Appendix B – CCN Cardiac Registry Codes* for the full technical definitions.

3.2 Rationale for choosing CAD as a QBP

CAD has been identified as a QBP using the evidence-based selection framework as presented in Figure 4 below.

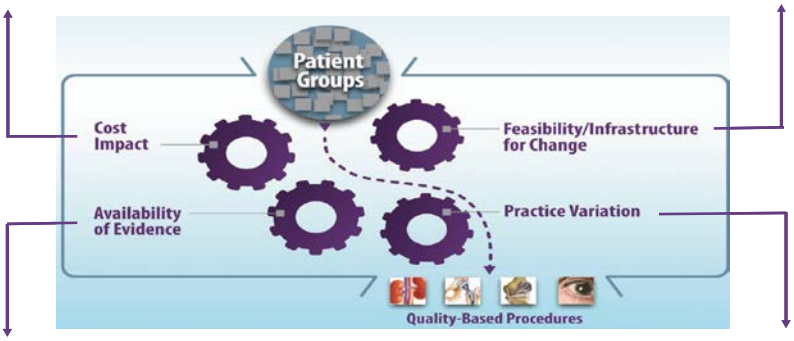
Figure 4: Evidence-based framework for CAD QBP.

Cost Impact

- In Fiscal Year 2012-13, there were 44,828 cardiac cath only and 23,095 PCI Ontario-funded procedures performed in the province. In the same year, there were 6,510 Ontario-funded isolated CABG surgeries performed in the province. These procedures represent significant costs to the healthcare system in the province.

Feasibility/Infrastructure for Change

- There are clinical leaders in cardiac care who are willing to act as champions for positive change.
- Many of these clinical leaders serve as clinical expert members on CCN's many clinical working groups.
- CCN has an existing infrastructure and relationships with cardiac care providers who participate in the CCN Cardiac Registry.
- CCN has Ministry support to maintain the CCN Cardiac Registry.
- The CCN Cardiac Registry is a repository of all cardiac procedures and surgeries performed on adults in Ontario. Following implementation of the QBP-based funding model, the CCN Cardiac Registry will provide a reporting mechanism for advanced cardiac centres to the Ministry.



Availability of Evidence

- 2014 Canadian Cardiovascular Society Guidelines for the Diagnosis and Management of Stable Ischemic Heart Disease.
- ACCF/AHA 2002 Guideline Update for the Management of Patients With Chronic Stable Angina.
- 2007 Chronic Angina Focused Update of the ACCF/AHA 2002 Guidelines for the Management of Patients With Chronic Stable Angina.
- 2013 ESC Guidelines on the Management of Stable Coronary Artery Disease.
- 2013 ACCF/AHA Guideline for the Management of ST-Elevation Myocardial Infarction.
- 2014 AHA/ACC Guideline for the Management of Patients With Non–ST-Elevation Acute Coronary Syndromes.
- 2011 ACCF/AHA Guideline for Coronary Artery Bypass Graft Surgery.
- Focused 2012 Update of the Canadian Cardiovascular Society Guidelines for the Use of Antiplatelet Therapy.
- CCN Recommendations for Best Practice STEMI Management in Ontario.
- ACCF/SCAI/STS/AATS/AHA/ASNC/HFSA/SCCT 2012 Appropriate Use Criteria for Coronary Revascularization Focused Update.
- 2012 Appropriate Use Criteria for Diagnostic Catheterization.
- "Report on Adult Cardiac Surgery in Ontario" CCN October 2012.
- "Report on Adult Percutaneous Coronary Interventions (PCI) in Ontario" CCN April 2013.
- Cardiac Care Network Annual Report 2012-2013
- "Cardiac Care Network Wait Times Data Trends" submitted monthly to the Ministry and published on http://www.ccn.on.ca.
- CCN Cardiac Registry, CIHI-DAD and NACRS, OCCI as sources for case costing, unit pricing and clinical data utilization.

Practice Variation

- Data from FY 2012/13 shows that wait times in Ontario for cath, PCI and CABG are well below the access targets for all advanced cardiac centres.
- There is considerable variation in the volume of procedures performed by each cardiac centre:
  - Hospital cath only case volumes ranged from 877 to 7,354 procedures.
  - Hospital PCI case volumes ranged from 576 to 2,670 procedures.
  - Hospital isolated CABG case volumes ranged from 287 to 980.
- There is a variation in the range of cardiac services offered at advanced cardiac centres in Ontario.
- Some centres offer cath services, some are stand-alone PCI centres offering cath and PCI services with no surgical back-up, and some are full service cardiac centres offering a cardiac surgical program.
- Currently 9 LHINs offer cardiac surgery and 13 offer cath and PCI services.
- The percentage of PCIs performed with a drug eluting stent varied between cardiac centres with a range of 43.6% to 73.4%.
- Mortality rates following PCI and isolated CABG in Ontario are relatively consistent between cardiac centres.
- The provincial average total length of stay (LOS) following isolated CABG, for the most recent year (October 1, 2010 to September 20, 2011), was 7.29 days.
- The average LOS following isolated CABG for individual cardiac centres ranged from 5.72 to 8.27 days indicating some variation between centres.
- The provincial average rate of red blood cell transfusions for isolated CABG procedures was 36.17% but this rate ranged from 20.79% to 45.09% between cardiac centres. The provincial average for plasma or platelet transfusion was 18.02% which ranged from 8.59% to 34.3% between centres.
- The provincial average rate of repeat revascularization (PCI) required at 1-year post-procedure was 11.2% but this rate ranged from 4.8% to 17.5% across PCI centres.
- In FY 2012-13, utilization of FFR, IVUS, and OCT varied across advanced cardiac centres from 2 to 523, 7 to 164, and 1 to 28 respectively.

3.3 Application of the evidence-based framework

Analysis of data from the CCN Cardiac Registry suggests that wait times are relatively consistent across the various advanced cardiac centres in Ontario. Mortality rates following isolated CABG surgery and PCIs are also relatively low across cardiac centres; however, there are other post-procedure clinical outcomes in which variation exists.

3.3.1 Wait Times

Wait times data are an important indicator of patterns of patient access to advance cardiac services. CCN has established maximum wait times for Cath, PCI and isolated CABG surgery based on patient clinical priority or urgency ranking. Patients are assigned a clinical priority ranking using a defined set of evidence-based criteria and based on an algorithm developed by CCN. Emergency surgeries, required within the next 24 hours, are not tracked in the current wait times data. All other patients are categorized as Urgent, Semi-Urgent, or Elective. Access targets for cath, PCI and isolated CABG are presented in Table 2 below:

Table 2: Access Targets for Cath, PCI, and CABG in Ontario

Procedure	Urgency	Access Target (Days)
Cath	Urgent	7
	Semi-Urgent	28
	Elective	84
PCI	Urgent	7
	Semi-Urgent	14
	Elective	28
CABG	Urgent	14
	Semi-Urgent	42
	Elective	90

CCN reports on wait times to the Ministry and to hospitals on a monthly basis. Wait times for cardiac services in Ontario are well below access targets across all three procedures, for each procedure, and at each hospital. CCN will continue to monitor and report on wait times and to work with hospitals and physicians ensuring that wait times remain low, and that adult cardiac patients in Ontario continue to have access to timely cardiac care.

3.3.2 Risk-Adjusted Clinical Outcomes

To examine variations in clinical outcomes across cardiac centres, CCN routinely reports on risk-adjusted post-procedural outcomes following both CABG and PCI procedures.[8] [9] CCN has been reporting on outcomes following CABG since 1994 and on outcomes following PCI since 2003. CCN outcomes reports present risk-adjusted mortality rates (in-hospital, 30-day and 1-year), length of stay (LOS), readmission rates (30-day and 1-year) and other post-procedural complications (stroke and renal failure). CCN's reports have demonstrated that mortality rates are low, relatively consistent between cardiac centres, and comparable to rates from other jurisdictions. Table 3 below summarizes provincial risk-adjusted mortality from CCN's most recent outcomes reports:

Table 3: Summary of Risk-Adjusted Provincial Mortality Rates Following PCI and CABG

Mortality Rate	Year	Total PCI	Isolated CABG
In-Hospital Mortality*	2008/09	1.52 (1.34 - 1.69)	1.84 (1.54 - 2.14)
	2009/10	1.56 (1.4 - 1.72)	1.6 (1.31 - 1.89)
	2010/11	1.36 (1.2 - 1.53)	1.74 (1.43 - 2.04)
30-Day Mortality**	2008/09	2.18 (1.97 - 2.4)	1.9 (1.61 - 2.2)
	2009/10	2.31 (2.11 - 2.51)	1.52 (1.23 - 1.8)
	2010/11	2.05 (1.85 - 2.25)	1.61 (1.31 - 1.92)
1-Year Mortality**	2008/09	4.83 (4.53 - 5.13)	4 (3.57 - 4.44)
	2009/10	5.04 (4.75 - 5.33)	3.71 (3.28 - 4.15)

**Data source: CCN Cardiac Registry linked to CIHI-DAD.*
***Data source: CCN Cardiac Registry linked to Ontario Registered Persons Database (RPDB).*
Data are expressed as mean and 95% confidence intervals. Each year of data runs from Oct. 1 to Sept. 31.

There are, however, some outcomes that CCN reports on that vary significantly from centre to centre, such as LOS and the requirement for blood product transfusions.

This CAD QBP provides the opportunity to standardize adult cardiac care across Ontario. It provides opportunities to ensure patients receive the best possible care and achieve optimal outcomes. Quality improvement requires the ability to define the quality indicators to be measured, develop a platform for

[8] (Cardiac Care Network of Ontario (CCN), 2012)

[9] (Cardiac Care Network of Ontario (CCN), 2013)

measurement, and track measured indicators for change. A framework for reporting quality indicators currently exists within the CCN Cardiac Registry to measure adult cardiac care delivery in Ontario. CCN has been using the CCN Cardiac Registry, linked to administrative data sources, to monitor and report on outcomes for PCI and CABG at a hospital, regional, and provincial level since 1994. CCN has risk-adjusted many of these outcomes to enable meaningful comparisons with common standards and benchmarks as well as comparisons between providers. CCN will continue to develop and refine quality indicators and risk-adjustment models to measure the quality of these procedures in Ontario and to ensure that Ontarians have access to the highest possible quality of cardiac care.

3.4 Objectives of the CAD QBP

The key objectives of the CAD QBP are to:

- Improve health outcomes of CAD patients;
- Identify and manage the cost of advanced cardiac procedures for the diagnosis and treatment of CAD on the healthcare system;
- Ensure advanced cardiac procedures and related tests are performed appropriately according to recommended guidelines;
- Be accountable to patients with CAD through public reporting of quality and performance metrics;
- Ensure equitable access to standardized care for the treatment of CAD across Ontario; and
- Address service gaps and/or need for capacity and infrastructure management to determine future development needs.

3.5 Documentation and Clinician Engagement

3.5.1 How will the cardiac procedures for CAD be documented? Is there a need for a new data collection process?

Through the Cardiac Registry, CCN has been responsible for tracking all advanced cardiac procedures in Ontario. Dedicated staff at each hospital is accountable for the entry and verification of data in the registry. This staffs includes, but are not limited to, Regional Cardiac Care Coordinators (RCCCs), surgical coordinators, and data clerks.

Once a patient is referred for an advanced cardiac procedure, the clinical pathway is documented as the reason for referral. Patient information such as medical history, relevant test results, and existing comorbidities are entered into the CCN Cardiac Registry. These patient characteristics are factored into a calculation of an Urgency Rating Score (URS) as well as a Recommended Maximum Wait Time (RMWT) that are used to help triage patients. While the patient is waiting for the procedure or surgery (i.e. wait time), clinical status changes are captured resulting in an adjustment to URS and RMWT, and possible reassignment of the clinical pathway. They are also adjusted based on delays and cancellations. After the patient receives a procedure, all related information is entered into the registry, including: date, type, and details of the procedure.

Data entered into the registry are immediately available for query and analysis. Volumes of the advanced cardiac procedures are verified and submitted by the hospitals to CCN. Utilization rates of specialized ancillary procedure equipment (e.g., drug eluting stent (DES)) are also collected. CCN reports these rates monthly and annually at the hospital and provincial level.

To standardize documentation and procedural coding, the CCN Cardiac Registry will be used as the source of data for QBP funding volumes and clinical evaluation. The use of the CCN Cardiac Registry does not require a new data collection process. The registry captures comprehensive information on cath, PCI and isolated CABG (i.e., patient characteristics, wait times, and procedural details and volumes). The Cardiac Registry is regularly updated, which allows for changes to and the addition of new data elements (e.g., smoking cessation education).

3.5.2 Implications on documentation, physician charting and CAD QBP funding

Prior to QBP implementation, the CCN Cardiac Registry was used as the data source for volumes and funding of advanced cardiac procedures in Ontario. Clinical documentation will not change with the introduction of the CAD QBP.

QBP funding will remain dependent on the accuracy and completeness of data entered into the registry from the patient's chart. At regular intervals, CCN Cardiac Registry reports will be generated to inform funding volumes and for reconciliation.

3.5.3 Clinical engagement

CCN convened the Cardiac QBP Expert Advisory Panel, comprised of clinical, technical- and health data-experts and other stakeholders, to support the provincial quality agenda related to the HSFR strategy. The purpose of the panel was to develop, support, and promote the utilization and implementation of evidence-based best practice clinical care pathways, quality indicators, and pricing models for the CAD QBP.

The provincial CCN Cardiac Registry and CIHI's DAD and NACRS were used as the primary sources of data to describe practice and outcomes variation across Ontario for advanced cardiac procedures. This work was conducted to support recommendations for systematic and standardized practices and clinical practice documentation. Recommendations of clinical care best practices were derived from available evidence, cardiac society guidelines, clinical experience, and expert consensus. The clinical pathways and quality indicators were validated through a secondary review process via a webcast that engaged a broader audience that included cardiologists, cardiac surgeons, hospital administration, decision support, and other stakeholders.

4.0 Best Practices Guiding the Implementation of CAD QBP

4.1 Best Practice – CAD Clinical Pathway

Best practices[10] for treatment and management of CAD including stable angina and ACS as well as for the diagnostic and revascularization procedures for patients with CAD were defined using a combination of expert consensus and evaluation of available guidelines and literature. The following clinical pathways for CAD patients undergoing cath, PCI and CABG apply to both acute and non-acute conditions (i.e. STEMI, NSTEMI, UA, and stable angina). While these pathways were expert consensus and guidelines- derived, they reflect current practices across advanced cardiac centres in Ontario. A Heart Team (consisting of interventional cardiologist, cardiovascular surgeon, and cardiologist) approach to revascularization is recommended in patients with complex CAD.

4.1.1 Risk Factor Modification for Patients with CAD

Risk factor modification is one of the goals of management of patients with CAD. Pharmacological and lifestyle modification strategies include, but are not limited to:

- Treatment for hypertension, diabetes, and elevated lipids;
- Nutrition and diet education;
- Smoking cessation education and counselling;
- Screening and treatment for depression; and
- Cardiac rehabilitation education and referral.

In Canada, one in three people following a heart attack develop clinical depression.[11] While a heart attack can trigger depression it was also found that depression is an independent risk factor for CAD.[12] Individuals with both cardiovascular disease and depression have an impaired quality of life and increased health problems and risk of death.[13] However, it was noted that treatment of depression in cardiovascular patients is only associated with improved depressive symptoms with no improvement in patient outcomes.[14]

4.1.2 Education

Prompt medical attention is sometimes necessary for patients with symptoms of cardiac ischemia. Patient education that includes disease process, prognosis, treatment options, and signs and symptoms of cardiac ischemia should be part of the healthcare intervention. In addition, medications should be reviewed and instructions on proper drug use (e.g., sublingual nitroglycerin) should be provided to patients and their families, as needed. When reasonable, all patients should receive education prior to procedures.

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[10] Best practice refers to a combination of best available evidence and clinical consensus as recommended by the Clinical Expert Advisory Group.

[11] (Public Health Agency of Canada (PHAC), 2009)

[12] (Kwawaja, Westermeyer, Gajwani, & Feinstein, 2009)

[13] (Public Health Agency of Canada (PHAC), 2009)

[14] (Thombs, et al., 2008)

To ensure optimal and high-quality care, it is important to make appropriate choices for diagnostic testing, treatments, and procedures. It is recognized that unnecessary tests and treatments may potentially expose patients to harm causing undue stress not only to patients, but also financial strain to the healthcare system. Choosing Wisely Canada (CWC), launched in April 2014, was developed to assist physicians and patients engage in conversation to make informed choices based on definitive evidence. The goal is to change the culture of "more is better" when it comes to treatments and procedures. CWC provides physician recommendations of items physicians and patients should address during consultation.[15]

4.1.3 Informed consent

As part of the informed consent process, it is recognized that each patient's presentation is unique and that the physician must discuss risks and benefits of available approaches for coronary revascularization with the patient or designate and family. This consent process should address three key elements: voluntary consent, mental capacity to consent, and properly informing the patient or designate.[16]

4.1.4 Goals of care

Patients should be given the opportunity to make informed decisions about care and treatment, in partnership with healthcare professionals. For example, the inter-professional team must discuss goals of care with the patient prior to any procedure. With the patient's consent, family and/or caregivers should also be given the opportunity to be involved in decisions about treatment and care. Planned and regular family meetings may be necessary to update the plan of care as the patient's condition changes.

4.2 Assessment, Diagnosis and Treatment for CAD

4.2.1 Acute Coronary Syndrome (ACS) – STEMI, NSTEMI and UA

ACS is a spectrum of clinical presentations that include STEMI, NSTEMI, and UA, representing varying degrees of coronary artery occlusion commonly caused by the disruption of atherosclerotic CAD plaque. Patients with ACS may present to a hospital emergency room (or designated chest pain unit) via private transportation or brought in by emergency medical services (EMS) personnel or ambulance. Initial recognition, early risk stratification, and immediate management of ACS are critical in ensuring optimal clinical outcomes.

Women, diabetics, and the elderly may present with atypical chest pain and symptoms that should be given special considerations.[17] Young adults, particularly women who present with ACS require careful and meticulous examination. Recent study has shown that this cohort of ACS patients is at increased risk of poorer access to care.[18] The screening for early detection of MI and care for ACS patients should be structured on standardized protocols and a coordinated system based on approved practice guidelines from symptom recognition to hospital discharge.

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[15] (Choosing Wisely Canada, 2014)

[16] (Canadian Medical Protective Association (CMPA), 2014)

[17] (Fitchett, et al., 2011)

[18] (Pelletier, et al., 2014)

At First Medical Contact:

First Medical Contact (FMC) with patients may happen with EMS personnel (outside of hospital) or at hospital emergency department (ED). For all ACS patients, the immediate acquisition of a 12-lead electrocardiogram (ECG) by the emergency medical personnel at FMC is recommended. Moreover, patients presenting in the ED with a chief complaint of any of the following signs and symptoms will require immediate triage by a nurse and should be referred for further evaluation:[19] [20] [21] [22]

Chest pain or discomfort:

- Central or substernal, upper abdominal, epigastric discomfort;
- Pain radiating to neck, jaw, shoulders, back, one or both arms;
- Sensation of pressure, crushing, tightness, heaviness, cramping;
- Burning, aching;
- Accompanying dyspnea, indigestion, nausea, vomiting, diaphoresis; or
- Associated hypotension or ventricular arrhythmias.

Other symptoms associated with myocardial ischemia:

- Isolated dyspnea;
- Weakness;
- Diaphoresis;
- Light-headedness and/or syncope; and
- Nausea.

Symptoms of clinical instability:

- Progressive angina (i.e. new onset angina with progressive symptoms or exacerbation of previous angina with more frequent, severe, or prolonged pain occurring at a lower exercise threshold or at rest); and
- Prolonged chest pain (i.e. 20 minutes).

Other considerations:

- The elderly, women, and individuals with diabetes may present with 'anginal equivalents' or symptoms that are not typical for myocardial ischemia; and
- Young adults (aged 18-55) may present with no chest pain, anxiety[23].

Physical and laboratory examination:

Physical and initial laboratory exams should consist of:[24] [25] [26]

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[19] (O'Gara, et al., 2013)

[20] (Amsterdam, et al., 2014)

[21] (Hamm, et al., 2011)

[22] (Steg, et al., 2012)

[23] (Pelletier, et al., 2014)

[24] (O'Gara, et al., 2013)

[25] (Amsterdam, et al., 2014)

[26] (Fitchett, et al., 2011)

- Brief and targeted initial physical examination and assessment of the following:
    - Current and past medical history;
    - Medications; and
    - Signs and symptoms.
- Obtain 12-lead ECG with goal of within 10 minutes of arrival in ED or chest pain unit (if not already performed by EMS);
- Troponin (I or T);
- Creatine kinase-MB (CK-MB);
- Complete blood count (CBC) with platelet count;
- International normalized ratio (INR);
- Activated partial thromboplastin time (aPTT);
- Electrolytes and magnesium;
- Blood urea nitrogen (BUN);
- Creatinine;
- Glucose; and
- Serum lipids.

In addition, B-type natriuretic peptide (BNP) or N-terminal of the prohormone-BNP (NT-proBNP) test may be considered to assess risk in patients with suspected ACS. [27]

Diagnosis:

Patients with definite ACS must be triaged based on a pattern of the 12-lead ECG (i.e. ST segment and T wave changes) and those with possible ACS are sent for further investigations (i.e. non-invasive cardiac testing). If STEMI is detected, the decision for reperfusion treatment with either fibrinolysis or primary PCI (PPCI) should be made within 10 minutes.[28] [29]

Risk stratification tools such as Thrombolysis in Myocardial Infarction (TIMI) risk score, Receptor Suppression Using Integrilin (PURSUIT) risk model, and Global Registry of Acute Coronary Events (GRACE) risk model are useful in determining appropriate therapy and management for patients with ACS.[30]

Immediate treatment:

Immediate treatment includes:[31]

- 162-325mg Aspirin or acetylsalicylic acid (ASA) chewed;
- Nitroglycerin, sublingual (for ongoing symptoms and with no hypotension and recent use of phosphodiesterase inhibitor);
- Supplemental oxygen (for hypoxia and dyspnea); and
- Morphine for pain control.*

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[27] (Amsterdam, et al., 2014)

[28] (O'Gara, et al., 2013)

[29] (Steg, et al., 2012)

[30] (O'Gara, et al., 2013)

[31] (Fitchett, et al., 2011)

*While it is important to keep the patient comfortable and pain-free, careful assessment should be made and caution taken prior to morphine administration. There is a growing body of evidence against routine administration of morphine in the setting of ACS. Large registry data showed that the use of morphine either alone or in combination with nitroglycerin in patients presenting with NSTE ACS was associated with higher mortality even after risk adjustment and matching on propensity score for treatment.[32] Similarly, a recent study involving STEMI patients showed prehospital administration of ticagrelor resulted in significant improvement of ST-segment resolution in patients who did not receive morphine.[33] Moreover, for STEMI patients receiving PPCI, a drug-to-drug interaction has been demonstrated between morphine and the P2Y12 platelet inhibitors: prasugrel and ticagrelor resulting in delayed onset of action of these oral antiplatelet agents.[34]

Careful patient assessment should be made prior to initiation of intensive antithrombotic or anticoagulation therapy. Validated bleeding risk tools such as Can Rapid Risk Stratification of Unstable Angina Patients Suppress Adverse Outcomes with Early Implementation of the American College of Cardiology Foundation (ACCF)/American Heart Association (AHA) Guidelines (CRUSADE) Registry, and Acute Catheterization and Urgent Intervention Triage Strategy (ACUITY) are available to assist clinicians in determining the appropriate pharmacologic agent and dosing of antithrombotic/anticoagulation for ACS patients.

Monitoring:

Monitoring of ACS patient should include:[35] [36] [37] [38] [39]

- Continuous cardiac ECG during evaluation and early phase of hospitalization;
- Intravenous access;
- Continuous pulse oximetry; and
- Having emergency resuscitation equipment (including defibrillation) readily available.

Treatment:

Patients with ACS must be observed with continuous ECG monitoring and managed with either invasive or conservative strategy.[40] STEMI patients are considered for immediate reperfusion therapy while NSTEMI/UA patients are treated according to the patient's clinical presentation and risk-stratification score. The timing of revascularization therapy differs between types of ACS patients; however, initial treatment may be delayed or further invasive treatment may be scheduled. While in hospital, a STEMI or NSTEMI/UA patient may need to undergo a revascularization procedure by PCI, CABG, or a combination of both based on clinical assessment and/or the need for additional cardiac investigations. Patients with multiple lesions or multiple vessel disease treated with PCI may undergo a staged or scheduled procedure within the same

[32] (Meine, et al., 2005)

[33] (Montalescot, et al., 2014)

[34] (Parodi, et al., 2015)

[35] (O'Gara, et al., 2013)

[36] (Amsterdam, et al., 2014)

[37] (Fitchett, et al., 2011)

[38] (Hamm, et al., 2011)

[39] (Steg, et al., 2012)

[40] (Amsterdam, et al., 2014)

episode of care (i.e., same admission). For some patients, PCI may be required to be performed as an outpatient procedure. ACS patients who are discharged home with arrangements for a scheduled or staged PCI should be referred as stable angina patients.

In addition to reperfusion therapy, ACS patients require standard pharmacologic therapy and tailored according to patient's needs that may include a combination of anti-anginals, dual antiplatelet, antithrombotic, angiotensin-converting-enzyme (ACE) inhibitors/angiotensin receptor blockers (ARBs)/aldosterone antagonists, beta blockers, statins, calcium channel blockers, and proton-pump inhibitors (PPIs).

4.2.1.1 STEMI

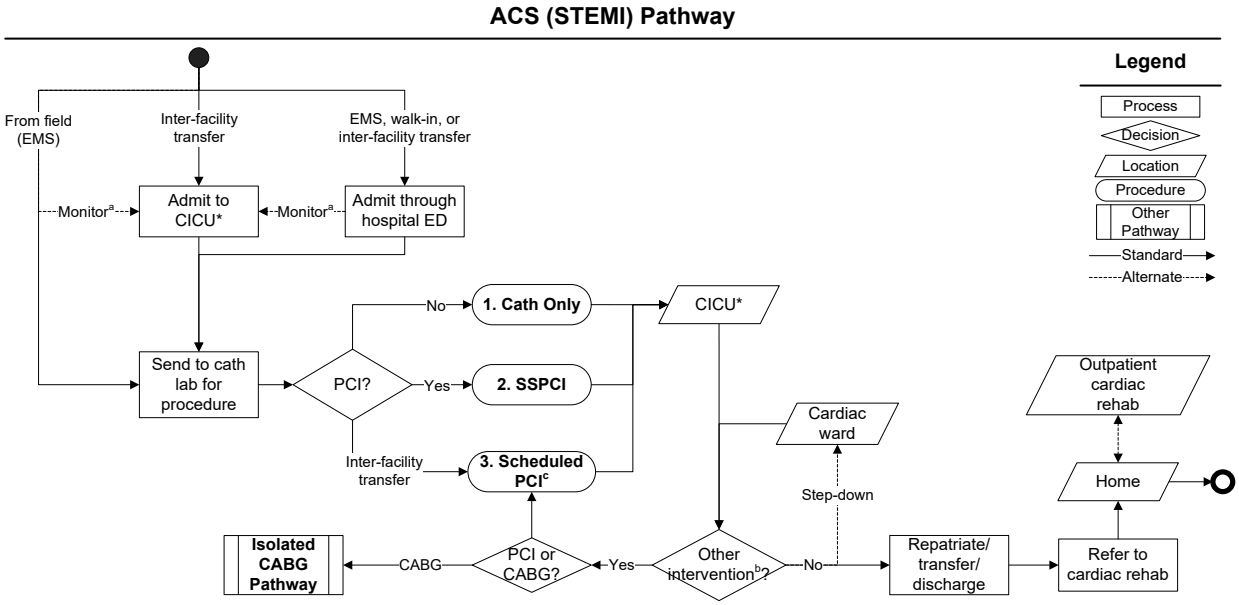
CAD may present as STEMI ACS where the 12-lead ECG shows persistent ST segment elevations in two or more contiguous leads or new or presumed new left bundle branch block (LBBB)[41] which may indicate complete obstruction of the coronary artery involved. ST segment elevation, measured on 12-lead ECG at J-point, should be > 0.25 mV in men less than 40 years of age, or > 0.20 mV in men 40 years of age or over, or > 0.15 mV in women in leads V1-V3 and/or > 0.10 m V in other leads in the absence of left ventricular (LV) hypertrophy or LBBB.[35] Ventricular pacing may also mask signs of ischemia or injury. Further evaluation with a right-sided ECG may be indicated for patients with inferior myocardial infarction in order to rule out right ventricular involvement.[42] [43] PCI is considered the gold standard initial reperfusion treatment for STEMI, which requires immediate transfer of the patient to a cath lab or inter-hospital transport to a PCI-capable centre (Refer to Figure 5 for STEMI pathway).

[41] (Fitchett, et al., 2011)

[42] (O'Gara, et al., 2013)

[43] (Steg, et al., 2012)

Figure 5: Pathway for STEMI



1. **Cath Only** – with or without FFR/IVUS/OCT
2. **Same Sitting PCI (SSPCI)** – with or without FFR/IVUS/OCT/Thrombectomy; includes primary PCI, pharmaco-invasive PCI, rescue PCI, and other SSPCI
3. **Scheduled PCI** (includes staged PCI) - with or without FFR/IVUS/OCT/Thrombectomy

a. Patients are monitored in CICU until the cath lab is available.
b. Patients may require CABG after cath or PCI; delayed PCI or medical management after cath.
c. Scheduled PCI are STEMI inpatients or transferred from other hospital. Outpatients are reclassified.***

***__IMPORTANT__: The STEMI patients who are discharged home with arrangements for an outpatient scheduled/staged PCI should be reclassified as **stable angina** patients.

Note: STEMI pathway includes post cardiac arrest and cardiogenic shock patients (with or without STEMI). STEMIs with or without an event are admitted to CICU. An event is any cath/PCI with heart failure, cardiac arrest, cardiac tamponade, transfusion for bleeding, etc.; with or without IABP*, ventilator, inotropes, temp pacer, mechanical circulatory support, dialysis, etc.

* CICU = Cardiac Intensive Care Unit; IABP = Intra-Aortic Balloon Pump

STEMI Reperfusion Strategy:

As ischemia can progress rapidly to infarction, time is critical in treatment of STEMI. Timely reperfusion for STEMI is vital in improving patient outcomes.[44] [45] Timely reperfusion requires a coordinated system of care involving the EMS, healthcare institution's specialized areas such as the ED, cardiac cath lab and the cardiac intensive care units (CICU). It is recommended that all communities participate in a regional STEMI system of care that includes assessment and quality improvement of EMS and hospital-based care activities.[46] STEMI protocols and guidelines should be in place to ensure timely diagnosis, transportation, and intervention. For more details refer to the 2013 CCN Recommendations for Best-Practice STEMI in Ontario available at: http://www.ccn.on.ca/CCN_Public/UploadFiles/files/Recommendations_for_Best_Practice_STEMI_Management_in_Ontario_(6).pdf.

The reperfusion strategy should be administered to all eligible STEMI patients within 12 hours of symptom onset. Primary PCI (PPCI) is the recommended reperfusion strategy with a goal of 90 minutes or less from

[44] (Cantor, et al., 2009)

[45] (Rollando, et al., 2012)

[46] (O'Gara, et al., 2013)

first medical contact to device (balloon) inflation. However, if fibrinolytic therapy is chosen as the reperfusion strategy, it should be administered within 30 minutes of hospital arrival. Fibrinolytic therapy is recommended when there is an anticipated delay of >120 minutes to performing PPCI. For STEMI patients who initially arrive at a non-PCI capable centre, immediate EMS transfer to a PCI-capable hospital is recommended with FMC to device time goal of 120 minutes or less.[47] [48]

a. Primary PCI:

Ideally, PPCI should be performed within 12 hours of ischemic symptoms onset. While PCI should be performed in 'culprit' lesions or blockage causing symptoms of ACS, it is not recommended that intervention be performed in a non-infarct artery during the time of PPCI in STEMI patients who are hemodynamically stable.[49] The placement of a BMS or DES is considered useful in PPCI; however, the decision about what stent to use should be made after careful consideration of the patient's bleeding risks and ability to comply with the required dual antiplatelet therapy. Dual Antiplatelet Therapy (DAPT) including aspirin and a $P2Y_{12}$ receptor inhibitor are the recommended treatment for all ACS patients.[50]

b. Fibrinolytic Therapy:

Fibrinolytic therapy is the recommended reperfusion strategy in the absence of contraindications and when PPCI is not feasible. When fibrinolysis is administered, the ACCF/AHA STEMI Guidelines state that it is reasonable to perform immediate angiography and/or PCI between 3 and 24 hours post fibrinolytic administration.[51] It is also considered reasonable to perform urgent angiography and/or PCI for failed fibrinolytic therapy. However, it may be beneficial to immediately transfer (to a PCI centre) high-risk STEMI patients within 6 hours of thrombolysis for early cath/PCI.[52] The nursing care for post fibrinolytic STEMI patients is the same as in post PPCI care but with special considerations due to an increased bleeding risk.

Care of STEMI Patients:

All STEMI patients should be admitted to the intensive care unit for a continuous ECG and pulse oximetry monitoring with ready access to hemodynamic monitoring and defibrillation. Placement of electrocardiographic monitoring leads should be based on infarct location and rhythm to optimize detection of ischemic changes. Nursing care should be provided by critical care certified RNs, with staffing based on patient-specific needs, provider competencies, and organizational priorities.[53] [54]

4.2.1.2 NSTEMI/UA

NSTEMI or UA ACS, common manifestations of CAD, are defined as the presence of ST segment depression or prominent T-wave inversion on 12-lead ECG and/or positive serum cardiac biomarker of

[47] (O'Gara, et al., 2013)

[48] (Steg, et al., 2012)

[49] (O'Gara, et al., 2013)

[50] (Bell, et al., 2011)

[51] (O'Gara, et al., 2013)

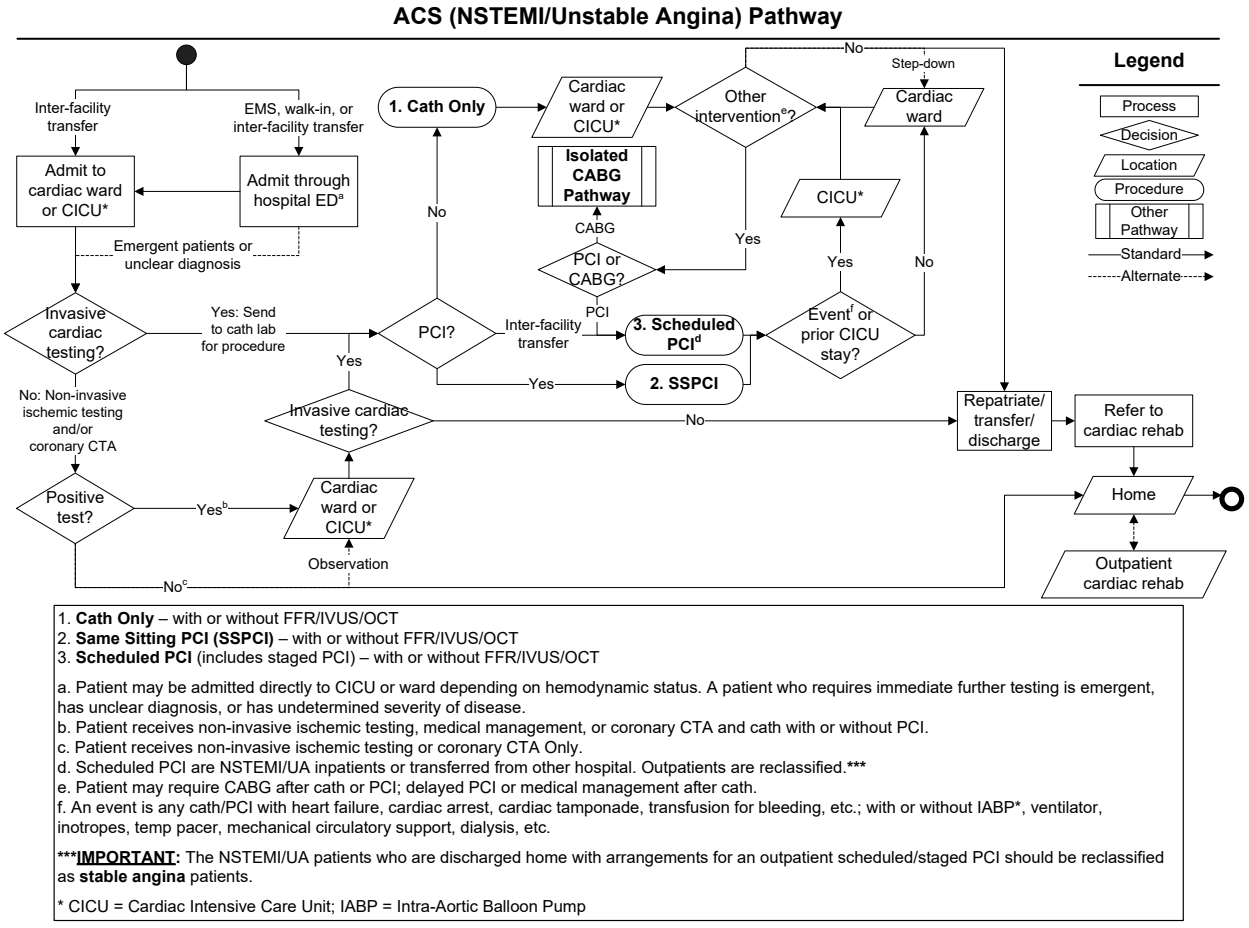
[52] (Cantor, et al., 2009)

[53] (O'Gara, et al., 2013)

[54] (Steg, et al., 2012)

necrosis (i.e. CK-MB or troponin) in the absence of ST-segment elevation and in the setting of appropriate clinical presentation (chest discomfort or angina).[55] [56] Figure 6 illustrates the common pathway for NSTEMI/UA patient through the healthcare system.

Figure 6: Pathway for NSTEMI/UA



1. **Cath Only** – with or without FFR/IVUS/OCT
2. **Same Sitting PCI (SSPCI)** – with or without FFR/IVUS/OCT
3. **Scheduled PCI** (includes staged PCI) – with or without FFR/IVUS/OCT

a. Patient may be admitted directly to CICU or ward depending on hemodynamic status. A patient who requires immediate further testing is emergent, has unclear diagnosis, or has undetermined severity of disease.
b. Patient receives non-invasive ischemic testing, medical management, or coronary CTA and cath with or without PCI.
c. Patient receives non-invasive ischemic testing or coronary CTA Only.
d. Scheduled PCI are NSTEMI/UA inpatients or transferred from other hospital. Outpatients are reclassified.***
e. Patient may require CABG after cath or PCI; delayed PCI or medical management after cath.
f. An event is any cath/PCI with heart failure, cardiac arrest, cardiac tamponade, transfusion for bleeding, etc.; with or without IABP*, ventilator, inotropes, temp pacer, mechanical circulatory support, dialysis, etc.

***IMPORTANT: The NSTEMI/UA patients who are discharged home with arrangements for an outpatient scheduled/staged PCI should be reclassified as **stable angina** patients.

* CICU = Cardiac Intensive Care Unit; IABP = Intra-Aortic Balloon Pump

Assessment:

Patients with non-persistent ST segment elevation are placed under a predetermined observation period. Serial ECGs (e.g., 15-30 minute intervals) may be required to identify ischemic changes.[57] In all patients who present with symptoms of ACS, frequent and ongoing assessment using risk stratification tools and evaluation of signs and symptoms, ECG, troponin levels, electrolytes, hemoglobin level, blood sugar, and renal function should be made for the first 12-24 hours.[58] If required, further evaluations are made including functional cardiac testing (e.g., resting nuclear scan or echocardiography) and/or stress testing or non-

[55] (Amsterdam, et al., 2014)

[56] (Hamm, et al., 2011)

[57] (Amsterdam, et al., 2014)

[58] (Fitchett, et al., 2011)

invasive coronary imaging study (e.g., coronary computed tomographic angiography (CTA)).[59] The assessment of LV function is used to guide further pharmacologic therapy.

Inpatient admission to the critical care unit or cardiac ward is recommended according to the patient's condition and specific needs. Patients with active, ongoing ischemia/injury or hemodynamic or electrical instability are admitted to the intensive care unit. Those that are relatively stable but have a positive cardiac biomarker, functional/stress test, or coronary CTA are admitted for further inpatient evaluation and treatment in a telemetry unit. Low-risk ACS patients with normal test results at the end of observation period may be considered for an early stress test or discharged and may return for outpatient stress testing within 72h.[60] [61] [62]

Monitoring:

For hemodynamically stable NSTEMI/UA patients the guidelines recommend the following:

- Admit as inpatient for bed rest;
- Continuous ECG monitoring; and
- Observe for recurrent ischemia.

Likewise, patients with continuing discomfort and/or hemodynamic instability should be hospitalized for at least 24h in a coronary intensive care unit with the ability to perform rapid cardioversion and defibrillation. The unit must have adequate staff to perform the required functions. The patient needs to be placed on:

- Bed rest;
- Continuous cardiac rhythm monitoring;
- Continuous pulse oximetry, if on supplemental O_2; and
- Frequent assessment of vital signs and mental status.

4.2.2 Stable Angina

Stable coronary artery disease is defined as an established pattern of transient angina pectoris resulting from episodes of myocardial oxygen supply-demand imbalance related to ischemia or hypoxia. Angina pectoris may occur spontaneously or as a result of physical or emotional stress and is reproducible. The goal of therapy for stable angina is to alleviate symptoms, prevent cardiovascular events, and reduce mortality.[63] [64] Figure 7 illustrates the common pathway of stable angina patients undergoing diagnosis and treatment.

[59] (Hulten, et al., 2013)

[60] (Amsterdam, et al., 2014)

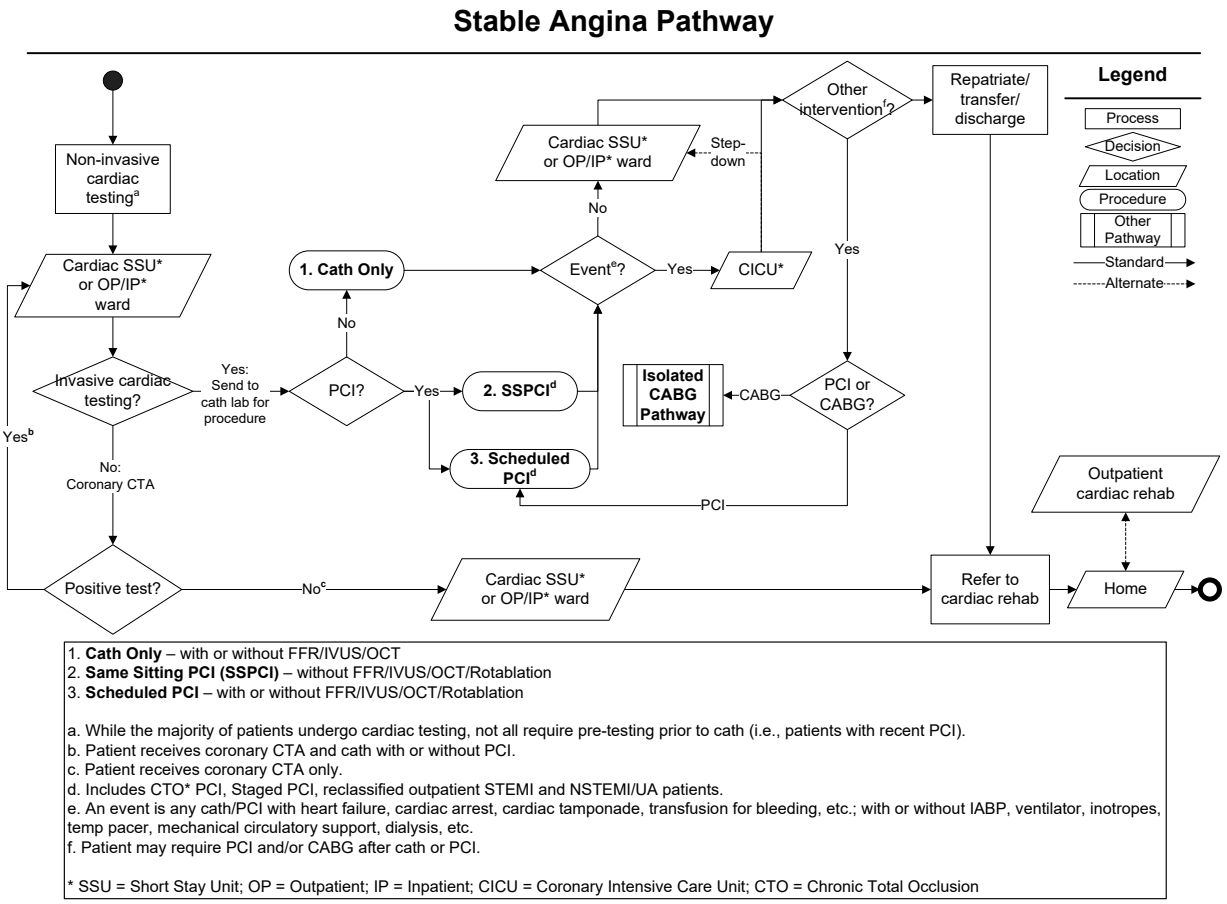
[61] (Fitchett, et al., 2011)

[62] (Hamm, et al., 2011)

[63] (Fraker TD Jr., 2007)

[64] (Montalescot, et al., 2013)

Figure 7: Pathway for Stable Angina



Assessment:

The focus of assessment for stable angina is prevention of future cardiovascular events. Clinical risk assessment includes:[65] [66] [67]

- Physical assessment including severity and pattern of angina pectoris;
- Evaluation of medical history:
  - previous heart disease
  - determine possible other cause of angina pectoris (e.g., aortic stenosis)
  - comorbid conditions (i.e., heart failure, valvular disease, CV and peripheral vascular disease, and renal disease)
  - other diseases (hyperlipidemia, hypertension, anemia, thyroid disease, etc.)
- Review of medication and compliance; and
- Screen for depression and appropriately treat.

[65] (Mancini, et al., 2014)

[66] (Fraker TD Jr., 2007)

[67] (Montalescot, et al., 2013)

Tests and laboratory investigations:

The Canadian Cardiovascular Society (CCS) guidelines[68] recommend that the initial assessment includes the following evaluation tests and blood investigations:

- 12-lead ECG;
- Full cholesterol panel;
- Hemoglobin;
- Hemoglobin A1c;
- Fasting blood glucose;
- Thyroid function;
- Renal function;
- Liver function;
- Non-invasive testing (e.g., exercise stress test, functional cardiac testing), or coronary CTA[69], if indicated; and/or
- Invasive cardiac testing (e.g., coronary angiography), if indicated.

Treatment:

Based on clinical assessment and non-invasive and/or invasive cardiac test results, medical, or revascularization therapy (surgical or non-surgical) may be indicated. Making appropriate treatment choices are important in ensuring optimal and quality patient care. Treatment options have to be discussed with the patient and/or family in collaboration with cardiologist, primary care physician, and sometimes cardiovascular surgeon. When the decision is made on the type of revascularization, the patient and family should be educated about the procedure or surgery and appropriate preparation provided.

4.3 Advanced Cardiac Procedures

CAD patients may be required to undergo an invasive cardiac test (e.g., angiography) to evaluate the presence and significance of atherosclerosis. Cardiac catheterization or coronary angiography is performed prior to determination of appropriate reperfusion strategy such as PCI or CABG. Each of these procedures should be performed according to evidence or best practice guidelines. The operators performing cardiac procedures or surgery must have completed appropriate clinical training and experience and demonstrate satisfactory outcomes. Likewise, the team (e.g., cardiac anesthetists, anesthesia assistants, respiratory therapists, nurses, technologists, etc.) supporting the physician at the cath lab or operating room table should have appropriate education, training, and experience to provide safe and competent care.[70]

4.3.1 Cardiac catheterization:

As a diagnostic procedure, coronary angiogram is performed in patients with known or suspected CAD. Additionally, non-CAD patients with complex clinical condition or medical diagnosis may be required to undergo an angiogram in an outpatient or inpatient setting. Ideally, patients referred for this procedure have completed a non-invasive cardiac test with results that warrant a more definitive test for the diagnosis of

[68] (Mancini, et al., 2014)

[69] (Hulten, et al., 2013)

[70] (Patel, Dehmer, Hirshfeld, Smith, & Spertus, 2012)

CAD. Additional imaging procedures such as FFR or IVUS may also be needed to enhance the results of angiographic testing and aid in making treatment decisions. The AHA/ACC provides some criteria for the appropriate use of coronary angiograms;[71] however, they should not be considered in isolation but rather in the context of the patient and clinical environment.[72]

4.3.2 Percutaneous Coronary Intervention (PCI):

The decision to use PCI as treatment for CAD is based on patient factors and local practice patterns. In certain cases, careful examination of options by the Heart Team may be required prior to determination of the revascularization method. For example, for patients with diabetes and multiple vessel disease, one strategy may be preferred over another (e.g., PCI vs. CABG).[73]

To optimize procedural outcomes, certain conditions and requirements have to be met at each stage of the procedure i.e. pre, intra, and post.

Pre-procedure for cath or PCI:

Prior to the procedure, it is essential to:

- Obtain informed consent;
- Clip hair from puncture site if hair interferes with the procedure;
- Document blood investigations results for coagulation studies (i.e. INR), complete blood count, electrolytes, renal profile including estimated glomerular filtration rate (eGFR);
- Obtain and provide copy of 12-lead electrocardiogram in patient's record;
- Obtain and document physical assessment and medical history;
- Document results of non-invasive cardiac testing (i.e. stress testing or functional imaging), if completed;
- Administer pre-medications as needed; and
- Complete pre-procedure checklist.

Intra-procedure for cath and PCI:

Recommendations for infection prevention and control (IPAC) measures are based on Center for Disease Control (CDC) recommendations and established guidelines.[74] In addition, hand hygiene and universal precautions are important components of IPAC practices in cath laboratories.[75]

For cath and PCI:

- Prep skin (femoral or radial puncture site) with a broad-spectrum antimicrobial agent as per institution's approved solution (i.e. 2% chlorhexidine-based solution is preferred and either 70% isopropyl alcohol or tincture of iodine as substitutes). Allow the antiseptic to air-dry (for iodophor, leave on skin for at least 2 minutes) prior to skin puncture;

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[71] (Patel, et al., 2012)

[72] (Mohareb, Qiu, Cantor, Kingsbury, Ko, & Wijeysundera, 2015)

[73] (Farkouh, et al., 2012)

[74] (Chambers, et al., 2006)

[75] (Provincial Infecttious Diseases Advisory Committee (PIDAC), 2012)

- Aseptic technique should be used including donning of hair covering, masks, sterile gown, and sterile gloves;
- Cover the entire patient with non-porous sterile drape;
- Drugs (for all PCI):[76]
    - ASA 162 or 325mg loading dose, if not given prior to procedure
    - $P2Y_{12}$ receptor inhibitor (clopidogrel 600mg or prasugrel 60mg or ticagrelor 180mg), if not given prior to procedure
    - Antithrombotic therapy:
        - Bivalirudin or combination of IV GPIIb/IIIa receptor antagonist (abxicimab, eptifibatide, or tirofiban) and unfractionated heparin combination
        - Administer bolus doses as recommended for therapy selected
- Access to point of care device to measure activated clotting time as required;
- Access to cardiac surgery;
- Access to hemodynamic support devices (for example, intra-aortic balloon pump (IABP)) and perfusion therapy;
- Access to emergency equipment including defibrillator; and
- Access to CICU.

The use of ancillary tools to further assess the lesions or augment the intervention may be required for certain cases. The guidelines recommend the use of the following reasonable: [77]

- Thrombectomy or manual device for aspiration of clots reasonable for PPCI;
- FFR for intracoronary assessment of stenosis severity and may be used according to the following conditions:
    - Culprit lesions should be treated immediately;
    - When non-invasive testing is contraindicated, non-culprit stenosis in patients with recent ACS either during the index or in a staged procedure;
    - To identify hemodynamically relevant coronary lesion(s) when evidence of ischemia is unavailable; and
    - Revascularization of stenosis with FFR <0.80 in patients with angina symptoms or a positive stress test.
- IVUS and OCT may be considered to characterize lesions, improve stent deployment, or assess stent apposition.

Implantation of stents:

In certain cases, the coronary artery may not be amenable to stenting; however, whenever possible, coronary stents (DES or BMS) should be implanted in the diseased vessels being treated to restore or improve coronary blood flow. Current evidence suggests the implantation of DES is preferred over BMS in the majority of patients with moderate to severe coronary artery disease.[78] [79] [80] [81]

[76] (O'Gara, et al., 2013)

[77] (O'Gara, et al., 2013)

[78] (Machadoa, et al., 2014)

[79] (Garg, et al., 2014)

[80] (Jaguszewski, et al., 2015)

[81] (Gorla, Loffi, Verma, Margonato, & Salermo-Uriarte, 2014)

Post-procedure care for cath and PCI:

Manual pressure or a vascular closure device may be used for hemostasis after sheath removal. It is recommended to use either sterile gauze or sterile and semi-permeable dressing to cover the catheter or puncture site. The use of vascular closure devices (VCD) is common post arterial punctures; however, it should be noted that VCDs are associated with more severe vascular complications than manual hemostasis. VCDs should be avoided in the following scenarios:[82]

- Punctures into pre-existing synthetic vascular graft;
- If systemic infection is a possibility; and
- Sheath has been in-dwelling for a prolonged period of time.

The patient is transferred to an appropriate patient care area for post procedure care. Stable patients post cath or PCI may be discharged within 24 hours. All STEMI ACS and hemodynamically unstable NSTEMI/UA patients require at least 24-hour care in an intensive care unit environment for close observation and monitoring. All other ACS patients can recover in a monitored cardiac unit such as telemetry. Routine ACS medical therapies should be initiated within 24 hours of presentation and continued after discharge from the hospital. The DAPT must be continued post initial loading dose after PCI and maintained as follows:[83] [84] [85] [86] [87]

- Aspirin 81 to 325 mg daily for indefinite period (81 mg preferred); **AND**
- Continue therapy for 1 year (may be longer for drug–eluting stent) with one of the following:
    - Clopidogrel: 75 mg daily **OR**
    - Prasugrel: 10 mg daily **OR**
    - Ticagrelor: 90 mg twice a day.

4.3.3 Isolated Coronary Artery Bypass Graft:

Isolated Coronary Artery Bypass Graft (CABG) is a surgery performed by cardiothoracic surgeons to bypass blockages or obstructions of diseased coronary arteries. This procedure involves the implantation of blood vessel (artery or vein) graft to restore blood flow to the heart muscle. CABG can be performed with or without cardiopulmonary bypass (CPB) allowing the surgery to be completed on non-beating or beating heart respectively.[88]

Those patients diagnosed with coronary artery disease that is not treatable by PCI and those with greater than 3 vessel disease are candidates for CABG surgery. The Freedom trial compared the PCI approach to

[82] (Chambers, et al., 2006)

[83] (O'Gara, et al., 2013)

[84] (Amsterdam, et al., 2014)

[85] (Bell, et al., 2011)

[86] (Hamm, et al., 2011)

[87] (Steg, et al., 2012)

[88] (Sundt, 2014)

CABG for patients with multi- vessel disease and co-existing diabetes. This trial demonstrated superiority of CABG versus PCI for this cohort with lower rates of myocardial infarction and mortality.[89]

The surgical procedure can be accomplished via traditional open sternotomy with the patient placed on CPB, also known as the heart lung machine. Through this approach, the heart can be stopped to allow for revascularization of vessels that are harvested from the leg (vein graft), the arm (i.e. radial artery) or directly from the left or right internal mammary artery (LIMA or RIMA) now known as the left or right internal thoracic artery (LITA or RITA).

CABG is the preferred method of treatment for those having left main disease or triple vessel disease with lowered ejection fraction. While PPCI is currently first line therapy for STEMI, emergency CABG is now reserved for those with: 1) left main and/or 3-vessel CAD, 2) ongoing ischemia after successful or failed PCI, 3) coronary anatomy not amenable to PCI, 4) a mechanical complication of STEMI, and 5) cardiogenic shock. CABG is recommended in patients with resuscitated sudden cardiac death or sustained ventricular tachycardia thought to be caused by significant CAD (>50% stenosis of left main coronary artery and/or >70% stenosis of 1, 2, or all 3 coronary arteries) and resultant myocardial ischemia.[90] (Refer to Figure 8 for the isolated CABG pathway).

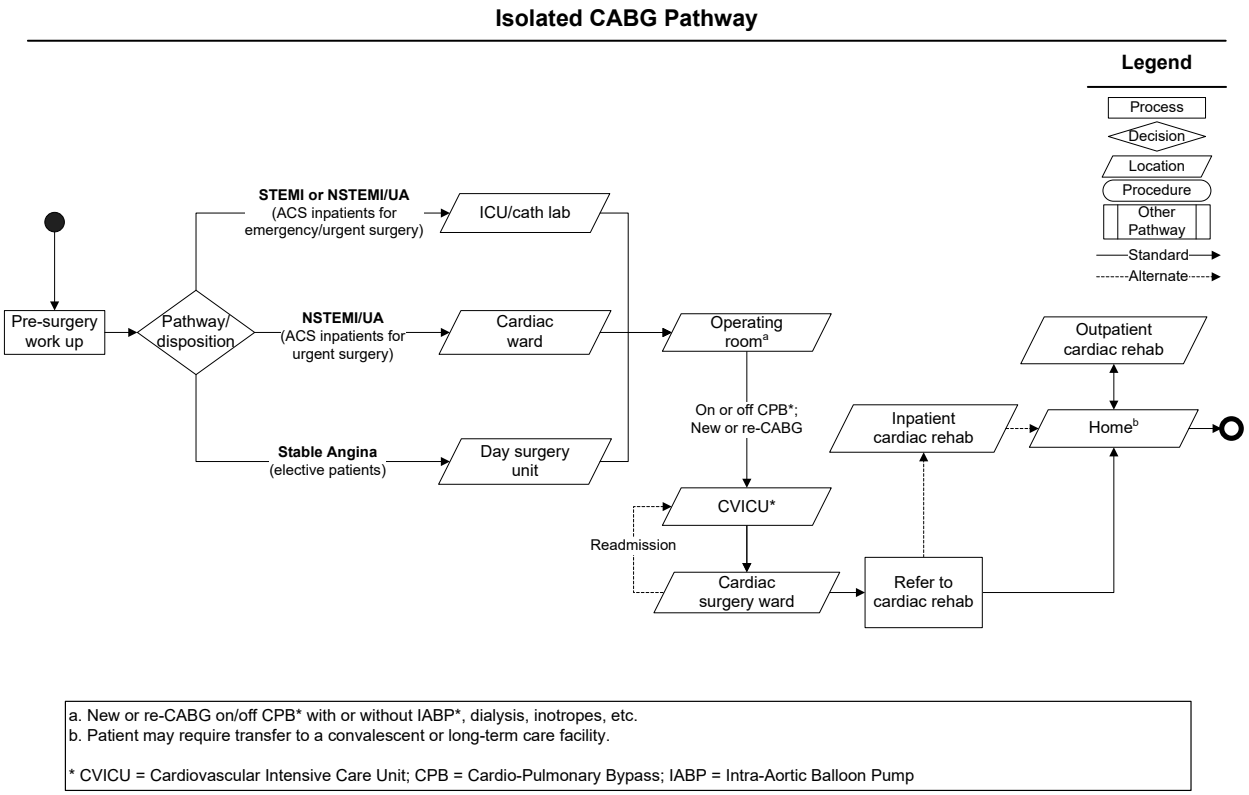
Literature shows that certain patients with an existing illness may be at higher risk for morbidity and mortality post CABG. Groups identified as higher risk are those over the age of 80 versus those 75-80 (11% versus 2.6%), with a high proportion having more than one co-morbid condition.[91] Additional factors that may influence the approach for coronary revascularization are the presence of diabetes or chronic kidney dysfunction. Moreover, these factors can also increase a patient's risks for cardiac surgery.

[89] (Farkouh, et al., 2012)

[90] (Hillis, et al., 2011)

[91] (Hillis, et al., 2011)

Figure 8: Pathway for Isolated CABG



Conventional CABG is performed via midline sternotomy, mini-sternotomy, or additional approaches such as:

- Off Pump Coronary Artery Bypass (OP-CAB) – median sternotomy similar to the traditional approach, however the heart remains beating. This procedure is performed with the use of stabilization devices to allow grafts to be surgically attached.
- Minimally Invasive Direct Coronary Artery Bypass (MIDCAB) – minimally invasive approach allowing direct visualization of vessels to be bypassed.
- Totally Endoscopic Coronary Artery Bypass (TECAB) – is the least invasive technique performed through small portholes allowing entry of surgical instruments. This technique is accomplished with the assistance of robotics.

The hybrid approach combines both PCI and minimally invasive access for off-pump CABG for patients with multi-vessel coronary artery disease. Research has indicated that the hybrid approach decreases the length of time spent in the intensive care unit, and decreases the overall length of stay. This approach has also been shown to decrease the need for blood transfusions in comparison to Off Pump (OP-CAB) where the CABG is performed through a median sternotomy without the use of cardiopulmonary bypass.[92]

[92] (Kon, et al., 2008)

Pre-CABG surgery:

Prior to surgery, the following should be completed:

- Obtain informed consent;
- Assess patient's potential need for blood transfusion and undergo appropriate blood management techniques to prevent transfusion;
- Conduct surgical risk assessment using Society of Thoracic Surgeons (STS) and Synergy between PCI with TAXUS and cardiac surgery (SYNTAX) scores;
- Determine the optimal surgical approach based on patient risk factors;
- Determine whether the procedure will be performed on or off CPB;
- Preconditioning management of myocardial ischemia is recommended to prevent intraoperative or postoperative MI;
- Anesthesia assessment;
- Correction of any existing hypoxia, anemia, or electrolyte imbalance;
- Administer as needed:
    - Prophylactic antibiotics for prevention of post-operative infection
    - Aspirin (100 mg to 325 mg daily)
    - Statin therapy
    - Beta blockers
    - Prevention and management of postoperative atrial fibrillation using antithrombotic therapy (anticoagulant and antiplatelet)[93]
- Clip hair from surgical site if hair interferes with procedure; and
- Complete pre-surgical checklist.

Discontinue any medications prior to procedure that may result in increased blood loss or transfusion (e.g., anticoagulants, $P2Y_{12}$ receptor inhibitors, glycoprotein IIb/IIIa inhibitors). The timing of discontinuation should be made according to the recommended schedule.

Blood conservation strategies should be used to limit the need for intraoperative or postoperative blood transfusions that have been shown to increase a patient's morbidity and mortality. Patients undergoing CABG surgery that did not have a blood transfusion are shown to have decreased rates of port operative infection, and reduced length of stay.

The formation of the Ontario Transfusion Coordinators (OnTraC) across Ontario has implemented measures to decrease the needs for blood transfusions for patients undergoing cardiac surgery.[94] Such strategies include but are not limited to:

- Management and preoperative correction of anemia;
- Use of cell saver intraoperatively and postoperatively which returns a patients salvaged blood after being washed and filtered;
- Use of drugs that decrease bleeding (i.e., aprotinin, tranexamic acid, and epsilon-aminocarproic acid);
- Blood transfusion is considered reasonable according to the guidelines when hemoglobin is less than 6 g/dL and as indicated by patient's clinical status; Preoperative management of patients on antiplatelet medication

[93] (Lahtinen, et al., 2004)

[94] (Freedman, Luke, Escobar, Vernich, & Chiavetta, 2008)

i.e. if clopidogrel is used, this should be discontinued at least 5 days before surgery and replaced with low-dose aspirin perioperatively (75-125 mg daily)[95]; and
- For some patients, the use of preoperative autologous blood transfusion may be an option.[96]

Patients undergoing cardiac surgery should be treated with an antibiotic as a preventative measure to reduce the risk of infection. The choice of antibiotic will be based on patient presentation, risk of pre-existing infection, and allergies. Those without suspected *methicillin-resistant staphylococcus aureus* (MRSA) are recommended to receive a first or second generation cephalosporin. Those with known or suspected MRSA should be treated with vancomycin alone or in combination with another antibiotic.[97]

Conduct and document pre-surgical tests as needed:

- Document blood investigations results for coagulation studies (i.e., INR), complete blood count (including hemoglobin), electrolytes, renal profile including eGFR;
- Assessment of renal function i.e. creatinine, glomerular filtration rate (GFR);
- Obtain and provide copy of 12-lead electrocardiogram in patient's record;
- Obtain and document physical assessment and medical history;
- Non-invasive cardiac testing (i.e. stress testing or functional imaging);
- Pre-operative cardiac catheterization;
- Carotid artery duplex scanning is reasonable in selected patients who are considered to have high risk features;
- Identify known risk factors for bleeding[98]:
    - Female;
    - Small body surface area;
    - Age greater than 70 years; and
    - Those taking preoperative antithrombotic therapy i.e. abciximab, clopidogrel, direct thrombin, inhibitors, low-molecular-weight heparin, long-acting direct thrombin inhibitors, thrombolytic therapy, aspirin, dipyridamole, eptifibatide, tirofiban; and
- Preventative measures for deep vein thrombosis (i.e. use of anti-embolism stockings, mechanical compression devices, early ambulation, adequate hydration).[99]

Intra-CABG surgery:

Operating room standards should be based according to hospital protocol and recommendations by authoritative organizations such as:

- Accreditation Canada International[100];
- Operating Room Nurses Association of Canada (ORNAC)[101];
- Association of Operating Room Nurses (AORN)[102]; and

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[95] (Ferrandis, Llau, & Mugarra, 2009)

[96] (Canadian Blood Services, 2013)

[97] (Hillis, et al., 2011)

[98] (Ferrandis, Llau, & Mugarra, 2009)

[99] (National Institute for Health and Care Excellence (NICE), 2010)

[100] (Accreditation Canada International, 2014)

[101] (Operating Room Nurses Association of Canada (ORNAC), 2013)

[102] (Association of periOperative Registered Nurses (AORN))

- Provincial Infectious Diseases Advisory Committee (PIDAC).[103]

The following activities are completed at the early intra-surgical phase:

- Selection of the anatomic approach and clinically appropriate conduit(s);
- Heparin loading dose is administered prior to inserting cannulas for cardiopulmonary bypass; and
- Measurement of activated clotting time (ACT) using a point-of-care testing device. ACT value greater than 480 seconds is needed before commencing CPB.

During surgery, maintenance of normal body temperature is recommended for the majority of procedures; however, mild hypothermia may be used at time of aortic cross clamping.

Monitoring should include:

- Physiologic and cardiac monitoring (including heart rate, blood pressure, peripheral oxygen saturation, and body temperature);
- Monitoring for ST segment changes that may indicate perioperative myocardial infarction with blood troponin measurement recommended;[104]
- Arterial line for continuous monitoring of hemodynamic status;
- Central venous pressure monitoring;
- Continuous ECG monitoring;
- Pulmonary artery catheter (PAC) when indicated. Recent studies have demonstrated no additional benefit for monitoring patients undergoing coronary revascularization versus use of central venous pressure (CVP)[105];
- Urinary catheter;
- Arterial blood gases, hemoglobin, and electrolytes investigation typically done in conjunction with ACT monitoring by anesthesia or perfusion;
- Utilize continuous intravenous insulin to achieve target intraoperative blood glucose levels as per hospital protocol;
- Trans-esophageal echocardiogram (TEE), when reasonable;
- IABP, when indicated; and
- Routine epi-aortic ultrasound scanning is reasonable to evaluate the presence, location, and severity of plaque in the ascending aorta to reduce complications.

Post-CABG surgery:

After completion of surgery, the patient is weaned from the CPB machine. At this time, blood salvaged during surgery is processed by use of cell saver[106] and transfused as deemed appropriate, and then the patient is transferred to the cardiovascular intensive care unit (CVICU) for post-surgical care. Length of stay in the ICU varies by approach and is based on patient's comorbidities.[107]

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[103] (Provincial Infecttious Diseases Advisory Committee (PIDAC), 2012)

[104] (Fleisher, et al., 2014)

[105] (Schwann, et al., 2011)

[106] (Ferraris, Brown, & Despotis, 2011)

[107] (Hillis, et al., 2011)

Prior to weaning from cardiopulmonary bypass, the patient should be warmed to 37 degrees Celsius, have normalized electrolytes and corrected acidosis or alkalosis, with a hematocrit in the range of 20-25% or according to institutional policy.

Heparin reversal is achieved by administration of protamine. Dosing of protamine should be made according to guidelines and institutional policy bearing in mind potential effects of excessive dosing. It was noted that a protamine to heparin ratio greater than 2.6:1 can impair platelet function and increase bleeding.[108]

Administer post-operative medications as needed:

- Continue intravenous insulin to achieve target postoperative blood glucose levels for up to 48-72 hours is recommended[109];
- Beta blockers;
- Statins; and
- ACEs or ARBs as indicated (consider continuing upon discharge where reasonable).

Early Extubation:

Post operatively, CABG patients are typically extubated within 4 hours of arrival to the ICU. This practice has been shown to decrease length of stay in the ICU, decrease risk of hospital acquired pneumonia, and shorten overall hospital stay.[110]

Pain Management:

Pain after cardiac surgery has been considered as one of the most severe types of post-surgical pain and tends to be at its worst in the first 48 hours.[111] [112]Furthermore, the use of the internal mammary artery during CABG has been associated with an increase in post-operative pain.[113] Studies have indicated that high level of acute pain is a predictor of chronic pain after cardiac surgery. The development of chronic pain post cardiac surgery ranges from 21% to 55% and is a key reason for emergency room visits and hospital readmissions.[114]

An important issue in the prevention of developing a chronic pain syndrome is the adequate control of pain in the acute phase of surgical recovery. Several key risk factors have been identified in the development of a chronic pain syndrome including the following: presence of preoperative anxiety, depression, high level of stress,[115] age<60, and surgery>2 hours.[116]

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[108] (Dunning, et al., 2008)

[109] (Hillis, et al., 2011)

[110] (Rashid, Sattar, Dar, & Khan, 2008)

[111] (Cogan, J, 2010)

[112] (Choinière, et al., 2014)

[113] (Mazzeffi & Khelemsky, 2011)

[114] (Cogan, J, 2010)

[115] (Choinière, et al., 2014)

[116] (Cogan, J, 2010)

There are a variety of tools that have been identified as beneficial in the assessment of cardiac surgical patients. The screening tool for addiction risk assessment (STAR) has specifically been designed for patients that will be treated by opioids. Additionally, the Barriers questionnaire focuses on the assessment of patient's beliefs about pain management so these can be addressed before surgery.[117] Preoperative evaluation using these and similar tools will help create a patient-centred and customized educational plan to address any misconceptions preoperatively.

Therapies for pain control after cardiac surgery can be managed by a variety of modalities and adequate pain control evaluated by valid and reliable tools such as the Numeric Pain Rating Scale.[118] By combining several types of agents and methods to treat pain, research indicates a decrease in narcotic use, a decrease in morbidity, and improved patient satisfaction.[119]

Transition and Follow-Up Care for all Advanced Cardiac Procedures:

Integration is one of health domains of QBPs. A patient's transition from hospital to home setting, or from inpatient to outpatient, and their integration in community are important aspects of healthcare that should be addressed prior to the patient's discharge. An interprofessional approach to discharge planning could potentially improve the patient's satisfaction with hospital discharge process and well-being after discharge.[120] A patient-centred, interprofessional discharge and follow-up consultation and planning with the patient and/or family may occur as soon as the patient is admitted. The discharge plan should include, but is not limited to:

- Post procedure/surgery education;
- Medical management;
- Access to in-patient or out-patient rehabilitation;
- Information regarding return to work;
- Lifestyle modification education; and
- Discussion about follow-up clinic visits.

Patient access to community supports requires transfer of accountability and referral to primary care providers and community programs with defined documentation and communication. A systematic referral is vital for cardiac rehabilitation in improving the patient's participation in supervised exercise programs.[121] In order for patients to obtain optimal benefit from exercise programs, cardiac rehabilitation should commence within 30 days of hospital discharge.[122] Cardiac rehabilitation is strongly recommended for patients with coronary artery disease particularly those with multiple modifiable risk factors.[123] [124] Similarly,

[117] (Choinière, et al., 2014)

[118] (Cogan, J, 2010)

[119] (Gritsenko, Khelemsky, Kaye, Validevu, & Urman, 2014)

[120] (Preen, et al., 2005)

[121] (Grace, et al., 2011)

[122] (Dafoe, Arthur, Stokes, Morrin, & Beaton, 2006)

[123] (Amsterdam, et al., 2014)

[124] (Montalescot, et al., 2013)

smoking cessation in-hospital education and cessation therapy should be offered for all identified smokers among CAD patients.[125] [126]

5.0 Implementation of Best Practices

While there exists a high level of care provided to CAD patients, variability exists in practice, outcomes and indicators of efficiency across Ontario suggesting opportunities for improvements in the delivery of cardiac services. Implementation of best practices based on established guidelines may improve system efficiencies and reduce the regional disparities in clinical outcomes, benefiting patients and the health-care system. As a system support for cardiac care services, CCN acts to enhance quality of care and outcomes and monitor timely access for advanced cardiac procedures. In addition to CCN, the network should include stakeholders involved in the delivery of services, including interprofessional care providers in hospitals, outpatient centers, administrators, and EMS with a standard approach to support evidence-based and effective diagnostic and therapeutic management for CAD patients.

An organization–specific implementation plan may include:

- A gap assessment of the current standard of practice and the recommended best practice recognizing the need (s) for change;
- An assessment of the readiness of the institution to provide a full breadth of care and possible barriers to implementation;
- Identification of stakeholders and their required involvement;
- Dedicated individual(s) to provide support for education and implementation;
- Timelines for implementation;
- Forums for discussion and education;
- Roll-out plans focused around the unique areas identified for changes;
- Follow-up evaluation of progress;
- Participation in a formal provincial cardiac network and registry; and
- A sustainability plan for maintaining the Best Practice Standards.

Details of each of these steps are clearly outlined in 'Toolkit to Support the Implementation of Quality-Based Procedures' published by the Ontario Hospital Association (OHA) available at https://www.oha.com/KnowledgeCentre/Library/Toolkits/Documents/OHA_QBProcedures_toolkit_FNL.pdf . According to OHA, there are three key success factors to QBP implementation: senior leadership support, clinician engagement, and high quality data. Furthermore, organizations should consider engaging patients in this process. Patient participation in the evaluation and implementation of CAD QBP is one of the ways in which patient's values and perspectives are heard and integrated into health decisions.

Data management requires consistent and complete data entry for every data field in CCN Cardiac Registry by dedicated personnel (i.e. RCCCs or data clerks). Training and ongoing support for new and existing personnel responsible for data entry are provided by CCN. Education of hospital decision support personnel on CCN Cardiac Registry may also be provided by CCN. The CCN database is accessible to

[125] (O'Gara, et al., 2013)

[126] (Hillis, et al., 2011)

authorized users with the ability to generate custom reports that can be used for hospital administrative, research, or clinical data.

The addition of new and future cardiac procedures in Cardiac QBP would require the education and training not only of personnel involved in these procedures, but also of RCCCs, data clerks, hospital clinical decision support, and relevant hospital stakeholders. CCN will continue its process of updating the cardiac registry on a regular basis to reflect accurate collection of recommended procedural details, quality indicators, and outcome measures.

6.0 What Does It Mean for Interprofessional Teams?

Patient-centeredness in health care is one of the quality domains of QBPs. Best practice dictates that it is critical to integrate interprofessional collaborative health care delivery models into the care of CAD patients to achieve and maintain quality and patient-centeredness. The World Health Organization defines collaborative practice in health care as occurring "when multiple health workers from different professional backgrounds work together with patients, families, caregivers and communities to deliver the highest quality of care."[127]

Standardization of best practices for treatment of CAD will require individual hospitals to consider a coordinated interprofessional team approach to CAD involving a network of care providers with various expertise including but not limited to cardiologists, interventional cardiologists, cardiovascular surgeons, nurses, nurse practitioners, intensive care practitioners, technologists, pharmacists, dietitians and other allied health providers to facilitate continuity of inpatient and outpatient care. In addition, the contribution of decision support and health records department should be considered for accurate coding and documentation of advanced cardiac procedures. Innovative solutions are required to plan for and meet the future needs of CAD care and maintain levels of service delivery. As a provincial system support, CCN is well-positioned to lead novel and innovative initiatives to address gaps and meet current and future needs in delivery of cardiovascular care services.

How does the CAD best practice pathway align with clinical practice?

The recommendations for best practice CAD management are based on evidence from current literature, guidelines and consensus of the clinical expert group.The pathways were derived from the current national guidelines such as those described within the CCS, ACCF/AHA and ESC practice guidelines for the management of patients with of stable angina and ACS. Also, taking into account current ACS protocols in place in Ontario hospitals and the collective experience of the clinical advisory committee shaped the development of the pathways recommended herein. Alignment of these recommendations with current clinical practice will vary across institutions; however, it is felt that many hospitals are currently following similar practices.

Will adoption of the CAD pathway change current clinical practice?

It is expected that this will provide standardization in clinical practice, however the extent of change will vary based on the individual circumstances of each hospital's adoption of the recommended pathway. Adoption of evidence-based best practices is expected to improve patient outcomes through:

- Systematic referrals and viable links to community and outpatient programs;
- Interprofessional and patient-centred approach to care;
- Programmatic and team approach to management of complex CAD;
- Standardized patient education and discharge planning;
- Application of risk reduction strategies; and
- Effective medication management.

[127] (Health Professions Networks Nursing & Midwifery Human Resources for Health, 2010)

7.0 Service Capacity Planning

The impact that QBP-based funding will have on hospital volumes of cardiac revascularization procedures is unknown. Careful volume monitoring and planning will be required to ensure that QBP-based funding implementation does not disrupt current service capacity. Currently the volume of isolated CABGs performed annually in Ontario has remained relatively constant (Table 4). It is not expected that this trend should be affected by implementation of QBP-based funding.

Table 4: Volumes of Cardiac Revascularization Procedures Performed in Ontario

Procedure	2009/10	2010/11	2011/12	2012/13	2013-14
Isolated CABG	6,848	6,651	6,558	6,510	6,714
PCI	21,006	21,967	21,943	23,095	24,214
% of PCI with DES	43.9%	44.4%	48.4%	54.4%	66.4%

Data source: CCN Cardiac Registry

The volume of PCIs being completed in Ontario has been steadily increasing over the past five fiscal years. In addition, the proportion of PCIs being performed using a DES is also increasing. Due to increases in technology, including DES, imaging techniques, and procedural skills, there are more patients undergoing PCI for the treatment of CAD. It is expected that this trend will continue after implementation of QBP-based funding. It is possible that new PCI capacity will eventually be required to meet this increasing demand.

According to the recent report released by CCN[128], there is significant variation in revascularization patterns across Ontario and the decision to use either CABG or PCI to treat CAD is affected by many factors. Hospital administrators will need to continue to work together with clinicians to ensure that patients continue to receive the most appropriate procedures and the highest quality of care.

[128] (Cardiac Care Network of Ontario (CCN), 2010)

8.0 Performance Evaluation and Feedback

An integrated scorecard for CAD will be required to be developed in order to allow the Ministry to measure changes in clinical practice resulting from implementation of QBP-based funding for treatment of CAD. This section of the handbook provides some high level recommendations for indicators from which to build this scorecard, based on existing work done to measure the quality of care of procedures designed to treat CAD in Ontario.

The Cardiac Care Network of Ontario (CCN) is responsible for maintaining the CCN Cardiac Registry in Ontario. This registry is a comprehensive, provincial database which can be used to track the volume and wait times of procedures performed to treat CAD, including Cath, PCI and CABG, in Ontario along with many important clinical variables associated with these procedures. When linked to provincial health abstract databases these data can be used to calculate post-procedural outcomes and track standardized performance across the province. CCN has been reporting on long term and post-procedural outcomes following CABG in Ontario since 1991 and following PCI since 1996. CCN is committed to continue to review and develop indicators to evaluate the performance of CAD treatment in Ontario.

Currently, the quality of care provided to patients with CAD in Ontario is high, with outcomes comparable to other Canadian and international jurisdictions. This has been demonstrated in recent outcomes reports released by CCN. Based on these reports, there are a number of indicators that have been reported by CCN in the past and are ready to be implemented as part of the integrated score card immediately.

8.1 Quality Indicators for Immediate Implementation

A. General CAD Quality Indicators:

1. Risk-adjusted 30-day and 1-year mortality rates *(for **isolated CABG** and **PCI**)*.
2. Risk-adjusted blood product (red blood cells, whole blood, plasma or platelets) transfusion rates *(for **isolated CABG** and **PCI**)*.
3. Post-procedural stroke within 30 days.
4. Door-to-balloon time *(for **primary PCI**)*.
5. Rate of readmission to ICU within 48 hours from inpatient ward location.
6. Total length of stay (TLOS).
7. Mean and 90th percentile wait times in days.
8. Percentage of procedures completed within RMWT.
9. Percentage of patients referred to cardiac rehabilitation program upon discharge.

B. CAD QBP-Specific Quality Indicators:

1. Rate of FFR use (*for **cath only** and **PCI***)
2. Rate of IVUS or OCT use (*for **cath only** and **PCI***)
3. Rate of long LOS (>2 days) (*for **cath only** and **PCI***)
4. Rate of DES use (*for **PCI***)
5. Rate of atherectomy use (*for **PCI***)
6. Rate of ICU LOS (≥4 days) (*for **isolated CABG***)

8.2 Proposed Quality Indicators for Future Development

There are also a number of indicators that have not previously been reported and would require further development before they could be implemented as part of the integrated score card.

1. Rate of surgical site infection.
2. Percentage of identified smokers offered smoking cessation education.

8.3 Integrated Scorecard

In introducing the QBPs the Ministry has a strong interest in:

1. Supporting monitoring and evaluation of the impact (intended and unintended) of the introduction of QBPs
2. Providing benchmark information for clinicians and administrators that will enable mutual learning and promote on-going quality improvement
3. Providing performance-based information back to Expert Panels to evaluate the impact of their work and update as required in real time

There was recognition that reporting on a few system-level indicators alone would not be sufficient to meet the Ministry's aim of informing and enabling quality improvement initiatives at the provider-level. Therefore measures meaningful to hospitals and clinicians that are interpretable and have demonstrable value in improving the quality of care provided to patients are also of utmost importance.

To guide the selection and development of relevant indicators for each QBP, the Ministry, in consultation with experts in evaluation and performance measurement, developed an approach based on the policy objectives of the QBPs and a set of guiding principles. This resulted in the creation of an integrated scorecard with the following six quality domains:

- Effectiveness (including safety)
- Appropriateness
- Integration
- Efficiency
- Access
- Patient-centeredness

The scorecard is based on the following guiding principles:

- ***Relevance*** – the scorecard should accurately measure the response of the system to introducing QBPs
- ***Importance*** – to facilitate improvement, the indicators should be meaningful for all potential stakeholders (patients, clinicians, administrators, LHINs and the Ministry)
- ***Alignment*** – the scorecard should align with other indicator-related initiatives where appropriate
- ***Evidence*** – the indicators in the integrated scorecard need to be scientifically sound or at least measure what is intended and accepted by the respective community (clinicians, administrators and/or policy-decision makers)

A set of evaluation questions was identified for each of the QBP policy objectives outlining what the Ministry would need to know in order to understand the intended and unintended impact of the introduction of QBPs. These questions were translated into key provincial indicators resulting in a QBP scorecard (see table below).

Table 4: Quality Domains

Quality Domain	What is being measured?	Key provincial indicators
Effectiveness	What are the results of care received by patients and do the results vary across providers that cannot be explained by population characteristics as well as is care provided without harm?	1. Proportion of QBPs that improved outcomes 2. Proportion of QBPs that reduced variation in outcome 3. Proportion of (relevant) QBPs that reduced rates of adverse events and infections
Appropriateness	Is patient care being provided according to scientific knowledge and in a way that avoids overuse, underuse or misuse?	4. Proportion of QBPs that reduced variation in utilization 5. Proportion of (relevant) QBPs that saw a substitution from inpatient to outpatient/day surgery 6. Proportion of (relevant) QBPs that saw a substitution to less invasive procedures 7. Increased rate of patients being involved in treatment decision 8. Proportion of (relevant) QBPs that saw an increase in discharge dispositions into the community
Integration	Are all parts of the health system organized, connected and work with another to provide high quality care?	9. Reduction in 30-day readmissions rate (if relevant) 10. Improved access to appropriate primary and community care including for example psychosocial support (e.g. personal, family, financial, employment and/or social needs) 11. Coordination of care (TBD) 12. Involvement of family (TBD)
Efficiency	Does the system make best use of available resources to yield maximum benefit ensuring that the system is sustainable for the long term?	13. Actual costs vs. QBP price
Access	Are those in need of care able to access services when needed?	14. Increase in wait times for QBPs / for specific populations for QBP 15. Increase in wait times for other procedures 16. Increase in distance patients have to travel to receive the appropriate care related to the QBP 17. Proportion of providers with a significant change in resource intensity weights (RIW)
Patient-Centeredness (*to be further developed*)	Is the patient/user at the center of the care delivery and is there respect for and involvement of patients' values, preferences and expressed needs in the care they receive? (TBC)	18. Increased rate of patients being involved in treatment decision 19. Coordination of care (TBD) 20. Involvement of family (TBD)

It should be noted that although not explicitly mentioned as a separate domain, the equity component of quality of care is reflected across the six domains of the scorecard and will be assessed by stratifying indicator results by key demographic variables and assessing comparability of findings across sub-groups. Where appropriate, the indicators will be risk-adjusted for important markers of patient complexity so that they will provide an accurate representation of the quality of care being provided to patients.

The Ministry and experts recognized that to be meaningful for clinicians and administrators, it is important to tie indicators to clinical guidelines and care standards. Hence, advisory groups that developed the best practices were asked to translate the provincial-level indicators into QBP-specific indicators. In consulting the advisory groups for this purpose, the Ministry was interested in identifying indicators both for which provincial data is readily available to calculate and those for which new information would be required. Measures in the latter category are intended to guide future discussion with Ministry partners regarding how identified data gaps might be addressed.

In developing the integrated scorecard approach, the Ministry recognized the different users of the indicators and envisioned each distinct set of measures as an inter-related cascade of information. That is, the sets of indicators each contain a number of system or provincial level measures that are impacted by other indicators or driving factors that are most relevant at the Local Health Integration Networks (LHINs), hospital or individual clinician level. The indicators will enable the province and its partners to monitor and evaluate the quality of care and allow for benchmarking across organizations and clinicians. This will in turn support quality improvement and enable target setting for each QBP to ensure that the focus is on providing high quality care, as opposed to solely reducing costs.

It is important to note that process-related indicators selected by the expert panels will be most relevant at the provider level. The full list of these measures is intended to function as a 'menu' of information that can assist administrators and clinicians in identifying areas for quality improvement. For example, individual providers can review patient-level results in conjunction with supplementary demographic, financial and other statistical information to help target care processes that might be re-engineered to help ensure that high-quality care is provided to patients.
Baseline reports and regular updates on QBP specific indicators will be included as appendices to each QBP Clinical Handbook. Reports will be supplemented with technical information outlining how results were calculated along with LHIN and provincial-level results that contextualize relative performance. Baseline reports will also be accompanied by facility-level information that will facilitate sharing of best practices and target setting at the provider-level.

The Ministry recognizes that the evaluation process will be on-going and will require extensive collaboration with researchers, clinicians, administrators and other relevant stakeholders to develop, measure, report, evaluate and, if required, revise and/or include additional indicators to ensure that the information needs of its users are met.

9.0 Support for Change

The Cardiac Care Network, in collaboration with the QBP expert panel for coronary artery disease, will continue to provide support and ongoing education to the provincial cardiac centres related to these QBPs. In addition, CCN will employ its clinical working groups that deal specific to coronary artery disease (i.e., Cath/PCI, STEMI/EMS, Cardiovascular Surgery, Cardiac Diagnostics (e.g., PET scan), Heart Rhythm, and Echocardiography) to support the implementation of CAD QBP.

The Ministry, in collaboration with its partners, will deploy a number of field supports to support adoption of the funding policy. These supports include:

- Committed clinical engagement with representation from cross-sectoral health sector leadership and clinicians to champion change through the development of standards of care and the development of evidence-informed patient clinical pathways for the QBPs.
- Dedicated multidisciplinary clinical expert group that seek clearly defined purposes, structures, processes and tools which are fundamental for helping to navigate the course of change.
- Strengthened relationships with Ministry partners and supporting agencies to seek input on the development and implementation of QBP policy, disseminate quality improvement tools, and support service capacity planning.
- Alignment with quality levers such as the Quality Improvement Plans (QIPs). QIPs strengthen the linkage between quality and funding and facilitate communication between the hospital board, administration, providers and public on the hospitals' plans for quality improvement and enhancement of patient-centered care.
- Deployment of a Provincial Scale Applied Learning Strategy known as IDEAS (Improving the Delivery of Excellence Across Sectors). IDEAS is Ontario's investment in field-driven capacity building for improvement. Its mission is to help build a high-performing health system by training a cadre of health system change agents that can support an approach to improvement of quality and value in Ontario.

We hope that these supports, including this Clinical Handbook, will help facilitate a sustainable dialogue between hospital administration, clinicians, and staff on the underlying evidence guiding QBP implementation. The field supports are intended to complement the quality improvement processes currently underway in your organization.

10.0 Frequently Asked Questions

1. Will physician payment models change as a result of QBP implementation?

At this time, physician payment models and OHIP fee schedules, as they relate to QBPs, will remain unchanged. Physicians currently working under fee-for-service will continue to submit claims to OHIP for consultations, performing the procedure and follow-up.

2. How will hospitals be compensated for providing care to more complex patients under the QBP process?

Patient complexity, co-morbid conditions, and procedural factors were taken into account in the costing/pricing methodology used for Cardiac QBP.

3. Was there any cardiac catheterization from the CCN Cardiac Registry that was not included in the CAD pathway?

In the CCN Cath Referral Form, the referring physician is able to check mark the reason for the cardiac catheterization. If the referral reason for cath is not coronary artery disease or rule-out CAD, then it is not included in the cath volume in CAD pathway. Other reasons for cath are: arrhythmia, congenital, heart failure, aortic stenosis, other valvular, no primary reason or other.

11.0 Membership

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Clinical		
Amlani, Dr. Shy	Interventional Cardiologist CPU Physician Lead	William Osler Health System
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12.0 References

Accreditation Canada International. (2014). *Standards*. Retrieved March 5, 2014, from Accrediation Canada: http://www.internationalaccreditation.ca/Accreditation/acstandards.aspx

Amsterdam, E., Wenger, N., Brindis, R., Casey, D. J., Ganiats, T., Holmes, D. J., et al. (2014). 2014 AHA/ACC guideline forthe management of patients with non–ST elevation acute coronary syndrome. *J Am Coll Cardiol, 64*, e139-228.

Association of periOperative Registered Nurses (AORN). (n.d.). *AORN's Guidelines for Perioperative Practice 2015 edition.* Retrieved February 27, 2015, from AORN: https://www.aorn.org/Guidelines/

Bell, A., Roussin, A., Cartier, R., Chan, W., Douketis, J., Gupta, A., et al. (2011). The use of antiplatelet therapy in the outpatient setting: Canadian Cardiovascular Society Guidelines. *Canadian Journal of Cardiology, 27*, S1-S59.

Butchart, E., Gohlke-Barwolf, C., Antunes, M., Tornos, P., De Caterina, R., Cormier, B., et al. (2005). Recommendations for the management of patients after heart valve surgery. *European Heart Journal, 26*, 2463-2471.

Canadian Blood Services. (2013, March). *Transfusion Medicine.* Retrieved March 20, 2015, from Canadian Blood Services: http://www.transfusionmedicine.ca/sites/transfusionmedicine/files/articles/CGTTChapter16_June2013_FINAL.pdf

Canadian Medical Protective Association (CMPA). (2014). *Good Practices: Informed Consent*. Retrieved December 2014, 2014, from The Canadian Medical Protective Association: https://www.cmpa-acpm.ca/cmpapd04/docs/ela/goodpracticesguide/pages/communication/Informed_Consent/three_key_elements_2-e.html

Cantor, W., Fitchett, D., Borgundvaag, B., Ducas, J., Heffernan, M., Cohen, E., et al. (2009). Routine early angioplasty after fibrinolysis for acute myocardial infarction. *N Engl J Med, 360*, 2705-18.

Cardiac Care Network of Ontario (CCN). (2010). *Variations in Revascularization Practice in Ontario.* Toronto: CCN.

Cardiac Care Network of Ontario (CCN). (2012). *Report on Adult Cardiac Surgery in Ontario.* Toronto: CCN.

Cardiac Care Network of Ontario (CCN). (2013). *Ontario Cardiac Services Road Map.* Toronto: CCN.

Cardiac Care Network of Ontario (CCN). (2013). *Report on Adult Percutaneous Coronary Interventions (PCI) in Ontario.* Toronto: CCN.

Cardiac Care Network of Ontario (CCN). (June 2013). *Recommendations for best practices STEMI management in Ontario.* Toronto: CCN.

Chambers, C., Eisenhauer, M., McNicol, L., Block, P., Phillips, W., Dehmer, G., et al. (2006). Infection control guidelines for the cardiac catheterization laboratory. *Catheterization and Cardiovascular Interventions, 67*, 78-86.

Choinière, M., Watt-Watson, J., Victor, J., Baskett, R., Bussières, J., Carrier, M., et al. (2014). Prevalence of and risk factors for persistent postoperative nonanginal pain after cardiac surgery: A 2-year prospective multicentre study. *CMAJ*, 1-11.

Choosing Wisely Canada. (2014, April 12). *Cardiology*. Retrieved from Choosing Wisely Canada: http://www.choosingwiselycanada.org/about/what-is-cwc/

Cogan, J. (2010). Pain management after cardiac surgery. *Seminars in Cardiothoracic and Vascular Anesthesia, 14*(3), 201-204.

Dafoe, W., Arthur, H., Stokes, H., Morrin, L., & Beaton, L. (2006). Universal access: But when? Treating the right patient at the right time: Access to cardiac rehabilitation. *Canadian Journal of Cardiology, 22*(11), 905-911.

Dunning, J., Versteegh, M., Fabbri, A., Pavie, A., Kolh, P., Lockowandt, U., et al. (2008). Guideline on antiplatelet and anticoagulation management in cardiac surgery. *European Journal of Cardio-thoracic Surgery, 34*, 73-92.

Farkouh, M., Domanski, M., Sleeper, L., Siami, F., Dangas, G., Mack, M., et al. (2012). Strategies for multivessel revascularization in patients with diabetes. *N Engl J Med, 367*, 2375-84.

Ferrandis, R., Llau, J., & Mugarra, A. (2009). Perioperative management of antiplatelet drugs in cardiac surgery. *Curr Cardiol REv, 5*(2), 125-132.

Ferraris, V., Brown, J., & Despotis, G. (2011). 2011 Update to The Society of Thoracic Surgeons and the Society of Cardiovascular Anesthesiologists. *Ann Thorac Surg, 91*, 944-982.

Fitchett, D., Theroux, P., Brophy, J., Cantor, W., Cox, J., Gupta, M., et al. (2011). Assessment and management of acute coronary syndrome (ACS): A Canadian perspective on current guideline-recommended treatment - Part I: Non- ST segment Elevation ACS. *Canadian Journal of Cardiology, 27*, S387-S401.

Fleisher, L., Fleischmann, K., Auerbach, A., Barnason, S., Beckman, J., Bozkurt, B., et al. (2014). 2014 ACC/AHA guideline on perioperative cardiovascular evaluation and management of patients undergoing non-cardiac surgery. *J Am Coll Cardiol, 64*, e77-137.

Fraker TD Jr., F. S. (2007). 2007 chronic angina focused update of the ACC/AHA 2002 Guidelines for the Management of Patients With Chronic Stable Angina. *J Am Coll Cardiol, 50*, 2264-74.

Freedman, J., Luke, K., Escobar, M., Vernich, L., & Chiavetta, J. (2008). Experience of a network of transfusion coordinators for blood conservation (Ontario Transfusion Coordinators (ONTrac). *Transfusion, 48*, 237-250.

Garg, A., Brodie, B., Stuckey, T., Garberich, R., Tobbia, P., Hansen, C., et al. (2014). New generation drug-eluting stents for ST-elevation myocardial infarction: A new paradigm for safety. *Catheterization and Cardiovascular Interventions , 84*, 955-962.

Gorla, R., Loffi, M., Verma, E., Margonato, A., & Salermo-Uriarte, J. (2014). Safety and efficacy of first-generation and second-generation drug-eluting stents in the setting of acute coronary syndromes. *J Cardiovasc Med, 15*, 532-542.

Grace, S., Chessex, C., Arthur, H., Chan, S., Cyr, C., Dafoe, W., et al. (2011). Systematizing inpatient referral to cardiac rehabilitation: A joint policy position of the Canadian Association of Cardiac Rehabilitation and Canadian Cardiovascular Society. *Canadian Journal of Cardiology, 27*, 192-199.

Gritsenko, K., Khelemsky, Y., Kaye, A., Validevu, N., & Urman, R. (2014). Multimodal therapy in perioperative analgesia. *Best Practice & Research Clinical Anaesthesiology, 28*, 59-79.

Hamm, C., Bassand, J., Agewall, S., Bax, J., Boersma, E., Bueno, H., et al. (2011). ESC Guidelines for the management of acute coronary syndromes in patients presenting without persistent ST-segment elevation. *European Heart Journal, 32*, 2999-3054.

Harvard Medical School. (2014, March 13). *Gender Matters.* Retrieved from Harvard Health Publications: http://www.health.harvard.edu/newsweek/Gender_matters_Heart_disease_risk_in_women.htm

Health Professions Networks Nursing & Midwifery Human Resources for Health. (2010). *Framework for action on interprofessional education and collaborative practice.* Geneva: World Health Organization (WHO).

Heart and Stroke Foundation. (2010). *A Perfect Storm of Heart Disease Looming in Horizon: An Annual Report on Canadians' Health.* Heart and Stroke Foundation.

Hillis, L., Smith, P., Anderson, J., Bittl, J., Bridges, C., Byrne, J., et al. (2011). 2011 ACCF/AHA guideline for coronary artery bypass graft surgery. *Circulation, 124*, e652-e735.

Hulten, E., Goehler, A., Bittencourt, M., Bamberg, F., Schlett, C., Truong, Q., et al. (2013). Cost and resource utilization associated with the use of computed tomography to evaluate chest pain in the emergency department: The rule-out myocardial infarction using computer assisted tomography (ROMICAT) study. *Circ Cardiovasc Qual Outcomes, 6*, 514-524.

Jaguszewski, M., Ghadri, J.-R., Seifert, B., Hiestand, T., Herrera, P., Gaemperli, O., et al. (2015). Drug-eluting stents vs. bare metal stents in patients with cardiogenic shock: A comparison by propensity score analysis. *J Cardiovasc Med, 16*, 220–229.

Kon, Z., Brown, E., Tran, R., Joshi, A., Reicher, B., Grant, M., et al. (2008). Simultaneous hybrid coronary revascularization reduces postoperative morbidity compared with results from conventional off-pump coronary artery bypass. *The Journal of Thoracic and Cardiovascular Surgery, 135*(2), 367-375.

Kwawaja, I., Westermeyer, J., Gajwani, P., & Feinstein, R. (2009). Depression and Coronary Artery Disease: The Association, Mechanisms, and Therapeutic Implications. *Psychiatry, 6*(1), 38-51.

Lahtinen, J., Biancari, F., Salmela, E., Mosorin, M., Satta, J., Rainio, P., et al. (2004). Postoperative atrial fibrillation is a major cause of stroke after off-pump coronary artery bypass surgery. *Ann Thorac Surg, 77*, 1241-4.

Leon, M., Smith, C., Mack, M., Miller, D., Moses, J., Svensson, L., et al. (2010). Transcatheter aortic-valve implantation for aortic stenosis. *N Engl J Med , 363*, 1597-1607.

Machadoa, C., Raposoa, L., Dores, H., Leal, S., Teles, R., Goncalves, P., et al. (2014). Second-generation versus first-generation drug-eluting stents for the treatment of patients with acute coronary syndromes and obstructive coronary artery disease. *Coronary Artery Disease , 25*, 208-214.

Mancini, G., Gosselin, G., Chow, B., Kostuk, W., Stone, J., Yvorchuk, K., et al. (2014). Canadian Cardiovascular Society guidelines for the diagnosis and management of stable ischemic heart disease. *Canadian Journal of Cardiology, 30*, 837-849.

Mazzeffi, M., & Khelemsky, Y. (2011). Poststernotomy Pain: A clinical review. *Journal of Cardiothoracic and Vascular Anesthesia, 25*(6), 1163-1178.

Meine, T., Roe, M., Chen, A., Patel, M., Washam, J., Ohman, E., et al. (2005). Association of intravenous morphine use andoutcomes in acute coronary syndromes: Results from the CRUSADE Quality Improvement Initiative. *Am Heart J, 149*, 1043-9.

Ministry of Health and Long Term Care (MOHLTC). (2013). *Maintaining the Gains, Moving the Yardstick: 2011 Report of the Chief Medical Officer of Health to the Legislative Assembly of Ontario.* MOHLTC.

Mohareb, M., Qiu, F., Cantor, W., Kingsbury, K., Ko, D., & Wijeysundera, H. (2015, March 10). *Validation of the appropriate use criteria for coronary angiography: A cohort study.* Retrieved March 11, 2015, from Annals of Internal Medicine.

Montalescot, G., Sechtem, U., Achenbach, S., Andreotti, F., Arden, C., Budaj, A., et al. (2013). 2013 ESC guidelines on the management of stable coronary artery disease. *European Heart Journal, 34*, 2949-3003.

Montalescot, G., van 't Hof, A., Lapostolle, F., Silvain, J., Lassen, J., Bolognese, L., et al. (2014). Prehospital Ticagrelor in ST-Segment. *N Engl J Med , 371*, 1016--27.

National Institute for Health and Care Excellence (NICE). (2010, March 18). *Venous Thromboembolism: Reducing the risk*. Retrieved March 6, 2014, from NICE Guidelines: http://www.nice.org.uk/guidance/cg92/chapter/introduction

Nishimura, R., Otto, C., Bonow, R., Carabello, B., Erwin, J. I., Guyton, R., et al. (2014). AHA/ACC guideline for the management of patients with valvular heart disease. *Circulation, 129*, 1-235.

O'Gara, P., Kushner, F., Ascheim, D., Casey, D. J., Chung, M., de Lemos, J., et al. (2013). 2013 ACCF/AHA guideline for the management of ST-elevation myocardial infarction: A report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. *J Am Coll Cardiol, 61*, e78-140.

Operating Room Nurses Association of Canada (ORNAC). (2013, April). *Standards for Perioperative Registered Nursing Practice 11th Edition* . Retrieved March 5, 2014, from ORNAC: http://www.ornac.ca/standards/

Parodi, G., Bellandi, B., Xanthopoulou, I., Capranzano, P., Capodanno, D., Valenti, R., et al. (2015). Morphine is associated with a delayed activity of oral antiplatelet agents in patients with ST-elevation acute myopcardial infarction undergoing primary percutaneous coronary intervention. *Circ Cardiovasc Interv, 8*, e001593.

Patel, M. (2013). Fractional flow reserve and the appropraite use criteria: Determining best practice in revascularization. *Cardiac Interventions, Jan/Feb*, 64-74.

Patel, M., Bailey, S., Bonow, R., Chambers, C., Chan, P., Dehmer, G., et al. (2012). ACCF/SCAI/AATS/AHA/ASE/ASNC/HFSA/HRS/SCCM/SCCT/SCMR/STS 2012 appropriate use criteria for diagnostic catheterization. *J Am Coll Cardiol, 59*(22), 857-881.

Patel, M., Dehmer, G., Hirshfeld, J., Smith, P., & Spertus, J. (2012). ACCF/SCAI/STS/AATS/AHA/ASNC/HFSA/SCCT 2012 appropriate use criteria for coronary revascularization focused update. *J Am Coll Cardiol, 59*(9), 857-81.

Pelletier, R., Humphries, K., Shimony, A., Bacon, S., Lavoie, K., Rabi, D., et al. (2014). Sex-related differences in access to care among patients with premature acute coronary syndrome. *CMAJ*, 1-8.

Preen, D., Bailey, B., Wright, A., Kendall, P., Phillips, M., Hung, J., et al. (2005). Effects of a multidisciplinary, post-discharge continuance of care intervention on quality of life, discharge satisfaction, and hospital length of stay: A randomized controlled trial. *International Journal for Quality in Health Care, 17*(1), 43-51.

Provincial Infecttious Diseases Advisory Committee (PIDAC). (2012). *Routine practices and additional precautions in all healthcare settings, 3rd edition.* Public Health Ontario.

Public Health Agency of Canada (PHAC). (2009). *Tracking Heart Disease and Stroke in Canada.* PHAC.

Rashid, A., Sattar, K., Dar, M., & Khan, A. (2008). Analyzing the outcome of early versus prolonged extubation following cardiac surgery. *Ann Thorac Cardiovasc Surg, 14*, 218-223.

Rollando, D., Puggioni, E., Robotti, S., De Lisi, A., Bravo, M., Vardanega, A., et al. (2012). Symptom onset-to-balloon time and mortality in the first seven years after STEMI treated with primary percutaneous coronary intervention. *Heart, 98*(23), 1738-42.

Schwann, N., Hillel, Z., Hoeft, A., Barash, P., Möhnle, P., Miao, Y., et al. (2011). Lack of effectiveness of the pulmonary artery catheter in cardiac surgery. *Anesthesia-Analgesia, 113*(5), 994-1002.

Statistics Canada. (2010). *CANSIM Table 105-0501 and Catalogue No. 82-221-X.* Statistics Canada.

Steg, P., James, S., Atar, D., Badano, L., Blo¨mstrom-Lundqvist, C., Borger, M., et al. (2012). ESC Guidelines for the management of acute myocardial infarction in patients presenting with ST-segment elevation. *European Heart Journal, 33*, 2569-2619.

Sundt, T. (2014, March 14). *Patient information: Adult cardiac surgery.* Retrieved from The Society of Thoracic Surgeons: http://www.sts.org/patient-information/adult-cardiac-surgery/cabg-information

Thombs, B., de Jonge, P., Coyne, J., Whooley, M., Frasure-Smith, N., Mitchell, A., et al. (2008). Depression screening and patient outcomes in cardiovascular care: A systematic review. *JAMA, 300*(18), 2161-2171.

Vahanian, A., Alfieri, O., Andreotti, F., Antunes, M., Baron-Esquivias, G., Baumgartner, H., et al. (2012). Guidelines on the management of valvular heart disease (version 2012). *European Heart Journal, 33*, 2451-2496.

Webb, J., Rodés-Cabau, J., Fremes, S., Pibarot, P., Ruel, M., Ibrahim, R., et al. (2012). Transcatheter aortic valve implantation: A Canadian Cardiovascular Society Position Statement. *Canadian Journal of Cardiology, 28*, 520-528.

Appendix A – List of Abbreviations

ACCF	American College of Cardiology Foundation
ACS	Acute Coronary Syndrome
AHA	American Heart Association
BMS	Bare Metal Stent
CABG	Coronary Artery Bypass Graft
CAD	Coronary Artery Disease
Cath	Left Heart Catheterization
CCN	Cardiac Care Network of Ontario
CCS	Canadian Cardiovascular Society
CICU	Cardiac Intensive Care Unit
CHF	Congestive Heart Failure
CIHI	Canadian Institute for Health Information
COPD	Chronic Obstructive Pulmonary Disease
CPB	Cardiopulmonary Bypass
CTA	Computed Tomographic Angiography
DAD	Discharge Abstract Database
DAPT	Dual Antiplatelet Therapy
DES	Drug Eluting Stent
ECG	Electrocardiogram
ED	Emergency Department
EMS	Emergency Medical Services
FFR	Fractional Flow Reserve
FMC	First Medical Contact
HBAM	Health Based Allocation Model
HSFR	Health System Funding Reform
IABP	Intra-aortic Balloon Pump
ICU	Intensive Care Unit
IVUS	Intravascular Ultrasound
LOS	Length of Stay
MI	Myocardial Infarction
Ministry	Ministry of Health and Long-Term Care
NACRS	National Ambulatory Care Reporting System
NSTEMI	Non-ST Elevation Myocardial Infarction
OCCI	Ontario Case Costing Initiative
OCT	Optical Coherence Tomography
PCI	Percutaneous Coronary Intervention
PPCI	Primary PCI
QBP	Quality-Based Procedure
RCCC	Regional Cardiac Care Coordinator
RMWT	Recommended Maximum Wait Time
STEMI	ST Elevation Myocardial Infarction
UA	Unstable Angina

Appendix B – CCN Cardiac Registry Code Definition

General Inclusion Criteria

(«Removal Date» - «Date of Birth») ≥ 20
AND («Authority Issuing» (Wait Times Data)='CANON' **OR** («Authority Issuing» (Wait Times Data)=NULL **AND** «Authority Issuing» (Patient Profile)='CANON'))) **AND** «Funding Source»='H'
AND «Removal Reason»='PS'
AND «Primary Reason»='D'
AND «Discharge/Transfer Date» is not NULL
AND «Booking Status»="Active"

Pathway Criteria and Inpatient/Outpatient Inclusions by Cost Group

Pathway	Criteria	Inpatient/Outpatient Inclusions		
Isolated CABG	«Primary Reason Type» in ('E', 'R', 'N', 'U', 'S')	Inpatient Only		
		Cath Only	**Scheduled/Staged PCI**	**SSPCI**
ACS (STEMI)	«Primary Reason Type» = 'S' AND Wait Location <> ('99996' [Other] or '99998' [Home] or NULL)	Inpatient or Outpatient	Inpatient or Outpatient	
ACS (NSTEMI/UA)	«Primary Reason Type» in ('N', 'U') AND Wait Location <> ('99996' [Other] or '99998' [Home] or NULL)			
Stable Angina	«Primary Reason Type» in ('E', 'R') OR («Primary Reason Type» = 'U' AND Wait Location = '99998' [Home])	Outpatient Only		

Inclusions by QBP Group

QBP Group	**Isolated CABG**	«Service Detail 1»='Surgical' **AND** «Bypass Surgery»='Y' **AND** «Aortic Valve Surgery»='N' **AND** «Mitral Valve Surgery»='N' **AND** «Other Valve Surgery»='N' **AND** «Tricuspid Valve Surgery»='N'		
	SSPCI	«Service Detail 1» in ('CATH Lab Diagnostic', 'CATH Lab Intervention') **AND** «SSPCI»='Y'		
	Scheduled/ Staged PCI	«Service Detail 1» in ('CATH Lab Diagnostic', 'CATH Lab Intervention') **AND** («Scheduled PCI»='Y' **OR** «Staged PCI»='Y')		
	Cath Only	**Catheterization**	**OR**	**Other Cath**
		«Service Detail 1» in ('CATH Lab Diagnostic', 'CATH Lab Intervention') **AND** «Coronary Angiogram»='Y' **AND** «SSPCI=»'N' **AND** «Catheter Based Valve Procedure»='N' **AND** «Trans Catheter Aortic Valve Intervention (TAVI)»='N' **AND** «Complex Congenital/Structural Procedure»='N' **AND** «Catheter Based Congenital/Structural Procedure»='N' **AND** «Myocardial Biopsy»='N'		«Service Detail 1» in ('CATH Lab Diagnostic', 'CATH Lab Intervention') **AND** «Right Heart Catheterization»='N' **AND** «Coronary Angiogram»='N' **AND** «SSPCI»='N' **AND** «Scheduled PCI»='N' **AND** «Staged PCI»='N' **AND** «Myocardial Biopsy»='N' **AND** «Catheter Based Valve Procedure»='N' **AND** «Trans Catheter Aortic Valve Intervention (TAVI)»='N' **AND** «Valvuloplasty»='N' **AND** «Complex Congenital/Structural Procedure»='N' **AND** «Catheter Based Congenital/Structural Procedure»='N' **AND** («Atherectomy/Thrombectomy»='Y' **OR** «Atherectomy»='Y' **OR** «Thrombectomy»='Y' **OR** «IVUS»='Y' **OR** «FFR»='Y')


Ontario