Quality-Based Procedures Clinical Handbook: Coronary Artery Disease

1.0 Purpose

This clinical handbook has been created to serve as a reference of the evidence-based rationale and clinical consensus which drives the development of the policy framework and implementation approach for the Coronary Artery Disease (CAD) 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, 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 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 time 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 practice 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, 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

Historically, a large portion of health service providers’ funding has been grounded on:

- A base annualized funding (global allocation), which is used to maintain day-to-day operations, such as: staff wages and benefits, overhead costs and service/maintenance contracts;
- New incremental funding, based on a funding formula, which takes into account demographics and acuity; and
- Growth funding targeted at fastest growing communities, hospital type (i.e. small/rural to cover service gaps, academic hospital sites to cover higher cost and acuity).

There needs to be a move to better integrate and align funding mechanisms across sectors to respond to volume and mix of services that meet population need through the pathways of care for patients. By focusing on an enhanced alignment between high quality patient care and funding, reductions in variation in practice across the province can be achieved. The results of such reduction in practice variation facilitate the adoption of best clinical evidence-informed practices, ensuring our patients receive the right care at the right place and at the right time.

In response to these fiscal challenges, as of April 1, 2012, the Ministry of Health and Long-Term Care (Ministry) has implemented Health System Funding Reform (HSFR). Over the fiscal years 2012/13 to 2014/15, HSFR will shift much of Ontario’s health care system funding for hospitals and Community Care Access Centres (CCACs) away from the current global funding allocation towards paying for activity and patient outcomes, to further support quality, efficiency and effectiveness in the health care system.

HSFR is predicated on the tenets of Ontario’s Action Plan for Health Care and is aligned 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.

HSFR is comprised of three key components:

1. Organizational-Level funding, which will be allocated as base funding using the Health Based Allocation Model (HBAM).
2. Quality-Based Procedure (QBP) funding, which will be allocated for targeted clinical areas based on a “price x volume” approach premised on evidence-based practices and clinical and administrative data.
2.1 What are we moving towards?

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. A global funding approach may not account for complexity of patients, service levels and costs and may reduce incentives to adopt best practices that result in improved patient outcomes in a cost-effective manner.

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

The variations in patient care evident in the global funding approach warrant the move towards a system where ‘money follows the patient’ (Figure 1).

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

Figure 1: The Ontario government is committed to moving towards patient-centred, evidence-informed funding that reflects local population needs and incent delivery of high quality care
2.2 How will we get there?

The Ministry has adopted a multi-year implementation strategy to phase in the HSFR strategy and will make modest funding shifts beginning April 2012. A three-year outlook has been provided to the field to support planning for upcoming funding policy changes.

The Ministry has released a set of tools and guiding documents to further support the field in adopting the funding model changes. For example, a Quality-Based Procedure (QBP) interim list has been published for stakeholder consultation and to promote transparency and sector readiness. The list is intended to encourage providers across the continuum to analyze their service provision and infrastructure in order to improve clinical processes and where necessary, build local capacity. However, as implementation evolves, the interim list will continue to undergo further refinements pending stakeholder feedback and advice from the QBP Clinical Expert Advisory Groups.

The successful transition from the current ‘provider-centred’ funding model towards a ‘patient-centred model’ will be catalyzed by a number of key enablers and field supports. These enablers translate to actual principles that guide the development of the funding reform implementation strategy related to QBPs. These principles further translate into operational goals and tactical implementation, as presented in Figure 2.

Figure 2: Principles guiding the implementation of funding reform related to Quality-Based Procedures

<table>
<thead>
<tr>
<th>Principles for developing QBP implementation strategy</th>
<th>Operationalization of principles to tactical implementation (examples)</th>
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<tr>
<td>▪ Cross-Sectoral Pathways</td>
<td>▪ Development of best practice patient clinical pathways through clinical expert advisors and evidence-based analyses</td>
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<td>▪ Evidence-Based</td>
<td>▪ Integrated Quality Based Procedures Scorecard</td>
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<td>▪ Balanced Evaluation</td>
<td>▪ Alignment with Quality Improvement Plans</td>
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<td>▪ Transparency</td>
<td>▪ Publish practice standards and evidence underlying prices for QBPs</td>
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<tr>
<td>▪ Sector Engagement</td>
<td>▪ Routine communication and consultation with the field</td>
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<td>▪ Knowledge Transfer</td>
<td>▪ Clinical Expert Advisory Groups</td>
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<tr>
<td></td>
<td>▪ Overall HSFR Governance structure in place that includes key stakeholders</td>
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<tr>
<td></td>
<td>▪ Technical and clinical engagement sessions</td>
</tr>
<tr>
<td></td>
<td>▪ Applied Learning Strategy/ IDEAS</td>
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<td></td>
<td>▪ Tools and guidance documents</td>
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<td></td>
<td>▪ HSFR Helpline; HSIMI website (repository of HSFR resources)</td>
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</table>
2.3 What are Quality-Based Procedures?

QBPs involve clusters of patients with clinically related diagnoses or treatments. Coronary artery disease (CAD) was chosen as a QBP using an evidence and quality-based selection framework that identifies opportunities for process improvements, clinical re-design, improved patient outcomes, and enhanced patient experience and potential cost savings.

The evidence-based framework used data from:
- Cardiac Care Network (CCN) Cardiac Registry;
- The Canadian Institute for Health Information (CIHI) 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 was used from the Ontario Case Costing Initiative (OCCI), and Ontario Cost Distribution Methodology (OCDM). Evidence from Canada and other jurisdictions and World Health Organization (WHO) reports was used to assist with the patient clusters and the assessment of potential opportunities.

The evidence-based framework assessed patients using five perspectives, as presented in Figure 3. This evidence-based framework has identified QBPs that have the potential to improve quality of care, standardize care delivery across the province and show increased cost efficiency.

Figure 3: Evidence-Based Framework

An evidence and quality-based framework has identified Quality-Based Procedures that have the potential to both improve quality outcomes and reduce costs

- Does the clinical group contribute to a significant proportion of total costs?
- Is there significant variation across providers in unit costs/volumes/efficiency?
- Is there potential for cost savings or efficiency improvement through more consistent practice?
- How do we pursue quality and improve efficiency?
- Are there potential areas for integration across the care continuum?

- Are there clinical leaders able to champion change in this area?
- Is there data and reporting infrastructure in place?
- Can we leverage other initiatives or reforms related to practice change (e.g. Wait Time, Provincial Programs)?

- Is there variation in clinical outcomes across providers, regions and populations?
- Is there a high degree of observed practice variation across providers or regions in clinical areas where a best practice or standard exists, suggesting such variation is inappropriate?
Practice Variation

The CCN Cardiac Registry is the provincial repository of all advanced cardiac procedures in Ontario. Patient demographics, comorbidities, and procedural details are collected from all advanced cardiac centres for the registry. The DAD has every Canadian patient discharge (except Quebec), coded and abstracted for over 50 years. This information is used to identify patient transition through the acute care sector, including discharge locations, expected lengths of stay and readmissions for every patient, based on their diagnosis and treatment, age, gender, co-morbidities and complexities and other condition-specific data. A demonstrated large practice or outcome variance may represent a significant opportunity to improve patient outcomes by reducing this practice variation and focusing on evidence-informed practice. 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. Ontario has detailed case costing data from several hospitals, as far back as 1991 for all patients discharged, from as well as daily utilization and cost data by department, by day, and by admission.

Availability of Evidence

A significant amount of research has been completed both in Canada and across the world to develop and guide clinical practice. Working with clinical experts and best practice guidelines, the clinical pathways were developed for these QBPs. Appropriate evidence-informed indicators can be established to measure the quality of QBP care and help identify areas for improvement at the provider level and to monitor and evaluate the impact of QBP implementation.

Feasibility/Infrastructure for Change

Clinical leaders play an integral role in this process. Their knowledge of the patients and the care provided or required represents an invaluable component of assessing where improvements can and should be made. Many groups of clinicians have already formed and provided evidence and the rationale for care pathways and evidence-informed practice.

Cost Impact

The selected QBP should have as a guide no less than 1,000 cases per year in Ontario and represent at least one per cent of the provincial direct cost budget. While cases that fall below these thresholds may in fact represent improvement opportunity, the resource requirements to implement a QBP may inhibit the effectiveness for such a small patient cluster, even if there are some cost efficiencies to be found. Clinicians may still work on implementing best practices for these patient sub-groups, especially if it aligns with the change in similar groups. However, at this time, there will be no funding implications. The introduction of evidence into agreed-upon practice for a set of patient clusters that demonstrate opportunity as identified by the framework can directly link quality with funding.

Impact of Transformation

The selected QBPs must align with the government’s transformational priorities including alignment with the tenets of Ontario’s Action Plan for Health Care. In addition, a natural progression and trajectory to assess a QBP’s impact on transformation would be to begin to look at other patient cohorts (e.g., paediatric patient populations), impact on the transition of care from acute-inpatient to community care setting, significant changes from historical funding models/approaches, integrated care models etc. QBPs with a lesser cost impact but a large impact on the transformation agenda may still be a high priority for creation and implementation.
2.4 How will QBPs encourage innovation in health care delivery?

QBP strategy is driven by clinical evidence and best practice recommendations from the Clinical Expert Advisory Groups. The Clinical Expert Advisory Groups are comprised of cross-sectoral, multi-geographic and multi-disciplinary membership with representation from patients as well. The panel members leverage their clinical experience and knowledge to define the patient populations and recommend best practices.

Once recommended best practices are defined, these practices are used to understand required resource utilization for the QBPs and 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 redesign to improve patient outcomes.

Best practice development for the QBPs is intended to promote standardization of care by reducing unexplained variation and ensure the patient gets the right care at the right place and at the right time. Best practices standards will encourage health service providers to ensure the appropriate resources are focused on the most clinically and cost effective approaches.

QBPs create opportunities for health system change 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 will be in the development of indicators to allow for the evaluation and monitoring of actual practice and support on-going quality improvement.
3.0 Description of Coronary Artery Disease

Describe the coronary artery disease population.

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. 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. It is important to note that there are more deaths due to heart disease than cancer. 1

CAD includes stable angina and acute coronary syndromes (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 about 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 the younger age groups, those aged 35-39, the prevalence of high blood pressure increased 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 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 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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4 Ibid.
5 Statistics Canada, CANSIM, table 105-0501 and Catalogue no. 82-221-X.
6 Ministry of Health and Long-Term Care News Release Maintaining the Gains, Moving the Yardstick, 2011 Report of the Chief Medical Officer of Health to the Legislative Assembly of Ontario (February 7 2013).
Table 1: Characteristics of CAD Patients who underwent Advanced Cardiac Procedures in Ontario (FY 12/13)

<table>
<thead>
<tr>
<th>Characteristics of CAD Patients</th>
<th>Cath</th>
<th>PCI</th>
<th>Isolated CABG</th>
</tr>
</thead>
<tbody>
<tr>
<td>Volume</td>
<td>44,828</td>
<td>23,095</td>
<td>6,510</td>
</tr>
<tr>
<td>Average Age (mean)</td>
<td>65.3</td>
<td>65.0</td>
<td>65.9</td>
</tr>
<tr>
<td>Age Cohort (%)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a) 20 - 44</td>
<td>4.5</td>
<td>4.0</td>
<td>2.2</td>
</tr>
<tr>
<td>b) 45 - 64</td>
<td>41.3</td>
<td>45.2</td>
<td>40.4</td>
</tr>
<tr>
<td>c) 65 - 74</td>
<td>29.5</td>
<td>26.7</td>
<td>35.7</td>
</tr>
<tr>
<td>d) 75+</td>
<td>24.6</td>
<td>24.1</td>
<td>21.8</td>
</tr>
</tbody>
</table>

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  | 0.0  | 0.1  |
| iv) Yes                        | 9.5  | 5.7  | 8.9  |
| i) Creatinine                  |      |     |               |
| i) 0 - 120 umol/L              | 76.0 | 71.9 | 82.2 |
| ii) 120-180 umol/L             | 6.8  | 7.0  | 8.3  |
| iii) >180 umol/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.
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 percutaneous coronary intervention (PCI) or coronary artery bypass graft (CABG) surgery.

Using a similar technique as an angiogram, a PCI (also called angioplasty) involves inserting a wire through a catheter into the blocked coronary artery. A balloon (with or without “stent” or metal scaffold) is then inflated and flattens the blockage against the wall of the artery. Stents are currently available in a bare metal (BMS) and drug eluting (DES) format. This facilitates the flow of blood through the vessel while opening the artery and allowing the stent to remain in place (where a stent is used). 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 other procedure (e.g. valve surgery).

**CAD QBP Inclusion/Exclusion Criteria.**
This QBP is for the provision of invasive diagnostic and revascularization procedures for blocked coronary arteries presenting as acute coronary syndrome or stable angina. Access to PCI and cardiac surgery services and the acuity of patient at time of presentation determine the type of treatment the patient will receive. Hemodynamically compromised ACS patients are assessed and treated as inpatients while ACS patients who have been stabilized and those with stable angina may be treated as elective or ambulatory care patients.

**Inclusion Criteria:**
- Patients equal to or over 20 years of age;
- Male and female patients and those cases indicated as unknown;
- Ontario-resident reported cases that have been performed within an Ontario hospital (acute facility); and
- Removal reason in the CCN Registry as ‘procedure started’ for cath, PCI and isolated CABG.

**Exclusion Criteria:**
- Out of hospital interventions;
- Cases with missing procedure date in the CCN Registry; and
- ACS STEMI treated with thrombolytic therapy only.

**CCN Cardiac Registry Definition:**

**General Inclusion:**

\[
\text{PATIENT\_AGE} \geq 20 \\
\text{AND} \quad (\text{Cardiacwaitlistentry.AuthorityIssuing='CANON'} \\
\text{OR} \quad (\text{Cardiacwaitlistentry.AuthorityIssuing=NULL} \\
\text{AND} \quad \text{waittimepatient.AuthorityIssuingCardCD='CANON'}})) \\
\text{AND} \quad \text{cardiacwaitlistentry.FundingSourceCD='H'} \\
\text{AND} \quad \text{cardiacwaitlistentry.removaldate > 0} \\
\text{AND} \quad \text{cardiacwaitlistentry.RemovalReasonCD='PS'}
\]
Stable CAD Pathway: CCN Cardiac Registry Definition

PCI
ReferralPrimaryReasonCD = ‘D’
AND
ReferralPrimaryReasonTypeCD in (‘E’, ‘R’)
AND
ProcedureRequestedCD in (‘CATHD’, ‘CATHI’)
   AND (Cardiacofflistingdetails.Cath_SSPclIND=’Y’
       OR cardiacofflistingdetails.Cath_ScheduledPciIND=’Y’
       OR cardiacofflistingdetails.Cath_StagedPciIND=’Y’)

Isolated CABG:
ProcedureRequestedCD=’SURG’
   AND cardiacofflistingdetails.Surgery_ByPassSurgeryIND=’Y’
   AND cardiacofflistingdetails.Surgery_AorticValveSurgeryIND=’N’
   AND cardiacofflistingdetails.Surgery_MitralValveSurgeryIND=’N’
   AND cardiacofflistingdetails.Surgery_OtherValveSurgeryIND=’N’
   AND cardiacofflistingdetails.tricuspidvalvesurgeryind=’N’

CATH Only:
ReferralPrimaryReasonCD = ‘D’
AND
ReferralPrimaryReasonTypeCD = (‘E’, ‘R’)
AND
ProcedureRequestedCD in (‘CATHD’, ‘CATHI’)
   AND (CATH_Count=1 OR
       OtherDCC_Count=1)
WHERE
Catherization:
   IF
       cardiacofflistingdetails.Cath_CoronaryAngiogramIND=’Y’
       AND cardiacofflistingdetails.Cath_SSPclIND=’N’
       AND cardiacofflistingdetails.Cath_CatheterBasedValveProcedure=’N’
       AND cardiacofflistingdetails.Cath_TransCathAorticValveInterve=’N’
       AND cardiacofflistingdetails.Cath_ComplexCongenitalProInd=’N’
       AND cardiacofflistingdetails.Cath_CatheterBasedCongenitalStru=’N’
       AND cardiacofflistingdetails.Cath_MyocardialBiopsyIND=’N’
   THEN CATH_Count= 1
   ELSE CATH_Count= 0
   
   Other Cath:
   IF
       cardiacofflistingdetails.Cath_RightHeartCatheterizationIND=’N’
       AND cardiacofflistingdetails.Cath_CoronaryAngiogramIND=’N’
       AND cardiacofflistingdetails.Cath_SSPclIND=’N’
       AND cardiacofflistingdetails.Cath_ScheduledPciIND=’N’
       AND cardiacofflistingdetails.Cath_StagedPciIND=’N’
   THEN Other_Cath_Count= 1
   ELSE Other_Cath_Count= 0
AND cardiacofflistingdetails.Cath_MyocardialBiopsyIND='N'
AND cardiacofflistingdetails.Cath_CatheterBasedValveProcedure='N'
AND cardiacofflistingdetails.Cath_TransCathAorticValveInterve='N'
AND cardiacofflistingdetails.Cath_ValvuloplastyIND='N'
AND cardiacofflistingdetails.Cath_ComplexCongenitalProInd='N'
AND cardiacofflistingdetails.Cath_CatheterBasedCongenitalStru='N'
AND (cardiacofflistingdetails.Cath_AtherectomyThrombectomyIND='Y'
OR cardiacofflistingdetails.Cath_AtherectomyIND='Y'
OR cardiacofflistingdetails.Cath_ThrombectomyIND='Y'
OR cardiacofflistingdetails.Cath_IvusIND='Y'
OR cardiacofflistingdetails.Cath_FfrIND='Y')
THEN OtherDCC_Count=1
ELSE OtherDCC_Count=0

ACS (NSTEMI/UA) Pathway: CCN Cardiac Registry Definition

PCI
ReferralPrimaryReasonCD = 'D'
AND
ReferralPrimaryReasonTypeCD in ('N', 'U')
AND
ProcedureRequestedCD in ('CATHD' 'CATHI')
AND (Cardiacofflistingdetails.Cath_SSPciIND='Y'
OR cardiacofflistingdetails.Cath_ScheduledPciIND='Y'
OR cardiacofflistingdetails.Cath_StagedPciIND='Y')

Isolated CABG:
ProcedureRequestedCD='SURG'
AND cardiacofflistingdetails.Surgery_ByPassSurgeryIND='Y'
AND cardiacofflistingdetails.Surgery_AorticValveSurgeryIND='N'
AND cardiacofflistingdetails.Surgery_MitralValveSurgeryIND='N'
AND cardiacofflistingdetails.Surgery_OtherValveSurgeryIND='N'
AND cardiacofflistingdetails.tricuspidvalvesurgeryind='N'

CATH Only:
ReferralPrimaryReasonCD = 'D'
AND
ReferralPrimaryReasonTypeCD in ('N', 'U')
AND
ProcedureRequestedCD in ('CATHD' 'CATHI')
AND (CATH_Count=1 OR 
OtherDCC_Count=1)

WHERE
Catherization:
IF
    cardiacofflistingdetails.Cath_CoronaryAngiogramIND='Y'
    AND cardiacofflistingdetails.Cath_SSPciIND='N'
    AND cardiacofflistingdetails.Cath_CatheterBasedValveProcedure='N'
    AND cardiacofflistingdetails.Cath_TransCathAorticValveInterve='N'
AND cardiacofflistingdetails.Cath_ComplexCongenitalProInd='N'
AND cardiacofflistingdetails.Cath_CatheterBasedCongenitalStru='N'
AND cardiacofflistingdetails.Cath_MyocardialBiopsyIND='N'
THEN CATH_Count= 1
ELSE CATH_Count= 0

Other Cath:

IF
cardiacofflistingdetails.Cath_RightHeartCatheterizationIN='N'
AND cardiacofflistingdetails.Cath_CoronaryAngiogramIND='N'
AND cardiacofflistingdetails.Cath_SSPCInd='N'
AND cardiacofflistingdetails.Cath_ScheduledPciIND='N'
AND cardiacofflistingdetails.Cath_StagedPciIND='N'
AND cardiacofflistingdetails.Cath_MyocardialBiopsyIND='N'
AND cardiacofflistingdetails.Cath_CatheterBasedValveProcedure='N'
AND cardiacofflistingdetails.Cath_TransCathAorticValveInterv='N'
AND cardiacofflistingdetails.Cath_ValvuloplastyIND='N'
AND cardiacofflistingdetails.Cath_ComplexCongenitalProInd='N'
AND cardiacofflistingdetails.Cath_CatheterBasedCongenitalStru='N'
AND (cardiacofflistingdetails.Cath_AtherectomyThrombectomyIND='Y'
  OR cardiacofflistingdetails.Cath_AtherectomyIND='Y'
  OR cardiacofflistingdetails.Cath_ThrombectomyIND='Y'
  OR cardiacofflistingdetails.Cath_IvusIND='Y'
  OR cardiacofflistingdetails.Cath_FfrIND='Y')
THEN OtherDCC_Count=1
ELSE OtherDCC_Count=0

ACS (STEMI) Pathway: CCN Cardiac Registry Definition

PCI
ReferralPrimaryReasonCD = 'D'
AND
ReferralPrimaryReasonTypeCD = 'S'
AND
ProcedureRequestedCD in ('CATHD' 'CATHI')
  AND (Cardiacofflistingdetails.Cath_SSPCInd='Y'
    OR cardiacofflistingdetails.Cath_ScheduledPciIND='Y'
    OR cardiacofflistingdetails.Cath_StagedPciIND='Y')

Isolated CABG:
ProcedureRequestedCD='SURG'
  AND cardiacofflistingdetails.Surgery_ByPassSurgeryIND='Y'
  AND cardiacofflistingdetails.Surgery_AorticValveSurgeryIND='N'
  AND cardiacofflistingdetails.Surgery_MitralValveSurgeryIND='N'
  AND cardiacofflistingdetails.Surgery_OtherValveSurgeryIND='N'
  AND cardiacofflistingdetails.tricuspidvalvesurgeryind='N'
**CATH Only:**
ReferralPrimaryReasonCD = 'D'
AND
ReferralPrimaryReasonTypeCD = 'S'
AND
ProcedureRequestedCD in ('CATHD', 'CATHI')
  AND (CATH_Count=1 OR
       OtherDCC_Count=1)

**WHERE**
Catherization:
  IF
    cardiacofflistingdetails.Cath_CoronaryAngiogramIND='Y'
    AND cardiacofflistingdetails.Cath_SSPciIND='N'
    AND cardiacofflistingdetails.Cath_CatheterBasedValveProcedure='N'
    AND cardiacofflistingdetails.Cath_TransCathAorticValveInterve='N'
    AND cardiacofflistingdetails.Cath_ComplexCongenitalProInd='N'
    AND cardiacofflistingdetails.Cath_CatheterBasedCongenitalStru='N'
    AND cardiacofflistingdetails.Cath_MyocardialBiopsyIND='N'
  THEN CATH_Count= 1
  ELSE CATH_Count= 0

Other Cath:
  IF
    cardiacofflistingdetails.Cath_RightHeartCatheterizationIN='N'
    AND cardiacofflistingdetails.Cath_CoronaryAngiogramIND='N'
    AND cardiacofflistingdetails.Cath_SSPCIind='N'
    AND cardiacofflistingdetails.Cath_ScheduledPciIND='N'
    AND cardiacofflistingdetails.Cath_StagedPciIND='N'
    AND cardiacofflistingdetails.Cath_MyocardialBiopsyIND='N'
    AND cardiacofflistingdetails.Cath_CatheterBasedValveProcedure='N'
    AND cardiacofflistingdetails.Cath_TransCathAorticValveInterve='N'
    AND cardiacofflistingdetails.Cath_ValvuloplastyIND='N'
    AND cardiacofflistingdetails.Cath_ComplexCongenitalProInd='N'
    AND cardiacofflistingdetails.Cath_CatheterBasedCongenitalStru='N'
    AND (cardiacofflistingdetails.Cath_AtherectomyThrombectomyIND='Y'
         OR cardiacofflistingdetails.Cath_AtherectomyIND='Y'
         OR cardiacofflistingdetails.Cath_ThrombectomyIND='Y'
         OR cardiacofflistingdetails.Cath_IvusIND='Y'
         OR cardiacofflistingdetails.Cath_FfrIND='Y')
  THEN OtherDCC_Count=1
  ELSE OtherDCC_Count=0

**CIHI DAD/NACRS DEFINITION:**

**General Inclusion:**
Age ≥ 20
  AND Ontario Funded cases

**Excluding:**
Out of hospital interventions
**Cath Only:**
Any Intervention is 3IP10VX* with Intervention Status Attribute code DX AND not a SSPCI

**SSPCI:**
Intervention A = 3IP10VX* and Intervention A status attribute = DX AND Intervention B = (1IJ50* OR 1IJ57GQ*) AND (Operation Room date/time in A = Operation Room date/time in B and Operation Room date/time out A = Operation Room date/time out B) AND all the Operation Room date/time in and out not missing

*Note: Intervention A (3IP10VX*) must occur prior to Intervention B (1IJ50* OR 1IJ57GQ*)*

**PCI:**
Any Intervention is 1IJ50* OR 1IJ57GQ*

**Isolated CABG:**
Any Intervention is 1IJ76*

**Excluding:**
- 1HS*
- 1HT*
- 1HU*
- 1HV*
- 1HW*
Describe the evidence-based rationale for choosing Coronary Artery Disease as a QBP.

Coronary Artery Disease 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 catheterizations, and 23,095 PCI procedures performed in Ontario. In the same year, there were 6,510 Ontario-funded Isolated CABG surgeries performed in the province. These procedures represent significant cost 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 MOHLTC 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 MOHLTC.

Availability of Evidence
- There is a great deal of evidence to support the development of this QBP as noted below:
  - ACCF/AHA 2002 Guideline Update for the Management of Patients With Chronic Stable Angina.
  - 2013 ESC Guidelines on the Management of Stable Coronary Artery Disease.
  - Focused 2012 Update of the Canadian Cardiovascular Society Guidelines for the Use of Antiplatelet Therapy.
  - CCN Recommendations for Best Practice STEMI Management in Ontario.
  - 2012 Appropriate Use Criteria for Diagnostic Catheterization.
  - “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 MOHLTC 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 clinically recommended wait time for all advanced cardiac centres.
- There is considerable variation in the volume of procedures performed by each cardiac centre:
  - Hospital Cath 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 the advanced cardiac centres in Ontario.
  - Some centres offer Cath only services, some are stand-alone PCI (SA-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 (DES) varied between cardiac centres with a range of 43.6% to 74.3%.
- 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 7.9 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 repeat revascularization (PCI) required at 1-year post-procedure was 11.8% 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.
Describe the 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.

Wait Times

Wait time 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 time data. All other patients are categorized as Urgent, Semi-Urgent, or Elective. Recommended wait times for Cath, PCI and Isolated CABG are presented in Table 2 below:

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Urgency</th>
<th>Recommended Wait Time (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cath</td>
<td>Urgent</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Semi-Urgent</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>84</td>
</tr>
<tr>
<td>PCI</td>
<td>Urgent</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Semi-Urgent</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>28</td>
</tr>
<tr>
<td>CABG</td>
<td>Urgent</td>
<td>14</td>
</tr>
<tr>
<td></td>
<td>Semi-Urgent</td>
<td>42</td>
</tr>
<tr>
<td></td>
<td>Elective</td>
<td>90</td>
</tr>
</tbody>
</table>

CCN reports on wait times to the Ministry of Health and Long-Term Care and to hospitals on a monthly basis. Wait times for cardiac services in Ontario are well below the recommended wait time 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 to ensure that wait times remain low, and that adult cardiac patients in Ontario continue to have access to timely cardiac care.

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. 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, readmission rates (30-day and 1-year) and other post-procedural complications (stroke, renal failure). CCN’s reports have demonstrated that mortality rates are low, relatively consistent between cardiac centres, and comparable to rates from other

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

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

*Data source: CCN Cardiac Registry linked to CIHI-DAD.
**Data source: CCN Cardiac Registry linked to Ontario Registered Persons Database.
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 length of stay (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 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.

Describe the key objectives of the coronary artery disease 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 coronary artery disease 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.
**How will the cardiac procedures for CAD be documented? Is there a need for a new data collection process?**

CCN holds the registry for tracking all advanced cardiac procedures in Ontario. Once a patient is referred for a cardiac procedure, their clinical history and existing comorbidities are entered into the Cardiac Registry by the Regional Care Coordinators (RCCCs) and Data Clerks. After the patient receives a procedure, the RCCC or Data Clerk enters all related information into the registry including date of procedure, procedure performed, and specific procedural details. Cardiac procedural utilization is verified monthly by the hospitals and reported by CCN at the local and provincial level.

To standardize documentation and procedural coding, it is recommended that the CCN Cardiac Registry should be used as the source of data for future costing and evaluation. The use of the CCN Cardiac Registry would not require a new data collection process. The registry captures comprehensive information and details of cath, PCI and isolated CABG patient comorbidities, wait times and procedures. The Cardiac Registry is updated bi-annually which would allow for additional data elements to be collected (e.g., smoking cessation education).

**How will clinical documentation change? What are the implications on physician charting on billing and CAD QBP funding?**

Currently there are no standardized guidelines or recommendations regarding what information need to be recorded onto patient charts by physicians. This inconsistency has resulted in variability of coding practices for various advanced cardiac procedures and surgeries. Using the CCN Cardiac Registry, consistent and granular data is available for accurate coding and review of advanced cardiac procedures in Ontario.

A monthly CCN Cardiac Registry report may be generated to inform costing reconciliation at each healthcare system. Procedural coding should be based on this report to create and maintain consistency in submission process for provincial funding of advanced cardiac procedures and surgeries.

**How were the clinicians engaged? Please describe the process for clinical engagement.**

CCN convened the Cardiac QBP Expert Advisory Panel composed of clinical, technical and health data experts and other stakeholders to support the provincial quality agenda related to the Health System Funding Reform and Quality-Based Procedures strategy. The purpose of the Expert 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 Coronary Artery Disease (CAD) including: diagnostic procedures - cardiac catheterizations; interventional procedures - percutaneous coronary interventions (PCI), and isolated coronary artery bypass graft surgery.

The provincial CCN Cardiac Registry and CIHI’s Discharge Abstract Database (DAD) 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 the recommendation for systematic and standardized practices and documentation. Recommendations of clinical care best practices were derived from available evidence, cardiac society guidelines, experience and expert consensus. The clinical pathways and quality indicators were validated through a secondary review process via a validation webcast that engaged a broader audience.
4.0 Best practices guiding the implementation of CAD QBP

Best Practice – CAD Clinical Pathway:

Best practices for 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 catheterization, PCI and CABG apply to both acute and non-acute conditions (i.e. STEMI, NSTEMI, UA, and stable CAD). A Heart Team (consisting of interventional cardiologist, cardiovascular surgeon, and cardiologist) approach to revascularization is recommended in patients with complex CAD.

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 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. While heart attack can trigger depression it was also found that depression is an independent risk factor for CAD. Individuals with both cardiovascular disease and depression have an impaired quality of life, increased health problems and risk of death. However, it was noted that treatment of depression in cardiovascular patients is only associated with improved depressive symptoms with no improvement in patient outcomes.

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 healthcare intervention. In addition, medications should be reviewed and instructions on proper drug use (e.g., sublingual nitroglycerin) provided to patients and their families, as needed. When reasonable, all patients should receive education prior to procedures.

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

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better” when it comes to treatments and procedures. CWC provides physician recommendations of items physicians and patients should address during consultation.\(^\text{14}\)

**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 revascularization with the patient and family.

**Goals of care:**

The inter-professional team must discuss goals of care with patient and family prior to any procedure.

**Assessment, Diagnosis and Treatment For CAD:**

1. **Acute Coronary Syndrome (ACS) – STEMI and NSTEMI/UA:**

ACS is a spectrum of clinical presentations including 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.\(^\text{15}\) 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.\(^\text{16}\) 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.

**At First Medical Contact (FMC):**

FMC with patients may happen with EMS personnel (outside of hospital) or at hospital emergency department (ED). Patients presenting in 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:\(^{17,18,19,20}\)

Chest pain or discomfort:

- Central or substernal, upper abdominal, or epigastric discomfort;
- Pain radiating to neck, jaw, shoulders, back, one or both arms;

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• 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;
• Nausea;
• 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.

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).

Physical and laboratory examination:

Physical and initial laboratory exams should consist of:

• Brief and targeted initial physical examination and assessment of the following:
  • Current and past medical history;
  • Medications;
  • 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);
• CK-MB;
• CBC with platelet count;
• INR;
• aPTT;
• Electrolytes and magnesium;
• BUN;
• Creatinine;
• Glucose; and

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• Serum lipids.

**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.27,28

Risk stratification tools such as Thrombolysis in Myocardial Infarction (TIMI) risk score, Receptor Suppression Using Integrelin (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.29

**Immediate treatment:**
Immediate treatment includes:30

- 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.

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 ACCF/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:31,32,33,34,35
- 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.36 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, coronary artery bypass graft (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 episode of care (i.e., same admission). For some patients, PCI may be required to be performed as an outpatient procedure. The ACS patients who are discharged home with arrangements for a scheduled or staged PCI shall be reclassified as stable angina patients (i.e., PCI referral reason is stable angina).

STEMI:
CAD may present as ST elevation myocardial infarction (STEMI) acute coronary syndrome where the 12-lead ECG shows persistent ST elevations in two or more contiguous leads or new or presumed new left bundle branch block (LBBB)37 which may indicate complete obstruction in the coronary artery involved. ST elevation, measured on 12-lead ECG at J-point, should be > 0.25 mV in men <40 years of age, or > 0.20 in men 40 years of age or over, or > 0.15 mV in women in leads V1-V3 and/or > 0.10 in other leads in the absence of left ventricular (LV) hypertrophy or LBBB35. Further evaluation with a right-sided ECG may be indicated for patients with inferior myocardial infarction in order to rule out right ventricular involvement.38,39 PCI is

considered the gold standard as the initial reperfusion treatment for STEMI, which requires immediate transfer of patient to a cath lab or inter-hospital transport to a PCI-capable centre (Refer to Figure 5 for STEMI pathway).

**Figure 5: Pathway for STEMI**

**ACS (STEMI) Pathway**

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). STEMI's 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.\(^{40,41}\) Timely reperfusion requires a coordinated system of care involving the emergency medical services (EMS), healthcare institution’s specialized areas such as the emergency department, cardiac catheterization lab and the cardiac intensive care units (CICU). 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](http://www.ccn.on.ca/CCN_Public/UploadFiles/files/Recommendations_for_Best_Practice_STEMI_Management_in_Ontario_(6).pdf).

Reperfusion strategy should be administered to all eligible STEMI patients within 12 hours of symptom onset. Primary PCI is the recommended reperfusion strategy with a goal of 90 minutes.

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or less from 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 primary PCI. 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.42,43

a. **Primary PCI (PPCI):**

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 primary PCI in STEMI patients who are hemodynamically stable.44 The placement of a bare-metal or drug-eluting stent is considered useful in primary PCI. However, the decision about what stent to use should be made after careful consideration of 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 recommended treatment for all ACS patients.45

b. **Fibrinolytic Therapy:**

Fibrinolytic therapy is the recommended reperfusion strategy in the absence of contraindications and when primary PCI 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.46 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.47 The nursing care for post fibrinolytic STEMI patients is the same as in post PPCI care but with special considerations due to increased bleeding risk.

**Care of STEMI Patients:**

All STEMI patients should be admitted to the intensive care unit for a continuous cardiac (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 changes. Nursing care should be provided by critical care certified RNs, with staffing based on patient-specific needs, provider competencies, and organizational priorities.48,49

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**NSTEMI/UA:**

Non-ST elevation myocardial infarction (NSTEMI) or Unstable Angina (UA) acute coronary syndrome, a common manifestation of CAD, is defined as the presence of ST segment depression or prominent T-wave inversion on 12-lead electrocardiogram (ECG) and/or positive serum cardiac biomarker of 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). Figure 6 illustrates the common pathway for NSTEMI/UA patient through the healthcare system.

**Figure 6: Pathway for NSTEMI/UA**

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**Assessment:**

Patients with non-persistent ST elevation are placed under a predetermined observation period. 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. If required, further evaluations are made including:

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functional cardiac testing (e.g., resting nuclear scan or echocardiography) and/or stress testing or non-invasive coronary imaging study (e.g., coronary CTA). Inpatient admission to the critical care unit or cardiac ward is recommended according to 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 early stress test or discharged and return for outpatient stress testing within 72h.

**Monitoring:**

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

- Admit as inpatient for bed rest;
- Continuous cardiac rhythm 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 defibrillation quickly. 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 O₂; and
- Frequent assessment of vital signs and mental status.

### 2. Stable CAD:

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 CAD is to alleviate symptoms, prevent cardiovascular events, and reduce mortality. Figure 7 illustrates the common pathway of stable CAD patients undergoing diagnosis and treatment.

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Figure 7: Pathway for Stable CAD

**Stable CAD Pathway**

**Assessment:**
The focus of assessment for stable CAD is prevention of future cardiovascular events. Clinical risk assessment includes:

- 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
  - other disease (hyperlipidemia, hypertension, anemia, thyroid disease, etc.)
- Review medication and compliance; and
- Screen for depression and appropriately treat.

**Tests and laboratory investigations:**
Initial evaluation tests and blood investigations include:

- Electrocardiogram;
- Fasting lipid profile;
- Hemoglobin;

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- Blood glucose;
- Thyroid function;
- Renal function;
- Non-invasive testing (e.g., exercise stress test, functional cardiac testing), or coronary CTA\textsuperscript{61}, if indicated; and
- 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 is 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.

**Advanced Cardiac Procedures**
CAD patients may be required to undergo 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.\textsuperscript{62,63}

1. **Cardiac catheterization:**
Angiogram is considered an appropriate initial test for patients with definite or suspected acute coronary syndromes. Direct referral for angiogram for patients without known CAD is considered appropriate only if the patient is symptomatic with a high pretest probability.\textsuperscript{64}

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 revascularization method. For example, for patients with diabetes and multiple vessel disease, one strategy may be preferred over another (e.g., PCI vs. CABG).\textsuperscript{65}


\textsuperscript{62} Patel, MR. Fractional Flow Reserve and the Appropriate Use Criteria: Determining Best Practice in Revascularization. Cardiac Interventions Today Jan/Feb 2013; 64-74.


Certain conditions and requirements have to be met at each stage of procedure or surgery: pre, during, and after.

**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 procedure;
- Document blood investigations results for coagulation studies (i.e. INR), complete blood count, electrolytes, renal profile including 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. In addition, hand hygiene and Universal Precautions are important components of IPAC practices in catheterization laboratories.

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;
- 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):
  - ASA 162 or 325mg loading dose, if not given prior to procedure
  - P2Y<sub>12</sub> 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 (abximab, 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); and perfusion therapy
- Access to emergency equipment including defibrillator; and
- Access to cardiac intensive care unit.

The use of ancillary tools to further assess the lesions or augment the intervention may be required for certain cases:

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- The guidelines consider the use of thrombectomy or manual device for aspiration of clots reasonable for PPCI\(^{68}\).
- For intracoronary assessment of stenosis severity\(^{69}\), Fractional flow reserve (FFR) measurement 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 can be evaluated by FFR either during the index or in a staged procedure
- FFR is also recommended to identify hemodynamically relevant coronary lesion(s) when evidence of ischemia is unavailable;
- Revascularization of stenosis with FFR <0.80 is recommended in patients with angina symptoms or a positive stress test; and
- Intravascular Ultrasound (IVUS) and Optical Coherence Tomography (OCT) may be considered to characterize lesions, improve stent deployment, or assess stent apposition.

**Post-procedure care for cath and PCI:**

It is recommended to use either sterile gauze or sterile and semi-permeable dressing to cover the catheter or puncture site. Manual or vascular closure device may be used for hemostasis after sheath removal. The use of vascular closure devices (VCD) is common post arterial punctures; however, it should be noted that VCD’s are associated with more severe vascular complications than manual hemostasis. VCD’s should be avoided in the following scenarios:
- 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.\(^{70}\)

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 hospital. The DAPT must be continued post initial loading dose after PCI and maintained as follows\(^{71,72,73,74,75}\):
- Aspirin 81 to 325 mg daily for indefinite period (81 mg preferred);
  - AND

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\(^{69}\) Ibid.


• Continue therapy for 1 year (may be longer for drug–eluting stent) with one of the following:
  o Clopidogrel: 75 mg daily OR
  o Prasugrel: 10 mg daily OR
  o Ticagrelor: 90 mg twice a day.

3. Isolated CABG:
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.⁷⁶

Those patients diagnosed with coronary artery disease that are not treatable by primary PCI and those with greater than 3 vessel disease are candidates for coronary artery bypass graft (CABG) surgery. The Freedom trial compared the PCI approach to 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.⁷⁷

The surgical procedure can be accomplished via traditional open sternotomy with the patient placed on cardiopulmonary bypass (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 internal mammary artery (LIMA) now known as the left internal thoracic artery (LITA).

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.⁷⁸

Literature shows that certain patients with 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.⁷⁹ 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.

⁷⁹ Ibid.
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 traditional approach, however 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 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.  

**Pre-CABG surgery:**
Prior to surgery the following should be completed:

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**Figure 8: Pathway for Isolated CABG**

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• Obtain informed consent;
• Assess patient suitability for autologous blood donation and undergo appropriate blood management techniques to prevent transfusion;
• Conduct surgical risk assessment using STS and SYNTAX scores;
• Determine optimal surgical approach based on patient risk factors;
• Determine whether 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 or electrolyte imbalance;
• Administer as needed:
  o Prophylactic antibiotics for prevention of post-operative infection
  o Aspirin (100 mg to 325 mg daily)
  o Statin therapy
  o Beta blockers
  o Prevention and management of postoperative atrial fibrillation using antithrombotic therapy (anticoagulant and antiplatelet),
• 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 recommended schedule.

Blood Conservation Strategies should be used to limit the need for intraoperative or postoperative blood transfusions that have been shown to increase 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. Such strategies include but are not limited to:

• When possible, patients undergoing CABG should donate their own blood (autologous donation);
• Use of cell saver intraoperatively and postoperatively which returns patients salvaged blood after being washed and filtered;
• Use of drugs that decrease bleeding (i.e., aprotinin, tranexamic acid, and epsilon-aminocaproic 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; and
• Preoperative management of patients on antiplatelet medication 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).

Patients undergoing cardiac surgery should be treated with antibiotic as a preventative measure to reduce the risk of infection. 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.\(^{84}\)

**Conduct and document pre-surgical tests as needed:**

- Document blood investigations results for coagulation studies (i.e., INR), complete blood count, 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\(^ {85}\):
  - 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).\(^ {86}\)

**Intra-CABG surgery:**

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

- Accreditation Canada International\(^ {87}\);
- Operating Room Nurses Association of Canada (ORNAC)\(^ {88}\);
- Association of Operating Room Nurses (AORN)\(^ {89}\); and
- Provincial Infectious Diseases Advisory Committee (PIDAC).\(^ {90}\)

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.

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\(^{87}\) Accreditation Canada International. QMentum International: Operating Room Standards.


\(^{89}\) Association of periOperative Registered Nurses (AORN). 2014 Edition Perioperative Standards and Recommended Practices. AORN, AORN, Inc.

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;\(^{91}\)
- 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)\(^{92}\);
- Urinary catheter;
- Arterial blood gases, 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;
- Intra-aortic balloon pump (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 CPB machine then transferred to the cardiovascular intensive care unit (CVICU) for post-surgical care. Length of stay in the ICU varies by approach and based on patients comorbidities.\(^{93}\)

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.\(^{94}\)

Administer post-operative medications as needed:
- Continue intravenous insulin to achieve target postoperative blood glucose levels for up to 48-72 hours is recommended\(^{95}\).

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• 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.96

Pain Management:
A recent study published in the Canadian Medical Association Journal studied patient’s level of pain post cardiac surgery. Pain was rated worst in the first 48 hours with approximately 10 percent of patients having persistent pain at the end of the 2-year study period. The presence of anxiety preoperatively increased the risk for developing persistent post-operative pain. The study indicates that there is a lack of evidence for measures to prevent or minimize post-operative and persistent pain and that ongoing studies are needed to identify pain treatment for this group of patients.97

Transition and Follow-Up Care for all Advanced Cardiac Procedures:
Integration is one of health domains of QBPs. 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 patient’s discharge. An interprofessional approach to discharge planning could potentially improve patient’s satisfaction with hospital discharge process and well-being after discharge.98 Patient-centred interprofessional discharge and follow-up consultation and planning with patient and/or family may occur as soon as the patient is admitted. Discharge plan should include, but 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.

Systematic and viable links to community programs with defined documentation and communication should occur before patient’s discharge from hospital. A systematic referral is vital for cardiac rehabilitation in improving patient’s participation in supervised exercise programs.99 In order for patients to obtain optimal benefit from exercise programs, cardiac rehabilitation should commence within 30 days of hospital discharge.100 Cardiac rehabilitation is strongly recommended for patients with coronary artery disease particularly those with multiple

modifiable risk factors.\textsuperscript{101,102} Similarly, smoking cessation in-hospital education and cessation therapy should be offered for all identified smokers among CAD patients.\textsuperscript{103,104}


5.0 Implementation of best practices

*How should the best practices be implemented to ensure standardized and optimal patient care delivery?*

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](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.

**Describe data management implications.**

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 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 bi-annually to reflect accurate collection of recommended procedural details, quality indicators, and outcome measures.
6.0 What does it mean for interprofessional teams?

Will Coronary Artery Disease (CAD) QBP have any implication on inter-professional teams (i.e. physicians, nurses, allied health, health records etc.)?

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."  

Standardization of best practices for treatment of CAD will require individual hospitals to consider a coordinated interprofessional team approach to coronary artery disease 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 current national guidelines such as those described within the ACCF/AHA and ESC Practice Guidelines for the Management of Patients with Coronary Artery Disease and the CCS Guidelines for the Use of Antiplatelet Therapy. Also, taking into account current CAD protocols in place in Ontario hospitals and the collective experience of the clinical advisory committee shaped the development of the pathway 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.

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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. It is doubtful that any new cardiac surgery centres will be required in Ontario.

Table 4: Volumes of Cardiac Revascularization Procedures Performed in Ontario

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<thead>
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</thead>
<tbody>
<tr>
<td>Isolated CABG</td>
<td>6,848</td>
<td>6,651</td>
<td>6,558</td>
<td>6,510</td>
<td>6,714</td>
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<tr>
<td>PCI</td>
<td>21,006</td>
<td>21,967</td>
<td>21,943</td>
<td>23,095</td>
<td>24,214</td>
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<td>% of PCI with DES</td>
<td>43.9%</td>
<td>44.4%</td>
<td>48.4%</td>
<td>54.4%</td>
<td>66.4%</td>
</tr>
</tbody>
</table>

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 drug eluting stent (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 centres will eventually be required to meet this increasing demand.

According to the recent report released by CCN\(^{106}\), 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.

8.0 Performance evaluation and feedback

An integrated scorecard for CAD will be required to be developed in order to allow the MOHLTC 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.

**Quality Indicators for Immediate Implementation:**

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

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.

**Proposed Quality Indicators for Future Development:**

1. Rate of surgical site infection.
2. Percentage of identified smokers offered smoking cessation education.
3. Rate of fractional flow reserve (FFR) use.
In introducing the QBPs the MOHLTC has a strong interest in:

1. Supporting the 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; and
- 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; and
- **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 5).
Table 5: Quality Domains

<table>
<thead>
<tr>
<th>Quality Domain</th>
<th>What is being measured?</th>
<th>Key provincial indicators</th>
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<tbody>
<tr>
<td><strong>Effectiveness</strong></td>
<td>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?</td>
<td>• Proportion of QBPs that improved outcomes&lt;br&gt;• Proportion of QBPs that reduced variation in outcome&lt;br&gt;• Proportion of (relevant) QBPs that reduced rates of adverse events and infections</td>
</tr>
<tr>
<td><strong>Appropriateness</strong></td>
<td>Is patient care being provided according to scientific knowledge and in a way that avoids overuse, underuse or misuse?</td>
<td>• Proportion of QBPs that reduced variation in utilization&lt;br&gt;• Proportion of (relevant) QBPs that saw a substitution from inpatient to outpatient/day surgery&lt;br&gt;• Proportion of (relevant) QBPs that saw a substitution to less invasive procedures&lt;br&gt;• Increased rate of patients being involved in treatment decision&lt;br&gt;• Proportion of (relevant) QBPs that saw an increase in discharge dispositions into the community</td>
</tr>
<tr>
<td><strong>Integration</strong></td>
<td>Are all parts of the health system organized, connected and work with another to provide high quality care?</td>
<td>• Reduction in 30-day readmissions rate (if relevant)&lt;br&gt;• Improved access to appropriate primary and community care including for example psychosocial support (e.g. personal, family, financial, employment and/or social needs)&lt;br&gt;• Coordination of care (TBD)&lt;br&gt;• Involvement of family (TBD)</td>
</tr>
<tr>
<td><strong>Efficiency</strong></td>
<td>Does the system make best use of available resources to yield maximum benefit ensuring that the system is sustainable for the long term?</td>
<td>• Actual costs vs. QBP price</td>
</tr>
<tr>
<td><strong>Access</strong></td>
<td>Are those in need of care able to access services when needed?</td>
<td>• Increase in wait times for QBPs / for specific populations for QBP&lt;br&gt;• Increase in wait times for other procedures&lt;br&gt;• Increase in distance patients have to travel to receive the appropriate care related to the QBP&lt;br&gt;• Proportion of providers with a significant change in resource intensity weights (RIW)</td>
</tr>
<tr>
<td><strong>Patient-Centeredness</strong></td>
<td>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)</td>
<td>• Increased rate of patients being involved in treatment decision&lt;br&gt;• Coordination of care (TBD)&lt;br&gt;• Involvement of family (TBD)</td>
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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 MOHLTC and clinical experts recognized that in order 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 MOHLTC recognized there are 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 quality-based procedures. In addition, CCN will employ its working groups that deal specific to coronary artery disease (Cath/PCI, STEMI/EMS, Cardiovascular Surgery, Cardiac PET Scan, Heart Rhythm, and Echocardiography) to support the implementation of CAD QBP.

The MOHLTC, 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

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.

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.

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, 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.

Why are Cardiac QBP definitions from both the CCN Cardiac Registry and CIHI?
Both definitions are included as reference for volume reconciliation and verification by hospitals.
# 11.0 Membership

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<thead>
<tr>
<th>NAME</th>
<th>TITLE</th>
<th>ORGANIZATION</th>
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<tbody>
<tr>
<td><strong>Clinical</strong></td>
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</table>
| Amlani, Dr. Shy    | Interventional Cardiologist  
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| Cantor, Dr. Warren | Interventional Cardiologist  
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| Cohen, Dr. Eric    | Interventional Cardiologist  
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                     Associate Professor, Department of Medicine,  
                     University of Toronto                            | Sunnybrook Health Sciences Centre                    |
| Dzavik, Dr. Vladimir | Interventional Cardiologist  
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                     Professor of Medicine, University of Toronto  
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                     Cardiology and Cardiac Intensive Care, Peter Munk  
                     Cardiac Centre  
                     Brompton Funds Professor in Interventional  
                     Cardiology                                              | University Health Network and Mount Sinai Hospital  |
| Feindel, Dr. Chris | Cardiac Surgeon  
                     Antonio & Helga DeGasperis Chair in Clinical  
                     Outcomes Research in Cardiac Surgery  
                     Professor of Surgery, University of Toronto        | University Health Network                           |
| Latter, Dr. David  | Cardiac Surgeon  
                     Division Head, Cardiac Surgery  
                     Director of Clinical Fellowship Program  
                     Vice Chair Education, Department of Surgery  
                     University of Toronto                              | St. Michael's Hospital                               |
| Ouzounian, Dr. Maral | Cardiovascular Surgeon  
                     Assistant Professor of Surgery, University of  
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| Velianou, Dr. James | Interventional Cardiologist  
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                     Co-Director, Catheterization Laboratory  
                     Associate Professor of Medicine, McMaster University | Hamilton Health Sciences Centre                       |
| Wijeysundera, Dr. Harindra | Interventional Cardiologist  
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                     of Health Policy, Management and Evaluation,  
                     University of Toronto  
                     Adjunct Scientist, Institute for Clinical Evaluative  
                     Sciences (ICES)                                        | Sunnybrook Health Sciences Centre                     |
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<td>Vice President, Corporate Services and</td>
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<td>Southlake Regional Health Centre</td>
<td>St. Mary's General Hospital</td>
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12.0 References

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33. Ministry of Health and Long-Term Care News Release Maintaining the Gains, Moving the Yardstick, 2011 Report of the Chief Medical Officer of Health to the Legislative Assembly of Ontario (February 7 2013).


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