ONTARIO HEALTH - CORHEALTH ONTARIO
AND MINISTRY OF HEALTH

Quality-Based Procedure Clinical Handbook

Non-Cardiac Vascular (Aortic Aneurysm)

REVISED MARCH 2022

Ontario

Table of Contents

List of Abbreviations

AA	Aortic aneurysm
AAA	Abdominal aortic aneurysm
AEVAR	Advanced EVAR
AR	Aortic arch
AS	Ascending thoracic aorta only
CACS	Comprehensive Ambulatory Classification System
CCI	Canadian Classification of Health Interventions
CCN	Cardiac Care Network of Ontario
CIHI	Canadian Institute for Health Information
DAD	Discharge Abstract Database
DI/IR	Diagnostic imaging/interventional radiology
ECG	Electrocardiogram
ED	Emergency department
EVAR	Endovascular Aneurysm Repair
FY	Fiscal year
GEM	Growth and Efficiency Model
HBAM	Health-Based Allocation Model
HIG	HBAM Inpatient Grouper
ICD-10-CA	International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada
LEOD	Lower Extremity Occlusive Disease

LHIN	Local Health Integration Network
LOS	Length of stay
MAC	Major Ambulatory Cluster
MCC	Major Clinical Categories
MET	Metabolic equivalent
MI	Myocardial infarction
MOH	Ministry of Health
MOHLTC	Ministry of Health and Long-Term Care
MRDx	Most Responsible Diagnosis
NACRS	National Ambulatory Care Reporting System
NCV	Non-cardiac vascular
NEC	Not elsewhere classified
OA	Open Approach
OCCI	Ontario Case Costing Initiative
OHA	Ontario Hospital Association
PCP	Primary Care Provider
pEVAR	Percutaneous EVAR
PTA	Percutaneous Transluminal (arterial) Approach
QBP	Quality-Based Procedure
SCU	Special Care Unit
SLR	Standardized LOS Ratio
SMR	Standardized Mortality Ratio

SR	Standardized Ratio
SRR	Standardized 30-day Readmission Ratio
TH	Thoracic (descending) (thoracoabdominal) (overlapping regions) aorta
WTIS	Wait Time Information System

Preface

The Non-Cardiac Vascular (NCV) Aortic Aneurysm (AA) Quality-Based Procedure (QBP) subgroup was introduced in FY 2013/14 based on the initial QBP Clinical Handbook from February 2013 (which was later revised in September 2013 and January 2014).

Since that time, this QBP Clinical Handbook has been updated to include additional procedures and coding revisions, as summarized below.

Ontario Health - CorHealth Ontario

Ontario Health - CorHealth Ontario is a key advisor to the Ministry of Health (MOH) providing overall leadership and strategic direction to support the planning and delivery of high-quality cardiac, stroke and vascular care in the province. Together with its partners including the MOH, hospitals, and care providers, Ontario Health - CorHealth Ontario plays a central role in the system to improve the quality, efficiency, accessibility and equity of cardiac, stroke and vascular services for patients across Ontario.

Ontario Health - CorHealth Ontario and working groups of clinical, technical and health data experts and other stakeholders have played an integral role in the initial planning, development and revision of this QBP Clinical Handbook.

March 2022 Revision Summary

A revision to the AA QBP Clinical Handbook was made in March 2022. The updates are summarized below.

1. Expanding the AA repair definition to include non-elective procedures;
2. Expanding the AA repair definition to include advanced procedures (similar to previous versions of the QBP Clinical Handbook prior to February 2021 but with the expectation that this procedure will now be funded through the QBP); and
3. Revisions to diagnosis codes associated with existing elective procedures.

The former definition of the AA QBP excluded a substantial proportion of AA repair cases. In fiscal year (FY) 2019/20, 55% of all aortic repairs done annually in Ontario qualified for the AA QBP by its former definition. Expanding the AA QPB definition to include non-elective and advanced AA repairs (and formally adding outpatient procedures to the QBP following the February 2021 revision) will increase the proportion of QBP-qualifying cases to approximately

83%. Aortic repairs for trauma, iatrogenic injury, and other non-identified indications account for the remaining 17% of repairs.

Updates to the QBP Clinical Handbook patient groupings are summarized in Table 1.

Table 1. Summary of March 2022 Updates to AA Groupings

QBP Clinical Handbook (March 2022 Updates)	QBP Clinical Handbook (February 2021)
Elective AA Repair (Standard and Moderate) Includes inpatient and outpatient (see Notes) Includes thoracic and juxtarenal aorta	**Elective AA Repair (Standard and Moderate)** Includes inpatient and outpatient (see Notes) Includes thoracic and juxtarenal aorta
Non-Elective AA Repair (Standard and Moderate) Includes thoracic and juxtarenal aorta	
Advanced Elective AA Repair Includes aortic arch and thoracoabdominal aorta	This category was included in the January 2014 and October 2018 QBP Clinical Handbooks, but these procedures were not funded through the QBP (see Notes).
Advanced Non-Elective AA Repair Includes aortic arch and thoracoabdominal aorta	

Notes:

1. As communicated by the MOH in February 2021 (and updated Frequently Asked Questions in May 2021), the NCV QBP is being expanded in phases; in Phase 1 (FY 2020/21 and FY 2021/22), the QBP Clinical Handbooks (AA and LEOD) were updated (in February 2021) to include outpatient procedures, and hospitals were provided with flexibility to use inpatient QBP funding for outpatient procedures; in Phase 2 (FY 2022/23), the QBP Clinical Handbooks were updated (in March 2022) to include non-elective and advanced AA procedures, and the NCV QBP will be formally updated to include outpatient, non-elective and advanced AA procedures.
2. Since NACRS cannot distinguish between elective and non-elective, all **outpatient** cases are included under Elective AA Repair (Standard and Moderate).

3. All groups include **open** and **endovascular** procedures; only approved hospitals can use NCV QBP funding for **Endovascular Aneurysm Repair (EVAR)** procedures.
4. **Advanced Endovascular Aortic Repair (AEVAR)** procedures were initially included in the NCV AA QBP when it was introduced in FY 2013/14; from FY 2014/15 to FY 2021/22, funding for Advanced Endovascular Aortic Repair (AEVAR) procedures was provided separately through the MOH Provincial Programs Branch (including both elective and non-elective procedures).
5. See section 3.1 for definitions of standard, moderate and advanced patient groups.
6. See section 3.2 for definitions (inclusion/exclusion criteria).

The rationale for the update is provided below.

I. Inclusion of Non-Elective Procedures

The AA QBP Clinical Handbook now includes both elective and non-elective AA repair procedures.

The QBP expansion to include non-elective cases will increase the scope of AA repair procedures that qualify for QBP funding, thereby promoting consistent funding of these procedures under the same funding envelope, irrespective of how the patient was admitted, and setting the foundation for a future population-based approach to service provision.

The MOH relies on information from Canadian Institute for Health Information (CIHI) databases to reconcile volumes of QBP-qualifying procedures completed at each hospital. Elective and non-elective QBP volumes will follow separate volume allocation and reconciliation processes consistent with MOH practice.

Full details of the updated AA inclusion criteria are provided in section 3.0 “Description of this QBP”.

II. Inclusion of Advanced Aortic Aneurysm Repair Procedures

Historical Background: Following release of the initial FY 2013/14 provincial funding allocation for the NCV QBP, concerns were raised by hospitals that the price for AA repair (Provincial Total Cost per Case Price of $19,584, which varied by hospital depending on each hospital’s Case Mix Index) would create significant budget pressures specifically for AEVAR. The pressures were related to the costs associated with custom graft procurement, as it exceeded the allocated funding.

Working in consultation with the then Ministry of Health and Long-Term Care (MOHLTC) Health System Information Management and Investment (HSIMI) Division, Funding Modelling Team, the Cardiac Care Network (CCN) convened a working group consisting of academic and community hospitals with both clinical and financial representatives that perform high AA procedure volumes (including AEVAR) to make recommendations for adjustments to the QBP pricing of AA procedures based on the patient cohorts described in the QBP Clinical Handbook.

While Advanced AA repair procedures were still included in the QBP Clinical Handbook, the MOHLTC at the time made the decision to exclude AEVAR and Advanced open AA procedures from QBP funding in FY 2014/15 and they were discretely funded through the MOH Provincial Programs Branch (including both elective and non-elective procedures) and hospital global budgets respectively.

Current Update: The current QBP expansion also includes Advanced AA repair procedures, with the aim to enhance the comprehensiveness and flexibility in managing the funding envelope. In addition, advances in stent-graft technology have made available a broader range of off-the-shelf devices that may reduce the cost of Advanced AA procedures.

As a result, the MOH will need to update the pricing in FY 2022/23 to reflect current prices and to discretely fund Advanced AA procedures through the AA QBP.

Full details of the Advanced AA classification and coding updates are provided in section 3.0 "*Description of this QBP"*.

III. Code Revisions

As part of this revision, Ontario Health - CorHealth Ontario, in consultation with vascular stakeholders and the MOH, excluded the following AA repair Most Responsible Diagnosis (MRDx) code from the AA QBP Clinical Handbook technical definition:

- I71.9 (aortic aneurysm of unspecified site)

A review of FY 2019/20 data revealed that this code is not widely used (≤5 cases provincially), and, as the code does not specify the location of the aneurysm, removal is intended to encourage improved reporting.

With the expansion of this QBP Clinical Handbook definition to capture a more comprehensive population of patients requiring aortic repair, the following MRDx codes have been included:

- I710 – Dissection of aorta (any part); and
- I711, I713, I715 - Ruptured aortic aneurysm

- I716 – Thoracoabdominal aortic aneurysm, without mention of rupture – this code has been added to Advanced AA Repair for when location attribute is equal to 'AR'

In addition, the following AA Canadian Classification of Health Interventions (CCI) codes were included based on alignment as a principal procedure for AA repair:

- 1KA50GQOA – Dilation, abdominal aorta, using percutaneous transluminal approach (PTA) and balloon dilator with (endovascular) stent (insertion); and
- 1ID50GQOA – Dilation, aorta not elsewhere classified, using PTA and balloon dilator with (endovascular) stent (insertion)

Full details of the AA MRDx and CCI codes are provided in section 3.0 "*Description of this QBP*".

February 2021 Revision Summary

A revision to the AA QBP Clinical Handbook was made in February 2021. The rationale for the update is provided below.

Inclusion of Same Day (Outpatient) Procedures

Through engagement with administrative and clinical experts aimed at identifying opportunities to streamline and increase the transparency and comprehensiveness of activity included in the vascular QBP, it became apparent that the definition of the AA QBP was a potential barrier to the uptake of advancing technologies and to processes that enable selected cases to be done without an inpatient hospital stay.

It is recognized and well-documented that, through advances in technology and process, AA repair can safely and effectively be conducted as a same day procedure in carefully selected patients. In particular, the use of minimally invasive interventions, including endovascular aneurysm repair (EVAR) and percutaneous EVAR (pEVAR), has increased the ability to care for patients without a hospital stay but with similar long-term outcomes. As such, these endeavors should be supported and expanded whenever possible to optimize patient outcomes with best value. The AA QBP Clinical Handbook has thus been updated to include same day procedure cases.

In FY 2018/19 and FY 2019/20, 4.1% and 5.0% of aortic repairs in Ontario were provided as a same day procedure, respectively; however, it is anticipated that the inclusion of AA repairs as same day procedures in the QBP definition will result in a shift of cases from inpatient to outpatient. This inclusion will have the added benefit of supporting the shift towards minimally

invasive and less resource-intensive treatment modalities, thus freeing up valuable operating room time and inpatient beds and promoting patient recovery at home.

With respect to **funding**, hospital vascular programs are funded for non-QBP-qualifying AA procedures through their hospital global budget, while funding for QBP-qualifying procedures is provided through the AA QBP and funding for AEVAR procedures was provided separately through the MOH Provincial Programs Branch (including both elective and non-elective procedures). This fragmentation has added to a complex administrative environment for the coordination, planning and management of a vascular program, one that can at least be partially mitigated by the addition of same day AA procedures into the QBP. QBP expansion will ensure consistent volume management and funding of AA repair under one funding envelope, irrespective of how the patient was admitted, and sets the foundation towards a population-based approach to vascular service provision.

With respect to **reporting**, details about inpatient procedures were mandated for entry into CIHI databases as were details about same day (outpatient) procedures completed in fully equipped operating rooms, hybrid operating rooms and catheterization labs. However, there remained an unknown number of AA procedure volumes performed on a same day (outpatient) basis in diagnostic imaging/interventional radiology (DI/IR) suites where CIHI reporting was not mandatory. The absence of reporting of these procedures in the CIHI databases, such as National Ambulatory Care Reporting System (NACRS), presented data gaps that contributed to challenges with transparently and comprehensively estimating volumes of AA procedures at individual hospitals and provincially. To address this challenge, CorHealth Ontario, in consultation with vascular stakeholders, worked with the MOH, CIHI and hospitals to communicate mandatory reporting of these cases into CIHI databases as of FY 2020/21.

Full details of the same day AA inclusion criteria are provided in section 3.0 *"Description of this QBP".*

October 2018 Revision Summary

Code Revisions

In 2018, CIHI released an update to the CCI, a list of codes which provides comprehensive coverage of diagnostic, therapeutic and other associated healthcare interventions.

Recognizing that specific CCI codes are leveraged as part of the technical cohort definition of the AA QBP, the MOHLTC asked CorHealth Ontario to review the changes, assess the impact, and provide an update to the AA QBP Clinical Handbook incorporating the code changes.

There were two changes to the CCI code list that had an impact on the AA cohort definition.

1) Deactivation of 1IA^^, 1IB^^ and 1IC^^ codes with reclassification to 1ID^^ codes
2) Mandatory location attribute added to 1ID^^ codes

Table 2. 2018 Coding Revisions

CCI Codes	Location	Update	Location Attribute
1IA^^	Ascending Aorta	Deactivated and reclassified to 1ID^^	AS
1IB^^	Arch of aorta	Deactivated and reclassified to 1ID^^	AR
1IC^^	Thoracic (descending) aorta	Deactivated and reclassified to 1ID^^	TH
1ID^^	Aorta not elsewhere classified (NEC)	Mandatory location attribute to be coded	

Therapeutic interventions on the ascending aorta are not in scope for the AA QBP. To exclude the ascending aorta procedures from the QBP, the "AS" (ascending) location attribute was added as an exclusion to the cohort definition.

Therapeutic interventions on the aortic arch fall within the **advanced** pathway of an AA procedure. The definition was updated to reflect that any 1ID^^ code with the "AR" location attribute will be considered an advanced AA procedure.

Therapeutic interventions on the thoracic (descending) aorta fall within the **moderate** pathway of an AA procedure. The location attribute of "TH" however includes both thoracic (descending) aorta as well as thoracoabdominal (overlapping regions) aorta which fall within the advanced pathway. The MRDx criteria will be used to distinguish between the two.

The CCI codes in this revision were presented in truncated form to increase the clarity and simplify the list of codes.

Full details of the updated inclusion/exclusion criteria and CCI code changes are provided in section 3.0 *"Description of this QBP".*

1.0 Purpose

Provided by the Ministry of Health

This QBP Clinical Handbook offers a compendium of the evidence-based rationale and clinical consensus driving the development of the policy framework and implementation approach for this QBP.

The clinical recommendations in this document and any subsequent adjustments to the funding model for these procedures are not intended to take the place of the professional skill and judgment of health care providers.

As with all QBPs, hospitals can supplement volumes as required using their global budgets, and changes to the QBP funding model do not impact physician billing.

2.0 Introduction to Quality-Based Procedures

Provided by the Ministry of Health

QBPs involve clusters of patients with clinically related diagnoses or treatments. QBPs use an evidence- and quality-based selection framework that identifies opportunities for process improvements, clinical redesign, improved patient outcomes, enhanced patient experience, and potential cost savings.

The evidence-based framework used data from the Discharge Abstract Database (DAD) adapted by the MOH for its Health-Based Allocation Model (HBAM) repository, which preceded the Growth and Efficiency Model (GEM).

The HBAM Inpatient Grouper (HIG) groups inpatients according to diagnosis or treatment for most of their inpatient stay. Day surgery cases are grouped in NACRS by the principal procedure they received.

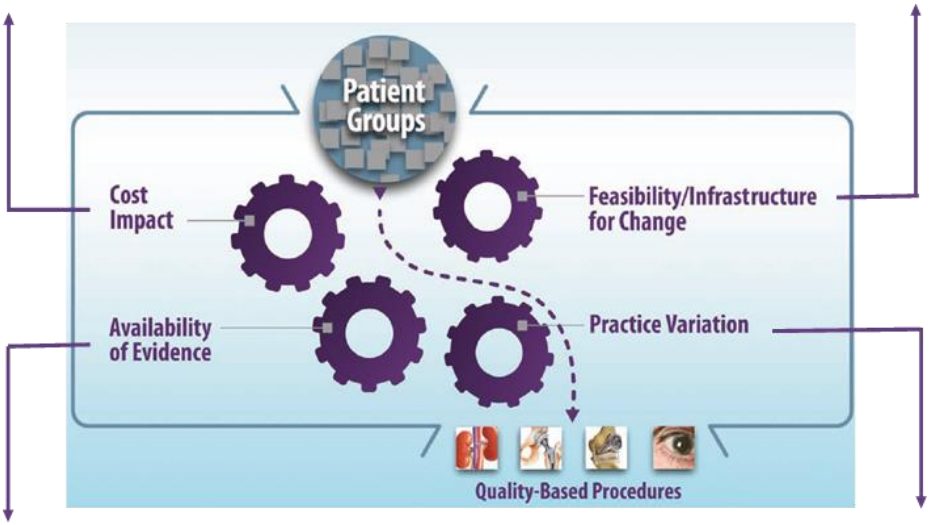
Additional data were used from the Ontario Case Costing Initiative (OCCI). Evidence in publications from Canada and from other jurisdictions and in World Health Organization reports was also used to determine patient clusters and to assess potential opportunities.

The evidence-based framework assessed patients as presented in Figure 1. This framework identified QBPs that have the potential to both improve quality outcomes and reduce costs.

Figure 1. Evidence-Based Framework for QBPs

- 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?
- Is 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 a clinical evidence base for an established standard of care and/or care pathway? How strong is the evidence?
- Is costing and utilization information available to inform development of reference costs and pricing?
- What activities have the potential for bundled payments and integrated care?

- 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

Patient transition including discharge locations, expected length of stay (LOS), and readmissions are captured by CIHI and can be analyzed on the basis of diagnosis and treatment, age, sex, comorbidities and complexities, and other condition-specific data. Large practice or outcome variance can represent opportunity to improve patient outcomes by reducing this practice variation and focusing on evidence-informed practice. A large standard deviation from expected LOS and costs are flags to such variation. Ontario has detailed case-costing data for all patients discharged from a case-costing hospital from 1991 onwards, as well as daily resource use and cost data by department, by day, and by admission.

Availability of Evidence

Much Canadian and international research has been undertaken to develop and guide clinical practice. By use of these recommendations and those of the clinical experts, best-practice

guidelines and clinical pathways can be developed for QBPs and appropriate evidence-informed indicators can be established to measure performance.

Feasibility/Infrastructure for Change

Clinical leaders are integral to this process. Their knowledge of 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 provided rationale-for-care pathways and evidence-informed practice.

Cost Impact

The implementation of an evidence-based funding methodology can help to promote efficiencies and standardize costs. The introduction of evidence into practice for a set of patient clusters through the QBP Clinical Handbook and evidence-based framework for QBPs can also demonstrate opportunities to link quality with funding.

2.1 How Will QBPs Encourage Innovation?

Implementing evidence-informed pricing for the targeted QBPs will encourage health care providers to adopt best practices in their care delivery models and maximize their efficiency and effectiveness. Moreover, best practices that are defined by clinical consensus will be used to understand required resource use for the QBPs and further assist in developing evidence-informed pricing.

Implementation of a “price x volume plus quality” strategy for targeted clinical areas will motivate providers to:

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

Clinical process improvement can include better discharge planning, eliminating duplicate or unnecessary investigations and paying greater attention to the prevention of adverse events (e.g., postoperative complications). These practice changes, together with adoption of evidence-informed practices, will improve the overall patient experience and clinical outcomes and help create a sustainable model for health care delivery.

3.0 Description of this QBP

An AA is a localized expansion or bulge of the aorta. An aneurysm can occur along the entire length of the aorta; however, most commonly the infrarenal segment of the abdominal aorta is affected. If left untreated, an AA can continue to expand and can result in rupture and death.

AAs can occur in both men and women but are more common in men with a male: female ratio of approximately 4:1. **Abdominal aortic aneurysms (AAA)** are present in 5 to 7% of men >65 years of age and are most often asymptomatic. AAAs are 5 to 6-fold more common in those with a history of smoking compared to non-smokers.

The major complication is aneurysm rupture, which requires emergency surgery to prevent death. In the United States, ruptured AAA is the 13th leading cause of death. The mortality rate after rupture is high: about 50% of patients die before reaching hospital. Of those who reach the hospital alive, approximately 40% die before, during or following emergency surgery.

Repair of AA aims to prevent death from rupture. AA can be repaired by an **open operation (open AA repair)** or by a less-invasive technique called **endovascular aneurysm repair (EVAR)**.

3.1 Patient Groups

This revised QBP Clinical Handbook (March 2022 Revision) is for the provision of open or endovascular repair of AA, in either an inpatient or same day (outpatient) procedure setting and done either electively or non-electively. AA repair is classified into three (3) groups based on anatomical level and/or interventional complexity as follows:

1. **Standard:** the majority of aneurysms are in this group and are those that involve the infrarenal aortoiliac segment. Standard aortic aneurysm repair can be identified by a) use of a clamp below the renal arteries during open repair; or b) use of a standard (non-fenestrated) endograft for EVAR.

2. **Moderate:** aneurysms requiring moderately advanced open or endovascular techniques and perioperative care. These include aneurysms in the following locations:
    a. Thoracic aorta
    b. Juxtarenal aorta. Juxtarenal aortic aneurysm repair can be identified by a) use of a clamp above the renal arteries during open repair; or b) use of fenestrated endovascular grafts for EVAR.

c. Abdominal and iliac aneurysms that require iliac branched devices for repair with or without iliac femoral bypass or aortofemoral bypass.

3. **Advanced:** aneurysms requiring advanced open or branched endovascular techniques and perioperative care. These include aneurysms in the following locations:
    a. Aortic arch
    b. Thoracoabdominal aorta e.g., involving both the thoracic and abdominal aorta.

Only hospitals with a Level 1 or Level 2 **vascular program designation**[1] and that have received written MOH approval are eligible to use AA QBP funding for **EVAR**. It is recommended that hospitals that received funding for AEVAR through the MOH Provincial Programs Branch be eligible to receive QBP funding for **advanced AA repair** (advanced open and AEVAR). Hospitals with a Level 1 vascular program that do not receive QBP funding for advanced AA repair can apply for funding through the CorHealth/MOH process for new or expanding Cardiac, Stroke and Vascular programs.

The following table summarizes the updated scope of the AA repair groupings.

Table 3. Updated Scope of AA Groupings

Open	Endo-vascular	Thoracic Aorta	Juxtarenal Aorta	Aortic Arch	Thoraco-abdominal	Inpatient	Outpatient[2]
Elective AA Repair (Standard and Moderate)							
✓	✓	✓	✓	×	×	✓	✓
Non-Elective AA Repair (Standard and Moderate)							
✓	✓	✓	✓	×	×	✓	×
Advanced Elective AA Repair							
✓	✓	×	×	✓	✓	✓	×
Advanced Non-Elective AA Repair							
✓	✓	×	×	✓	✓	✓	×

[1] A complete list of recommended criteria for Level 1, Level 2, and Level 3 vascular programs is found in the Ontario Current State Assessment and Proposed Program Framework: Acute Care Vascular Service.
[2] Since NACRS cannot distinguish between elective and non-elective, all outpatient cases are included under Elective AA Repair (Standard and Moderate).

3.2 Inclusion and Exclusion Criteria

Principal Intervention codes, **Location Attribute** (where applicable) and **MRDx codes** have been used to identify the patient groups that are best aligned to the definitions for standard, moderate, and advanced AA repair. Intervention codes are from the 2018 Canadian Classification of Health Interventions (CCI), and diagnosis codes are from the 2018 Canadian Code Classifications, International Statistical Classification of Diseases and Related Health Problems, Tenth Revision, Canada (ICD-10-CA).[3]

Table 4. Elective AA Repair (Standard and Moderate)

<table>
<tr><th colspan="3">General Inclusion Criteria</th><th>General Exclusion Criteria</th></tr>
<tr><td colspan="3">Age greater or equal to 20</td><td rowspan="3">Principal intervention is abandoned
Out-of-hospital
Location attribute is equal to ‘AS’</td></tr>
<tr><td colspan="2">Inpatient</td><td>Same Day (Outpatient)</td></tr>
<tr><td colspan="2">Admit category is ‘L’ (elective)
MCC = 05
MCC partition = I</td><td>MAC = 05
CACS partition = I</td></tr>
<tr><td colspan="4">AS = Ascending thoracic aorta; CACS = Comprehensive Ambulatory Classification System; MAC = Major Ambulatory Cluster; MCC = Major Clinical Categories</td></tr>
<tr><th>Pathway</th><th colspan="2">Approach and Principal Intervention (CCI code)</th><th>Location Attribute</th><th>MRDx</th></tr>
<tr><td></td><td>Open</td><td>Endovascular</td><td></td><td></td></tr>
<tr><td colspan="5">Abdominal Aorta</td></tr>
<tr><td>Standard</td><td>1.KA.76.^^ – Bypass
1.KA.80.LA-^^ – Repair, OA</td><td>1.KA.50.GQ-OA – Dilation using PTA and balloon dilator with</td><td>Not Applicable</td><td>I710 (NEW)
I713 (NEW)
I714</td></tr>
</table>

[3] The AA QBP technical definitions in this clinical handbook were informed using the 2018 CCI codes and ICD-10-CA folio. The technical definitions have been validated against and remain in alignment with the 2022 version of the CCI codes and ICD-10-CA folio.

	1.KA.87.^^ – Excision partial	(endovascular) stent (insertion) **(NEW)** **1.KA.80.GQ-^^** – Repair, PTA		
Aorta NEC				
Moderate	**1.ID.76.^^** – Bypass **1.ID.80.LA-^^** – Repair, OA **1.ID.87.^^** – Excision partial	**1.ID.50.GQ-OA** – Dilation using PTA and balloon dilator with (endovascular) stent (insertion) **(NEW)** **1.ID.80.GQ-^^** – Repair, PTA	TH	I710 **(NEW)** I711 **(NEW)** I712
NEC = Not elsewhere classified; OA = Open approach; PTA = Percutaneous transluminal (arterial) approach; TH = Thoracic (descending) (thoracoabdominal) (overlapping regions) aorta				
MRDx Codes: I710 – Dissection of aorta [any part] **(NEW)** I711 – Thoracic aortic aneurysm, ruptured **(NEW)** I712 – Thoracic aortic aneurysm without mention of rupture I713 – Abdominal aortic aneurysm, ruptured, includes juxtarenal aorta **(NEW)** I714 – Abdominal aortic aneurysm without mention of rupture, includes juxtarenal aorta				

Table 5. Non-Elective AA Repair (Standard and Moderate)

General Inclusion Criteria	General Exclusion Criteria
Age greater or equal to 20	Principal intervention is abandoned Out-of-hospital
Inpatient	

Admit category is 'U' (urgent/emergent) (non-elective) MCC = 05 MCC partition = I			Location attribute is equal to 'AS'	
AS = Ascending thoracic aorta; MCC = Major Clinical Categories				
Pathway	**Approach and Principal Intervention (CCI code)**		**Location Attribute**	**MRDx**
	Open	**Endovascular**		
Abdominal Aorta				
Standard	Same as Elective AA Repair	Same as Elective AA Repair	Same as Elective AA Repair	Same as Elective AA Repair
Aorta NEC				
Moderate	Same as Elective AA Repair	Same as Elective AA Repair	Same as Elective AA Repair	Same as Elective AA Repair

Table 6. Advanced Elective AA Repair

General Inclusion Criteria			**General Exclusion Criteria**	
Age greater or equal to 20			Principal intervention is abandoned Out-of-hospital Location attribute is equal to 'AS'	
Inpatient				
Admit category is 'L' (elective) MCC = 05 MCC partition = I				
AS = Ascending thoracic aorta; MCC = Major Clinical Categories				
Pathway	**Approach and Principal Intervention (CCI code)**		**Location Attribute**	**MRDx**
	Open	**Endovascular**		

<table>
<tr><td colspan="5">Aorta NEC</td></tr>
<tr><td rowspan="2">Advanced</td><td rowspan="2">1.ID.76.^^ – Bypass
1.ID.80.LA-^^ – Repair, OA
1.ID.87.^^ – Excision partial</td><td rowspan="2">1.ID.50.GQ-OA – Dilation using PTA and balloon dilator with (endovascular) stent (insertion) (NEW)
1.ID.80.GQ-^^ – Repair, PTA</td><td>AR</td><td>I710 (NEW)
I711 (NEW)
I712
I715 (NEW)
I716 (NEW)</td></tr>
<tr><td>TH</td><td>1715 (NEW)
1716</td></tr>
<tr><td colspan="5">AR = involving or originating at aortic arch with or without any other regions of aorta; NEC = Not elsewhere classified; OA = Open approach; PTA = Percutaneous transluminal (arterial) approach; TH = Thoracic (descending) (thoracoabdominal) (overlapping regions) aorta</td></tr>
<tr><td colspan="5">MRDx Codes:
I710 – Dissection of aorta [any part] (NEW)
I711 – Thoracic aortic aneurysm, ruptured (NEW)
I712 – Thoracic aortic aneurysm without mention of rupture
I715 – Thoracoabdominal aortic aneurysm, rupture (NEW)
I716 – Thoracoabdominal aortic aneurysm, without mention of rupture (NEW for AR)</td></tr>
</table>

Table 7. Advanced Non-Elective AA Repair

General Inclusion Criteria	General Exclusion Criteria
Age greater or equal to 20	Principal intervention is abandoned Out-of-hospital Location attribute is equal to ‘AS’
Inpatient	
Admit category is ‘U’ (urgent/emergent) (non-elective) MCC = 05 MCC partition = I	
AS = Ascending thoracic aorta; MCC = Major Clinical Categories	

Pathway	Approach and Principal Intervention (CCI code)		Location Attribute	MRDx
	Open	Endovascular		
Aorta NEC				
Advanced	Same as Advanced Elective AA Repair	Same as Advanced Elective AA Repair	Same as Advanced Elective AA Repair	Same as Advanced Elective AA Repair

3.3 Initial Rationale for Choosing this QBP

AA was initially identified as a QBP using the evidence-based framework presented in Figure 1 with the findings summarized in Table 6 below.

Table 6. Evidence-Based Framework for Aortic Aneurysm Repair

Cost Impact	Feasibility/Infrastructure for Change
• In FY 2010/11, there were 1,776 elective AA repairs in Ontario adults at a cost of over $41M. Note: Costs were based on a provincial costing average of select OCCI hospitals' data. • There was significant variation of average LOSs and costs for these services (typical patients only). In FY 2010/11 the average total repair costs for elective AA repair (AAA and thoracic Aortic Aneurysm Repair combined) was $23,148 and the min/max case costs were <$1,000 and >$300,000 respectively. These data included open and endovascular procedures. • Costs of AA repair by EVAR were driven by device costs. Device costs are not uniform across the province.	• There were clinical leaders in vascular care who were willing to act as champions for positive change. • CCN was building infrastructure and relationships with vascular care providers in the development of a provincial Vascular Care Network. • CCN had Ministry support to develop a NCV clinical outcomes registry. • Select elective vascular surgery procedures are monitored and publicly reported through the Access to Care Wait Time Information System (WTIS).

• Due to a wide variation in average LOS and costs between hospitals, following best practices and models of care should initiate cost savings while improving quality and efficiency in the delivery of care to patients. • Centralization of NCV services may be a feasible option as it should create centres of excellence for patients, ensure clinical competency of operators by maintaining a core minimum of cases performed, encourage economies of size and standardize models of care.	
Availability of Evidence	**Practice Variation**
• Access to EVAR in Ontario: Observations and Recommendations; submitted to the Ministry, October 2011. • A Vascular Services Quality Strategy for Ontario: Observations and Recommendations; submitted to the Ministry, May 2012. • The Vascular Society of Great Britain and Ireland, AAA Quality Improvement Programme • American College of Cardiology/American Heart Association Practice Guidelines for the Management of Patients with Peripheral Artery Disease • Canadian Cardiovascular Society Consensus Document on the Management of Peripheral Artery Disease. • Authoritative sources for case costing /unit pricing and clinical utilization data was available for reference. • Payments and integrated care were potentially going to be bundled by clinical complexity and by case-by-case	Data from FY 2010/11 indicates considerable variation in wait times, case volumes and outcomes: • Hospital **AAA** case **volumes** ranged from 1 to 228 procedures. • Hospital **thoracic AA** case **volumes** ranged from 1 to 20 procedures. • 13 Local Health Integration Networks (LHINs) offered AA repair with 9 offering both **open** and **endovascular** techniques. • Hospital utilization of **EVAR** ranged from 0% to 76% of all AA cases in FY 2010/11. • The provincial average total **LOS** following **open AAA repair** was 10.2 days and ranged from 3.1 to 12.5 days across hospitals. Following **EVAR for AAA**, the provincial average total LOS was 7.3 days and ranged from 3.0 to 11.1 days across hospitals. • The provincial average total **LOS** following **open thoracic AA repair** was 11.6 days and ranged from 8.1 to 24.0 days across hospitals. Following **EVAR for thoracic AA** the provincial average total LOS was 9.43 days and ranged from 3.0 to 14.0 days across hospitals.

provisioning for the cost of custom grafts when required.	• The average **Special Care Unit (SCU) stay** following **open AAA repair** was 68.5 hours and ranged from 14.4 to 130.9 hours across hospitals. Following **EVAR for AAA** the average SCU stay was 15.8 hours, ranging from 1.6 to 59 hours across hospitals. • The average **SCU stay** following **open thoracic AA repair** was 73.8 hours and ranged from 35.7 to 144 hours across hospitals. Following **EVAR for thoracic AA**, the average SCU stay was 52 hours, ranging from 0 to 113.3 hours across hospitals. • The identified practice variations would benefit from a provincial strategy that is based on best practices and standards of care. • NCV services would benefit from a coordinated and standardized network environment where providers can collaborate, develop and implement innovative optimized care delivery models to enhance patient outcomes. • Essential to the successful deployment of such coordinated action would be a prospectively maintained provincial database to follow designated quality indices.

3.4 Initial Application of the Evidence-Based Framework

Initial analysis of FY 2010/2011 administrative data from Ontario hospitals suggested that there were variations across the province with respect to wait times for elective AAA repair, availability and/or utilization of endovascular technology and risk-adjusted clinical outcomes.

Wait Times

Wait time data are an important indicator of patterns of patient access to surgical services. Recommended maximum wait times are established based on patient clinical priority or urgency ranking. Patients are assigned a clinical priority ranking using a defined set of evidence-

based criteria. The surgeon assigns the patient a priority based on the criteria and the urgency of the situation (Priority 1-4) which indicates the urgency in which intervention is needed.

- **Priority 1** indicates that emergency surgery is required within the next 24 hours (these data are not tracked in the wait times data).
- **Priorities 2-4** are for non-emergency patients, where the recommended maximum wait time for Priority 2 is ≤ 14 days, Priority 3 is ≤ 56 days and Priority 4 is ≤ 182 days.

In FY 2010/2011, there were 199 Priority 2 AAA repairs and 827 Priority 3 repairs in Ontario, representing a Priority 3 to Priority 2 ratio of approximately 4:1. Priority 3 to Priority 2 ratios across LHINs ranged from 16:1 to 0.8:1. These results may continue to reflect variation in surgeons' allocation of AAA patients to the different priority categories.

The average provincial wait time for a Priority 2 patient awaiting AAA repair was 40 days with a range from 12 to 105 days. The average provincial wait time for a Priority 3 patient was 48 days with a range from 26 to 245 days. These results indicate an opportunity to improve equitable access to NCV care across Ontario.

Risk-Adjusted Clinical Outcomes

To examine variation in clinical outcomes across LHINs, standardized outcome ratio analyses were completed. A standardized ratio (SR) is the ratio of actual outcomes to the number of outcomes that would be expected for a hospital given the demographics and clinical complexities of their patients. An SR greater than 1.0 indicates that the outcome, following adjustments for age and comorbidity, occurred at a frequency greater than the provincial average. An SR less than 1.0 indicates that the outcome occurred at a frequency less than the provincial average.

Standardizing outcome ratios allows for meaningful comparisons between hospitals or regions. Reported below are the SRs for in-hospital mortality, LOS and 30-day readmission. For these initial analyses, inpatient data from FY 2008/09 and FY 2009/10 for all patients older than 17 years were used.

- The **standardized mortality ratio (SMR)** for elective EVAR ranged from 0.9 to 3.4 and for open repair ranged from 0.4 to 1.6.
- The **standardized LOS ratio (SLR)** for elective EVAR ranged from 0.7 to 1.4 and for open repair ranged from 0.8 to 1.8.
- The **standardized 30-day readmission ratio (SRR)** for elective EVAR ranged from 0.7 to 2.9 and for open repair ranged from 0.5 to 1.6.

Centralization

There is a large body of literature indicating improved clinical outcomes for elective aortic aneurysm repair when done in high-volume dedicated vascular centers.

- Hospital AAA case volumes in Ontario for FY 2010/11 ranged from 1 to 228 procedures.

Technology Utilization

In FY 2010/11, 13 of 14 Ontario LHINs had at least one hospital that performed AA repair. The North West LHIN did not at the time have any hospitals that performed AA repair. Of the 13 LHINs, all had at least one hospital that performed open AA repair however only nine (9) LHINs had a hospital that performed EVAR. EVAR procedures ranged from 0% to 76% of elective AAA cases.

Ontario data indicated that increasing the proportion of minimally invasive EVAR procedures resulted in:

- Lower in-hospital mortality (0.6% for EVAR; 2 % for open repair);
- Lower LOS (7.3 days following EVAR for AAA; 10.2 days following open repair of AAA);
- Reduced SCU resource utilization (an average of 15.8 hours per case following EVAR; an average of 68.5 hours per case following open repair); and
- Higher proportion of patients being discharged home (95% following EVAR; 89% following open repair)

Inclusion of AA as a QBP provides opportunities to ensure equitable access to standardized NCV care across Ontario. Moreover, it provides opportunities to ensure patients receive the best possible care and achieve optimal outcomes. The QBP initiative is in-line with many of the recommendations that were submitted to the MOHLTC in May 2012 by CCN and its Ontario Vascular Services Advisory Committee in the report **"A Vascular Services Quality Strategy for Ontario: Observations and Recommendations"**.

Quality improvement requires the ability to define the quality indicators to be measured, develop a platform for measurement and benchmark and track the measured indicators for change. During development of the Vascular Services Quality Strategy for Ontario it was identified that existing data sources were ineffective for this purpose due to the wide variation in coding practices between hospitals and the limitations of contemporary administrative data.

Fundamental to the implementation of the described framework is the ability to continuously **monitor and report on outcomes** for selected NCV procedures at a hospital, regional and

provincial level by way of a clinical NCV outcomes registry. Outcomes should be risk-adjusted to enable meaningful comparisons with common standards and benchmarks as well as comparisons between providers.

It was thought at the time that a NCV outcomes registry would support the acquisition of data to determine current procedural volumes, case cost and develop projections of future volumes as well as provide a quality tool to aid clinical decision-making and service delivery planning and be a valuable resource for research initiatives.

Furthermore, there was strong interest within the vascular community and CCN to work together with the Ministry, LHINs, and other provincial programs on the development and implementation of a program model that would leverage current expertise, resources, infrastructure and established networks to ensure NCV care was able to fully benefit from provincial oversight and management.

3.5 Initial Objectives of this QBP

The key objectives of the AA QBP were to:

- Improve health outcomes of AA patients;
- Manage the cost of surgical and endovascular care for the treatment of AA on the healthcare system;
- Be accountable to patients with AA;
- Ensure equitable access to standardized care for AA across Ontario; and
- Address service gaps and/or need for capacity and infrastructure management to determine future development needs.

3.6 Documentation and Clinician Engagement

When the AA QBP was initially developed, all elective AA repairs performed in Ontario were documented in administrative databases by conventional chart abstraction methods. At that time, however, an analysis of Ontario hospital administrative data showed remarkable variability in coding and documentation practices. This variability inherently weakens the quality and reliability of data. Moreover, clinical characteristic details are limited. The result is that patient outcome measures selected for quality improvement efforts must be carefully interpreted with consideration of identified data limitations. Recommendations to improve data collection included:

- **Provider coding:** data should be classified at the provider or specialty level.

- **Diagnostic coding:** should be improved to clearly reflect the anatomical location of the AA (e.g., aortic arch, thoracic, thoracoabdominal, abdominal/ infrarenal or aortoiliac segment), whether side arteries are involved (e.g., renal, visceral or iliac arteries), whether the patient has associated occlusive aortoiliac disease and whether the intervention was to repair a non-ruptured aneurysm (elective) or a ruptured aneurysm (non-elective).
- **Procedure coding:** there should be a standard code for open AA repair and a standard code for EVAR. Current open AA repair intervention code definitions included open approach for AA repair, bypass or extraction. Coding should also reflect the complexity of repair, e.g., Standard, Moderate or Advanced as earlier described.
- **Collection of patient comorbidities:** should be improved, as increased patient complexity is correlated with increased costs of hospitalization. Preoperative patient comorbidities and aneurysm morphologic factors that may increase the difficulty of the intervention and the risk of postoperative complications should be documented prospectively in a standardized provincial NCV outcomes registry.

Based on these recommendations, the **Vascular Registry** was developed and implemented provincially in April 2014 to enable the collection and reporting of risk-adjusted patient outcomes.

With the introduction of CorHealth Ontario's **Information and Digital Strategy** in June 2018, CorHealth Ontario continued to focus on opportunities to enhance the value of reporting while reducing the data burden on hospitals. CorHealth Ontario engaged vascular clinical and administrative stakeholders through a formal Task Group with the aim of defining data needs to support health system vascular performance monitoring and improvement. The recommendations from the Task Group were used to inform decisions around current data acquisition practices as well as data reporting.

In 2018, through ongoing engagement with the Task Group and CorHealth Ontario's Vascular Leadership Council, and in collaboration with ICES, CorHealth Ontario developed a **provincial vascular reporting strategy**. Following an extensive literature review and a consultation and validation process, key patient characteristics, procedure characteristics and outcome indicators were identified as initial metrics to provide insight into provincial vascular health system performance. As the recommended characteristics and indicators could reasonably be satisfied through existing administrative databases, the Vascular Registry was decommissioned in May 2019.

CorHealth Ontario released an inaugural **Vascular Volumes and Outcomes Report** in March 2020 using data from health care administrative data sources which were risk-adjusted where

appropriate. Subsequent reports are released annually. Ontario Health - CorHealth Ontario will continue to work with the MOH and CIHI to address important data gaps and will rely on collaborative stakeholder input to shape the focus and scope of future data collection, analysis and reporting.

4.0 Best Practices to Guide Implementation

The provincial Discharge Abstract Database (DAD) was used initially as the primary source of evidence to describe practice and outcomes variation across Ontario for AA repair. This work was conducted to support the **Vascular Services Quality Strategy for Ontario** that was submitted by CCN to the MOHLTC in May 2012.

The clinical significance of these data was validated by consensus of the **Ontario Vascular Services Advisory Committee**, which had a membership of vascular surgeons, vascular and interventional radiologists and hospital administrators from academic and community hospitals from across Ontario.

Subsequent to the work of the Ontario Vascular Services Advisory Committee, CCN convened a **Vascular Care Working Group** to act on the recommendations of the strategy. The clinical expert panel that was formed to advise on the initial development of this QBP was a subcommittee of the Vascular Care Working Group (see Membership).

The panel members were engaged in this process through face-to-face meetings, teleconference, and email exchange which allowed the opportunity to review and evaluate relevant guidelines, literature, and data (see References) and to provide expertise and input and arrive at expert consensus for the initial content of this handbook.

Best practices were subsequently reviewed and updated by a review panel of vascular specialists, vascular program administrators and health data experts (see 2020 Review Panel Membership) and are reflected in this revised handbook.

4.1 Best-Practice Clinical Pathways

Two clinical pathways describe best practices for the treatment of AA based on the absence (asymptomatic) or presence (symptomatic) of symptoms.

1. **Asymptomatic patients** are considered clinically stable and are usually scheduled as either an inpatient or same day (outpatient) elective procedure.
2. **Symptomatic patients** are those with ruptured AA, are hemodynamically unstable or express other symptoms requiring time-sensitive, non-elective treatment typically as an inpatient procedure.

The patient clinical pathways are not treatment practice guidelines. They represent the common journey of AA patients through the healthcare system and are focused on quality, coordination and efficiency of care.

The following recommended best-practice clinical pathways apply to the treatment of asymptomatic (Figure 2) or symptomatic/ruptured (Figure 3) AA patients.

Both clinical pathways describe the continuum of care from initial patient presentation in a physician office, clinic or hospital to post-discharge follow-up care and on-going patient management. QBP funding, however, currently only includes the period that a patient is in hospital to receive treatment for AA.

Figure 2. Treatment of Asymptomatic Aortic Aneurysm

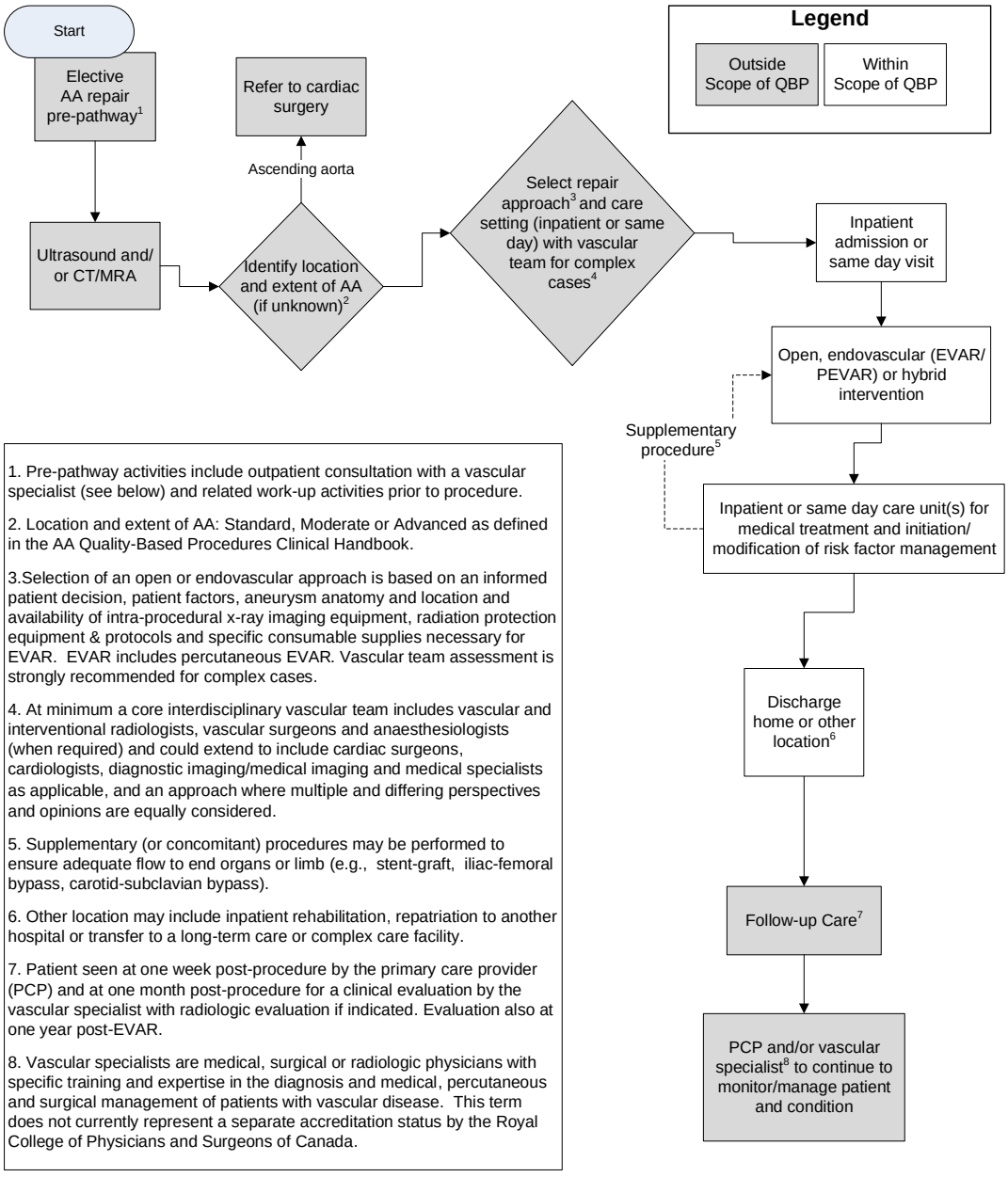
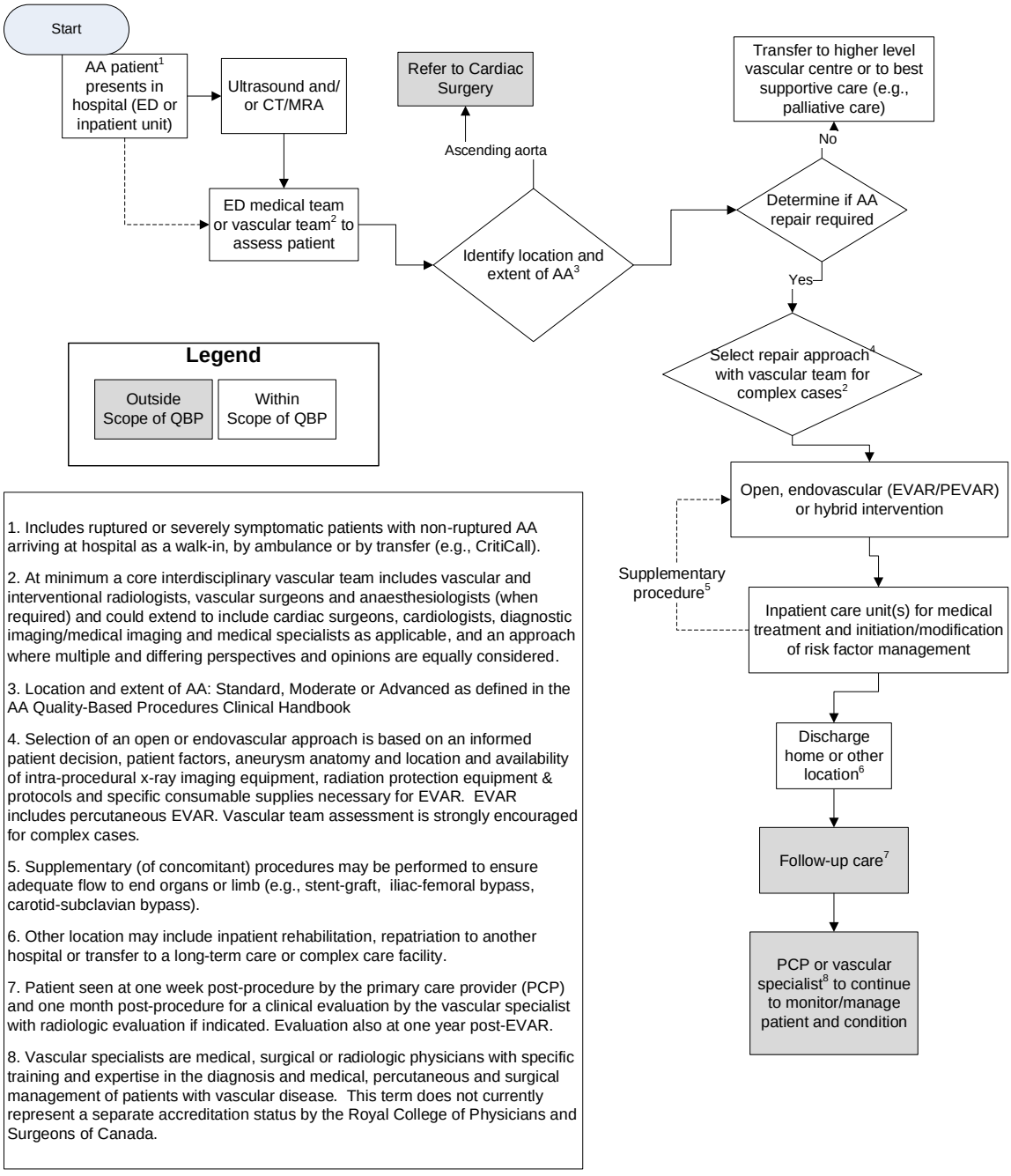


Figure 3. Treatment of Symptomatic Aortic Aneurysm



1. Includes ruptured or severely symptomatic patients with non-ruptured AA arriving at hospital as a walk-in, by ambulance or by transfer (e.g., CritiCall).

2. At minimum a core interdisciplinary vascular team includes vascular and interventional radiologists, vascular surgeons and anaesthesiologists (when required) and could extend to include cardiac surgeons, cardiologists, diagnostic imaging/medical imaging and medical specialists as applicable, and an approach where multiple and differing perspectives and opinions are equally considered.

3. Location and extent of AA: Standard, Moderate or Advanced as defined in the AA Quality-Based Procedures Clinical Handbook

4. Selection of an open or endovascular approach is based on an informed patient decision, patient factors, aneurysm anatomy and location and availability of intra-procedural x-ray imaging equipment, radiation protection equipment & protocols and specific consumable supplies necessary for EVAR. EVAR includes percutaneous EVAR. Vascular team assessment is strongly encouraged for complex cases.

5. Supplementary (of concomitant) procedures may be performed to ensure adequate flow to end organs or limb (e.g., stent-graft, iliac-femoral bypass, carotid-subclavian bypass).

6. Other location may include inpatient rehabilitation, repatriation to another hospital or transfer to a long-term care or complex care facility.

7. Patient seen at one week post-procedure by the primary care provider (PCP) and one month post-procedure for a clinical evaluation by the vascular specialist with radiologic evaluation if indicated. Evaluation also at one year post-EVAR.

8. Vascular specialists are medical, surgical or radiologic physicians with specific training and expertise in the diagnosis and medical, percutaneous and surgical management of patients with vascular disease. This term does not currently represent a separate accreditation status by the Royal College of Physicians and Surgeons of Canada.

Screening

As described in the **Vascular Services Quality Strategy for Ontario**, other jurisdictions have shown that implementation of a systematic AAA screening program can detect aneurysms in patients before they rupture and thus reduce the significant mortality rate from rupture and the high costs associated with treating ruptured aneurysms. It is therefore recommended that Ontario establish protocols and procedures for a population-based AAA screening and surveillance program and educate primary care providers on the guidelines for screening.

4.2 Comprehensive Aortic Aneurysm Care

In 2015 CCN released the **Ontario Current State Assessment and Proposed Program Framework: Acute Care Vascular Service**. The framework describes three distinct levels of hospital-based vascular programs. The levels are organized such that:

- A Level 1 program provides the most comprehensive vascular services.
- All levels assume a baseline of services including assessment, diagnostic testing, intervention and follow-up.
- All vascular programs have the necessary infrastructure, equipment and clinical expertise to provide at minimum a composite volume of **50 cases/year of open abdominal AA repair, carotid endarterectomy and lower extremity occlusive disease revascularization procedures** by open and/or endovascular approaches.
- The complexity of procedures should reflect the clinical expertise and experience within the program as well as appropriate resources and infrastructure.
- The provision of EVAR services is recommended at vascular programs that have the critical mass of patients to perform a minimum of **60 standard and/or moderate AA repair procedures** over a 2-year period, where **at least 30 are EVAR**.

A complete list of recommended criteria for Level 1, Level 2, and Level 3 vascular programs is found in the Ontario Current State Assessment and Proposed Program Framework: Acute Care Vascular Service.

Assessment

A complete assessment of the individual patient is undertaken prior to recommending repair of their AA. This assessment includes physiologic and patient-specific factors as well as the anatomic features of the aneurysm itself. Elective repair of aneurysms is a prophylactic procedure to prevent rupture. For a patient to benefit from such a procedure, they must have a certain life expectancy and the aneurysm must pose sufficient risk to warrant repair. Life

expectancy is predicated on comorbidities and generally a minimum 2-year life expectancy is required for a patient to benefit from such a repair.

Predicting risk of aneurysm rupture is not an exact science and there are many variables that contribute. The simplest measure is **maximum aortic diameter** which is directly related to the risk of aneurysm rupture.

Generally, in the average operative patient (Standard AA repair as defined previously), elective repair is recommended when the aorta reaches 55 mm in diameter (50 mm for women), at which point the risk of aneurysm rupture exceeds the perioperative mortality risk.

Certain anatomical features such as **saccular configuration** may lead to repair of smaller diameters. Also, the **rate of growth** (> 1 cm in 1 year) is considered an indication for repair less than size threshold. There is less robust data to support **diameter thresholds** for repair of other levels of the aorta and/or interventional complexities (e.g., aortic arch, thoracic, thoracoabdominal or moderate or advanced as defined previously). However, a larger diameter (e.g., 60 mm) is generally chosen as the size threshold at which point repair is recommended.

Once repair is recommended, the choice of technique (open or EVAR) considers:

- **Patient factors:** physiologic and perioperative risk, comorbidities, age, life expectancy, patient choice; and
- **Aneurysm factors**: anatomy, which is a marker for procedural success and durability.

Pre-Procedural Care

1. Appropriate physiologic risk assessment/ management of co-morbidities is undertaken when possible
    a. Cardiac risk assessment and stratification
        i. Testing could include: 12-lead ECG in patients with documented clinical risk factor(s); left-ventricular function test in patients with dyspnea or prior heart failure; non-invasive stress testing in patients with poor (less than 4 METs) or unknown functional capacity and three or more clinical risk factors, where clinical risk factors include: ischemic heart disease, compensated or prior heart failure, diabetes mellitus, renal insufficiency, and cerebrovascular disease
        ii. Identification of any of the following active cardiac conditions warrants delay or cancellation of non-emergent vascular intervention until cardiac condition improves/has been stabilized: unstable coronary syndromes, unstable or severe angina, recent myocardial infarction (MI) within one month of planned

intervention), decompensated heart failure, significant arrhythmias, severe valvular disease

b. Respiratory/pulmonary
    i. Respiratory assessment could include: patient history, physical examination, determination of functional capacity, response to bronchodilators, arterial blood gas analysis
c. Renal
    i. Renal function assessment could include: serum creatinine, creatinine clearance and/or glomerular filtration rate
d. Assessment of atherosclerotic risk factors
e. Appropriate anesthesiologist/anesthesiologist/another specialist assessment as required

2. Appropriate anatomical imaging must be available, including available CT workstation(s) that allow centerline measurements and multiplanar CT reconstructions
3. Patient consultation & informed consent. Standardized consent forms would ensure that all patients in Ontario receive consistent information from which to inform their decision

Intra-Procedural Care for Standard Complexity Procedures

1. Includes those features listed above for Standard complexity procedures above
2. Access to bypass standby, spinal cord drains and expertise to employ, spinal cord monitoring
3. Nurses and/or interventional technologists appropriately trained in vascular care

Post-Procedural Care

1. Access to a special care unit or step-down unit
2. Access to ventilation
3. Access to dialysis
4. Access to critical care services
5. Access to interventional cardiology
6. 24/7 on call coverage by an appropriately trained & experienced vascular specialist who can diagnose and treat complications
7. Access to vascular nurse practitioner, allied health care services and diagnostic services

Transitional Care

1. Patient consultation regarding discharge and follow-up planning
2. Discharge

3. Access to appropriate community support

Follow-up Care

1. Staple or suture removal
2. Follow-up visit with most responsible practitioner at 4 to 6 weeks following procedure. For patients who have had EVAR, a recommended component of the 4 to 6-week follow-up visit is CT imaging to monitor for graft-related complications
3. Following EVAR, radiologic surveillance should be completed on an annual basis
4. Following open AA repair, CT imaging should be completed after 5 years

The recommendations provided in the AA QBP pathway will improve patient outcomes by providing provincial standards for care, including minimum resource standards at hospitals providing vascular services. This includes the following benefits:

- **Adopting a standardized best-practice clinical pathway** for AA repair may reduce the volume of unnecessary testing both pre- and post-repair.
- **Risk and anatomic stratification** will identify patients who are very high risk and for whom surgery should be avoided since they would be unlikely to benefit and have an increased risk of complications. For patients considered eligible for repair, risk and anatomic stratification will help determine the most appropriate approach for repair (open or endovascular) that will offer the lowest risk of adverse outcomes for the patient.
- **Appropriate deep vein thrombosis prophylaxis** reduces post-operative complication of deep vein thrombosis and pulmonary embolism.
- **Improved and standardized postoperative care and discharge planning** in dedicated vascular units may result in reduced average LOS and an increased percentage of patients discharged home.

A patient-focused approach will increase communication between health care providers and patients thereby providing opportunities for discussion with patients on next steps and expected outcomes. In other jurisdictions, a focus on health care provider-patient communication has improved patient outcomes.

5.0 Implementation of Best Practices

The provincial DAD was used initially as the primary source of evidence to describe practice and outcomes variation across Ontario for AA repair. Although there is already a high level of care provided to patients having AA repair, there are variabilities in outcomes and indicators of efficiency across Ontario suggesting opportunities for improvements in the delivery of this core NCV service.

In May 2012, the **Vascular Services Quality Strategy for Ontario** was submitted by CCN to the MOHLTC. This document highlighted some key areas of variability that may be improved through implementation of standardized best practices coupled with appropriate benchmarking and measurement. Results of standardized ratio analyses showed areas of practice and outcome variability for the following: LOS, 30-day readmission rates, operative mortality and availability and utilization of technology for endovascular intervention.

Implementation of standardized best practices may improve system efficiencies and reduce the regional disparities in clinical outcomes, benefiting patients and the health-care system. As a system support to ensure the implementation of best practices for AA repair and other NCV services, formation of a **network of NCV care** was proposed with the primary goals to enhance quality of care and outcomes and provide timely access for NCV care.

The network should include stakeholders involved in the delivery of services, including interprofessional care providers in hospitals and outpatient centers, administrators with a standard approach to support evidence-based and effective diagnostic and therapeutic management for NCV patients, and organizations with expertise in emergency referral and management. Ontario Health – CorHealth Ontario's **Vascular Leadership Council** currently exists as this network.

An organization-specific plan for the implementation of best practices may include:

- A gap assessment of the current standard practice and the recommended best-practice recognising the need(s) for change;
- An assessment of the readiness of the institution and possible barriers to implementation;
- Identification of the 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 change;
- Follow-up evaluation of progress;
- Performance measurement and monitoring of relevant clinical and process outcomes; and
- A sustainability plan for maintaining the Best Practice Standards.

Details of each of these steps are outlined in the '**Toolkit to Support the Implementation of Quality-Based Procedures**' published by the Ontario Hospital Association (OHA), which is available under general tools and resources on the Health Quality Ontario QBP Connect website.

According to the 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 AA QBP is one of the ways in which patients' values and perspectives are heard and integrated into health decisions.

6.0 What Does it Mean for Interprofessional Teams?

A move towards standardization of best practices for treatment of AA will require hospitals to consider a coordinated and collaborative interprofessional vascular team approach to vascular care where multiple and differing perspectives and opinions are equally considered, and patient/caregiver informed choice is included.

The interprofessional vascular team should involve a network of care providers with various expertise including but not limited to vascular and interventional radiologists, surgeons (vascular, orthopedic and plastics), nurses, nurse practitioners, internal medicine practitioners, anesthesiologists, intensive care practitioners, technologists, pharmacists, and allied health providers to facilitate continuity of inpatient, outpatient, and rehabilitation care, and chronic disease management. Innovative solutions are required to plan for and meet the future vascular care human resource needs and maintain levels of service delivery.

The recommendations for interprofessional best-practice repair of AA are based on evidence from current guidelines (see References), current protocols and practice in Ontario hospitals, and consensus of subject matter experts (see Membership). Alignment of these recommendations with current clinical practice will vary across institutions, however it is felt that many hospitals are currently following similar practices.

7.0 Service Capacity Planning

In 2015, the CCN and its Vascular Care Working Group completed a current state analysis of provincial vascular services and developed the **'Ontario Current State Assessment and Proposed Program Framework: Acute Care Vascular Services'** framework for acute care vascular services in Ontario.

Using this framework as a guide, in 2016 CorHealth Ontario worked with hospitals to provide **Level 1-3 designations** to acute care vascular programs across the province. CorHealth Ontario then completed a re-evaluation of vascular programs in 2019 resulting in the current 9 hospitals with a Level 1 vascular program designation, 9 hospitals with a Level 2 vascular program designation and 2 hospitals with a Level 3 vascular program designation in the province of Ontario. Additionally, in 2020, one hospital with a Level 3 vascular program was re-designated as a Level 2 vascular program.

The impact that QBP-based funding will have on **hospital volumes** of AA repair remains to be determined; however, health service providers (clinicians and administration) will need to continue volume planning. Factors that could affect AA repair volumes include population screening for AA as well as a change in the number of hospitals providing AA repair services. Where service providers observe large changes in their desired volumes, there should be collaboration between administrators and health care practitioners to determine the appropriate strategies to address new volume targets.

Ontario Health - CorHealth Ontario will continue to work with the MOH and collaborate with vascular stakeholders including through the Ontario Health – CorHealth Ontario Vascular Leadership Council to monitor and report provincial and hospital volumes and outcomes and provide leadership and strategic direction to support the planning, funding and delivery of high-quality vascular care in the province.

8.0 Performance Evaluation and Feedback

To better understand volumes, patient outcomes, regional differences, and areas for quality improvement, the CCN and its Vascular Care Working Group established a provincial **Vascular Registry** as it was determined that the provincial health care administrative databases captured only administrative and procedural information.

The Registry was designed as a clinical database that was used for standardized collection of patient demographic, clinical, and procedure level information which could then be used for performance measurement, monitoring, and quality improvement.

As mentioned previously, with the introduction of CorHealth Ontario's **Information and Digital Strategy**, the focus shifted to enhancing the value of reporting while reducing the burden on hospitals for data collection. Through engagement with vascular stakeholders, a vascular reporting strategy was developed. As the recommended patient characteristics and outcome indicators could reasonably be satisfied through existing administrative databases, the Vascular Registry was decommissioned in May 2019.

CorHealth Ontario released to the 20 Ontario hospitals with vascular programs an inaugural **Vascular Volumes and Outcomes Report** in March 2020. Data were from health care administrative data sources which were risk-adjusted where appropriate. Subsequent reports are released annually. Ontario Health - CorHealth Ontario will continue to work with the MOH and CIHI to address important data gaps and will rely on collaborative vascular stakeholder input to shape the focus and scope of future data collection, analysis, and reporting.

9.0 Support for Change

An Ontario network of engaged vascular specialists and other health care professionals that provide care for AA patients can foster and support collaboration, continuous quality improvement, and increase efficiencies in NCV care.

In 2011, CCN, together with Ontario's NCV services providers and other stakeholder groups, formed the **Ontario Vascular Services Advisory Committee** and developed an evidence and consensus-based framework for a provincial quality strategy aimed at improving access to NCV care and NCV health outcomes for Ontarians. The strategy, entitled: **"A Vascular Services Quality Strategy for Ontario"** was submitted to the MOHLTC in May 2012.

Subsequently, CCN convened a **Vascular Care Working Group** to act on the recommendations of the strategy, and the **"Ontario Current State Assessment and Proposed Program Framework: Acute Care Vascular Services"** was developed in August 2015, which resulted in the designation of 21 hospitals with vascular programs in Ontario.

Ontario Health - CorHealth Ontario's Vascular Leadership Council continues to be an engaged and enthusiastic group of vascular leaders to provide direction and guidance to the organization. Ontario Health - CorHealth Ontario remains committed to providing leadership and strategic direction to support an Ontario network of vascular stakeholders and to continue to lead the change management related to this QBP.

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11.0 Membership

2013 Vascular Care Clinical & Technical Working Group QBP Sub-Committee

Member	Affiliation
Dr. Thomas Forbes (Clinical Group Chair)	London Health Sciences Centre
Dr. Andrew Dueck	Sunnybrook Health Sciences Centre
Dr. Thomas Lindsay	University Health Network, Toronto General Hospital
Dr. Marc Pope	Trillium Health Centre
Ms. Nancy Hunter (Technical Group Chair)	Cardiac Care Network of Ontario
Mr. Darren Gerson	Rouge Valley Health System
Ms. Karen Orescanin	Hamilton Health Sciences Centre
Ms. Filomena Travassos	Trillium Health Centre
Ms. Linda Welham	Southlake Regional Health Centre
Ms. Kori Kingsbury	Cardiac Care Network of Ontario
Mr. Mike Setterfield	Cardiac Care Network of Ontario
Mr. John Lohrenz	Cardiac Care Network of Ontario
Ms. Bernadette Verhiel	Cardiac Care Network of Ontario

2015 Vascular QBP Advisory Panel

Member	Affiliation
Ms. Marianne Beardsall	Southlake Regional Health Centre
Ms. Deb Bedini	Hamilton Health Sciences Centre
Ms. Ginette Bisson	The Ottawa Hospital

Member	Affiliation
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Dr. Tom Forbes	University Health Network
Mr. Darren Gerson	Rouge Valley Health System
Dr. Stewart Kribs	London Health Sciences Centre
Ms. Yvonne McDougall	Guelph General Hospital
Dr. Sudhir Nagpal	The Ottawa Hospital
Mr. Ben Petersen	Royal Victoria Hospital
Dr. Marc Pope	Trillium Health Centre
Dr. Jack Speirs	Windsor Regional Hospital
Dr. David Szalay	Hamilton Health Sciences Centre
Ms. Agnes Vandervecht	London Health Sciences Centre
Mr. Jonathan Wiersma	Royal Victoria Hospital
Vevien Braga	Cardiac Care Network of Ontario
Anne Forsey	Cardiac Care Network of Ontario
Gary Lee	Cardiac Care Network of Ontario
Dana Lian	Cardiac Care Network of Ontario
Anar Pardhan	Cardiac Care Network of Ontario
Mike Setterfield	Cardiac Care Network of Ontario
Graham Woodward	Cardiac Care Network of Ontario

2020 Vascular Stakeholder Reviewers

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Ms. Marianne Beardsall	Southlake Regional Health Centre
Ms. Deb Bedini	Hamilton Health Sciences Centre
Dr. Audra Duncan	London Health Sciences Centre
Dr. Tom Forbes	University Health Network
Mr. Fred Go	Scarborough Health Network
Dr. Jeff Jaskolka	William Osler Health System
Dr. Tom Lindsay	University Health Network
Dr. Mary MacDonald	Thunder Bay Regional Health Sciences Centre
Ms. Candice Mullings	Southlake Regional Health Centre
Dr. Benedetto Mussari	Kingston Health Sciences Centre
Dr. Sudhir Nagpal	The Ottawa Hospital
Dr. Dheeraj Rajan	University Health Network
Dr. Drew Schemmer	Royal Victoria Hospital
Ms. Barb Stanek	Southlake Regional Health Centre
Mr. Anson Trinh	Hamilton Health Sciences Centre
Mr. Craig Willson	Thunder Bay Regional Health Sciences Centre
Ms. Eley Wisniewski	Hamilton Health Sciences Centre
Wissam Haj-Ali	CorHealth Ontario

Member	Affiliation
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Elena Mintz	CorHealth Ontario
Mirna Rahal	CorHealth Ontario
Lynn Scholey	CorHealth Ontario
Mike Setterfield	CorHealth Ontario