

**CARDIAC CARE NETWORK**



**Ontario Current State Assessment  
and Proposed Program Framework:  
Acute Care Vascular Services**

AUGUST 2015





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# Executive Summary

## Introduction

The Cardiac Care Network of Ontario (CCN) serves as a system support to the Ontario Ministry of Health and Long-Term Care (MOHLTC), Local Health Integration Networks (LHINs), hospitals and care providers and is dedicated to improving quality, efficiency, access and equity in the delivery of adult cardiac and vascular services in Ontario.

In 2012, with the active participation and support of vascular services providers and other stakeholders, CCN developed an evidence- and consensus-based provincial strategy aimed at improving access to vascular care and vascular health outcomes for Ontarians. A review of the evidence revealed several key findings including:

- Significant variation in vascular disease prevalence and burden of disease across Ontario;
- Significant variation in vascular intervention rates across LHINs;
- Lack of capacity and service availability in some areas of Ontario; and
- Lack of standardization to support quality care and quality assurance.

The CCN Vascular Strategy included 10 recommendations to address these findings (CCN, 2012).

The Vascular Care Working Group (VCWG) was then established by CCN in 2013 and began defining a framework to standardize vascular services across Ontario. Through this process it became apparent that a comprehensive understanding of the current vascular services infrastructure and capacity landscape in Ontario was required. As such, CCN administered a vascular services survey to all acute care hospital corporations to gather this information. This document describes the results from the vascular services survey (Section I) and provides a framework for vascular services planning in Ontario (Section II).

## Objectives

To improve the quality of vascular care and patient outcomes in Ontario, a provincial vascular services survey highlighting current practices in vascular services was required to inform the development of the provincial vascular framework. The objectives of the vascular services survey were to identify the hospitals and physician specialties providing vascular services in Ontario as a means to identify gaps and inform future health services planning.

In addition to the results from the vascular services survey, the proposed vascular services framework takes into account administrative data, published literature, clinical guidelines,



regional best practices and consensus opinion. The aim was to develop a standard provincial framework that describes services of a high-quality hospital-based vascular program, including:

1. Scope of service delivery;
2. Proposed program structure; and
3. Minimum procedure volumes.

## **Section I - Vascular Services Survey**

This survey was administered to all 121 Ontario acute care hospitals and 99 hospitals provided a response (response rate of 82%). The survey revealed that vascular care is available across Ontario; however, there is high variability regarding the services available, supporting infrastructure and access to care.

Some important observations from the survey include:

- Diagnostic services including duplex ultrasound (US) and computed tomography angiography (CTA) are widely available; however, few hospitals have dedicated diagnostic vascular laboratory services;
- Twenty-seven hospitals performed at least 1 core procedure identified by the CCN VCWG (open aortic aneurysm (AA) repair, carotid endarterectomy (CEA) or lower extremity (LE) revascularization);
- Not all hospitals that had vascular specialists on staff provided access to these services 24 hours per day, 7 days per week for incoming emergencies;
- Centres performing high volumes of standard endovascular aneurysm repair (EVAR) also performed high volumes of standard open AA repairs; and
- Several hospitals indicated plans to add vascular prevention/screening, diagnostic or interventional programs to their current services in the next 2-3 years.

## **Section II - A Framework for Vascular Services Capacity Planning in Ontario**

The clinical focus of a vascular program is to provide vascular assessment and management, across the continuum of care for a spectrum of vascular conditions. In the context of the proposed framework, three distinct levels of hospital-based vascular programs (Levels 1, 2 and 3) should exist. All levels provide a baseline of services including assessment, diagnostic testing, surgical and interventional procedures and follow-up. The levels are organized such that a Level 1 program provides the most comprehensive vascular services. Moreover, the complexity of procedures should reflect the clinical expertise and experience within the program as well as the resources and infrastructure to provide appropriate support.

A summary of key criteria are described below:

- To be considered a vascular program, hospitals provide a combination of the following 'core' procedures:
  - Open surgical repair of abdominal aortic aneurysm;<sup>1</sup>
  - Carotid endarterectomy; and
  - Lower extremity revascularization either by open surgical and/or endovascular approaches.<sup>2</sup>
- Annual procedure volumes, measured as a composite of standard open abdominal AA repair, CEA and LE revascularization of at least 50 cases/year or 100 cases /2 years be maintained;
- Only Level 1 and 2 vascular programs provide standard/moderate EVAR, and advanced EVAR be provided at MOHLTC-approved Level 1 vascular programs;
- Programs that provide EVAR maintain a biannual minimum volume of at least 60 standard and/or moderate quality-based procedure (QBP)-defined AA repairs, where at least 30 are repaired using endovascular techniques; and
- All hospital-based vascular programs provide vascular services 24 hours/7 days per week for incoming emergencies. This may be achieved stand-alone or in a coordinated partnership with other hospitals.

With these criteria, all hospital-based vascular programs in the province will be identified enabling the establishment of a provincial vascular network. This network will provide opportunities for a provincial vascular quality assurance program supported by the CCN vascular registry.

Taking into consideration the observations made from the vascular survey and the framework for vascular services capacity planning, CCN recommends that:

1. Small volume programs consider consolidating and developing formal partnerships with other vascular programs within their local region to build capacity that will support a strong regionalized model.
2. Programs that have human resource capacity to support a Level 3 vascular program ensure that they meet the recommended criteria of a Level 3 vascular program.
3. A Level 3 vascular program be the minimum standard for vascular program capacity building at a LHIN level.
4. Hospitals that provide core interventional vascular services actively participate in a stand-alone or defined call network to ensure seamless emergency coverage occurs 24 hour a day, 7 days a week.

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1 See definitions in Quality-Based Procedures Clinical Handbook for Elective Aortic Aneurysm Repair. Available at <https://hsimi.on.ca/hdbportal/>

2 See definitions in Quality-Based Procedures Clinical Handbook for Elective Repair of Lower Extremity Occlusive Disease. Available at <https://hsimi.on.ca/hdbportal/>



## Introduction

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

Working with key stakeholders, CCN helps to plan, coordinate, implement and evaluate cardiovascular care and is responsible for the Ontario Cardiac and Vascular Registries. The information collected in these registries includes adult cardiac procedure 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

## Section I:

# Vascular Services Survey

### Methods

In September 2014, a vascular services questionnaire, developed by CCN and its Vascular Care Working Group (VCWG), was distributed to all 121 acute care hospital corporations in Ontario. Acute care hospital corporations were identified as indicated in the Ontario Public Hospitals Act (MOHLTC, 2014). All other hospital classifications, such as convalescent, chronic care, regional rehabilitation and children's hospitals were excluded. Hospital corporations operating more than one hospital site were treated as a single entity, resulting in one response on behalf of all hospitals in a given corporation. For example, Halton Healthcare Services consists of Georgetown, Milton and Oakville Trafalgar hospitals; however, one response was received from Halton Healthcare Services. Hospital corporations will be referred to as hospitals herein.

To maximize the opportunity for participation, a cover letter and electronic link to the questionnaire was distributed to hospitals via Ontario Hospital Association bulletins, LHIN Chief Executive Officers and direct email communication to hospital staff. Non-responding hospitals received phone call reminders regarding survey participation. The primary method of survey participation was through a web-based link in which data were entered and transferred into a secured database. A minority of hospitals participated via telephone interview in which their responses were transcribed by CCN staff directly into the secure database. The survey was closed to participation on December 4<sup>th</sup>, 2014.

Throughout this document, the following LHIN abbreviations are used: ESC (Erie St. Clair), SW (South West), WW (Waterloo Wellington), HNHB (Hamilton Niagara Haldimand Brant), CW (Central West), MH (Mississauga Halton), TC (Toronto Central), C (Central), CE (Central East), SE (South East), CH (Champlain), NSM (North Simcoe Muskoka), NE (North East) and NW (North West).





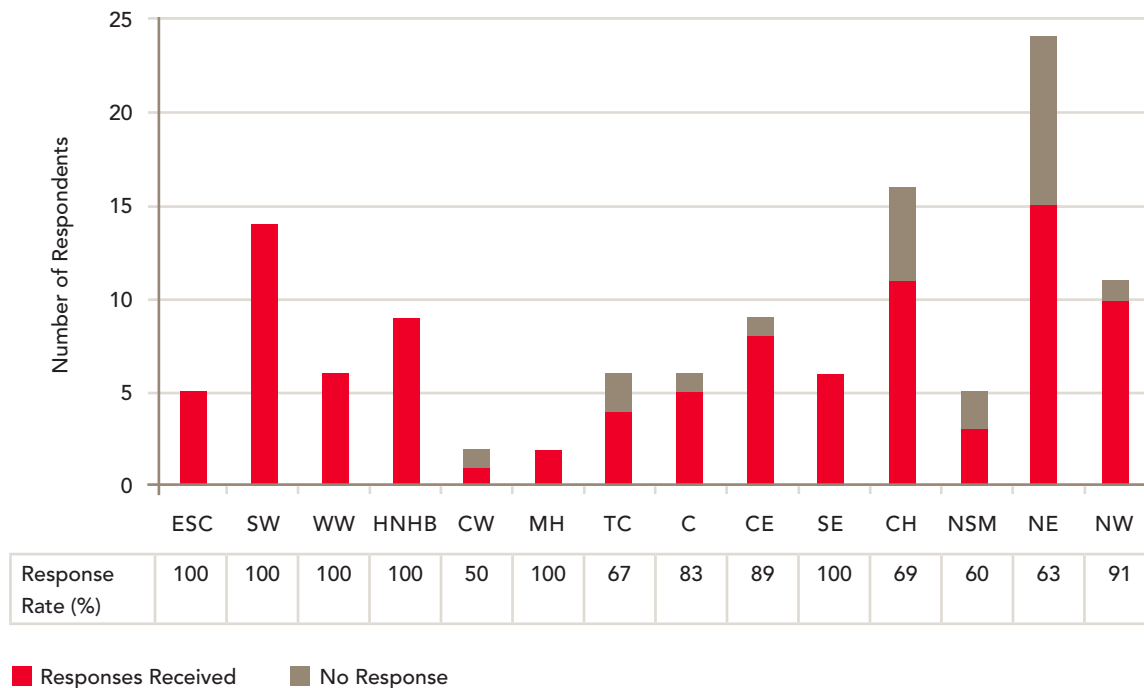
## Results

The survey results are represented by LHIN to reflect the provincial inventory of vascular services and to identify where small volume programs and gaps in service exist across Ontario. In addition, the results have been grouped by clinical services including: screening/prevention programs, diagnostic testing, interventional/surgical services, and by infrastructure supporting vascular care services. Survey respondents were also asked to identify if they planned to start or expand a vascular service within a 2-3 year planning horizon.

### Response Rate

The provincial response rate within this 2-month period was 82% with 99 unique responses received out of 121 distributed questionnaires. Of note, no correlation exists between the number of hospitals per LHIN and the number of hospital-based vascular programs or vascular procedures in each LHIN. Hospital response rates are provided in Figure 1.

Figure 1: Hospital respondents and response rates received from each LHIN.



## Clinical Services

### Screening/ Prevention

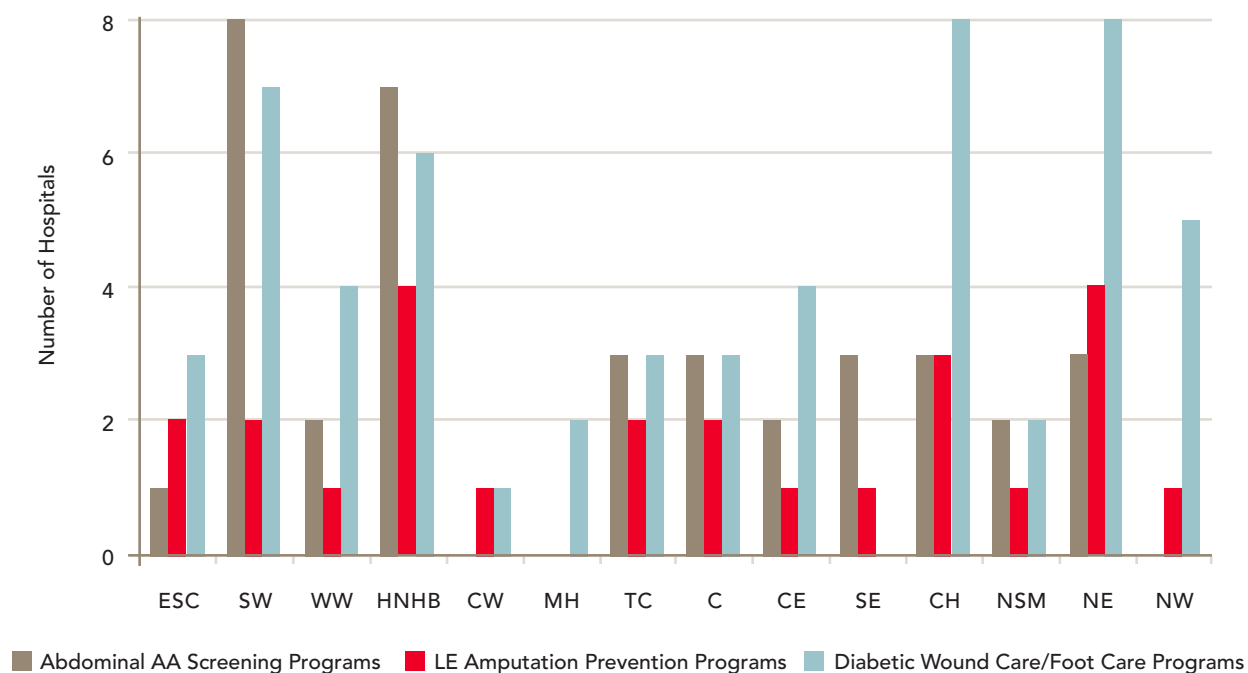
Vascular diseases are often asymptomatic until a major event occurs such as a ruptured aortic aneurysm or stroke. One strategy to reduce the incidence of these catastrophic events is to provide population screening programs. Currently, there are no established provincial standards or benchmarks for vascular screening programs in Ontario.

The vascular survey included questions about the types of vascular screening and prevention programs offered by hospitals. Specifically, 3 types of programs were targeted: abdominal aortic aneurysm (abdominal AA) screening, diabetic wound care/foot care, and lower extremity (LE) amputation prevention.<sup>3</sup> From the 99 hospitals that responded 65 indicated having at least 1 hospital-based vascular screening or prevention program:

- Abdominal AA screening programs were available at 37 hospitals;
- Diabetic wound care/foot care programs at 54 hospitals; and
- LE amputation prevention programs were available at 26 hospitals.

Of these 3 types of screening programs, none were available in all 14 LHINs (Figure 2). Of note, the screening programs refer to hospital screening services offered, not population-based screening programs.

Figure 2: Hospital-based vascular screening and prevention programs by LHIN.



3 Vascular screening and prevention programs may be located in independent health facilities (IHF); however, IHFs did not participate in the survey.



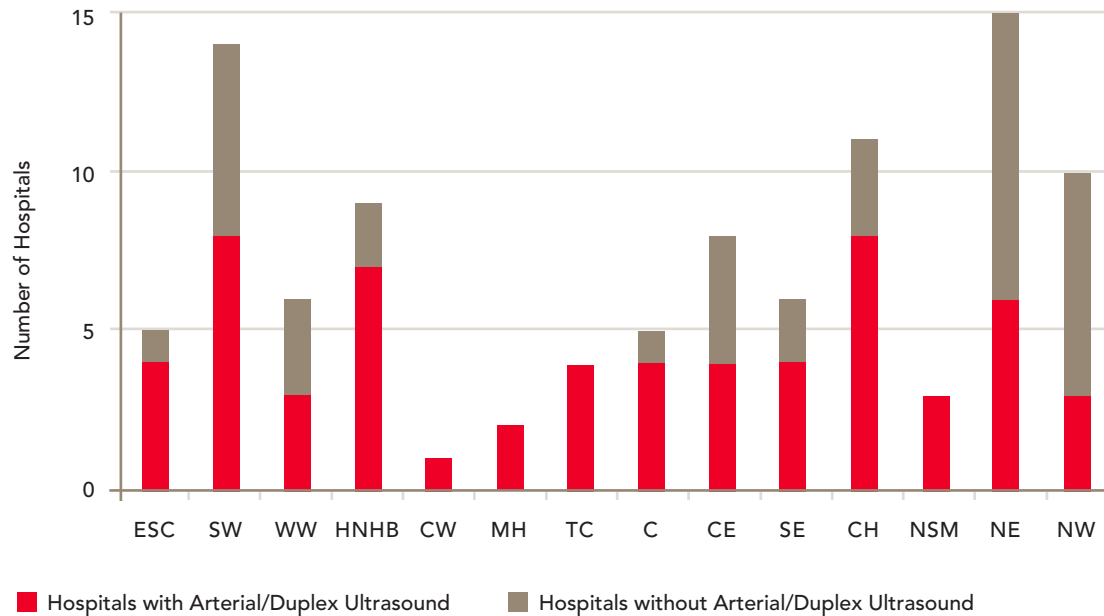
### Diagnostic Services and Vascular Laboratory

Patients with suspected vascular diseases are investigated using a variety of diagnostic modalities such as ultrasound (US), peripheral (non-cardiac) angiography, computed tomography angiography (CTA) and magnetic resonance angiography (MRA). Duplex US is a commonly used diagnostic test for the screening of peripheral artery disease (PAD), providing a preliminary assessment of its severity, and for graft surveillance following revascularization. Peripheral angiograms are performed to visualize narrowed or blocked arteries that supply blood to the legs and CTA is commonly used to determine whether a patient is a candidate for endovascular or surgical intervention and for graft surveillance following an endovascular procedure.

Vascular laboratories provide non-invasive vascular diagnostic testing and tracking of disease progression over time; however, not all hospitals with vascular programs have a dedicated vascular laboratory.

A total of 71 hospitals indicated having at least 1 on-site diagnostic imaging service available. Seventeen hospitals were identified as having a vascular laboratory. Six laboratories were accredited <sup>4</sup> and an additional 6 plan to become accredited within the next 2 years. The types and frequency of diagnostic imaging modalities per LHIN are summarized in Figures 3-6.

Figure 3: Hospital respondents by LHIN with and without arterial/duplex ultrasound vascular diagnostic imaging.



<sup>4</sup> All 6 accredited vascular laboratories received accreditation from the Intersocietal Accreditation Commission, Vascular Testing Program (formerly the Intersocietal Commission for the Accreditation of Vascular Laboratories) based in the USA.

Figure 4: Hospital respondents by LHIN with and without computed tomography angiography vascular diagnostic imaging.

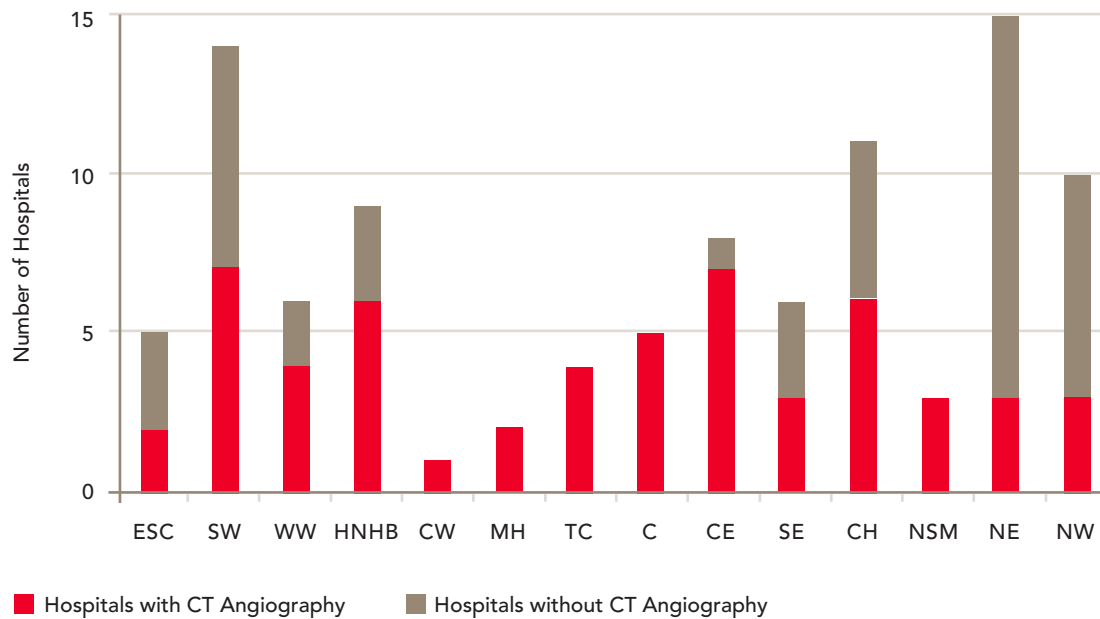


Figure 5: Hospital respondents by LHIN with and without peripheral (non-Cardiac) angiography vascular diagnostic imaging.

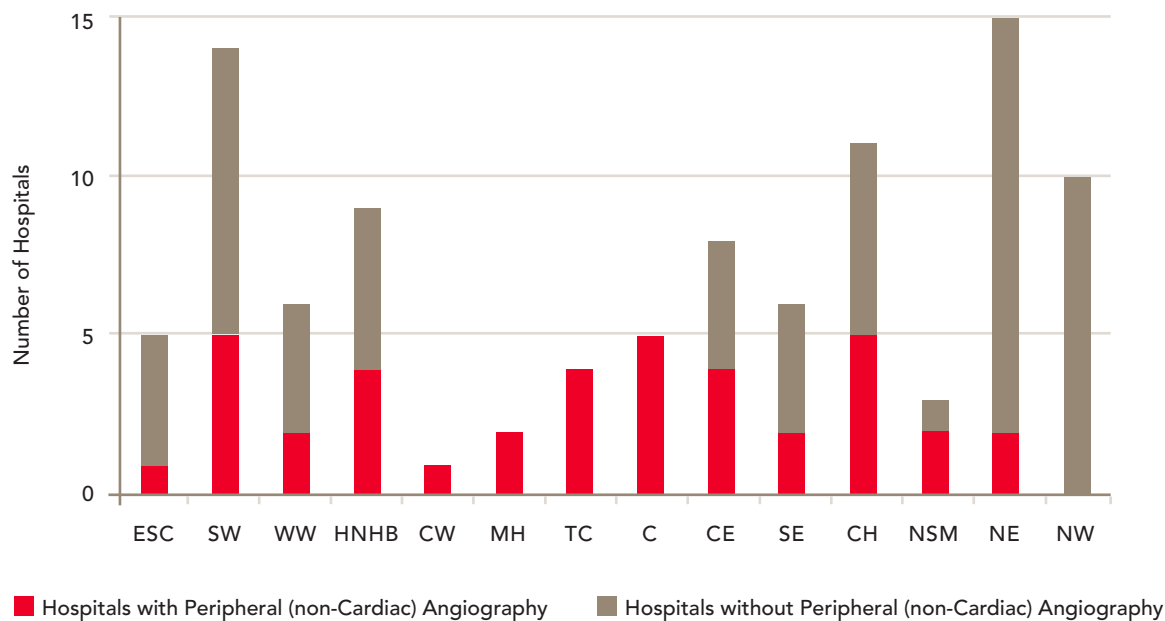
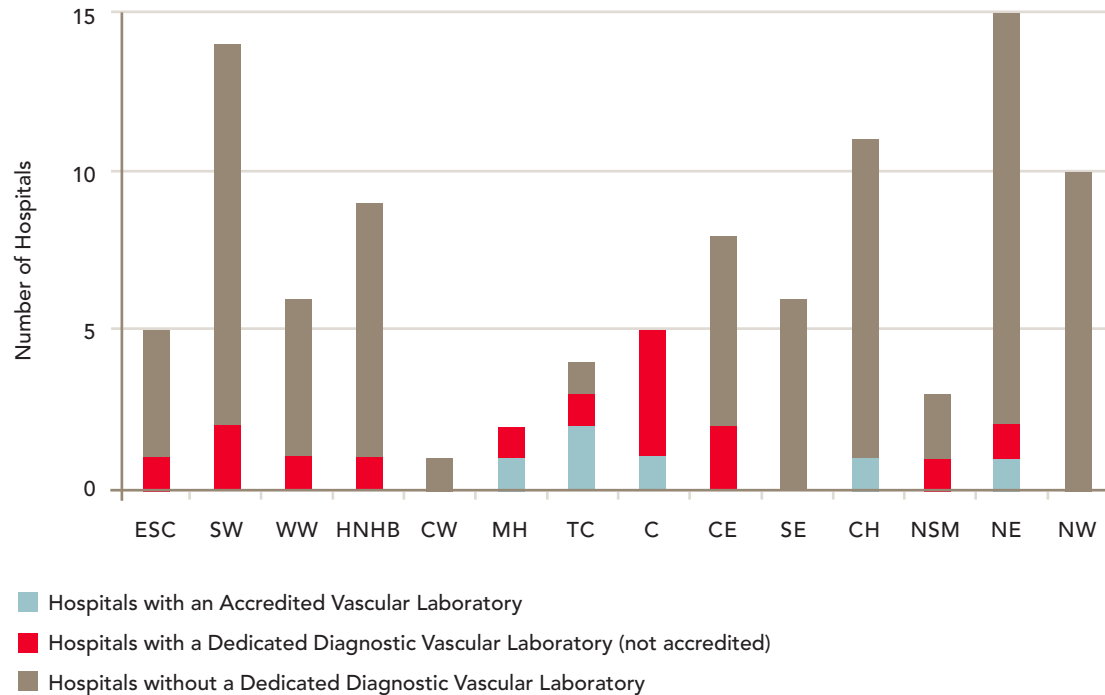




Figure 6: Hospital respondents by LHIN with and without dedicated diagnostic vascular laboratory services.



### Interventional/Surgical Vascular Services

Interventional/surgical vascular services refer to procedures falling under a broad scope of services; from core vascular procedures (e.g. aortic aneurysm repair) to procedures that may be done by a variety of surgical and/or interventional specialties. Forty hospitals indicated that they provided at least 1 of the following services:

- Amputation;
- Aortic aneurysm (AA) repair;
- Arteriovenous access creation;
- Carotid revascularization;
- Catheter directed thrombolysis;
- Lower extremity (LE) revascularization;
- Vein ligation/ stripping; and
- Venous access devices.

A list of the forty hospitals and the services provided are shown in the Appendix.

The CCN VCWG identified core vascular procedures that are considered the foundation of a vascular program. Vascular programs should perform a combination of the following principal procedures:

- Open abdominal AA repair;
- Carotid endarterectomy (CEA); and
- Lower extremity revascularization.

From the 40 hospitals performing any vascular service listed above, 27 indicated that they provided at least 1 core vascular procedure and this information is summarized by LHIN in Table 1. The majority of these vascular procedures were performed by vascular surgeons and interventional radiologists (IRs), although other surgical specialties, for instance general surgeons, participated in these procedures at some hospitals.

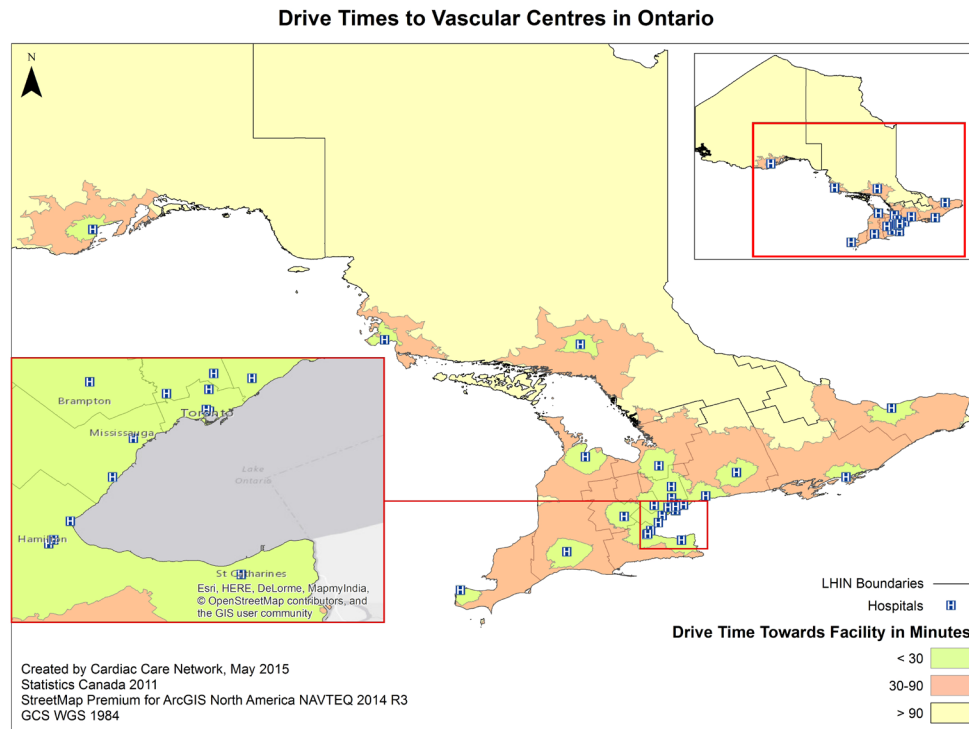
**Table 1: Hospitals by LHIN that performed 1, 2 or 3 core vascular procedures.**

No. of Core Procedures	LHIN													
	ESC	SW	WW	HNHB	CW	MH	TC	C	CE	SE	CH	NSM	NE	NW
3	1	1	1	3	1	1	3	4	2	1	1	1	2	-
2	-	1	-	1	-	1	-	-	-	-	-	-	-	-
1	-	-	-	-	-	-	-	-	1	-	-	-	-	1
No. of Hospital Respondents	5	14	6	9	1	2	4	5	8	6	11	3	15	10

The 27 hospitals providing core vascular services are depicted on the map in Figure 7. The populations served within a 30-minute (green polygon) and 90-minute (orange polygon) drive time are demonstrated. Much of southern Ontario has hospital access within 90-minutes; however, northern Ontario (including NE and NW LHINs) residents do not have similar accessibility.



Figure 7: Geographic distribution of hospitals providing core vascular services in Ontario with 30- and 90-minute drive time polygons.



## Aortic Aneurysm (AA) Repair

In order to align with the AA repair Quality-Based Procedure (QBP), aneurysm repair (open and endovascular) has been assigned the following naming conventions:

1. **Standard repair:** Aneurysms 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 endovascular aortic aneurysm repair (EVAR).
2. **Moderate repair:** Aneurysms requiring moderately advanced open or endovascular techniques and perioperative care. These include aneurysms in the following locations:
  - Thoracic aorta.
  - 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.
  - Abdominal and iliac aneurysms that require iliac branched devices for repair with or without iliac femoral bypass or aortofemoral bypass.

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

Twenty-six hospitals that responded to the survey indicated that they provided AA repair services. A summary of hospitals performing open AA repair and EVAR procedures is described in Table 2.

**Table 2: The number of respondent hospitals per LHIN providing open aortic aneurysm repair and endovascular aortic aneurysm repair.**

AA Repair	Number of Hospitals/LHIN													
	ESC	SW	WW	HNHB	CW	MH	TC	C	CE	SE	CH	NSM	NE	NW
Open repair														
Standard	1	2	1	4	1	2	3	4	2	1	1	1	2	-
Moderate	1	2	1	2	-	1	3	4	2	1	2	1	1	-
Advanced	-	1	-	1	-	-	3	-	-	1	2	-	1	-
EVAR														
Standard	-	1	1	1	-	1	3	3	2	1	1	1	1	-
Moderate	-	1	-	1	-	1	3	-	-	1	2	-	1	-
Advanced	-	1	-	1	-	1	3	-	-	-	2	-	1	-
No. of Hospital Respondents	5	14	6	9	1	2	4	5	8	6	11	3	15	10

Volume-outcome relationships for AA repair have been published (Karthikesalingam, 2010); however, in Ontario, no established minimum volume requirements for hospitals performing AA repair exist. Minimum volume requirements are proposed in Section II of this document. The requirement applies to hospital vascular programs with EVAR services and states that these hospitals must maintain a minimum 2-year volume of at least 60 QBP defined standard and/or moderate AA repair, where at least 30 are done by EVAR. Each hospital that performed standard open AA repair and/or standard EVAR provided an estimate of their volume of cases for FY 2013/14. Annual volume estimates were recorded by range, which were: 1-10 repairs, 11-30 repairs, 31-50 repairs or more than 50 repairs. Table 3 demonstrates the number of hospitals with estimated standard AA volumes within each range performed by open surgery and by EVAR.





Table 3: The number of hospitals that performed standard aortic aneurysm repair by open surgery and/or by endovascular aortic aneurysm repair, by volume.<sup>5</sup>

		Standard open AA repair volume				
		0	1-10	11-30	31-50	50
Standard EVAR AA Volume	0		5	2	2	-
	1-10	-	1	-	1	-
	11-30	-	-	1	-	3
	31-50	-	-	-	-	1
	>50	-	-	2	3	4

### Carotid Endarterectomy (CEA) and Carotid Stenting (CS)

The survey identified 23 hospitals in Ontario that provide CEA services and of these hospitals; CS was also performed at 13 centres (Appendix). The majority of CEA procedures were performed by vascular surgeons followed by ‘other’ specialties, such as neurosurgeons. Carotid stenting services were provided primarily by IRs, with vascular surgeons or ‘other’ specialties also performing this procedure. The number of hospitals per LHIN providing CEA and CS services and their estimated volumes are shown in Table 4.

Table 4: Number of respondent hospitals performing carotid endarterectomy and carotid stenting by LHIN and volume.

CEA & CS	Number of Hospitals/LHIN													
	ESC	SW	WW	HNHB	CW	MH	TC	C	CE	SE	CH	NSM	NE	NW
CEA Volume														
1-10	-	-	-	1	-	-	-	2	-	-	-	-	-	-
11-30	-	-	-	-	1	-	1	1	-	-	-	-	1	-
31-50	-	-	1	-	-	-	1	1	1	-	-	-	-	1
>50	1	1	-	2	-	1	1	-	1	1	1	1	1	-
CS Volume														
1-10	-	1	-	-	1	-	1	1	1	1	-	-	-	1
11-30	1	-	-	1	-	-	2	-	-	-	1	-	-	-
31-50	-	-	-	-	-	-	-	-	-	-	-	-	-	-
>50	-	-	-	-	-	1	-	-	-	-	-	-	-	-
No. of Hospital Respondents	5	14	6	9	1	2	4	5	8	6	11	3	15	10

<sup>5</sup> Only 25 of the 26 hospitals providing AA repair services performed standard open AA repair or EVAR. One hospital performed only moderate and advanced AA repair procedures. Survey information may have been completed by multiple individuals’ at the hospital and the results were not validated by CCN.

## Lower Extremity (LE) Revascularization

Twenty-six hospitals that responded to the survey indicated that they provided LE revascularization services. Specifically, open LE bypass (LEB) and peripheral endovascular interventions (PVI) were performed at 26 and 25 centres respectively. In FY 2013/14, 46% of the hospitals performing LEB procedures estimated their annual volumes to be >50. Whereas, 64% of PVI performing centres indicated that >50 procedures were carried out within the same time period. Hospitals that estimated high LEB volumes also estimated high PVI volumes suggesting that most high-volume centres provide both open and endovascular LE revascularization procedures. A breakdown of the number of hospitals per LHIN providing LEB and PVI services and their estimated volumes are shown in Table 5.

**Table 5: Number of respondent hospitals providing lower extremity revascularization by LHIN and volume.**

LE Revascularization	Number of Hospitals/LHIN													
	ESC	SW	WW	HNHB	CW	MH	TC	C	CE	SE	CH	NSM	NE	NW
LEB Volume														
1-10	-	1	-	-	-	-	-	-	1	-	-	-	-	-
11-30	-	-	-	2	-	1	-	4	-	-	-	-	1	-
31-50	-	-	-	1	1	-	2	-	-	-	-	-	-	-
>50	1	1	1	1	-	1	1	-	2	1	1	1	1	-
PVI Volume														
1-10	-	-	-	-	1	-	-	-	1	-	-	-	-	-
11-30	-	1	-	1	-	1	-	2	-	-	-	-	-	-
31-50	1	-	-	-	-	-	-	1	-	-	-	-	-	-
>50	-	1	1	3	-	1	3	-	2	1	1	1	2	-
No. of Hospital Respondents	5	14	6	9	1	2	4	5	8	6	11	3	15	10

Vascular surgeons were responsible for LEB procedures at all hospitals excluding 1 low volume (1-10 cases) hospital, where LEB was performed by general surgeons and 'other' specialists. PVI procedures were performed by vascular surgeons and IRs, exclusively.

PVI procedures are minimally invasive; therefore, overnight hospital stays are rarely required. Responses to this survey indicated that the proportion of PVI procedures completed as inpatient versus outpatient vary greatly across hospitals. The median percent of inpatient PVI procedures was 23% (IQR: 10-50), whereas the median percent of outpatient PVI procedures was 77% (IQR: 50-90).



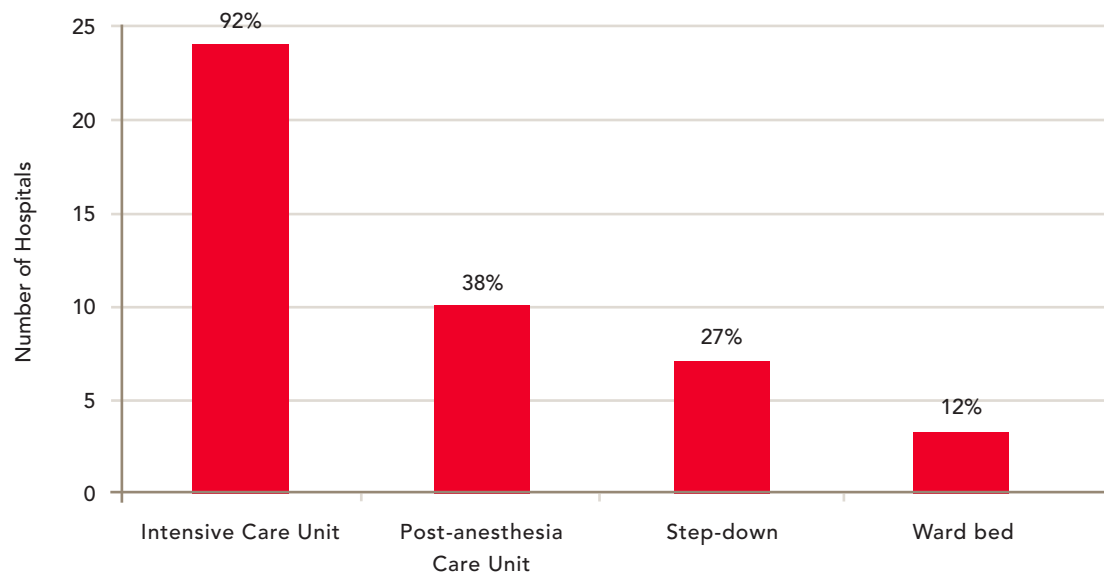
## Infrastructure Supporting Comprehensive Vascular Care Services

The complexity of care required for some vascular patients highlights the importance of hospital infrastructure to effectively support quality of care. Examples of key supporting hospital infrastructure include:

- Access to an intensive care unit (ICU) recovery area post open AA repair;
- Post-procedure care provided in dedicated vascular wards;
- Access to inpatient dialysis for patients with renal failure; and
- Developing partnerships for the continuum of care and high quality care.

From the 26 hospitals that provided AA repair surgery, the majority of hospitals utilized the ICU for post-procedure recovery. A smaller number of hospitals provided post-anesthesia care unit (PACU), step-down and ward beds as recovery options (Figure 8).

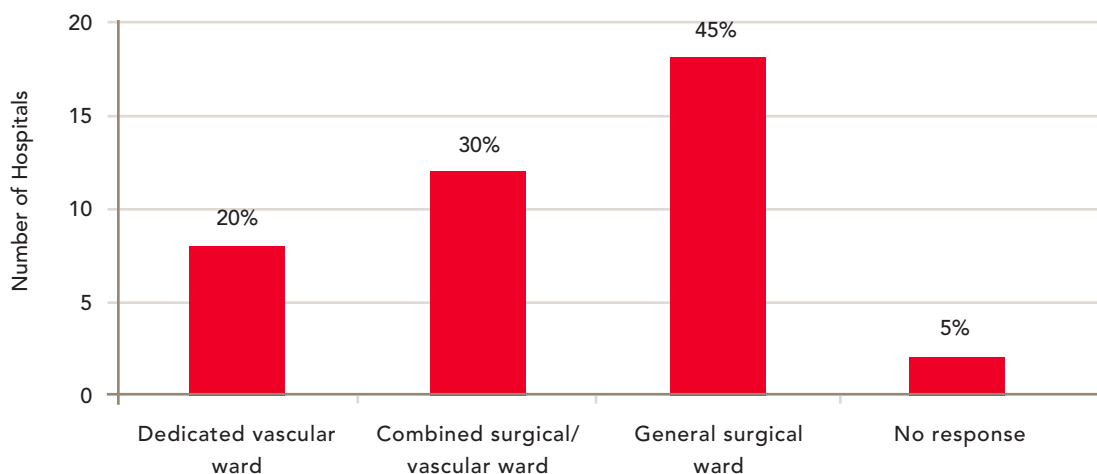
**Figure 8: Location of post-procedure recovery immediately following open aortic aneurysm repair at hospitals that provide AA repair (n=26).<sup>6</sup>**



<sup>6</sup> Note: Hospitals may utilize multiple post-procedure recovery areas for patients immediately following surgery.

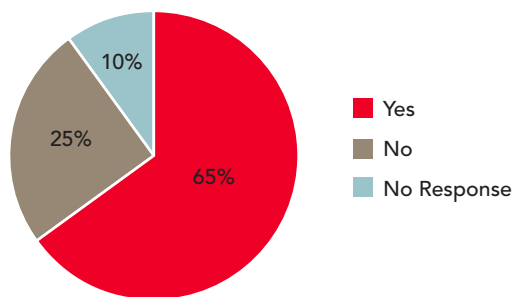
Vascular specific post-procedure care is more likely to be provided in a dedicated vascular unit with nursing staff trained in the care of vascular patients. Here, we demonstrate that inpatient recovery for vascular patients was most commonly located in the general surgical ward of respondent hospitals; whereas, vascular inpatient recovery at some hospitals occurred in a combined surgical/vascular ward or dedicated vascular ward (Figure 9).

**Figure 9: Type of ward for inpatient recovery at hospitals providing vascular interventional/surgical services (n=40).**



Given the prevalence of renal failure in the vascular patient population, a high proportion of hospitals provide inpatient dialysis support.<sup>7</sup> A small number of hospitals did not provide this service and 4 survey respondents omitted their response (Figure 10).

**Figure 10: Proportion of respondent hospitals with vascular interventional/surgical services providing inpatient dialysis support for vascular patients with renal failure (n=40).**

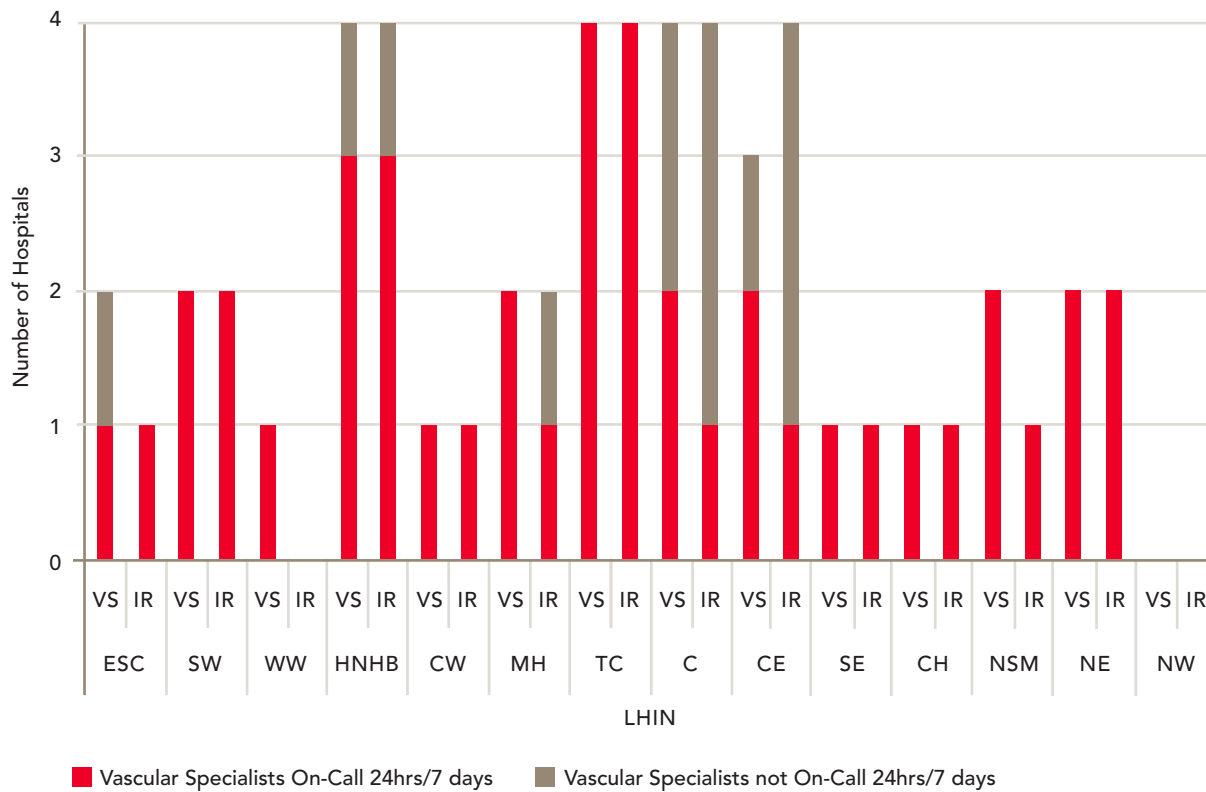


<sup>7</sup> Ontario Renal Network



Vascular emergencies such as ruptured aortic aneurysms or aortic dissections and acute limb ischemia require immediate attention to prevent loss of life or limb (MOHLTC, 2013). A comprehensive vascular program should provide access to emergency vascular services and a vascular specialist, 24 hours per day, 7 days per week. From the 40 respondent hospitals that provided any vascular interventional services, 11 hospitals did not have vascular specialists on staff, instead these services were provided by ‘other’ specialists such as general surgeons. Most hospitals with vascular specialists on staff maintained this service on a 24/7 call rotation (83%), while 17% of hospitals with vascular specialists on staff did not provide 24/7 coverage. For the hospitals that provided comprehensive 24/7 emergency access to vascular care, vascular surgeons participated in all call rotations, whereas in 75% of hospital respondents, IR’s participated (Figure 11).

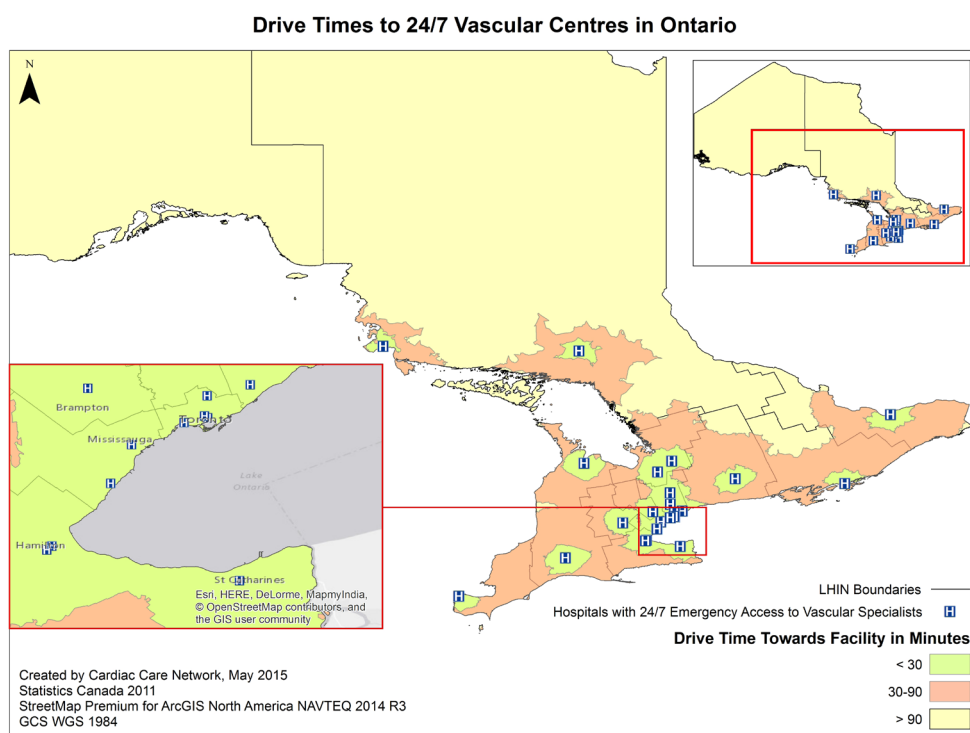
Figure 11: Number of respondent hospitals with vascular specialists on staff and that provide access to vascular surgeons and/or interventional radiologists 24 hours per day, 7 days per week.<sup>8</sup>



<sup>8</sup> VS=Vascular Surgeon, IR=Interventional Radiologist

The geographic location of hospitals providing access to 24/7 on-call vascular specialists are illustrated in Figure 12. The majority of the Greater Toronto Area and Niagara-region has access to 24/7 vascular care within a 30-minute drive, whereas most of southwest, eastern, and central Ontario has 90-minute access. In northern Ontario, there is limited access to 24/7 vascular specialist services as these services are only available in regions within a 90-minute drive of Sault Area Hospital and Health Sciences North (Figure 12).

**Figure 12: Geographic distribution of hospitals with vascular specialists on-call 24hrs/7days in Ontario with 30- and 90-minute drive time polygons.**



The continuum of care is an important consideration for providing comprehensive vascular services; therefore, partnerships between hospitals for vascular services were examined. In addition to relationship development for patient flow throughout a region, improved quality of care occurs through established mentoring relationships. Approximately 70% of hospital respondents indicated established partnerships for care of vascular patients. In particular, partnerships were developed for the following purposes:

- patient referral (61 hospitals);
- patient acceptance (24 hospitals);
- repatriation (43 hospitals); and
- mentorship (17 hospitals).



Riverside Health Care in Fort Frances, Ontario (NW LHIN), has formal agreements in place to refer their vascular patients to Thunder Bay Regional Health Sciences Centre as well as to St. Boniface General Hospital and Health Science Centre in Winnipeg, Manitoba. All other responses indicated partnerships with Ontario hospitals only.

### Future Service Planning – Self Reported by Survey Respondents

A primary objective of this survey was to identify the location and breadth of current vascular services in Ontario. Achieving an accurate picture of available services will enable identification of service gaps and will support a coordinated planning of future vascular services. Table 6 provides a summary, by LHIN, of new vascular services that are anticipated in the next 2 to 3 years as identified by hospitals.

**Table 6: Two-to-three year outlook of additional vascular services in Ontario, by LHIN, as identified by respondent hospitals.**

Service Type	Number of hospitals planning service	Hospital LHIN
Prevention/screening	2	NE, NW
Diagnostic testing	1	CH
Interventional program	3	SW, HNHB, C
EVAR (3 yr. outlook)	7	ESC, HNHB, CW, MH, C, CE, NW

### Vascular Survey Summary

On behalf of the CCN VCWG, CCN engaged Ontario hospitals in a survey to better understand the availability of clinical and interventional vascular services, as well as the hospital infrastructure that exists to support vascular patients. The responses from 82% of the acute care hospitals requested to participate in this exercise indicate that vascular services are available throughout most of Ontario; however, there was heterogeneity in the services offered across the province.

Some important highlights from the survey include:

- Most centres have screening or prevention programs that provide screening services, but not population-based screening. At least 1 of (i) Abdominal AA screening services, (ii) LE amputation prevention or (iii) diabetic wound care/foot care programs exist in each LHIN;
- Diagnostic services including arterial/duplex US or CT angiography were widely available; however, very few hospitals had dedicated diagnostic vascular laboratory services;

- From the 99 hospital respondents, approximately 70% provided at least 1 vascular service (diagnostic and/or interventional), whereas 27% performed at least 1 core procedure identified by the CCN VCWG (open AA repair, CEA or LE revascularization);
- Centres performing high volumes of standard EVAR also performed high volumes of standard open AA repairs;
- Post-procedure recovery following open AA repairs commonly occurred in the ICU and half of the hospitals had a dedicated vascular ward or combined surgical/vascular ward for inpatient recovery;
- Not all hospitals that had vascular specialists on staff provided access to these services 24 hours per day, 7 days per week for incoming emergencies;
- A majority of hospitals (69%) indicated that they had established partnerships with other hospitals for referrals, acceptance and repatriation of vascular patients, in addition to mentorship activities; and
- Several hospitals indicated plans to add vascular prevention/screening, diagnostic or interventional programs to their current services in the next 2-3 years.

The variation identified in this survey demonstrates a lack of availability of vascular services and standardization of practices in certain areas of the province, suggesting that improvements in quality of vascular care can be made. Key recommendations to enhance and ensure quality of vascular services for Ontario patients are:

1. Establish a framework and criteria that articulates a baseline of services that hospital-based vascular programs must offer, while enabling programs to offer services beyond the minimum requirements. This strategy is described in Section II - A Framework for Vascular Services Capacity Planning in Ontario, and will standardize delivery and ensure quality of vascular services while enabling programs to become centres of vascular excellence;
2. Hospitals providing core interventional/surgical vascular services (i.e. open abdominal AA repair, CEA and LE revascularization) serve as regional vascular programs and provide the foundation for a provincial vascular network;
3. Hospitals that provide core interventional/surgical vascular services actively participate in a stand-alone or regional call network to ensure seamless emergency coverage occurs 24 hour a day, 7 days a week.
4. Investigate further areas in which new or increased capacity may be required.





## Section II:

# A Framework for Vascular Services Capacity Planning in Ontario

In 2012, with the active participation and support of vascular services providers and other stakeholders, CCN developed an evidence- and consensus-based framework for a provincial strategy aimed at improving access to vascular care and vascular health outcomes for Ontarians (CCN, 2012). In reviewing the evidence and developing the strategy, key findings included:

- Significant variation in vascular disease prevalence and burden of disease across Ontario;
- Significant variation in vascular intervention rates across LHINs;
- Lack of capacity and service availability in some areas of Ontario; and
- Lack of standardization to support quality care and quality assurance.

Given the evidence in lack of availability of services and care gaps for patients, the lack of standardization in service models, and the inability to monitor and report on clinical outcomes and quality, the CCN Vascular Strategy included several recommendations:

1. A provincial vascular program should be developed to address the gap in disease management and quality assurance in vascular care in Ontario.
2. The vascular community, the CCN, and the MOHLTC should work together to develop and implement a provincial vascular program with governance structure that:
  - a) Builds a shared focus on excellence with CCN and other cardiovascular system organizations and providers;
  - b) Effectively uses leadership and capacity already in the field; and
  - c) Maximizes multidisciplinary collaborative approaches with the MOHLTC, LHINs, hospitals and other provincial programs.
3. A vascular clinical outcomes registry should be immediately established to support the acquisition of selected vascular outcomes data and enable quality outcomes reporting at hospital, regional, and provincial levels.

4. Adequate emergency coverage can and should be assured by implementing the following:
  - a) Regional on-call networks that provide continuous on-call coverage and include strategies for the management of multiple emergencies within a short time period;
  - b) Ensure that hospitals funded to provide elective care actively participate in a regional network to ensure that seamless emergency coverage occurs 24 hours a day, 7 days a week;
  - c) Expected participation in regional call networks and accountability for success must be built into hospital funding for vascular services; and
  - d) Ensure that hospitals that receive provincial funding for EVAR elective programs also must provide EVAR on an emergency basis.
5. Standardize and monitor vascular laboratory services.
6. Regionalize and coordinate vascular services within a provincial vascular network.
7. Implement an abdominal aortic aneurysm screening program.
8. Put in place programs for risk-factor reduction and rehabilitation.
9. Initiate health human resource planning early.
10. Coordinate with other relevant provincial programs.

In moving forward with the recommendations CCN established the CCN VCWG in 2013, dedicated to non-cardiac vascular care, leveraging clinical expertise and infrastructure to support vascular care with a focus on program competencies, clinical standards, access and quality of care and a framework for vascular services as a provincial program. As a first step, the VCWG was tasked with defining a framework to standardize vascular services across Ontario. With a focus on quality and coordination of care and patient outcomes, the vascular services framework could also be applied to support system-wide capacity planning, promote program efficiencies and evaluation.

Fundamental to this work was the completion of a current state assessment via survey to fully understand the current vascular services infrastructure and capacity landscape in Ontario (see Section I). In addition to the evidence generated from the survey, the proposed vascular services framework takes into account available administrative data, published literature, guidelines, examples from other jurisdictions and consensus opinion. The framework is presented in three key areas: (1) overview of scope and service delivery models; (2) proposed program structure; and (3) minimum volumes to be considered a vascular program.



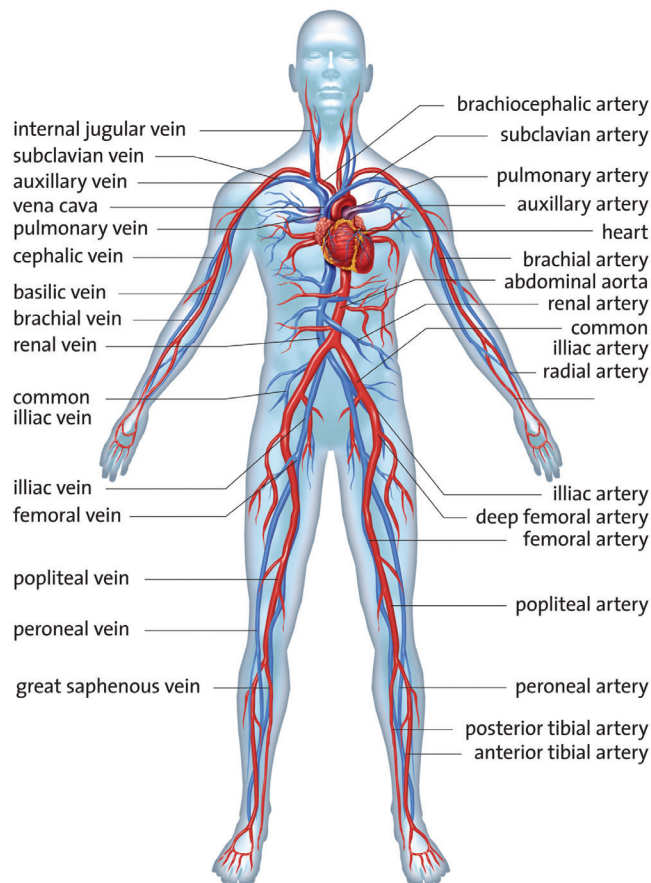
## Vascular Program – Scope and Service Delivery Models of Care

In defining a standard framework, the first priority was to focus on hospital-based vascular services and identify standards to support three levels of acute care vascular programs.<sup>9</sup>

The clinical focus of a vascular program is to provide vascular assessment and management, across the continuum of care, for the following conditions:

- Aortic disease;
- Carotid artery disease;
- Dialysis access;
- Peripheral artery disease;
- Venous disease; and
- Visceral and renal artery disease.

Figure 13: The vascular system is comprised of arteries and veins of the body.



<sup>9</sup> Vascular programs may exist in a physician office or community setting; however, these tend to focus on diagnostic and minor outpatient procedures and are not the focus of the framework at this time.

## Service Delivery Model – Capacity Planning

### Emergency Care

To ensure access to care, a minimum of vascular services should be provided within a specific geographic area. In addition, urgent access to advanced care for acute and life and limb threatening (MOHLTC, 2013) patient situations should be well defined with assessment and transfer protocols in place to ensure patients can access emergency care from anywhere in Ontario 24 hours per day, 7 days per week. In Ontario, CritiCall is an important resource that coordinates 24/7 emergency consultation and referral services for hospital-based physicians that require immediate specialist consultation for their patients. The Emergency Neuro Image Transfer System (ENITS), provided by eHealth Ontario, is a communication solution that has been adapted to enable cardiac and vascular specialists' remote access to on-demand computed tomography imaging for the purpose of a consultation request through CritiCall Ontario. Resources such as these have already improved access to emergency vascular care across the province. Given that there is an existing model to support emergency access, the priority of the VCWG is to ensure that established systems are used, and regularly monitored and evaluated with a focus on ongoing quality improvement.

### Elective/Urgent Care

A critical point in planning service delivery is to determine at what point investments should be made to build or expand services locally for patients to receive services in their own region, rather than be required to travel to an established vascular program elsewhere. While “closer to home” may be preferred, in some jurisdictions there may not be the critical mass of patients to sustain a quality program. Other jurisdictions such as the United Kingdom (UK) estimated that a population of 800,000 is required to maintain a vascular program with 6 surgeons (Grewal, Davis, & Hamilton, 2013). The vast geography and population density in certain areas of Ontario present challenges in determining a critical mass to sustain a vascular program in Ontario hence the UK model cannot be applied.

### Infrastructure, Human Resources and Service Type

It is proposed that there be three distinct types of hospital-based vascular programs. All levels assume a baseline of services including assessment, diagnostic testing, intervention and follow-up. The complexity of procedures should reflect the clinical expertise and experience within the program as well as appropriate resources and infrastructure. This may include dedicated beds with staffing resources and supports according to the standards established for best practices. Treatment protocols and clinical pathways need to be established and in place to support patient care, including emergency protocols for the care and management of patients who deteriorate clinically and urgently require a higher level of care. Ambulatory care areas should be appropriately staffed, with the necessary physical space and equipment to accommodate anticipated patient volumes.



For a hospital-based vascular program, there needs to be a system-wide plan to ensure appropriate clinical coverage that is reasonable and achievable, including on-call and consultation schedules.

Furthermore, a high degree of internal collaboration between clinical departments/divisions interacting with the vascular program will help to ensure its success. Examples may include the following areas:

- Medical imaging;
- Vascular testing facility;
- Interventional radiology suite;
- Operating rooms;
- Anesthesia;
- Critical care;
- Endocrinology;
- Nephrology;
- Occupational therapy (OT)/ Physiotherapy (PT);
- Pharmacy;
- Respiratory therapy; and
- Social work.

In addition, comprehensive vascular programs may also collaborate with the following areas:

- Catheterization laboratory;
- Hybrid operating rooms;
- Cardiac surgery; and
- Interventional radiology.

## Vascular Program Structure – Three Levels

To be considered a vascular program, hospitals provide a combination of the following procedures:

- Open surgical repair of abdominal aortic aneurysms;<sup>10</sup>
- Carotid endarterectomy; and
- Lower extremity revascularization either by open surgical and/or endovascular approaches.<sup>11</sup>

Further, an annual volume, measured as a composite of open abdominal AA repair, CEA and LE revascularization, of at least 50 cases/year or 100 cases/ 2 years be maintained. Minimum annual volumes are based on published literature supporting positive relationship between case volumes and improved outcomes for selected vascular procedures (Karthikesalingam, 2010; Arora, 2015); as well, historical procedure volumes at hospitals across Ontario were considered to guide recommended achievable minimum volume thresholds. In addition, a vascular program provides selected vascular diagnostic testing including vascular US, CTA, MRA, peripheral angiography and have access to a non-invasive vascular testing facility.<sup>12</sup>

The criteria for the three levels of vascular programs are based on peer reviewed literature, guidelines (Hirsch, et al., 2006), examples from international jurisdictions (e.g. the UK) (Grewal, Davis, & Hamilton, 2013), examples from other provincial programs (e.g. cardiac care in Ontario (CCN, 2013), and neurosurgery in Ontario), available administrative data (e.g. Canadian Institute for Health Information databases) as well as expert clinical opinion. Additionally, the framework takes into account unique considerations relative to Ontario's geography and population.

In the context of the proposed framework, it is assumed that all three levels provide a minimum of patient assessment and diagnostic testing services, and the levels are organized such that a Level 1 program provides the most comprehensive vascular services. A summary of criteria for each of the three program levels is provided in Table 7.

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10 See definitions in Quality-Based Procedures Clinical Handbook for Elective Aortic Aneurysm Repair. Available at <https://hsimi.on.ca/hdbportal/>

11 See definitions in Quality-Based Procedures Clinical Handbook for Elective Repair of Lower Extremity Occlusive Disease. Available at <https://hsimi.on.ca/hdbportal/>

12 See definition in the Intersocietal Accreditation Commission Standards and Guidelines for Vascular Testing Accreditation. Available at <http://www.intersocietal.org/vascular/standards/IACVascularTestingStandards2015.pdf>



Table 7: Criteria for the 3 Levels of Hospital-Based Vascular Programs.

Criteria	Level 1	Level 2	Level 3
Vascular procedure volume requirements: ≥50 cases/yr or ≥100 cases/2 yrs which is a composite of standard abdominal AA open surgical repair (OSR), CEA, open and endovascular LE revascularization	✓	✓	✓
Aortic aneurysm (AA) OSR & EVAR case volume requirements per 2 yrs: ≥60 standard and/or moderate QBP- defined AA repair where ≥30 are EVAR	✓	✓	-
QBP-defined advanced AA repair by OSR and/or EVAR	✓	-	-
Multi-slice CT Imaging	✓	✓	✓
CT vascular and IR post-processing software	✓	✓	-
Operating suite with minimum portable C-arm x-ray imaging system. (A fixed x-ray imaging system is recommended for EVAR)	✓	✓	-
Interventional/hybrid or minimally invasive operating suite with fixed x-ray imaging system is strongly recommended (Findeiss & Cody, 2011; Varu & Greenburg, 2013)	✓	-	-
Vascular services available 24/7 for emergency call; either stand-alone or in a coordinated partnership with other local hospitals.	✓	✓	✓
Vascular surgeons, IRs, anesthesiologists and nurses to support 24/7 emergency coverage	✓	✓	✓
Interprofessional care team	✓	✓	✓
Multi-specialty team available such as cardiology, interventional radiology, internal medicine, nephrology and neurology	✓	✓	✓
Cardiac surgery program (CCN, 2013)	✓	-	-
Access to a vascular testing facility	✓	✓	✓
Level 3 ICU/CCU facilities (Critical Care Services Ontario)	✓	✓	
Level 2 ICU/CCU facilities (Critical Care Services Ontario)	-	-	✓
Vascular/cardiovascular (CV) ward beds	✓	✓	-
Access to in-patient hemodialysis	✓	✓	-
Follow-up (out-patient)	✓	✓	✓
Access to rehabilitation	✓	✓	✓
Access to amputee/prosthetic clinic	✓	✓	✓
Involved in a network of vascular care provision with partner hospitals	✓	✓	✓
CCN Vascular Registry contribution	✓	✓	✓
Vascular/CV nurse practitioners (NP) and/or physician assistants (PA) (Bruni, 2002; Donker, et al., 2014)	✓	✓	-

Legend: ✓ Requirement - Not Applicable

EVAR is an appropriate alternative to open surgical repair of aortic aneurysms in many patients and can be safely used for both elective and emergent cases (OHTAC, 2005). However, EVAR is also one example of a procedure where basic infrastructure, clinical expertise and experience must be in place prior to providing this service as part of a vascular program. With advanced technology, EVAR is being used to repair more complex and technically challenging aneurysms. This level of care requires teams of specialized and experienced staff and enhanced facilities, including advanced imaging and treatment for patient care, and therefore it is recommended that specific volume thresholds are in place to ensure sufficient critical mass of patients to support quality care. Given this requirement, it is recommended that only Level 1 and 2 acute care vascular programs provide standard/moderate EVAR, and that advanced EVAR is only provided at MOHLTC-approved Level 1 vascular programs that meet the specified criteria. In addition, minimum requirements and specific criteria for all EVAR programs in Ontario are proposed (see Table 8).

**Table 8. Criteria for EVAR Programs in Ontario.**

Criteria	Description
<b>All EVAR Programs</b>	
Vascular surgery/IR program	Active program that provides inpatient and outpatient vascular services for a wide range of arterial procedures and must complete an annual composite volume of $\geq 50$ standard open abdominal AA, CEA and LE revascularization, either by open surgical and/or endovascular approaches. (or $\geq 100/2$ years).
24/7 emergency call	Vascular services must be available 24/7 for emergency cases; either stand-alone or in a coordinated partnership with other hospitals.
AA procedure volume	Must maintain a minimum 2-year volume of $\geq 60$ standard and/or moderate AA, where $\geq 30$ are done by EVAR.
Follow-up program	Must enroll all EVAR patients into a follow-up program to ensure long-term surveillance for endoleak and aneurysm growth.
CCN vascular registry	Must contribute to the CCN quality assurance vascular registry by entering required data for all aortic aneurysm repairs.
<b>Facilities</b>	
Multi-specialty team	Comprehensive management of complex aortic disease involving the ascending aorta, aortic arch and thoracoabdominal segments of the aorta spans multiple specialties, including but not limited, to vascular surgery, cardiac surgery, interventional radiology, cardiology, and hemodialysis services. Therefore, care for these patients is best provided in facilities that provide such a multi-specialty environment.





Criteria	Description
Surgical & endovascular operating suite	Procedural room specification to provide a safe, appropriate environment to allow for induction of anaesthesia, surgical cut-down or percutaneous access, post-operative recovery and conversion to open repair, should the need arise.
Anaesthesia facilities	Should be to the same standards as those for conventional operating theatres.
Access to in-patient hemodialysis	Dialysis access or post-op dialysis support facilities should be on-site (preferred). If not available then appropriate Memorandum of Understanding (MOUs) and protocols must be in place to transfer patients to facilities where renal support can be provided.
Vascular/cardiovascular ward	Inpatients should be cared for on a dedicated ward by interprofessional team who are skilled in the management of vascular patients.
<b>Equipment/ Infrastructure</b>	
Intra-procedural x-ray imaging	At minimum have a high-quality portable x-ray imaging system for use during standard infrarenal AA EVAR; however, a fixed x-ray imaging system is recommended.
Radiation protection	Equipment and technology should be available to minimize radiation exposure to staff and patient and to allow for use of alternative contrast media (e.g. CO <sub>2</sub> ), where appropriate.
Consumable supplies	A range of stent grafts and other necessary interventional radiology and surgical consumables to facilitate infrarenal AA repair, properly stored and immediately available.
<b>Health Human Resources</b>	
Medical team	Should include vascular surgeons, and might include interventional radiologists, and others as necessary with capacity to support 24/7 emergency coverage.
Anaesthesia	Anaesthesia staff that are appropriately trained to manage the complexities of this patient population.
Nursing	RPN/RN/NP staff appropriately trained and knowledgeable in the management of vascular/cardiovascular patients.

Criteria	Description
<b>Moderate EVAR Programs</b>	
Program competency, Skills and training	Documented experience providing standard surgical and endovascular AA repair with excellent outcomes.
<b>Equipment/ Infrastructure</b>	
Intra-operative imaging	At minimum have a high-quality portable imaging system for use during standard and moderate EVAR cases; however, a fixed imaging system is recommended.
Consumable supplies	A range of stent grafts and other necessary interventional radiology and surgical consumables to facilitate descending thoracic AA, juxtarenal and infrarenal AA repair and repair of the aortoiliac segment, properly stored and immediately available.
Cerebro-spinal fluid (CSF) drainage	Ability to establish prophylactic CSF drainage for thoracic repairs.
<b>Advanced EVAR Programs</b>	
Program competency, Skills and training	Documented experience providing standard and moderate surgical and endovascular AA repair with excellent outcomes.
<b>Equipment/ Infrastructure</b>	
Cardiac surgery program	Comprehensive management of complex aortic disease involving the aortic root, ascending aorta and aortic arch is restricted to facilities that provide a regional cardiac program in addition to a Level 1 vascular program.
Imaging	Full range of CT, MR, echocardiography (transthoracic and transesophageal).
Intra-operative imaging	High-quality fixed imaging system is strongly recommended.
Consumable supplies	A full range of stent grafts and other necessary interventional radiology and surgical consumables to facilitate repair of the entire length of the aorta, the aortoiliac segment and the aortic valve aortic arch, descending TAA, juxtarenal and infrarenal AA repair, properly stored and immediately available.
CSF drainage	Ability to establish prophylactic CSF drainage for thoracic and thoraco-abdominal repairs.



## Considerations for Establishing a Vascular Program

Given the necessary critical mass of patients and volumes to support a quality program, a hospital-based vascular program (Level 1, 2 or 3) requires the full support of administration and other stakeholders (hospitals, referring physicians and other providers) within the region. Moreover, a vascular program requires the appropriate infrastructure and regional supports aligned with the level of care, in order to provide the necessary clinical services to support and optimize patient care. Hospitals that are considering a vascular program expansion or adding a new vascular program may use the following elements as a guide to help determine readiness for program development:

### 1. Infrastructure

- a. An administrative commitment and necessary infrastructure upon which a robust vascular program with a focus on the continuum of care can be established;
- b. Capital investments as well as a necessary operational funding model benchmarked against similar existing programs in the province;
- c. Sufficient inpatient and ambulatory care resources, including available inpatient beds, as well as physical capacity to support all aspects of vascular care and clinic activities relative to the level of vascular service provided;
- d. Existence of a service plan for vascular diagnostics (including appropriate use criteria defined by existing standards/guidelines) and trained staff to conduct testing. Provision of in-hospital vascular diagnostic testing must be present to appropriately service inpatient and ambulatory patient populations, including: vascular ultrasound, CT, MR, and peripheral angiography. Emergent/urgent testing must be available for inpatients 24/7; and
- e. Evidence that comprehensive quality assurance program and risk management strategies are established, including vascular program evaluation, monitoring and reporting systems to ensure best practice guidelines are followed and tracking and monitoring of adverse events.

### 2. Clinical Services

- a. A clear plan for 24/7 on-site coverage for vascular emergencies with vascular surgeons and interventional radiologists available to ensure adequate emergency and postoperative care or active participation in a regional call system within the network to provide such care;
- b. Clearly defined clinical pathways must exist for the care of vascular patients using evidence-based best practice guidelines;
- c. Dedicated inpatient ward beds where clinical teams are skilled in the management of post-surgical and post-interventional vascular patients who are transferred from within or repatriated from centres where advanced vascular procedures are performed;

- d. Dedicated Level 3 ICU beds for vascular patients at hospitals with a Level 1 or Level 2 vascular program; nurses in this unit must be trained and maintain competence in critical care with the ability to manage complex critically-ill vascular patients;
- e. Dedicated Level 2 ICU beds for vascular patients at hospitals with a Level 3 vascular program;
- f. Access to inpatient hemodialysis for patients with renal failure;
- g. Protocols must exist relating to the care of the critically-ill patient during the stabilization and intra-hospital transport period in the event a patient requires transfer to a higher level of care;
- h. A vascular team consisting of anesthesiologists, radiologists, surgeons, and other physicians who have appropriate vascular training;
- i. Evidence of necessary human resources (including interprofessional teams consisting of medical, nursing, OT, pharmacy, PT, and social work) trained and assigned to care for elective and emergent vascular patients;
- j. Ambulatory care areas appropriately staffed with vascular-trained health providers;
- k. Established and defined clinical activity to support assessment, screening and care of acute and chronic aspects of vascular disease (i.e., vascular screening and prevention programs such as abdominal AA screening, vascular rehabilitation, diabetes/ulcer education, smoking cessation program, etc.);
- l. Established and defined clinical activity to support the provision of core vascular procedures (i.e., open abdominal AA repair, LE revascularization, and CEA); and
- m. A complete understanding of the current state of vascular services within the region, including access, wait times, referral patterns, repatriation, and patient outcomes (including elective and emergency procedures) benchmarked against provincial aggregate data when available.

### 3. Regional Supports

- a. Adoption of standardized referral tools by providers in the community and institutional settings to ensure the patient is assigned the appropriate level of care within an appropriate wait time;
- b. Comprehensive discharge planning programs including ambulatory care clinics and rehabilitation services to provide patient care requirements upon hospital discharge, available 5 days per week, with established protocols to expedite care and transitions to community supports, as appropriate;



- c. Evidence of repatriation agreements to ensure continuity and comprehensiveness of care for patients transferred between hospitals. This includes a well-established relationship with an advanced, full service vascular centre (i.e. Level 1 or 2) with agreements in place for patient transfer and repatriation post procedure;
- d. A strong level of community/public engagement, including consultation with clinical experts and other relevant leaders in the healthcare field in support of the program; and
- e. The support of the LHIN with confirmation that the vascular services are aligned with the LHIN's current Integrated Health Services Plan.

### Quality Assurance (QA)

Fundamental to the provision of vascular services is the ability to continuously monitor and report on volumes and outcomes of vascular procedures at hospital, regional, and provincial levels. An examination of provincial administrative vascular data indicates that there are variations in clinical outcomes across hospitals; for example, some hospitals have a higher than expected mortality rate or longer than expected hospital lengths-of-stay (CCN, 2012). However, there are inherent limitations with the currently available administrative data. As part of its obligation, CCN has developed and will implement a vascular registry to enable a more rigorous platform for monitoring access, utilization and quality of care.

In addition, the CCN vascular registry platform will inform clinical practice, service delivery/capacity planning and provide data that can be used to establish and benchmark case costing.

It is anticipated that a CCN-based provincial vascular registry will be launched in FY 2015/2016 with the expectation that all vascular programs provide data to the registry. A provincial QA plan, with defined quality indicators will facilitate ongoing review and follow-up to improve processes and clinical outcomes.

### A Provincial Vascular Network

The diagnosis, treatment and management of vascular disease can be complex as patients with vascular disease often have other conditions and multiple comorbidities, including coronary artery disease, cerebrovascular disease, diabetes, hypertension and chronic kidney disease. Vascular disease is a chronic illness and control of risk factors such as smoking, obesity, and sedentary lifestyle is a critical component of intervention. In addition, vascular disease can present with an acute, life threatening event that requires immediate attention to save life and/or limb (MOHLTC, 2013). Due to their comorbidities, vascular patients often have multiple care requirements and some may need prolonged hospital stay which may raise important care issues particularly in centres where rehabilitation and community services are not readily available. As the patient transitions from hospital to home, their access to community supports requires a transfer of accountability and referrals to primary care providers, follow-up clinics, rehabilitation, and other services.

Ideally, a comprehensive vascular program is patient-centered with inter-professional teams that include collaboration between physician specialties, nursing, allied health professionals, rehabilitation experts, and others. The scope of vascular intervention goes beyond traditional surgery and also encompasses endovascular interventions that have specific requirements for physical space, equipment and imaging skills. There are some procedures that are complex and high risk, and for this reason, should be performed at high volume centres to support quality of care. A hospital-based vascular program may provide a spectrum of outpatient and inpatient vascular health services.

Identifying all vascular programs in the province creates an opportunity to establish a provincial vascular network that follows a ‘hub-and-spoke’ model. A provincial vascular network will benefit patients by enabling smooth transitions along their continuum of care and will encourage a collaborative environment that fosters sharing of best-practices between the hubs and spokes.

Hospitals with vascular programs that provide concentrated clinical expertise including advanced vascular care imaging and intervention are considered the ‘hubs’ and centres providing related vascular support services (e.g., screening/diagnostic services, patient referral, follow up, etc.) are considered ‘spokes’. When a clinician determines that a patient with a vascular disorder requires consultation with a vascular specialist, timely referral to a hospital with a Level 1, 2, or 3 vascular program should be made to ensure appropriate care. Likewise, patients may be referred from a hospital with a Level 2 or 3 vascular program to one with a Level 1 or 2 vascular program if it is determined that a higher level of care is required. Patients who received treatments from a ‘hub’ may be transitioned to a ‘spoke’ for follow-up care. Formal partnerships between vascular programs and/or vascular support centres may already exist or may be developed and maintained to allow seamless movement of patients between care providers while facilitating the creation of mentorship relationships between ‘hubs’ and ‘spokes’. Partnerships within a provincial vascular network are expected to enhance clinical practice and patient outcomes.

## Observations and Recommendations

Analysis of the CCN 2014 vascular survey provided a current provincial landscape and overview of infrastructure of hospital-based vascular services. Moreover, the analysis identified areas with interventional vascular capacity, areas where new or increased capacity is likely needed (i.e. NW Ontario) and may provide a framework from which a provincial vascular network could be determined. Based on the results of the survey, together with the recommendations from the 2012 provincial vascular strategy, the following key observations were made:

1. There are hospitals providing core interventional vascular services (i.e. open abdominal AA repair, CEA and LE revascularization) at a volume below the recommended threshold for a Level 3 vascular program.
2. There are 6 hospitals with both vascular surgeons and interventional radiologists on staff in which the vascular services provided do not meet the recommended criteria of a Level 3 vascular program.



3. All LHINs except the North West LHIN have at least 1 hospital that meets the recommended criteria of a Level 3 vascular program. These hospitals could serve as regional vascular programs and may provide a foundation for the hubs of a provincial vascular network.
4. Hospitals with less than 3 staff vascular surgeons and/or interventional radiologists are less likely to provide a 24/7 service for incoming vascular emergencies than hospitals with 3 or more staff vascular surgeons and/or interventional radiologists.

Based on these observations it is recommended that:

1. Small volume programs consider consolidating and developing formal partnerships with other vascular programs within their local region to build capacity that will support a stronger regionalized model.
2. Programs that have human resource capacity to support a Level 3 vascular program ensure that they meet the recommended criteria of a Level 3 vascular program.
3. A Level 3 vascular program be the minimum standard for vascular program capacity building at a LHIN level.
4. Hospitals that provide core interventional vascular services actively participate in a stand-alone or regional call network to ensure seamless emergency coverage occurs 24 hour a day, 7 days a week.

## Summary

This document is intended to outline criteria for the development of a vascular service program with the objective of providing an effective evidence-informed and consensus-based framework for the provision of vascular services in Ontario. CCN supports leading practices and quality improvements aimed at balancing the needs of patient access with the provision of comprehensive vascular services for all Ontario.

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# Appendix:

## Hospital Level Summary of Available Vascular Services

LHIN	Hospital Corporation	Aortic Aneurysm Repair		Carotid Revascularization <sup>13</sup>	Lower Extremity Revascularization <sup>14</sup>	Amputation	Catheter Directed Thrombolysis	Vein Ligation/Stripping	Venous Access Devices
		Open	EVAR						
1	Bluewater Health Sarnia					•	•	•	
1	Chatham Kent Health Alliance					•	•	•	
1	Windsor Regional Hospital	•		•	•	•	•	•	•
2	Grey Bruce Health Services	•			•	•	•	•	•
2	London Health Sciences Centre	•	•	•	•	•	•	•	•
2	Tillsonburg District Memorial Hospital					•	•	•	
3	Guelph General Hospital	•	•	•	•	•	•	•	•
4	Hamilton General Hospital	•	•	•	•	•	•	•	•
4	Joseph Brant Hospital	•			•	•	•	•	•
4	Niagara Health System	•		•	•	•	•	•	•
4	St. Joseph's HealthCare, Hamilton	•		•	•	•	•	•	•
5	William Osler Health System	•	•	•	•	•	•	•	•
6	Trillium Health Partners	•	•	•	•	•	•	•	•
6	Halton Healthcare Services	•			•	•	•	•	•
7	St. Michael's Hospital	•	•	•	•	•	•	•	•
7	St. Joseph's Health Centre					•	•	•	•
7	Sunnybrook Health Sciences Centre	•	•	•	•	•	•	•	•
7	University Health Network	•	•	•	•	•	•	•	•

<sup>13</sup> Carotid Revascularization includes CAE and CS

<sup>14</sup> LE Revascularization includes LEB and PVI

LHIN	Hospital Corporation	Aortic Aneurysm Repair		Carotid Revascularization <sup>13</sup>	Lower Extremity Revascularization <sup>14</sup>	Amputation	Catheter Directed Thrombolysis	Vein Ligation/Stripping	Venous Access Devices
		Open	EVAR						
8	Humber River Hospital	•	•	•	•	•	•	•	•
8	Mackenzie Health	•	•	•	•	•	•	•	•
8	North York General Hospital	•		•	•	•	•	•	•
8	Southlake Regional Hospital	•	•	•	•	•	•	•	•
9	Peterborough Regional Health Centre	•	•	•	•	•	•	•	•
9	Rouge Valley Health System					•	•		
9	Scarborough General Hospital-General Division	•	•	•	•	•	•	•	•
9	Lakeridge Health				•	•	•	•	•
10	Kingston General Hospital	•	•	•	•	•	•	•	•
10	Quinte Health Care				•	•	•	•	•
11	Pembroke Regional Hospital				•	•	•	•	•
11	The Ottawa Hospital	•	•	•	•	•	•	•	•
11	University of Ottawa Heart Institute	•	•						
12	Orillia Soldiers' Memorial Hospital					•	•	•	•
12	Royal Victoria Regional Health Centre	•	•	•	•	•	•	•	•
13	Health Sciences North	•	•	•	•	•	•	•	•
13	Sault Area Hospital	•	•	•	•	•	•	•	•
13	St. Joseph's General Hospital Elliot Lake					•	•	•	•
13	West Parry Sound Health Centre					•	•	•	•
14	Riverside Health Care					•	•	•	•
14	Sioux Lookout Meno Ya Win					•	•	•	•
14	Thunder Bay Regional Health Sciences Centre			•		•	•	•	•

<sup>13</sup> Carotid Revascularization includes CAE and CS

<sup>14</sup> LE Revascularization includes LEB and PVI



## Glossary of Terms

Term	Description
AA	Aortic aneurysm
C	Central
CCN	Cardiac Care Network of Ontario
CCU	Coronary care unit
CE	Central East
CEA	Carotid endarterectomy
CH	Champlain
CS	Carotid stent
CSF	Cerebral spinal fluid
CTA	Computed tomography angiogram
CV	Cardiovascular
CW	Central West
ENITS	Emergency Neuro Image Transfer System
ESC	Erie St. Clair
EVAR	Endovascular aneurysm repair
HNHB	Hamilton Niagara Haldimand Brant
ICU	Intensive care unit
IHF	Independent health facility
IQR	Interquartile range
IR	Interventional radiologist
LE	Lower extremity
LEB	Lower extremity bypass
LHIN	Local Health Integration Network
MH	Mississauga Halton
MOHLTC	Ministry of Health and Long-Term Care
MOU	Memorandum of Understanding
MRA	Magnetic resonance angiography
NE	North East
NP	Nurse Practitioner
NSM	North Simcoe Muskoka
NW	North West
OHTAC	Ontario Health Technology Advisory Committee
OSR	Open surgical repair
OT	Occupational therapy
PA	Physician assistant
PACU	Post-anesthesia care unit
PAD	Peripheral artery disease
PT	Physiotherapy

PVI	Peripheral endovascular intervention
QA	Quality assurance
QBP	Quality-based procedure
SE	South East
SW	South West
TC	Toronto Central
UK	United Kingdom
US	Ultrasound
VCWG	Vascular care working group
WW	Waterloo Wellington



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