



Office of the Auditor General of Ontario

Value-for-Money Audit:
Cardiac Disease and
Stroke Treatment



December 2021

Ministry of Health

Cardiac Disease and Stroke Treatment

1.0 Summary

Cardiac disease and stroke comprise the majority of cardiovascular disease, which is the second most common cause of death in Canada, after cancer. Cardiovascular disease is responsible for over 200,000 emergency department visits a year in Ontario.

The Ministry of Health (Ministry) provides annual funding of about \$1.1 billion to hospitals to perform cardiac and stroke procedures and provide in-hospital care for cardiac and stroke patients. These procedures and care are primarily performed at 20 cardiac centres and 28 stroke centres throughout the province. Cardiac and stroke centres are hospitals that have the equipment and staff expertise needed to perform cardiac and stroke procedures. **Appendix 1** shows a list of hospitals designated as being cardiac and stroke centres by Ontario Health region, which are areas of the province with geographically co-ordinated health oversight. **Appendix 2** provides a glossary of terms related to cardiac disease and stroke.

CorHealth Ontario (CorHealth) is the provincial agency responsible for providing evidence-based guidance, as well as monitoring and reporting, on the performance of cardiac, stroke and vascular services in Ontario. CorHealth was established in 2016 through a merger of the Cardiac Care Network of Ontario and the Ontario Stroke Network. The Ministry is presently transitioning CorHealth from a standalone agency to a division within Ontario Health, a provincial agency that oversees

administration of the Ontario health-care system. The transition is targeted for completion in late 2021/22.

Like all health-care services, the ability to provide treatment for patients with cardiac disease and stroke was significantly impacted during the COVID-19 pandemic. As a result of a directive that was issued twice by the Chief Medical Officer of Health applicable from March 19, 2020 to May 26, 2020 and then again from April 20, 2021 to May 19, 2021, all non-essential and elective surgeries were stopped or reduced to minimum levels. The directive was applicable at times to enable hospitals to have sufficient capacity to treat patients with COVID-19.

Overall, we found that emergency/acute treatment for cardiac disease and stroke is generally being provided in alignment with best practice standards and guidance, including those adopted by CorHealth from Heart & Stroke. We also found that overall mortality following cardiac and stroke events in Ontario is similar to or better than the average of the other Canadian provinces. However, provincial treatment-time targets for emergency cardiac and stroke procedures have not been met. This is concerning, given that research has shown that meeting these targets results in better outcomes for patients, including reduced in-hospital mortality. There are also opportunities to provide better or more cost-efficient treatment. For example, we found that while many cardiac disease and stroke patients are well enough to no longer require care in acute hospital beds, they still have to stay in acute hospital beds while waiting to be transferred to a more appropriate care setting, such as an inpatient rehabilitation setting or a long-term-care home. In

2019/20 alone, if such patients had been transferred to the more appropriate care setting, we estimate that the province would have achieved health-system cost savings of over \$150 million.

With respect to cardiac disease treatment specifically, some non-emergency cardiac procedures are performed within the provincial wait-time targets; however, there has been an increase in the number of people on wait lists for those procedures, the length of time they are waiting, and the number of people who died while waiting. Our audit highlights a number of cost-effective cardiac treatment approaches and practices that could shorten hospital stays, reduce hospitalizations and costs, and improve patient outcomes. These approaches and practices are not widely and consistently implemented across the province. For example, although experts identified that increased use of non-invasive procedures is possible, many cardiac patients are still being treated with more invasive procedures.

Regarding stroke treatment specifically, we identified the need to increase public awareness of the need to quickly call an ambulance when experiencing stroke symptoms so that stroke patients can receive specialized care as quickly as possible in a facility well equipped to look after stroke patients. This is because “time is brain” is a fundamental rule of stroke treatment: the longer stroke treatment is delayed, the more permanent brain damage is expected. We also found that additional actions, including greater usage of a specific diagnostic imaging software by hospitals, are also needed to increase the number of stroke patients who can benefit from endovascular thrombectomy (EVT), which is a treatment to mechanically remove a blood clot using a catheter from a large vessel in the brain for stroke patients.

The following are some of our significant observations.

Cardiac Disease Treatment

- **Hospitals are generally not providing timely emergency treatment for heart attacks, which risks permanent heart damage for patients.**

When someone suffers a heart attack, timely

intervention is required to restore proper blood flow and prevent permanent damage to the heart. CorHealth has set treatment-time targets for a procedure called primary percutaneous coronary intervention (PPCI), which is used to reopen the artery and restore blood flow for patients with heart attacks. Under the targets, 75% of such patients should receive a PPCI procedure within 90 minutes of arriving at a hospital that is able to perform PPCI. For patients that arrive at a hospital that does not perform PPCI and therefore have to be transferred to a hospital that is able to perform PPCI, the target time is 120 minutes. However, between the second quarter of 2017/18 (when CorHealth started regularly collecting data) and 2020/21, fewer than 60% of such heart attack patients have received a PPCI procedure within the target times.

- **Wait lists for cardiac procedures have grown, resulting in worsening health conditions and more deaths while waiting.** During the five-year period before the COVID-19 pandemic, the average number of patients on wait lists for cardiac procedures grew about 44% (from 5,450 in 2015/16 to about 7,850 in 2019/20) and the number of patients dying while on a wait list grew about 42% (from 147 in 2015/16 to 209 in 2019/20). During the pandemic (which started impacting health-care delivery at the end of 2019/20 and through 2020/21), the average number of patients waiting for cardiac procedures grew further by over 6% (from about 7,850 in 2019/20 to about 8,340 in 2020/21) and the number of people dying while on a wait list grew further by over 10% (from 209 to 231).
- **Expert-identified practices and recommendations for cardiac procedures are not always followed.** We identified examples of cost-effective cardiac treatment approaches and practices recommended by experts that can shorten hospital stays, reduce hospitalizations and costs, and improve patient outcomes. However, either as a result of a lack of provincial support and funding or regional interest, these practices

and recommendations have not been widely and consistently implemented across the province. For example:

- **A minimally invasive cardiac procedure is not performed as often as it could be.**

Transcatheter aortic valve implantation (TAVI) is a minimally invasive procedure used to treat aortic valve stenosis. TAVI is an alternative to an invasive surgical aortic valve replacement (valve surgery). Historically, TAVI was typically used only in patients where surgery was considered high-risk. However, the Ministry approved expansion of funding of TAVI procedures for patients at intermediate or low surgical risk in 2021/22. Funding was added for additional TAVI procedures following this change, but TAVI is still not performed on everyone who could likely benefit from it. The number of funded TAVIs to accommodate this expansion will be about 2,600 in 2021/22, up from 1,940 in 2020/21. However, based on data from a 2019 study by the Canadian Cardiovascular Society, we estimate that expansion of TAVI to low-risk patient populations would likely double the number of TAVI procedures currently performed in Ontario, which would mean the number could increase to about 4,437 per year. If not all are funded, those who are otherwise eligible for TAVI may need to receive more invasive valve surgery.

- **An Integrated Heart Failure Care Initiative has not been widely implemented.** In 2019, CorHealth piloted an integrated initiative for heart failure care. Under this initiative, hospitals designated as cardiac centres can work with local community hospitals and primary care providers, like family physicians, to ensure that the right level of care is provided to heart failure patients at the right time. CorHealth informed us that the initiative has only been adopted by three regions (Ottawa, Guelph and London). These regions have reported positive impacts from the initiative. As an example of success from this initiative, in 2018/19 Guelph

region implemented the model along with other local heart failure strategies and for 2020/21 Guelph General Hospital's 30-day readmission rate for heart failure patients dropped to below 11% from over 22% in 2018/19.

- **Cardiac rehabilitation is under-utilized, despite its effectiveness in reducing deaths and health-care costs.**

Studies have shown that cardiac rehabilitation, which is a program of exercise, education and counselling to aid recovery, results in better patient outcomes, such as reduced risk of reoccurrence of cardiac events, a reduction in long-term mortality after initial hospitalization as well as lower health-care costs. A 2017 study by the University Health Network found that the province saved about \$3,000 per year per patient that completed at least two-thirds of their cardiac rehabilitation program. The savings were attributable to a reduction in the need to access other health-care services in the future, such as emergency department visits, that otherwise might have been needed. However, the same study also found that only about 33% of patients referred to cardiac rehabilitation actually completed at least two-thirds of the program. While the Ministry has provincial data on volumes of patient visits to outpatient cardiac rehabilitation, there is no centralized tracking of data such as attrition rate, or the percentage of referrals that actually attend. Without tracking such data, it is unclear whether patient needs are being met and it is difficult to tell why patients referred to a rehabilitation program drop out, or what actions can be taken to improve patient understanding and adherence.

- **A more accurate, non-invasive, and cost-effective diagnostic test for coronary artery disease is not widely used, despite medical expert recommendations.** Since 2016, the National Institute for Health and Care Excellence in the UK and the American College of Cardiology have recommended that it is appropriate to perform computerized tomography coronary

angiograms (CT-Angiogram) as the first line test for evaluating certain patients with no known coronary artery disease. Their recommendation is based on evidence that showed that CT-Angiograms are more accurate than stress tests that use ultrasound or other imaging to monitor the function of the heart when exercising. Other reasons they give for recommending that CT-Angiograms be used include the fact that such tests are non-invasive, and can further reduce the need for more invasive cardiac catheterization. Compared to other non-invasive testing, like stress testing, which uses ultrasound or other imaging to monitor the function of the heart while exercising, the total cost of diagnosing a patient using CT-Angiogram is about 20% less than a stress test. Despite these known benefits, we identified only one hospital in Ontario (the University of Ottawa Heart Institute) that regularly uses CT-Angiograms to diagnose coronary artery disease, even though many hospitals have a CT scanner and could potentially perform CT-Angiograms.

Stroke Treatment

- Hospitals are often not providing timely emergency treatment for stroke, which risks permanent brain damage for stroke patients.** Strokes require timely interventions to restore blood flow to the brain. A study showed that every minute an ischemic stroke remains untreated results in nearly two million neurons being destroyed. CorHealth adopted treatment-time targets for two key emergency stroke procedures that can break up, or remove, blood clots in ischemic stroke patients. If treatment-time targets are not met, patients may experience poorer outcomes such as increased disability or death due to more brain cell death.

 - One target relates to administering a medication called tissue plasminogen activator (tPA), which is a clot-dissolving drug used to restore blood flow in the treatment of ischemic stroke. CorHealth's target is to treat patients with tPA medication within a median time of 30 minutes of their arrival to a hospital. However, this target has not been met province-wide, though there has been some improvement from 2015/16 to 2019/20, as the median time it took for patients to receive tPA dropped from 50 minutes to 45 minutes.
 - The other target relates to performing a procedure called endovascular thrombectomy (EVT), which is a procedure that mechanically removes a blood clot using a catheter from a large vessel in the brain. This procedure is to be initiated within a median of 60 minutes of a patient's arrival at hospital. This target has never been met province-wide since 2017/18 when CorHealth started tracking hospital performance against its target. During the first two quarters of 2020/21, the median time it took to start the EVT procedure was 75 minutes from the time the patient arrived in hospital.
- The provincial financial support for a stroke awareness program stopped, despite the continued need to increase public understanding of the signs of a stroke and appropriate actions to take in the event of a stroke.** In 2020/21 the Ministry stopped funding Heart & Stroke's public campaign aimed at increasing public awareness of the three key signs of a stroke and of the need to call an ambulance to ensure patients get to a facility that is best able to provide stroke care. This was done despite the fact that polling of Ontarians done by Heart & Stroke in 2018/19 found that those who recalled seeing its public awareness campaign were six times as likely to identify all three symptoms of stroke compared with those who did not recall seeing the campaign materials. We found that many stroke patients did not go to a facility well-equipped for stroke treatment and care. Specifically:

 - If paramedics determine a stroke has likely occurred, instead of taking the person to the nearest hospital, they generally take them to a hospital that is specialized in stroke care. However, patients who go to a hospital on

their own, such as when transported by a family member, may unknowingly go to a hospital that is not as well-suited to treat a stroke. In 2019/20, about 40% of stroke patients did not take an ambulance to the hospital and about 30% (over 11,900 patients) of the stroke patients presenting to an emergency department with stroke symptoms did not go to the type of site (such as a stroke centre) that paramedics generally take a person they assess as experiencing a stroke. We also noted that in 2019/20, over 730 transfers of stroke patients to stroke centres were made for patients who presented at other hospitals without the assistance of an ambulance.

- Patients who arrive at a hospital that is not as well-suited to treat a stroke are less likely to be treated in a designated stroke unit. However, evidence suggests care on such a unit results in better patient outcomes, such as reduced in-hospital mortality, than when the patient is cared for on a general unit. In 2019/20, CorHealth targeted that more than 75% of stroke patients should be treated on designated stroke units but 54% actually were. The percentage of patients treated on designated stroke units was over 72% at stroke centres but under 24% at non-stroke centre hospitals.
- **An effective and necessary diagnostic test that helps determine the appropriate treatment for stroke patients can be expanded provincially.** Computerized tomography perfusion imaging (CT-Perfusion) is a diagnostic test that can be used to identify whether EVT is appropriate for the patient. However, of the 44 hospitals that CorHealth identified as ones that should be using CT-Perfusion software, as of July 2021 only 16 hospitals have purchased the software and are using it. When a hospital does not have CT-Perfusion imaging capability, stroke patients may need to be transferred to another hospital, which could result in a delay in receiving the necessary treatment. Additionally, Heart

& Stroke led the development of Canadian Stroke Best Practice Recommendations that state a reasonable starting target is more than 10% of all ischemic stroke patients receiving EVT. The target can be modified based on local factors or circumstances. However, only about 5.6% of such patients received EVT in the first two quarters of 2020/21. In Alberta, 7.8% of ischemic stroke patients received EVT in 2020/21.

- **The amount and availability of stroke rehabilitation does not meet patient needs.** The Canadian Stroke Best Practice Recommendations identify that medically and neurologically stable patients in inpatient stroke rehabilitation should get 180 minutes of rehabilitation per day. However, in 2019/20 the median amount of inpatient stroke rehabilitation received by patients was only about 69 minutes per day, which is about 60% below the 180-minute target, with some rehabilitation providers offering only 30 minutes or less of rehabilitation per day. Also, despite 2016 legislation that sets out an additional function for the Minister to “oversee and promote an evidence-based approach to the provision of physiotherapy services for post-stroke patients of all ages,” stroke survivors aged 20 to 64 who require physiotherapy but who are not hospitalized for their stroke are still being turned away from publicly funded physiotherapy at community physiotherapy clinics because the eligibility criteria remain unchanged, which still only cover select patients with Ontario Health Insurance Plan (OHIP), such as those who are under 20 or over 64 or patients who are admitted to the hospital.

Co-ordination, Oversight and Funding of Cardiac Disease and Stroke Care

- **Hospitals are not able to transfer many cardiac and stroke patients to a more appropriate care setting, which constrains acute hospital bed availability.** There are times that patients must remain in a hospital bed, despite no longer requiring acute care in a hospital setting, as there are no beds available at a more appropriate care

facility, such as inpatient rehabilitation or long-term care. Hospitals categorize these patients as Alternate Level of Care (ALC). In 2019/20, over 5,300 cardiac disease patients categorized as ALC spent over 82,000 days in acute hospital beds, while over 3,500 stroke patients categorized as ALC spent over 62,000 days in acute hospital beds. We estimate the province could have saved over \$150 million in 2019/20 (over \$94 million associated with cardiac disease patients and \$56 million associated with stroke patients) if all ALC patients had been transferred from acute hospital beds to their homes or more appropriate health-care settings immediately after being deemed ALC. In the meantime, more acute hospital beds would have been available to admit other patients sooner, such as patients waiting for cardiac procedures.

- **CorHealth does not have the oversight authority to improve the overall cardiac disease and stroke care system.** Hospital staff spoke favourably to us about the work done by CorHealth, but the agency is limited in its ability to improve cardiac and stroke care in Ontario. Unlike comparable organizations such as Cancer Care Ontario, CorHealth does not have power over hospitals to require them to follow any standards it establishes or adopt any best practices. CorHealth also cannot direct, or modify, funding to providers so as to encourage performance improvement or compliance with cardiac and stroke best practices, unlike comparable organizations in British Columbia (Cardiac Services BC and Stroke Services BC). Further, CorHealth focuses primarily on cardiac disease and stroke care for adults in a hospital setting, which means its work does not extend to cardiac disease and stroke primary prevention, paediatrics, or community-based care (such as rehabilitation). This limits the potential benefits from CorHealth's oversight of cardiac and stroke rehabilitation, including monitoring the performance of rehabilitation providers. In a June 2018 report, CorHealth made recommendations to the Ministry related to improving cardiovascular

rehabilitation in Ontario, which highlighted the need for a provincial and regional oversight structure. The Ministry has taken no action on this report.

- **Hospital purchase prices of cardiac equipment and supplies is not centrally tracked or reviewed to determine whether savings are possible through province-wide group buying.** Ontario hospitals are responsible for procuring their own equipment and supplies for cardiac procedures, unlike Alberta and British Columbia, which co-ordinate provincial procurement for cardiac and stroke devices. The Ministry has not performed any work to assess the variability of costs across hospitals that purchase cardiac and stroke devices and supplies, and some hospitals have co-ordinated group-buying on an ad hoc basis on a smaller scale. We noted that the difference in price that Ontario hospitals pay for the same types of devices can vary by as much as 367%. For example, one hospital was able to procure a simple ablation catheter at an average price of about \$300 while another hospital pays an average price of about \$1,400 for each simple ablation catheter.
- **Dedicated funding given to hospitals is outdated and does not cover the actual costs or patient demand for cardiac procedures, leading to delays in performing some procedures.** In 1997, a committee established by the Ministry identified that the rates paid to hospitals to perform most cardiac procedures should be reviewed annually. However, the last fulsome review of these rates was done 15 years ago in 2006/07. The outdated funding rates do not reflect the current costs hospitals incur to deliver cardiac procedures. For example, CorHealth estimated that in 2018/19 hospitals were being underfunded by about \$28 million compared with their actual costs to perform cardiac procedures. In some cases, the Ministry also underfunds cardiac procedure volumes compared with the volume of patients the hospital actually sees. While hospitals can make up these funding shortfalls by using funding from the hospital's global budget, they

may not be able to do so as this budget must cover all other hospital operations. As a result, hospitals have been delaying some cardiac procedures to the next year when additional dedicated funding will be provided. For example, a hospital informed us that in 2019/20 it saw 325 cardiac patients that needed transcatheter aortic valve implantation (TAVI) procedures, but because the hospital was only funded for 265 TAVI procedures, it deferred 60 of these procedures until 2020/21. Nine of these patients died in 2020/21 before a TAVI procedure could be performed.

COVID-19 Impacts on Cardiac Disease and Stroke Treatment

- **Fewer cardiac procedures were performed during the COVID-19 pandemic, resulting in longer wait times and wait lists, patients' worsened cardiac conditions, and increased deaths among those waiting in 2020/21 compared with 2019/20.** In response to the COVID-19 pandemic, Ontario's Chief Medical Officer of Health issued the same directive twice that required all non-essential and elective surgeries to stop or be reduced. The directive resulted in reducing the number of cardiac procedures performed by 13%, from about 129,200 in 2019/20 to about 111,900 in 2020/21. The number of people who died while on a wait list for a cardiac procedure also increased by over 10%, from 209 deaths in 2019/20 to 231 in 2020/21.
- **The impact of COVID-19 on cardiac disease and stroke treatment needs going forward is not fully known.** Beside the fact that there were fewer procedures performed as a result of the Chief Medical Officer of Health's directive, fewer patients sought treatment for cardiac and stroke related symptoms in 2020/21 compared with 2019/20. For example, data available from the Canadian Institute for Health Information shows that between March 2020 and June 2020 physicians provided 22% fewer combined in-person and virtual services for cardiac disease and stroke care compared with the same

time frame the year before. As a result, general practitioners made about 20% fewer referrals to cardiologists and about 19% fewer referrals to neurologists in 2020/21 compared to 2019/20. Stakeholders informed us that compared with pre-pandemic years, patients experiencing milder heart or stroke-related symptoms were not seeking proper and/or preventative care during the pandemic. As well, when patients actually did seek care, they were generally sicker than the typical cardiac disease and stroke patients seen before COVID-19. Because many patients were not seeking care during the pandemic, the volume of these "missing" patients is still unknown. Consequently, the current wait lists for cardiac procedures likely under-stated the needs of Ontarians. While the future cardiac disease and stroke treatment needs of these "missing" patients are not yet known, their future needs will likely further increase the demand for treatment on Ontario's hospitals.

This report contains 15 recommendations, with 39 action items, to address our audit findings.

Overall Conclusion

Our audit found that the Ministry, in association with CorHealth and health-care providers, does not have fully effective systems and procedures in place to provide cardiac and stroke services in a timely, equitable, and cost-efficient manner to meet Ontarians' needs and in accordance with applicable standards, guidelines and legislation.

In terms of cardiac disease treatment, urgent and emergency procedures were generally done within the treatment-time targets. Such targets were met less often for emergency procedures for heart attacks as well as semi-urgent and non-urgent scheduled procedures. Patients who received scheduled semi-urgent and non-urgent cardiac procedures generally had to wait longer to receive the procedures in 2019/20 compared with patients in 2015/16. Cardiac care practices that are cost-efficient and can prevent

emergency department visits or hospitalizations (such as remote monitoring) are not implemented in a consistent manner provincially. While cardiac standards and guidance are generally followed, this is not always the case, including CorHealth's Heart Failure Initiative, which has been adopted by only three regions in the province.

In terms of stroke treatment, procedures took longer to provide than treatment-time targets. Stroke standards and guidance are generally followed; however, key targets for the provision of stroke care are not met. These include the target number of stroke patients treated on designated stroke units and the target amount of inpatient stroke rehabilitation received by inpatients. Despite 2016 legislation that appears to remove age discrimination over who can receive publicly funded physiotherapy services, stroke patients aged 20 to 64 who require physiotherapy but who do not need hospitalization are not able to access publicly funded physiotherapy at community physiotherapy clinics. We also found that public understanding of stroke may worsen because the province no longer supports campaigns to raise public awareness of stroke symptoms and appropriate actions.

For both cardiac and stroke care, if patients who were medically cleared to be discharged from the hospital had been transferred to receive ongoing care in alternative appropriate settings, significant savings could have been achieved and more hospital beds would have been available to admit other patients sooner. Unlike comparable organizations in other provinces, CorHealth lacks both the scope and enforcement power over hospitals and rehabilitation providers to require them to follow any standards it establishes.

Our audit found that the Ministry did measure and report on the results and effectiveness of key cardiac disease and stroke services and initiatives through CorHealth Ontario. CorHealth is responsible for monitoring and reporting on hospital performance against performance indicators it establishes. However, measurement and reporting can be expanded. For example, the Ministry did not require

cardiac rehabilitation providers to track or report the number of referrals into their programs or the number of patients who actually complete the prescribed rehabilitation programs.

OVERALL MINISTRY RESPONSE

The Ministry of Health (Ministry) acknowledges the recommendations made by the Auditor General of Ontario and thanks her for conducting this timely audit. The Ministry is committed to the development and implementation of innovative initiatives and solutions that address the impact of Cardiac Disease and Stroke Treatment on the lives of Ontarians. We welcome any insights and recommendations provided by the Auditor General and these recommendations can be achieved for a better quality and integrated health-care system for cardiac and stroke patients.

The audit identifies areas of consideration that the Ministry is already taking measures to address and reinforces the Ministry's commitment to continuous improvement. The Ministry is confident that CorHealth Ontario (CorHealth) and Ontario Health will continue to deliver high-quality care to Ontarians with cardiac or stroke conditions and that they will make full use of the audit's recommendations to further improve that care.

In the coming months, Ontario Health will take on the work of CorHealth and will have the opportunity to further improve the oversight, integration, and co-ordination of care for cardiac and stroke patients across the continuum. The Ministry will continue to work closely with CorHealth and Ontario Health to ensure that Ontarians have access to equitable, integrated, cost-efficient cardiac and stroke services.

In 2020/21 the Ministry provided \$702 million in volume funding for advanced cardiac procedures at the 30 Ontario hospitals that provide these services. In addition, hospitals were funded \$212.2 million for the care and treatment for congestive heart failure and \$194.7 million in volume

funding for stroke procedures. Furthermore, the Ministry provided advanced cardiac hospitals with \$60 million in COVID-19 premium funding for cardiac procedures to support hospitals with the added costs of performing surgeries and procedures in a pandemic.

As Ontario continues to invest in cardiac and stroke services, including supporting new technologies and rate modernization, the Ministry will aim to ensure there is continuous system improvement to services and patient care, including care outside of hospitals, standards development, efficient and reflective funding, and measurement and evaluation.

OVERALL RESPONSE FROM CORHEALTH ONTARIO

CorHealth Ontario (CorHealth) appreciates the Auditor General's comprehensive audit of cardiac and stroke care in Ontario. We welcome opportunities to work together with our partners, including the Ministry of Health, clinical and system stakeholders, patients, and families, to improve these services in Ontario. In the coming months, Ontario Health will take on the work of CorHealth Ontario. Ontario Health will have the opportunity to further improve the oversight, integration, and co-ordination of care for cardiac, stroke and vascular patients across the continuum.

The recommendations within this report build upon the work that has been done to date by CorHealth Ontario, the Ministry of Health, and many other partners. The report also identifies further opportunities to drive improvements in several areas, many of which echo the goals and objectives of CorHealth's strategic plan.

CorHealth Ontario welcomes the recommendations from the Auditor General and knows that with the continued and ongoing support from the Ministry of Health and its stakeholders these recommendations can be achieved for a better

quality and integrated health-care system for cardiac, stroke and vascular patients.

In 2016, the Cardiac Care Network of Ontario and the Ontario Stroke Network merged to form CorHealth Ontario, with a mandate spanning cardiac, stroke and vascular care in the province. In just five years, CorHealth has been recognized for making significant improvements to the way cardiac, stroke and vascular services are delivered and managed in Ontario and continuing the work of the legacy organizations. These successes have been attributed to CorHealth's efficient team and strong focus on collaborative partnerships and engagement with its clinical and system stakeholders, as well as patients and families to address challenges across the continuum of care. Key improvements have been made to advance outcome reporting and develop mechanisms to support measurement and monitoring of key quality metrics for cardiac, stroke and vascular services and to support dialogue and share learnings across the province. Other achievements have led to an improved co-ordination of system planning and adoption of new technologies and modernization of current funding models and policies so that the best possible care is provided to cardiac, stroke and vascular patients.

2.0 Background

2.1 Causes of Cardiac Disease and Stroke

Cardiac (or heart) disease and stroke fall under the umbrella term of cardiovascular disease. Cardiovascular disease includes any disease or condition that affects an individual's circulatory system (heart and blood vessels). It involves narrowed, or blocked, blood vessels and can lead to different conditions, depending on where in the body those blood vessels are. This audit focused on cardiac disease conditions—the second leading cause of death in

Canada—and stroke, which is the fourth leading cause of death in Canada (see **Section 2.2**).

Figure 1 provides an overview of cardiac and stroke conditions. **Appendix 2** contains a glossary of terms related to cardiac disease and stroke treatment. **Appendix 3** identifies common cardiac disease and stroke conditions.

There are four major stages in the continuum of care for cardiac disease and stroke patients: (1) prevention; (2) diagnosis; (3) treatment; and (4) recovery/rehabilitation. **Figure 2** provides an overview of the sections in this report that relate to each of these four stages. This audit primarily focused on the treatment stage of both cardiac disease and strokes.

2.2 Impacts of Cardiac Disease and Stroke

In Canada, cancer is the leading cause of death (over 80,000 people died from cancer in 2019) but cardiac disease and stroke are the second and fourth leading causes of death, respectively. Combined, cardiac disease and stroke were responsible for about 66,000 deaths in 2019, with about 52,000 dying from cardiac disease and about 14,000 dying from stroke.

In Ontario, as shown in **Figure 3**, cardiac disease and stroke are responsible for a significant number of emergency department visits and hospitalizations in Ontario. Specifically:

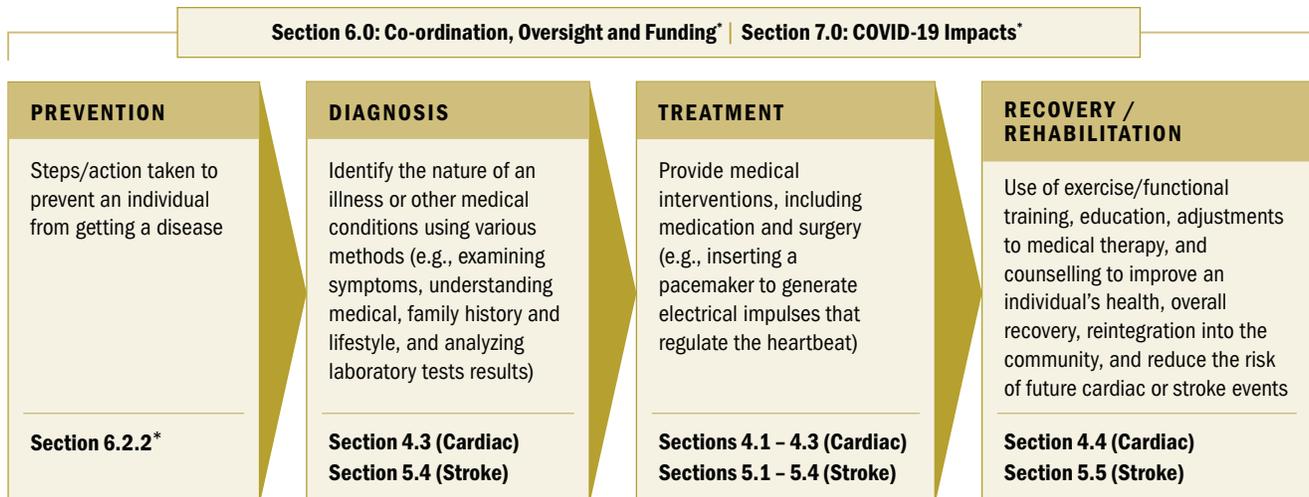
Figure 1: Overview of Cardiac Disease and Stroke Conditions

Prepared by the Office of the Auditor General of Ontario

	Affected Area	Description
Cardiac Disease	Heart	Based on the affected area of the heart, cardiac disease can be classified into three broad categories: <ol style="list-style-type: none"> 1. Mechanical, structural or muscular (e.g., cardiomyopathy) 2. Electrical (e.g., arrhythmia or abnormal heartbeats) 3. Plumbing (e.g., coronary artery disease)
Stroke	Brain	Based on the cause of an interruption in blood flow to the brain, stroke can be classified into two broad categories that relate to the resulting damage or death of brain tissue: <ol style="list-style-type: none"> 1. Caused by blockage of blood vessel (ischemic stroke) 2. Caused by bleeding or burst of blood vessel (hemorrhagic stroke)

Figure 2: Continuum of Care for Cardiac Disease and Stroke Patients

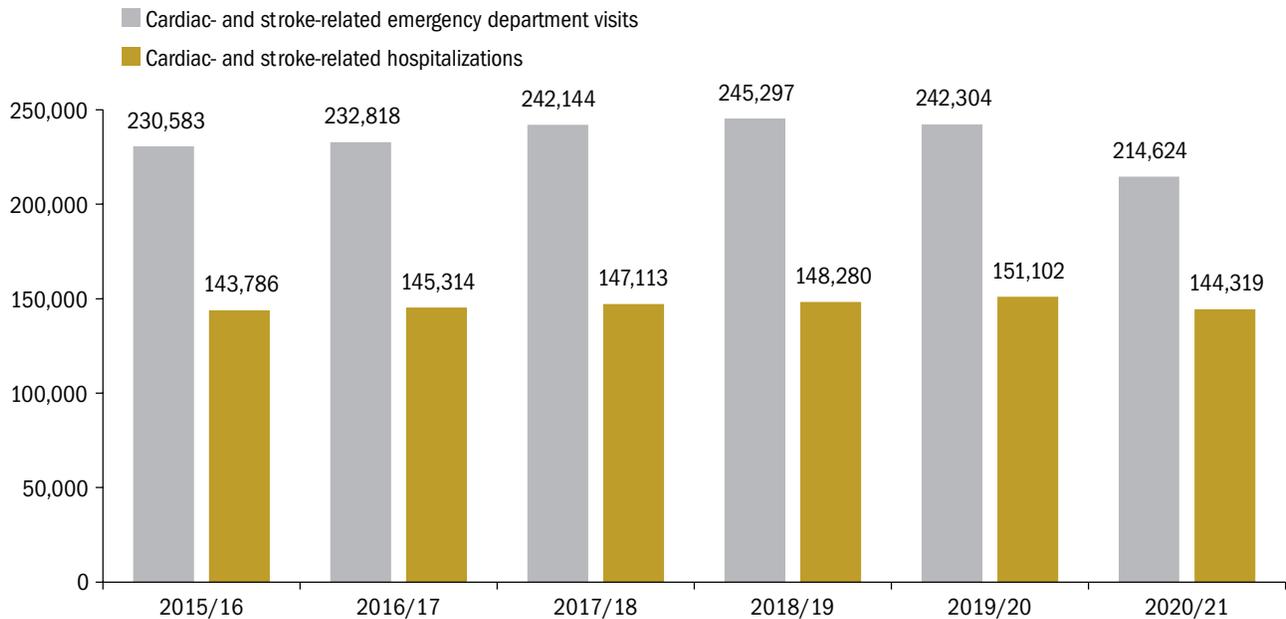
Prepared by the Office of the Auditor General of Ontario



* These sections are applicable to both cardiac disease and stroke care.

Figure 3: Cardiac Disease and Stroke-Related Emergency Department Visits and Hospitalizations, 2015/16–2020/21

Source of data: Ministry of Health



- In 2019/20 there were about 242,000 emergency department visits and about 151,000 hospital stays related to cardiac disease and stroke conditions. The 2019/20 figures represent an increase of about 5% for both as compared with 2015/16.
- In 2020/21, partially as a result of patient hesitancy to seek health-care services due to COVID-19 (see **Section 7.1**), emergency department visits related to cardiac and stroke conditions dropped by about 11% (from about 242,000 visits to about 215,000 visits) and hospital stays related to these conditions decreased by about 5% (from about 151,000 to about 144,000), compared with 2019/20.

2.3 Overview of Cardiac Disease and Stroke Treatment

To diagnose cardiac disease or a stroke, health-care providers, such as primary care physicians, review an individual's medical and family history and perform various diagnostic tests. The types of tests depend on the signs and symptoms the patient is experiencing.

These tests can be ordered by a primary care provider, a specialist, such as a cardiologist, or in an emergency department. For example, a blood test, called a troponin test, can be ordered when a patient presents in an emergency department with heart attack symptoms to determine whether a heart attack occurred.

Figure 4 identifies common diagnostic tests for cardiac disease and stroke.

2.3.1 Cardiac Disease Diagnosis and Treatment

In many cases, cardiac disease can be managed while the patient is in the community. For example, care can be provided by primary care providers or specialists. Such care can include medication and education. A number of different medications can be provided, including medication to prevent and treat abnormal heartbeats (antiarrhythmics), to reduce the risk of blood clots developing (anticoagulants, also known as blood thinners), or to lower an individual's heart rate and blood pressure (beta-blockers).

Some types of cardiac disease may not be diagnosed before an acute event occurs such as a heart

Figure 4: Examples of Common Diagnostic Tests for Cardiac Disease and Stroke

Prepared by the Office of the Auditor General of Ontario

Diagnostic Test	Description
Angiogram	This takes X-ray pictures of the coronary arteries and the blood vessels that supply blood to the heart.
Cardiac Catheterization	This is a relatively more invasive test used in conjunction with other tests and procedures to evaluate heart valves, heart function and blood supply and to determine whether an intervention is needed.
Chest X-Ray	This uses X-ray to identify if the heart is enlarged or if fluid is accumulated in lungs due to a heart attack.
Echocardiogram (ECHO)	This uses sound waves (ultrasound) to create a picture of the heart valves to show how well they are working and how blood flows through them.
Electrocardiogram (ECG/EKG)	This measures the electrical signal (or wave) travelling through the heart to check how the heart is functioning.
Exercise Stress Test	This measures the heart's electrical activity, blood pressure and heart rate during exercise (usually walking on a treadmill).
MRI or CT Scan	This detects stroke from a blot clot or bleeding within the brain.
Troponin Test	This is a blood test to determine whether there are elevated levels of troponin I or troponin T in the bloodstream, which are proteins released when the heart is damaged, such as by a heart attack.

attack, which is referred to in medical terms as myocardial infarction. In those emergency cases, an individual would need to visit an emergency department for diagnostic tests (see **Figure 4**) that can help assess their condition and identify the appropriate treatment option, which could include surgery. In non-emergency cases, cardiac procedures are scheduled in advanced. As shown in **Figure 5**, the number of cardiac procedures increased by about 8% between 2015/16 and 2019/20 (from about 119,000 to about 129,000 in 2019/20) and decreased by about 13% between 2019/20 and 2020/21, primarily as a result of the COVID-19 pandemic.

The Canadian Institute for Health Information collects information on all-cause in-hospital mortality occurring within 30 days of first admission for patients with an acute heart attack diagnosis by province. As shown in **Figure 6**, for 2019/20, Ontario's 30-day in-hospital mortality rate was the same as the Canada-wide average (6.1%). Additionally, as shown in **Appendix 4**, according to a 2015 report of mortality after admission to hospital for a heart attack in

34 countries, Canada and Switzerland each ranked seventh best with a mortality rate of 5.1 deaths per 100 patients aged 45 years and over. That is lower than the average rate of 7.5 deaths per 100 patients aged 45 years and over for countries that were included in the study.

2.3.2 Stroke Diagnosis and Treatment

Strokes often occur suddenly. To improve the chances of survival and recovery, identifying stroke symptoms early and acting quickly are critically important. For this reason, Heart & Stroke, a Canadian charity formerly known as the Heart & Stroke Foundation of Canada, is involved in research, advocacy and health promotion programs related to cardiac disease and stroke. Heart & Stroke developed the FAST campaign to focus on the three key signs of a stroke and the need for quick action to call 911 when experiencing or witnessing the signs that a stroke is occurring. (See **Section 5.2.2**).

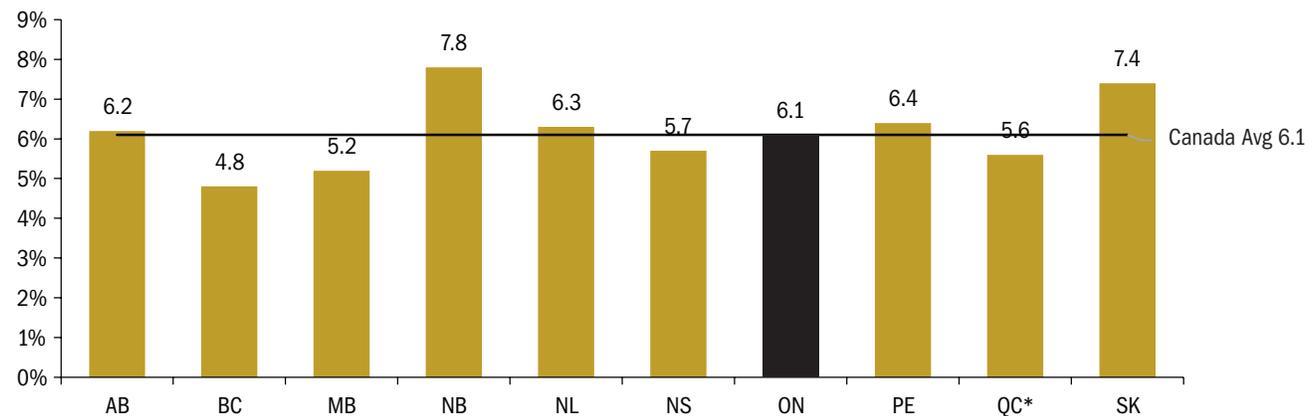
Figure 5: Number of Cardiac Procedures Performed, 2015/16–2020/21

Source of data: CorHealth Ontario

Procedure	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21	% Change Pre-COVID-19 (2015/16–2019/20)	% Change Post-COVID-19 (2019/20–2020/21)
Cardiac Catheterization	69,000	70,420	71,479	72,751	73,528	62,642	7	(15)
Complex Ablation	1,955	2,124	2,360	2,634	2,769	2,692	42	(3)
Coronary Artery Bypass Graft and Valve Surgery (done together)	1,427	1,555	1,418	1,458	1,251	1,176	(12)	(6)
Coronary Artery Bypass Graft (CABG) Surgery	6,894	7,093	7,019	7,018	7,105	5,923	3	(17)
Device Implants	3,517	3,569	3,602	3,649	3,646	3,371	4	(8)
Electrophysiology Study	4,923	5,093	5,339	5,552	5,735	5,146	16	(10)
Percutaneous Coronary Intervention (PCI)	25,500	26,526	27,190	27,870	28,018	24,359	10	(13)
Standard Ablation	2,423	2,397	2,476	2,445	2,471	2,013	2	(19)
Transcatheter Aortic Valve Implantation (TAVI)	745	863	1,023	1,411	1,831	1,940	146	6
Valve Surgery	2,708	2,727	2,869	2,994	2,837	2,662	5	(6)
Total Procedures	119,092	122,367	124,775	127,782	129,191	111,924	8	(13)

Figure 6: 30-day In-Hospital Mortality Rate Following a Heart Attack by Province (%), 2019/20

Source of data: Canadian Institute for Health Information



Note: Data is risk-adjusted, meaning that the numbers provided have been adjusted to consider factors related to the patients treated (such as the age of patients, pre-existing conditions) to make comparison between the provinces more useful.

* Quebec results are for 2018/19.

As soon as stroke symptoms are experienced, an individual should go to a hospital for immediate treatment. The appropriate stroke treatment will depend on the patient's condition and the type of stroke they experience (see **Appendix 3**). Some strokes called transient ischemic attacks, which

made up about 12% of hospitalized strokes in Ontario in 2020/21, can be resolved on their own or after taking medication such as aspirin. Other common types of strokes need to be treated using medication and/or surgery. For example, ischemic strokes, which are caused by blockage of a blood

vessel, and hemorrhagic strokes, which are caused by a burst blood vessel, are treated with medication and/or surgery. In 2020/21, ischemic strokes accounted for about 72% of hospitalizations while hemorrhagic strokes accounted for about 16% of hospitalizations. **Figure 7** shows the number of common stroke procedures performed in Ontario between 2015/16 and 2019/20.

The Canadian Institute for Health Information collects information on all-cause in-hospital mortality occurring within 30 days of first admission for patients with a stroke diagnosis. As shown in **Figure 8**, for 2019/20, Ontario's 30-day in-hospital mortality rate (10.5%) was lower than the Canada-wide average (11.4%). Additionally, as shown in **Appendix 5**, according to a 2017 report of mortality

Figure 7: Number of Stroke Procedures Performed, 2015/16–2019/20

Sources of data: CorHealth Ontario and Ministry of Health

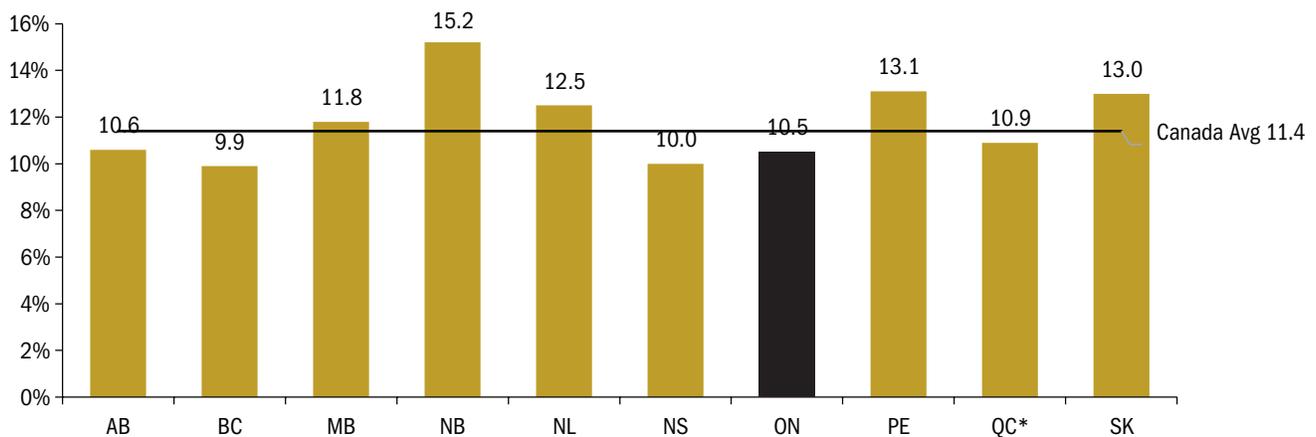
Stroke Treatment	2015/16	2016/17	2017/18	2018/19	2019/20	% Change (2015/16–2019/20)
Administration of Tissue Plasminogen Activator (tPA) ¹	1,860	1,980	2,003	2,035	2,110	13
Performance of Endovascular Thrombectomy (EVT) ²	n/a	n/a	685	817	1,002	n/a
Aneurysm Coiling ³	276	300	290	301	324	17
Aneurysm Clipping ³	97	87	83	79	80	(18)

Note: tPA and EVT are two common approaches for treating stroke. 2020/21 data is not available. Data is collected and analyzed by CorHealth Ontario and at the time of our audit it only had complete data to 2019/20.

1. tPA is an intravenous drug used in stroke patients to break up clots and restore blood flow to the brain.
2. EVT, a procedure that can be performed on some stroke patients, is where a physician inserts a catheter in a patient's groin to access and physically remove a blood clot from a large vessel in the brain. Ontario only started funding EVT procedures in 2017/18.
3. Aneurysm coiling and aneurysm clipping can be performed for hemorrhagic stroke patients.

Figure 8: 30-day In-Hospital Mortality Rate Following a Stroke by Province (%), 2019/20

Source of data: Canadian Institute for Health Information



Note: Data is risk-adjusted, meaning that the numbers provided have been adjusted to consider factors related to the patients treated (such as the age of patients, pre-existing conditions) to make comparison between the provinces more useful.

* Quebec results are for 2018/19.

rates after admission to hospital for ischemic stroke at 35 countries, the mortality rate in Canada of 7.9 deaths per 100 patients aged 45 years and over was only slightly higher than the average rate of 7.7 for countries that were included in the study.

2.4 Funding and Oversight of Cardiac Disease and Stroke Care

The Ministry of Health (Ministry) is responsible for funding cardiac disease and stroke care while CorHealth Ontario (CorHealth) is primarily responsible for overseeing the performance of hospitals with respect to cardiac disease and stroke.

2.4.1 Ministry of Health

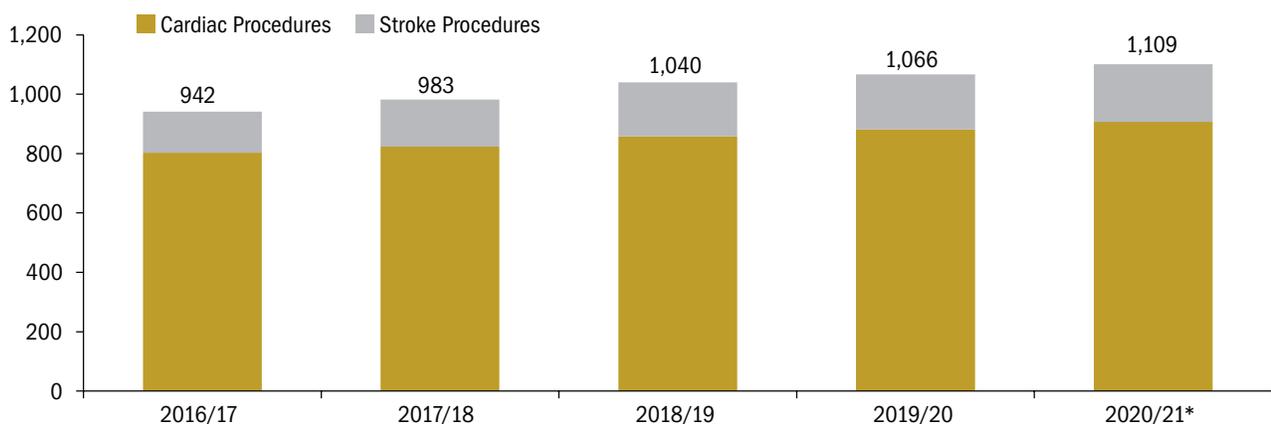
The Ministry allocates funds to hospitals for cardiac disease and stroke care through two models: (1) procedure-based funding; and (2) patient-based funding, which is referred to as quality-based procedure (QBP) funding. Specifically:

1. **Procedure-based funding** is used for advanced cardiac procedures, such as heart surgeries. Funding is provided to hospitals on a per-procedure basis at fixed rates for an allocation that the Ministry sets for each hospital at the beginning of the fiscal year. The Ministry works with hospitals throughout the year to make volume adjustments to the allocation, as required.
2. **Patient-based funding** is used to treat heart failure and stroke patients. Funding is provided to hospitals on a per-patient or procedure basis at fixed rates for an allocation that the Ministry sets for each hospital at the beginning of the fiscal year. Ontario Health Regions work with hospitals throughout the year to make volume adjustments to the allocation, as required. The purpose of the QBP funding is to improve quality of care and obtain better value for money by promoting the adoption of clinical best practices and strengthening the link between quality and funding.

Funding for cardiac and stroke procedures and care grew about 18% from 2016/17 to 2020/21, going from about \$942 million to about \$1.1 billion (see **Figure 9**). The funding included introducing and ramping up new technologies and procedures as well as new cardiac and stroke centres. If a hospital has used all its Ministry funding allocated for cardiac and stroke procedures and care, the hospital may use its global budget to fund and perform additional cardiac and stroke procedures and care.

Figure 9: Hospital Funding for Cardiac and Stroke Procedures, 2016/17–2020/21 (\$ million)

Source of data: Ministry of Health



Note: Cardiac procedures include those noted in **Figure 5**, as well as care and treatment for congestive heart failure. Stroke procedures include treatments for hemorrhagic, ischemic, and transient ischemic attacks, as well as endovascular thrombectomy. Funding for stroke procedures and congestive heart failure care for all fiscal years is based on initial allocations because post-reconciliation funding cannot be attributed to specific types of procedures.

* At the time of our audit, year-end reconciliations for cardiac procedure funding were not fully completed for 2020/21 so the amounts shown are the Ministry's initial allocations plus COVID-19-related premium payouts.

The Ministry designates certain hospitals throughout the province as cardiac centres and/or stroke centres. Cardiac centres and stroke centres are generally best equipped to provide cardiac disease and stroke treatment to patients because of their staff expertise and their ability to perform necessary diagnostic testing and procedures. See **Appendix 1** for a list of all cardiac and stroke centres in the province by Ontario Health Region.

2.4.2 CorHealth Ontario

CorHealth is a provincial agency funded by the Ministry with a mandate that covers adult cardiac, stroke and vascular care in the province. CorHealth was formed in 2016 through a merger of the Cardiac Care Network of Ontario and the Ontario Stroke Network. It was formally named CorHealth Ontario in June 2017.

CorHealth received about \$7.7 million in funding from the Ministry in 2020/21, which is about 9% less than the \$8.6 million its two predecessor organizations received in 2015/16 (see **Figure 10**). As of March 31, 2021, CorHealth had about 42 full-time equivalent employees.

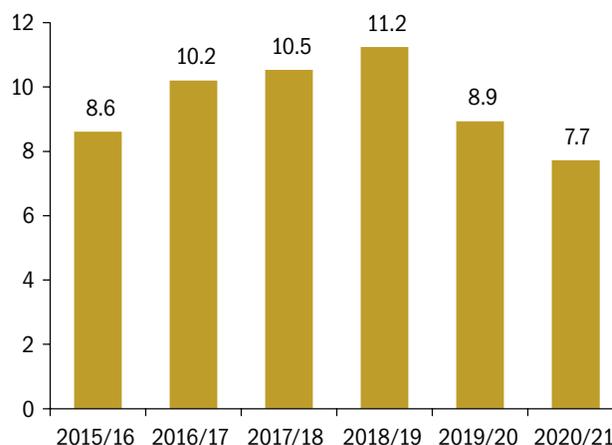
CorHealth's responsibilities include:

- providing evidence-informed guidance and recommendations to the Ministry, Ontario Health, the former Local Health Integration Networks (now part of Ontario Health), and hospitals to improve the quality, efficiency, accessibility and equity of cardiac, stroke and vascular services for Ontario patients;
- conducting data analyses and forecasting to support future provincial policy and funding programs to help deliver a consistent quality of health care across the province; and
- monitoring and reporting on hospital performance against performance indicators it establishes to assess whether performance is improving or declining at the hospital, regional, and provincial levels.

At the time of our audit, the Ministry planned to transition CorHealth from a standalone agency to a

Figure 10: Ministry Funding to CorHealth Ontario, 2015/16–2020/21 (\$ million)

Source of data: Ministry of Health



Note: Ministry funding to CorHealth Ontario dropped between 2018/19 and 2019/20 as a result of completion of several specific projects that were previously funded (such as work to develop an Echocardiography Quality Improvement project and work related to the development of quality-based procedures for cardiovascular care). 2015/16 refers to funding of the Cardiac Care Network of Ontario (\$5.9 million) and the Ontario Stroke Network (\$2.7 million).

division of Ontario Health. The target for completing the transition is in late 2021/22.

Other provincial agencies also have responsibilities that cover areas related to those covered by CorHealth. For example, Health Quality Ontario, which became a division of Ontario Health in December 2019, is a government agency funded by the Ministry to act as the government's advisor on the quality of health care in the province. Its role includes releasing clinical care standards and performance reporting on the health-care system as a whole.

Another example is Public Health Ontario, which is a provincial agency responsible for providing scientific evidence and expert guidance on matters related to public health as well as collecting and reporting on the burden of chronic diseases—including cardiovascular diseases—in Ontario. While both Health Quality Ontario's and Public Health Ontario's responsibilities cover some aspects of cardiac and stroke treatment, unlike CorHealth, their work is not solely focused on cardiovascular disease. Also, at times, performance reporting done by Health Quality Ontario for cardiac and stroke treatment is based on data collected by CorHealth.

2.5 Impact of COVID-19 on Cardiac Disease and Stroke Care

COVID-19 has impacted the lives of all Ontarians in many ways. It was officially declared a pandemic by the Lieutenant Governor in Council under the *Emergency Management and Civil Protection Act* on March 17, 2020. COVID-19 negatively impacted Ontarians' access to cardiac disease and stroke services.

For example:

- Primary care services, which include identifying and examining patients for symptoms and referring patients to specialists, could generally be obtained, but these services were often only provided virtually through telephone or video services rather than in person.
- Although emergency departments remained accessible for patients in need of immediate treatment as a result of cardiac disease or stroke symptoms, some people were hesitant to visit hospitals during the pandemic.
- Hospitals only consistently provided emergency or urgent cardiac disease and stroke procedures. Surgeries and procedures considered non-essential or elective were stopped or the number reduced from March 19, 2020 to May 26, 2020 and again from April 20, 2021 to May 19, 2021 when the Chief Medical Officer of Health issued a directive identifying that all non-essential and elective surgeries were to be stopped or reduced to minimum levels. During these periods, individuals who required non-emergency surgeries or procedures were put on a growing wait list.
- Rehabilitation services for cardiac and stroke patients were disrupted due to closures in certain in-person services, resulting in these services being provided to patients only virtually. The impact of these closures was regional. The reasons for these closures varied, which were primarily as a result of the provincial directive to ramp down non-emergency activities, a need to redeploy staff during this time to long-term-care

facilities and to other hospitals or as a result of COVID-19 outbreaks that occurred at the site.

Section 7.0 provides more details about the impacts of COVID-19 on cardiac disease and stroke treatment.

3.0 Audit Objective and Scope

Our audit objective was to assess whether the Ministry of Health (Ministry), in association with CorHealth Ontario (CorHealth) and regional or local community health-care providers, has effective systems and procedures in place to:

- provide cardiac disease and stroke services in a timely, equitable and cost-efficient manner to meet Ontarians' needs and in accordance with applicable standards, guidelines and legislation; and
- measure and report on the results and effectiveness of cardiac and stroke services and initiatives in meeting their intended objectives.

In planning for our work, we identified the audit criteria (see **Appendix 6**) we would use to address our audit objective. These criteria were established based on a review of applicable legislation, policies and procedures, internal and external studies and best practices. Senior management at the Ministry and CorHealth reviewed and agreed with the suitability of our objectives and associated criteria.

We conducted our audit between January 2020 and July 2021, with a pause on audit fieldwork between April 2020 and December 2020 in recognition of the heavy burden COVID-19 placed on the health-care system. We obtained written representation from Ministry and CorHealth senior management that, effective November 19, 2021, they had provided us with all the information they were aware of that could significantly affect the findings or the conclusion of this report.

Our audit work focused primarily on the Ministry's Health Services Branch, Hospitals Branch, and Provincial Programs Branch, as well as CorHealth. In performing our audit work, we:

- interviewed senior management and staff responsible for overall oversight and funding of cardiac disease and stroke care to understand current processes and challenges in Ontario;
- reviewed relevant reports and briefing notes related to cardiac disease and stroke care strategy;
- obtained details about hospital and community cardiac disease and stroke care received by Ontarians and on spending by hospitals, and billings of cardiac disease and stroke care by physicians;
- reviewed data on, and reasons for, emergency department and hospital stays related to cardiac disease and stroke treatment and care;
- reviewed analysis and reports on the availability in Ontario of cardiac disease and stroke treatment services; and
- analyzed performance reports (including wait time information) related to cardiac disease and stroke treatment by hospitals and rehabilitation providers.

Our audit work focused on seven hospitals/hospital groups that are or have cardiac centres and/or stroke centres (see **Appendix 1**). These hospitals/hospital groups are: Hamilton Health Sciences, London Health Sciences, The Ottawa Hospital, Thunder Bay Health Sciences, Trillium Health Partner, and Unity Health Toronto (specifically, St. Michael's Hospital), and University of Ottawa Heart Institute. We selected these hospitals based on geography (including at least one hospital in each of the five Ontario Health regions), as well as based on types and volumes of procedures performed. In performing our audit work, we:

- met or spoke with staff at the hospitals to understand the cardiac disease and stroke treatment services they provide and the challenges they experience;
- reviewed hospitals' program policies, procedures and other relevant documentation to understand their services and operations; and
- obtained details related to cardiac disease and stroke patients' treatment and experience, including cost and length of stay information, patient survey data and patient files.

Apart from contacting the seven hospitals specified above, we also met or spoke with staff and collected data from additional hospitals and relevant stakeholders across the province to better understand cardiac disease and stroke care practices, including rehabilitation and paediatric care (see **Appendix 7**).

To further understand the views and challenges of cardiac and stroke centres, in addition to the seven hospitals that are cardiac centres and/or stroke centres noted above, we also sent a survey to other hospitals, including 14 cardiac centres and 22 stroke centres. We received responses from nine cardiac centres and 13 stroke centres (64% of remaining cardiac centres and 59% of remaining stroke centres). Overall, through directly contacting and conducting survey of hospitals, we collected information and received responses from 15 (or 75%) of the 20 cardiac centres and 19 (68%) of the 28 stroke centres.

We also spoke with staff at Ontario Health and collected data on cancer programs to understand how oversight of Ontario's cancer treatment compares to cardiac disease and stroke.

To learn about previous and current procurement initiatives across Ontario hospitals, we met with Supply Ontario (an agency created under the Ministry of Government and Consumer Services on November 5, 2020 to centralize the government's supply chain and streamline procurement processes) and we interviewed representatives of Mohawk Medbuy Corporation and Plexxus, Ontario's two largest not-for-profit organizations specializing in health-care supply chain services.

We spoke with staff from Heart & Stroke to understand challenges for cardiac and stroke patients across Canada, to see how Ontario compares to other provinces in the provision of care, and to learn about the health promotion programs it delivers nationally.

To obtain further understanding on the cardiac disease and stroke systems in other provinces, we spoke with and collected data from staff at Alberta Health Services and the Provincial Health Services Authority in British Columbia.

We engaged an expert advisor who is a practicing cardiologist in another province to better understand best practices for cardiac disease and stroke treatment within Canada and worldwide.

We conducted our work and reported on the results of our examination in accordance with the applicable Canadian Standards on Assurance Engagements Direct Engagements issued by the Auditing and Assurance Standards Board of the Chartered Professional Accountants of Canada. This included obtaining a reasonable level of assurance.

The Office of the Auditor General of Ontario applies the Canadian Standard on Quality Control and, as a result, maintains a comprehensive quality control system that includes documented policies and procedures with respect to compliance with rules of professional conduct, professional standards and applicable legal and regulatory requirements.

We have complied with the independence and other ethical requirements of the Code of Professional Conduct of the Chartered Professional Accountants of Ontario, which are founded on fundamental principles of integrity, objectivity, professional competence and due care, confidentiality and professional behaviour.

4.0 Detailed Audit Observations: Cardiac Disease Care

4.1 Cardiac Procedures Are Not Always Performed on a Timely Basis and Wait Lists for Procedures Have Grown

4.1.1 Many Heart Attack Patients Are Not Receiving a Life-Saving Emergency Procedure within Provincial Treatment-Time Targets

A heart attack—referred to in medical terms as a myocardial infarction—occurs when blood flow is completely or partially blocked in a coronary artery. For patients experiencing a heart attack, it is necessary to restore oxygenated blood flow in a timely

manner to prevent permanent heart damage and death. “Time is muscle” is a phrase used in cardiology that highlights the importance of timely treatment, as the heart itself is a muscular organ that can be permanently damaged when starved of oxygen. When blood flow is completely blocked, the patient suffers what is known as an ST-Elevation Myocardial Infarction (STEMI). A procedure called primary percutaneous coronary intervention (PPCI) is used to reopen the artery and restore blood flow. At the time of our audit, 20 hospitals in the province were equipped to perform percutaneous coronary intervention (17 of which can perform PPCI on a 24/7 basis).

In 2017/18, CorHealth adopted the following provincial treatment time targets related to how quickly PPCI is performed on STEMI patients:

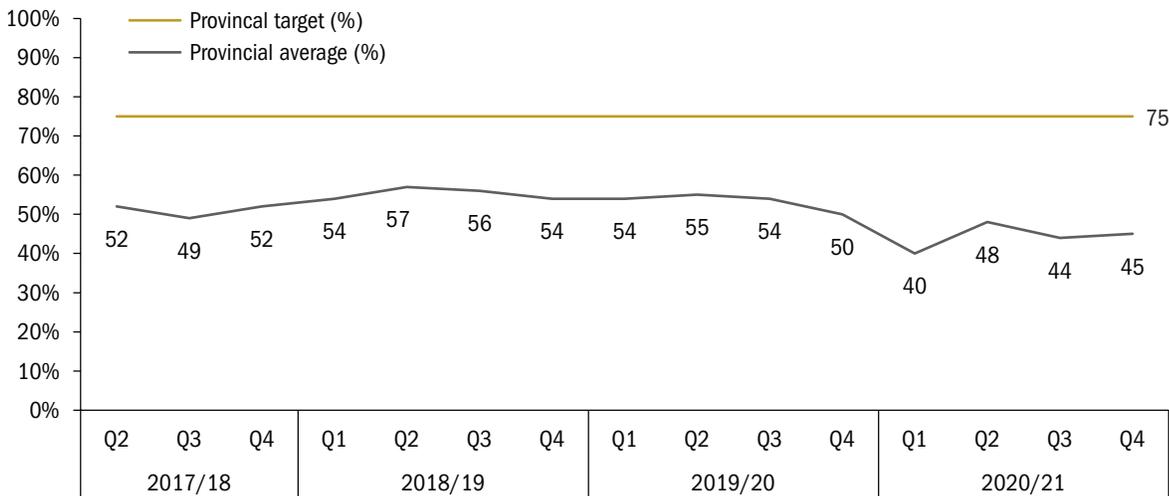
1. One target is that 75% of STEMI patients receive a PPCI procedure within 90 minutes of first medical contact when arriving at a hospital that can perform PPCI.
2. The other target applies when a patient arrives at a hospital but must be transferred to another hospital that can perform PPCI. In such cases the target is that 75% of STEMI patients receive a PPCI within 120 minutes of the patient’s arrival at the first hospital.

Failure to meet these targets can result in deaths of Ontarians. According to a 2006 study published in the *Journal of the American College of Cardiology*, both in-hospital death rates and death rates seven years post-procedure increased when patients had to wait longer for a PPCI to be performed. Specifically:

- The in-hospital mortality rate was 4.9% for patients treated between zero and 1.4 hours and it increased to 6.1% for patients treated between 1.5 hours to 1.9 hours. The rate increased further to 8.0% when patients had to wait between two and 2.9 hours, and to 12.2% when patients had to wait three or more hours.
- Mortality rates for patients seven years post-procedure was 12.6% for those treated between zero and 1.4 hours and it increased to 16.4% for patients treated between 1.5 hours and 1.9 hours. The rate increased further to 20.4% when patients

Figure 11: Percentage of ST-Elevation Myocardial Infarction (STEMI) Cases that Met 90-Minute Time-to-Primary Percutaneous Coronary Intervention (PPCI) Target, 2017/18–2020/21

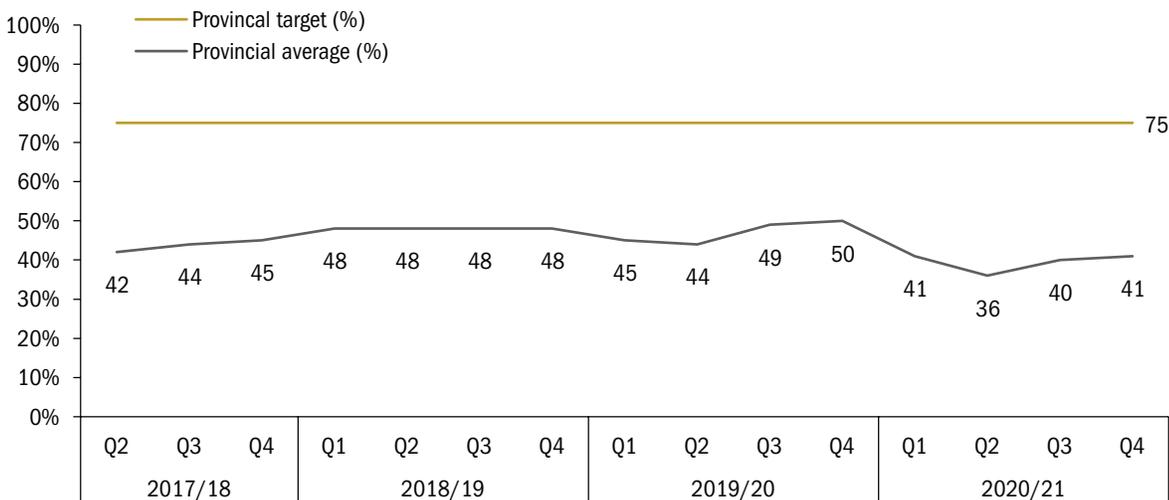
Source of data: CorHealth Ontario



Note: CorHealth Ontario has regularly collected this data since the second quarter of 2017/18.

Figure 12: Percentage of ST-Elevation Myocardial Infarction (STEMI) Cases that Met 120-Minute Time-to-Primary Percutaneous Coronary Intervention (PPCI) Target, 2017/18–2020/21

Source of data: CorHealth Ontario



Note: CorHealth Ontario has regularly collected this data since the second quarter of 2017/18.

had to wait between 2.0 and 2.9 hours, and to 27.1% when patients had to wait three or more hours.

Figure 11 and **Figure 12** show the historical performance against these PPCI time-to-treatment targets. As these figures indicate, these targets have never been met on a provincial level since the second quarter of 2017/18, when CorHealth began

consistently reporting performance against these targets. We also noted considerable variation in performance across the province. For example, for the final quarter of 2020/21:

- **Figure 11** shows about 45% (322 out of 715) of STEMI patients were treated within 90 minutes when arriving at a hospital that performs PPCIs, with performance ranging from about 6% at one

hospital (University Health Network) to about 67% at two others (London Health Sciences Centre and Windsor Regional Health).

- **Figure 12** shows about 41% (179 out of 436) of STEMI patients were treated within 120 minutes when presenting to a hospital that does not perform PPCIs, with performance ranging from about 8% for those transferred to one hospital (Kingston General Hospital) to about 58% for those transferred to another (Peterborough Regional Health Centre).

According to research documented by Ontario cardiologists and CorHealth staff in the Canadian Journal of Cardiology in July 2020, factors related to COVID-19 are suspected to have further contributed to the targets not being met. For example, increased safety measures, as well as the limited availability of transport services and of health-care personnel, likely increased the time for patients with heart attacks to be treated. As well, an overlap between symptoms of cardiac disease and COVID-19 can make definitive diagnosis of heart attack more difficult. **Section 7.0** provides more details about the impact of COVID-19 on cardiac treatment.

4.1.2 Wait-Time Targets for Cardiac Procedures Are Not Consistently Met

CorHealth tracks wait times for many cardiac procedures, but not all of these wait times are publicly

reported. Only wait times associated with the following three procedures tracked by CorHealth are publicly reported by Health Quality Ontario against the provincial wait-time targets (see **Figure 13**):

1. Diagnostic cardiac catheterization, which involves injecting dye into a patient's coronary arteries to determine the presence and extent of blockages using diagnostic imaging;
2. Percutaneous coronary intervention (PCI), which opens a narrowed coronary artery and places a stent to keep the artery open; and
3. Coronary artery bypass grafting (CABG), which is a surgical procedure done to divert blood flow around an obstructed coronary artery.

Figure 14 shows provincial performance against these targets for 2015/16–2019/20, which approximates the five fiscal years before elective procedures were first stopped as a result of COVID-19, and for 2020/21, which is when COVID-19 majorly impacted hospital operations. While Ontario hospitals were able to provide most emergency and urgent cardiac procedures within targeted timelines, they were unable to meet wait-time targets for semi-urgent and non-urgent procedures as often. The impact of COVID-19 on hospital operations did not significantly compromise provincial performance against these targets, with no large decline in 2020/21 performance compared with 2019/20. **Section 7.0** provides more details about the impact of COVID-19 on cardiac disease treatment.

Figure 13: Wait-Time Targets for Various Cardiac Procedures by Priority Level

Source: CorHealth Ontario and Health Quality Ontario

Priority Level ¹	Target Time from Referral to Diagnostic Cardiac Catheterization ²	Target Time from Decision to Percutaneous Coronary Intervention (PCI) ³	Target Time from Decision to Coronary Artery Bypass Graft (CABG) ³
Emergency and Urgent	7 days	7 days	14 days
Semi-Urgent	28 days	14 days	42 days
Non-Urgent	84 days	28 days	90 days

Note: The target wait times are expected to be achieved in nine out of 10 patients (90%) treated.

1. Emergency cases are those that require hospitalization and immediate attention, but they are tracked together with urgent cases. Urgent cases include those that are severe but do not require immediate attention. Semi-urgent cases include those that are scheduled in advance and involve some medical urgency, but do not require hospitalization. Non-urgent, or elective cases, are those scheduled in advance but do not have medical urgency.
2. Measured from when a patient is referred for the procedure to when the procedure actually occurs.
3. Measured from when a patient and surgeon or specialist decide to proceed with the procedure to when the patient actually has the procedure.

Figure 14: Performance Against Cardiac Wait-Time Targets by Procedure and Priority Level, 2015/16–2020/21

Source of data: CorHealth Ontario

	2015/16 (%)	2016/17 (%)	2017/18 (%)	2018/19 (%)	2019/20 (%)	2020/21 (%)
Cardiac Catheterization						
Emergency and Urgent	99	98	99	98	98	98
Semi-Urgent	89	80	79	84	80	83
Non-Urgent	100	99	99	99	99	96
Percutaneous Coronary Intervention (PCI)						
Emergency and Urgent	95	96	94	94	93	93
Semi-Urgent	67	61	59	52	52	55
Non-Urgent	84	82	77	75	73	74
Coronary Artery Bypass Graft (CABG)						
Emergency and Urgent	92	91	93	94	92	95
Semi-Urgent	87	87	86	90	91	90
Non-Urgent	95	89	89	93	93	90

In particular, the targets for semi-urgent and non-urgent PCI procedures have not been met. This likely contributed to Ontario having a higher 30-day readmission rate after PCI procedures compared with all other provinces (except British Columbia), per data published by the Canadian Institute for Health Information. Ontario's 30-day in-hospital mortality rate following a PCI procedure was 2.3%, which was not significantly different from other provinces. But it was slightly higher than the rate in Alberta and British Columbia. **Figure 15** provides a comparison of performance with respect to these metrics by province.

As shown in **Figure 13** and **Figure 14**, we further note that CorHealth's wait-time tracking for emergency and urgent cardiac procedures does not distinguish between emergency and urgent (scheduled) procedures, with both priority levels publicly reported against the same wait-time targets for the three procedures identified above. Reporting emergency procedures together with urgent scheduled procedures overstates how quickly Ontario is providing care for urgent scheduled procedures, as emergencies are treated much faster and without any wait time. Separating emergency from urgent procedures in wait time tracking would provide more meaningful reporting.

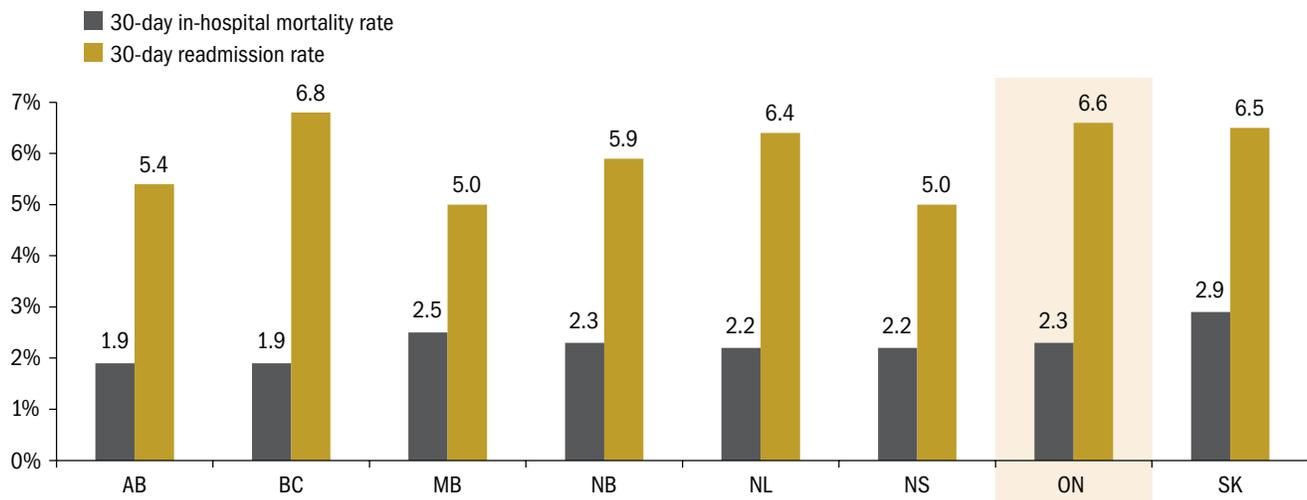
4.1.3 Wait Times, Wait Lists and Deaths While on Wait Lists for Cardiac Procedures Have Grown Due to Increased Demand

A comparison between 2015/16 and 2020/21 shows that wait times for most procedures and priority levels increased (see **Figure 16**).

- During the five-year period up to 2019/20, which approximates five years prior to major impacts of COVID-19, while the number of cardiac procedures performed grew over 8% (from over 119,000 procedures in 2015/16 to over 129,000 in 2019/20), the number of patients waiting for cardiac procedures during this period grew at a much faster rate: about 44% (from an average of about 5,450 patients in 2015/16 to about 7,850 in 2019/20). This resulted in wait times for many cardiac procedures either remaining about the same or increasing slightly from 2015/16 to 2019/20.
- During the COVID-19 pandemic, the number of cardiac procedures dropped over 13%, from about 129,000 procedures in 2019/20 to about 112,000 in 2020/21. At the same time, the average wait list grew by over 6%, from about 7,850 patients in 2019/20 to about 8,340 in 2020/21. This increase of less than 500 people

Figure 15: 30-day Mortality Rate and 30-day Readmission Rate Following a Percutaneous Coronary Intervention (PCI) by Province, 2016/17–2018/19

Source of data: Canadian Institute for Health Information



Note: Data for other provinces (Prince Edward Island and Quebec) and territories (Northwest Territories, Nunavut, and Yukon) was not available at the time of our audit. Data is risk-adjusted, meaning that the numbers provided have been adjusted to consider factors related to the patients treated (such as the age of patients, pre-existing conditions) to make comparison between the provinces more useful.

on the wait list was lower than the average wait-list growth of about 600 patients per year during the five-year period before 2020/21. This could be due to patients choosing to not seek treatment or not being able to access treatment during COVID-19, which is discussed further in **Section 7.0**.

Increasing wait lists also contributed to worsened patient conditions and more deaths among patients waiting for cardiac procedures (see **Figure 17**).

- During the five-fiscal year period ending in 2019/20, the number of deaths while waiting grew 42%, from 147 in 2015/16 to 209 in 2019/20. This rate aligned with the 44% increase in the average number of people on a wait list for a cardiac procedure over these fiscal years.
- From April 2021, shortly after the COVID-19 pandemic started, to the end of 2020/21, the number of patients who died while on wait lists increased by over 10%, from 209 in 2019/20 to 231 in 2020/21 (see **Section 7.0**).

An aging population has been driving more demand for cardiac health-care services. The growth in the number of people requiring cardiac procedures is likely to continue, given projections that show the population will continue to age. For example:

- Data from Statistics Canada showed that, while Ontario's population under the age of 64 grew about 5% (from about 11.6 million in 2016 to about 12.1 million in 2020), Ontario's population aged 65 and older grew three times faster, by about 15% (from about 2.3 million in 2016 to 2.6 million in 2020).
- Data from the Ministry of Health indicates that from 2016/17 to 2020/21, over 60% of all cardiac and stroke-related emergency department visits were for people aged 65 and older.
- Based on the Ministry of Finance's population growth projections for the next decade, the number of Ontarians aged 65 and older is expected to continue growing. By 2031, Ontario's total population is expected to grow 16% from 2020 levels, but the population of those aged 65 and older is expected to grow 42%.

Figure 16: Average Wait Time by Priority Level for Various Cardiac Procedures (Days), 2015/16–2020/21

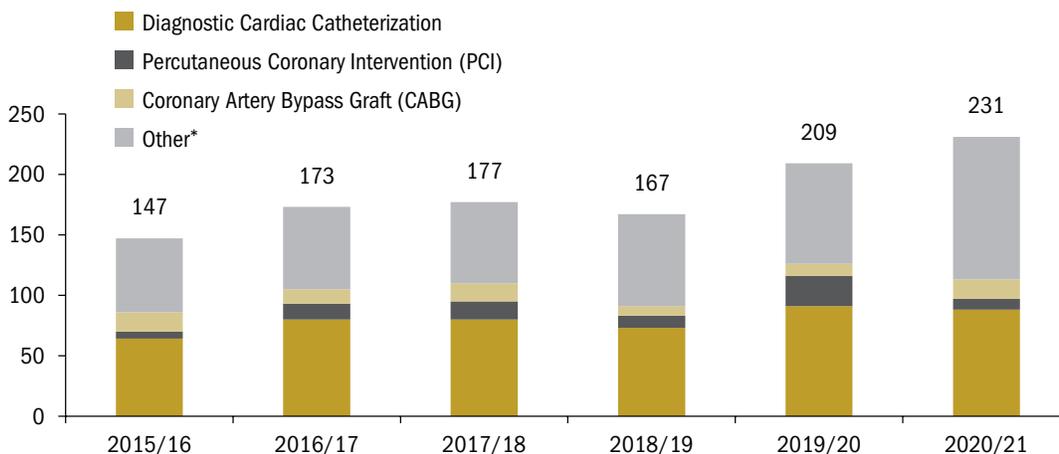
Source of data: CorHealth Ontario

Procedure and Priority Level	2015/16	2016/17	2017/18	2018/19	2019/20	2020/21
Diagnostic Cardiac Catheterization¹						
Emergency and Urgent	1	1	1	1	1	1
Semi-Urgent	14	18	18	17	19	19
Non-Urgent	17	21	22	20	23	27
Unassigned ²	13	16	14	17	16	16
Coronary Artery Bypass Graft (CABG)						
Emergency and Urgent	6	8	7	6	7	6
Semi-Urgent	17	19	18	16	14	16
Non-Urgent	31	38	38	32	31	34
Unassigned ²	26	23	27	12	23	15
Percutaneous Coronary Intervention (PCI)						
Emergency and Urgent	2	2	3	3	3	3
Semi-Urgent	13	15	16	18	19	19
Non-Urgent	15	16	21	21	21	24
Unassigned ²	3	18	5	4	5	3
Other³						
Emergency and Urgent	30	34	33	30	31	35
Semi-Urgent	50	60	57	55	51	75
Non-Urgent	41	47	44	45	42	46
Unassigned ²	71	81	84	87	93	105

1. Wait times for cardiac catheterizations are measured from the time of referral to when the procedure is performed to align with how performance is tracked against delivery-time targets. All other wait times are measured from the time the patient decides with their surgeon or specialist to have the procedure to when the procedure is performed.
2. Priority levels are determined by an algorithm. When required information is missing, no priority level is assigned. Some procedures, such as transcatheter aortic valve implantation (TAVI), do not have priority levels assigned since there are no priority-based wait-time targets in Ontario.
3. Other includes the following procedures: ablations (standard and complex), simultaneous CABG and valve replacement surgery, device implants, electrophysiology studies, isolated valve replacement surgery, and transcatheter aortic valve implantation (TAVI).

Figure 17: Deaths While on Wait List for Various Scheduled Cardiac Procedures, 2015/16–2020/21

Source of data: CorHealth Ontario



* Other includes the following procedures: ablations (standard and complex), simultaneous CABG and valve replacement surgery, device implants, electrophysiology studies, isolated valve replacement surgery, and transcatheter aortic valve implantation (TAVI).

It is important that the Ministry take Ontario's aging population into consideration when doing strategic planning and when making funding decisions and investments related to cardiac procedures to improve wait-time performance.

RECOMMENDATION 1

To improve wait-time reporting and provide patients with timelier cardiac disease procedures, we recommend that the Ministry of Health direct CorHealth Ontario to:

- develop separate wait-time targets for urgent and emergency procedures and separately track and report performance against these targets;
- evaluate cardiac procedures with no treatment-time targets to determine whether timely delivery of care can impact patient outcomes;
- set treatment-time targets for identified procedures, and publicly report performance against these targets;
- regularly assess performance of hospitals against all treatment-time targets for cardiac procedures and work with hospitals to take the necessary actions to move toward widespread achievement of these targets; and
- analyze hospitals' practices of managing wait lists for cardiac procedures to understand the reasons of growing wait lists and identify corrective actions.

MINISTRY RESPONSE

The Ministry recognizes the importance of performance targets to inform clinical care pathways that will improve quality of care for cardiac patients. The Ministry is prepared to work with CorHealth Ontario (and/or Ontario Health) to explore the potential for updating or developing wait-time targets and how that might be achieved, assessing performance of hospitals against these targets, and analyzing hospitals' practices of managing wait lists for cardiac procedures.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with this recommendation and supports advancement of measurement and reporting systems across the dimensions of quality that support improvement in patient outcomes. CorHealth is committed to continuing to deliver reports that accurately reveal the quality, including timeliness, of cardiovascular care across the province. These indicators and reports facilitate the sharing and dissemination of best practices and improvement strategies locally and provincially. In the fall of 2017, CorHealth initiated a Quality Performance Measurement and Monitoring (QPMM) cycle with all cardiac programs, the Ministry of Health and Local Health Integration Networks.

CorHealth will continue to provide this platform for regular measurement and monitoring of key quality metrics for cardiac services, and to support dialogue and share learnings across the province. CorHealth will support the Ministry of Health in any further recommendations or improvement opportunities related to timeliness of cardiac procedures.

4.2 Cost-Effective Cardiac Treatment Approaches and Practices Are Not Widely Used Provincially

4.2.1 Many Cardiac Patients Still Receive More Invasive Procedures Despite Expert Recommendations to Expand Use of Less Invasive Procedures

Transcatheter aortic valve implantation (TAVI) is a minimally-invasive procedure to treat aortic valve stenosis, which is a condition where the aortic valve does not open and close properly. Aortic valve stenosis results in restricted blood flow that, if left untreated, can lead to heart failure. TAVI reduces the need for another more invasive procedure called surgical aortic valve replacement (SAVR, or valve surgery). Valve surgery involves longer hospital stays and there are greater physical and psychological side-effects

following the procedure. In 2020/21, the median length of stay following a TAVI procedure was one day, compared to six days for valve surgery.

TAVI is currently offered at 11 hospitals in Ontario and has historically been funded only for individuals with severe aortic valve stenosis who would be at high risk of complications. The use of TAVI increased by about 160% (from 745 procedures in 2015/16 to 1,940 procedures in 2020/21) while valve surgery decreased by about 2% (from 2,708 procedures in 2015/16 to 2,662 procedures in 2020/21). Despite significant growth in the use of TAVI, the number of TAVI performed (1,940) in 2020/21 is still about 25% less than the number of valve surgeries performed (2,662) in 2020/21 (see **Figure 18**).

In 2020, Health Quality Ontario performed health technology assessments on TAVI and recommended that TAVI be funded in Ontario for patients with severe aortic valve stenosis and low or intermediate surgical risk. The findings of the health technology assessment found that in comparison with valve surgery, TAVI had more favourable short-term outcomes such as better quality of life and a slightly lower risk of mortality. In 2021/22, the Ministry updated patient eligibility criteria to include patients with low and intermediate risk, and provided growth funding for TAVI procedures, bringing the total number of funded TAVIs for 2021/22 to 2,601. Despite this

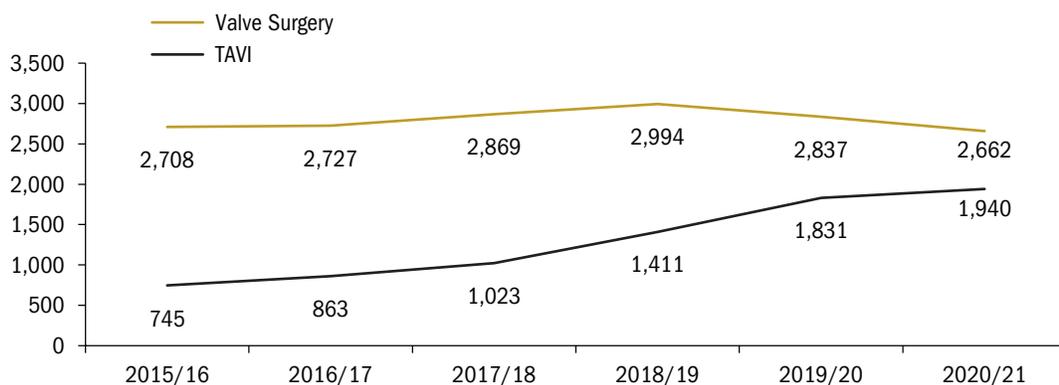
increased funding, TAVI is still not performed on everyone who could likely benefit from it in Ontario.

While there has been an increase in TAVI procedures based on the updated patient eligibility, it does not appear enough to be provided to all eligible patients. Based on data from a 2019 study by the Canadian Cardiovascular Society that estimated the population rate that TAVI would be suitable for, we estimate that expansion of TAVI procedures to low-risk patient populations would likely result in a need to fund and perform approximately 4,437 procedures per year, or about 1.7 times more than the number of procedures funded by the Ministry in 2021/22. This means that some patients who are otherwise eligible for TAVI procedures may need to undergo the more invasive valve surgery in order to receive their treatment in a timely manner.

Historically, TAVI procedures have been substantially more expensive than valve surgery because of the cost of the valve used in the procedure. The cost of a valve used in TAVI is about \$25,000, which is more than four times the cost of the \$6,000 valve typically used in valve surgery. The health technology assessments performed by Health Quality Ontario found that expanding funding for intermediate and low-risk patients would result in an increased annual cost of \$7 million to \$11 million over a five-year period. The assessments also found that costs could be reduced even further if the hospital stay can be

Figure 18: Number of Transcatheter Aortic Valve Implantations (TAVI) and Surgical Aortic Valve Replacements (Valve Surgery) Performed, 2015/16–2020/21

Source of data: CorHealth Ontario



reduced. For example, we noted that in 2020/21 six of the 11 hospitals in Ontario that are able to perform TAVI have reduced the length of the hospital stay for TAVI patients to just one day. They achieved reduced hospital stays using various methods, such as providing early physical therapy and exercise programs to improve patients' strength and functional independence, as well as using remote post-discharge monitoring. British Columbia has had a median length of stay of one day since 2016, almost five years earlier than Ontario, and still maintains this as recently as 2018 (most recent year data is available).

RECOMMENDATION 2

To allow for patients with aortic valve stenosis, a type of cardiac disease, to receive more effective care and to reduce their length of stay in hospital, we recommend that the Ministry of Health:

- assess the number of transcatheter aortic valve implantation (TAVI) procedures needed to cover all patients who are eligible, and adjust funding accordingly; and
- direct CorHealth to develop a standard for delivery of TAVI, and work with hospitals to confirm compliance with the standard to ensure TAVI can be performed cost-effectively.

MINISTRY RESPONSE

The Ministry supports this recommendation and agrees that it is important to address the adoption and diffusion of new and innovative technologies in a responsible way.

For nearly two years, the Ministry has engaged CorHealth to work with advanced cardiac hospitals on an Aortic Valve Implantation Initiative in order to develop standards of delivery and assist the sector in navigating the complexities of moving their programs from an open surgical method to a new, minimally invasive procedure for this patient population. As transcatheter aortic valve implantation (TAVI) programs continue to grow and evolve, the Ministry will also continue

to adjust funding so that all patients eligible for a TAVI can receive one.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees that patients with aortic stenosis should receive care that is delivered efficiently and results in excellent outcomes. In 2019, CorHealth began the Aortic Valve Implantation (AVI) Initiative to develop a model of care that ensures all patients with aortic stenosis receive evidence-based care, including timely and equitable access to AVI treatments, such as surgical aortic valve implantation or transcatheter aortic valve implantation (TAVI). CorHealth will continue to support the Ministry of Health's planning and resource allocation of TAVI to all eligible patients in Ontario through identification of anticipated volumes of procedures.

CorHealth will continue to work with Cardiac programs to monitor access and quality indicators related to TAVI to ensure best practice and standard delivery of care.

4.2.2 Integrated Heart Failure Care Initiative That Can Improve Patient Care and Reduce Hospitalizations Has Not Been Widely Implemented

Heart failure is a chronic, progressive condition where the heart is unable to pump enough blood to meet the body's demands. It can result in a life-threatening condition with symptoms including shortness of breath, fatigue and swelling in the legs, ankles and feet. According to a 2019 publication by Health Quality Ontario, in 2015 approximately 250,000 Ontarians, which was about 1.8% of the province's population, were affected by heart failure. More recently, in 2018/19, there were over 28,000 hospital admissions to Ontario hospitals with the main reason for hospitalization being heart failure. Of these admissions, about one in five were readmitted to hospital

within 30 days of a prior visit and about 8% died during a hospitalization for heart failure.

Due to the chronic nature of heart failure, patients may need to receive both primary and acute care, and they require careful monitoring to prevent readmission to hospital. In 2018, CorHealth released a document that described how heart failure care could be organized to allow for better care for patients with heart failure and to prevent additional hospitalizations. In 2019, Health Quality Ontario released Heart Failure Care in the Community Quality Standards, which describe how care can be better delivered in the community to improve patient outcomes. In 2019 CorHealth developed and piloted the Integrated Heart Failure Care Initiative (Initiative).

The purpose of the Initiative was to promote an integrated system for heart failure care under which cardiac centres can work with local community hospitals and primary care providers, such as family physicians, to ensure that the appropriate level of care is provided to heart failure patients at the right time. For example, a 2018 Ontario study published in the Canadian Medical Association Journal found that follow-up care with a cardiologist or family physician within seven days of discharge from an emergency department was associated with lower rates of future hospital admissions and long-term mortality. This timely follow-up care after discharge recommendation is incorporated in the Initiative.

However, at the time of our audit, CorHealth informed us that the Initiative has only been adopted by three regions: Ottawa, Guelph, and London. CorHealth confirmed with us that data on this Initiative has not yet been collected and that the Initiative has not been expanded beyond the three regions, though there are plans to expand once more data is gathered.

Of the three regions that adopted the Initiative, we noted that they have experienced positive results, such as reducing hospitalizations and better patient education. Specifically:

- Ottawa region was the first to implement the Initiative, doing so through its Champlain Heart Failure Initiative. Since 2013, University of Ottawa

Heart Institute (UOHI) has been providing guidance and oversight to 13 community hospitals in the region using a guideline tool developed by the American Heart Association. The Initiative brought regional members of the Champlain Local Health Integrated Network (LHIN) (which is now part of the East Ontario Health Region) together to identify any gaps in heart failure services, and propose solutions so that a plan could be developed with UOHI. A study by UOHI found large improvements in the number of patients receiving best practice care. For example, the percentage of community hospitals that provided formal education to patients related to heart failure, such as identifying symptoms and taking appropriate actions, has increased significantly. Before the Initiative only 25% of hospitals were providing this education; since the Initiative's adoption, 90% of hospitals provide this education.

- Guelph region started implementing the Initiative in March 2019. It reports that the Initiative has provided a framework that helps meet the needs of patients living with heart failure and their caregivers in Guelph. The Initiative also improves collaboration across health-care providers by enabling new partners to join. Guelph General Hospital identified the Initiative as one of the contributing factors to the reduction in the 30-day readmission rate for patients with heart failure. The readmission rate went from over 22% in 2018/19 to below 11% in 2020/21.
- While the London region was unable to fully operationalize the Initiative before 2021, we were informed that the Ontario Health West region has implemented a Best Care program that aligns with the Initiative. The Best Care program focuses on integrated chronic disease management and promotes evidence-based standards through all levels of care, and has seen positive outcomes for other chronic diseases such as asthma and chronic obstructive pulmonary disease. The Best Care program began work on heart failure in 2016 as a pilot, with full launch in 2018. The region has

experienced early success in improving outcomes, such as patient quality of life and reduced hospitalizations and emergency department visits.

RECOMMENDATION 3

To allow patients with heart failure to receive high quality of care in the community and reduce emergency department visits and hospitalizations, we recommend that the Ministry of Health:

- direct CorHealth to collect data to formally evaluate the Integrated Heart Failure Care Initiative in regions where it was adopted to determine what factors contributed to the success of the initiative; and
- develop and implement a plan to expand the Initiative to all appropriate regions.

MINISTRY RESPONSE

The Ministry recognizes the importance of early heart failure care in order to prevent hospitalizations and adverse outcomes. The Ministry is prepared to work with CorHealth to explore potential appropriate solutions to improving the quality of heart failure care and how that might be achieved.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with this recommendation and recognizes the importance of a provincial approach for driving integrated value-based health care for people with heart failure. CorHealth piloted the Integrated Heart Failure Care Initiative (IHFCI) to test the implementation of a model of integrated care delivery and a HF care quality standard. The key learnings have been used to inform recommendations around how to implement a model of integrated care delivery and a heart failure care quality standard. CorHealth continues to work with the pilot sites to understand the impact of the model and implications for driving improvement in integrated value-based health care for people with heart

failure. CorHealth also supports any alignment opportunities with Ontario Health to collaborate on chronic disease management priorities that may include the heart failure population.

4.2.3 Effective and Efficient Cardiac Disease Care Practices Used by Some Hospitals Are Not Widely or Consistently Adopted

We identified a number of initiatives related to the provision of more effective cardiac disease care, but they are not being implemented in a consistent manner provincially. These initiatives include remote monitoring, rapid assessment clinics, and integrated comprehensive care.

Remote Monitoring

Remote monitoring is a type of health-care delivery that uses information technologies, such as cell phones and tablets, to monitor and capture health data from patients and electronically transmit this information to health-care providers for assessment. Remote monitoring can result in earlier detection of changes in a patient's health condition, including an irregular heartbeat, which if undetected and untreated can lead to adverse events such as heart failure or stroke. Despite these benefits, remote monitoring is currently offered inconsistently across the province, depending on location and patient condition (see **Figure 19**).

Thirteen of the 20 cardiac centres in Ontario responded to our survey question on their use of remote monitoring (65% of all cardiac centres). Ten of these 13 cardiac centres that responded to our survey (77%) reported using remote monitoring for cardiac patients. Of these ten centres, nine (69%) used remote monitoring for heart failure, three (23%) for cardiac post-surgical patients, and two (15%) for irregular heartbeats. Some centres used remote monitoring for more than one condition.

Proactive and early intervention via remote monitoring helps reduce or avoid costly hospitalization. For example, the estimated cost of a remote monitoring program at the University Health Network

Figure 19: Availability of Remote Monitoring Programs by Patient Condition at Select Hospitals

Prepared by the Office of the Auditor General of Ontario

Patient Condition	Heart Failure	Post-Surgical
Hamilton Health Sciences		✓
London Health Sciences	✓	
Thunder Bay Regional Health Sciences Centre	✓	
Trillium Health Partners	✓	
Unity Health		
University of Ottawa Heart Institute	✓	✓

Note: "✓" indicates a monitoring program exists for this patient group. The information is provided by select hospitals in Ontario. Patients must meet certain eligibility criteria at each respective hospital.

(UHN) is about \$1,150 annually per patient with heart failure. This is less than one-seventh the cost of hospitalization, which is about \$8,200 per heart failure admission. Therefore, if remote monitoring is more widely adopted, potential savings or benefits associated with reduced or avoided hospitalizations could be substantial.

In 2020/21, CorHealth prepared a briefing note to the Ministry identifying the immediate need for the expansion of remote monitoring for heart failure patients, particularly in response to COVID-19. CorHealth also recommended that the Ministry consider funding a program that the UHN has been using for remote monitoring of their heart failure patients. This program allows patients to monitor and collect information on their weight, blood pressure, heart rate and symptoms and then report such information daily into the program's system. The system algorithm then provides real-time feedback to patients on actions they can take to manage their health. Information reported by a patient that fall outside of pre-defined thresholds automatically alerts clinicians to assess the patient for further intervention, including virtual consultations or visits to an outpatient clinic.

A study in 2020 by researchers at UHN found that a group of 315 patients in the remote monitoring program had a 50% reduction in heart failure hospitalizations in the six months after entering the program compared with six months before they enrolled in the program. CorHealth estimated that if

remote monitoring was expanded to 5,000 patients, this would result in annual savings of \$6.7 million. However, the Ministry has not taken any action to expand remote monitoring yet. The Ministry informed us that software and technology decisions are the responsibility of the hospitals. The Ministry said that a re-assessment of the congestive heart failure quality-based procedure funding is needed to allow hospitals to implement innovative approaches to caring for patients with heart failure; however, this work has not been completed.

Rapid Assessment Clinics

The purpose of rapid assessment clinics is to help triage patients who present at an emergency department with signs of a potential heart problem but are not in any immediate risk of an adverse cardiac event. Triage patients in rapid assessment clinics reduces the amount of time patients need to spend in emergency departments, avoids potential hospitalizations by facilitating fast access to the appropriate level of care, and allows for emergency department resources to be dedicated to patients with more urgent needs. Despite these benefits, not all hospitals currently have rapid assessment clinics. Thirteen of the 20 cardiac centres in Ontario responded to our survey question on their use of rapid assessment clinics (65%) of all cardiac centres. Nine of these 13 cardiac centres that responded to our survey (69%) reported having a rapid assessment clinic.

In hospitals that have these clinics, their operations vary, with each targeting different patient groups and following different referral processes. For example:

- Since 1998, Toronto Western Hospital has operated a Cardiac Evaluation and Rapid Treatment clinic that receives referrals from its emergency department for patients who show up with non-urgent heart pain. This allows patients to be discharged faster from the emergency department, thereby freeing up emergency room resources while still allowing these patients to be assessed in the clinic within three business days for necessary testing and treatment.
- Since 2011, Hamilton Health Science has offered a rapid assessment clinic for cardiac disease patients. The structure of the clinic was updated in 2017 to include cardiac-related diagnostic testing. The majority of referrals to the clinic come from its emergency department, with other referrals from family physicians through a central intake number.
- Since 2014, the University of Ottawa Heart Institute has operated a Rapid Intervention Clinic, with a nursing co-ordinator available via telephone 24/7 to triage patients with chest pain and other cardiac symptoms. After providing an assessment, the nurse directs the patient to the most appropriate level of care, which can help prevent emergency department visits and/or admissions into the hospital.

Integrated Comprehensive Care Model

An integrated comprehensive care model involves the establishment of protocols between hospitals and home-care providers to ensure a smooth transfer of patient care and to prevent readmissions, long waits in the emergency department, and to allow for faster discharge out of hospital. Under this model, an integrated care co-ordinator that works in their hospital helps patients navigate through the health-care system from before their surgery, through the hospital stay, and ultimately to their return to the community. The co-ordinator connects patients with home-care

support before they leave the hospital and integrates electronic patient records between the hospital and home-care provider. However, this integrated care model has not been widely adopted across the province, even though it has been used effectively by some hospitals and community providers. Thirteen of the 20 cardiac centres in Ontario responded to our survey question on their use of integrated comprehensive care models (65% of all cardiac centres). Only three of these 13 cardiac centres that responded to our survey (23%) reported using an integrated comprehensive care model. For example:

- Since 2012, St. Joseph's Healthcare Hamilton has offered an Integrated Comprehensive Care Program, led by St. Joseph's Home Care, in partnership with several community health-care providers. A wide range of patients, including those undergoing planned chest surgeries, as well as those suffering from chronic diseases, such as congestive heart failure and chronic obstructive pulmonary disorder, have benefitted from the program. From 2012-2018, St. Joseph's reported 98% patient satisfaction, up to a 30% reduction in emergency department visits and hospital readmission rates, and over 30,000 bed days saved under this model.
- In June 2019, the University Health Network partnered with a not-for-profit home-care organization to develop the Integrated Care Program (modelled largely after St. Joseph's Integrated Comprehensive Care Program). The Integrated Care Program has improved the transition from the hospital to the community for all sorts of patients including those suffering from heart failure and patients that have had cardiac or vascular surgeries. While the program is still in early stages, preliminary findings so far have shown an overall decrease in patient length of stay, emergency department visits and re-admissions.
- Since 2018, Trillium Health Partners (Trillium) has worked with a community health service provider to co-ordinate the transition of patients who had cardiac surgery from hospital to home care. From 2018/19 to 2020/21, Trillium has seen

a 40% decrease in readmission rate (from 6.2% to 3.7%), and a 33% decrease in patients returning to the emergency room following discharge.

RECOMMENDATION 4

To allow patients throughout the province with cardiac disease to receive more effective care in a consistent manner, we recommend the Ministry of Health:

- direct CorHealth to develop and implement standards for remote monitoring and work with hospitals to implement this provincially;
- perform a reassessment of the quality-based procedures for patients with congestive heart failure to determine whether funding for remote monitoring should be included;
- identify regions that could benefit from rapid assessment clinics and work with hospitals to ensure these clinics operate in a consistent manner; and
- identify patient groups that have benefited most from hospitals currently using an integrated comprehensive care model and work with hospitals and community providers to implement integrated care groups provincially where deemed appropriate.

MINISTRY RESPONSE

The Ministry encourages innovative solutions that increase the quality of care that patients receive, but leaves clinical decision making to physicians to determine the best solutions for their patients.

The Ministry will work with CorHealth and other sector partners on solutions to provide high-quality care across the province, including remote monitoring, rapid assessment clinic and integrated comprehensive care models where appropriate.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with this recommendation to ensure patients with cardiac disease are provided consistent and effective evidence-based care. CorHealth recognizes the value of remote monitoring and the need for developing and implementing provincial standards. CorHealth is working closely with the Ministry of Health to explore opportunities to further drive improvement, including through the use of rapid assessment clinics and integrated comprehensive care models, to ensure quality care for cardiac patients.

4.3 More Accurate, Non-Invasive and Cost-Effective Diagnostic Test for Coronary Artery Disease Not Widely Used in Ontario Despite Expert Recommendations

Only one Ontario hospital (the University of Ottawa Heart Institute) regularly uses computerized tomography coronary angiogram (CT-Angiogram) to diagnose coronary artery disease, despite evidence and expert consensus that CT-Angiogram is a cost-effective initial test to diagnose coronary artery disease in patients with non-urgent chest pain.

CT-Angiogram is a non-invasive diagnostic imaging test for detecting blockages in the coronary arteries. CT-Angiograms can be performed faster and pose less risk than an invasive cardiac catheterization. Cardiac catheterization involves insertion of a long thin tube called a catheter in an artery or vein in a patient's groin and then threading it through the blood vessels to the patient's heart. Patients who have a CT-Angiogram experience less discomfort and recovery time. As such, the CT-Angiogram has become recognized as a cost-effective, non-invasive alternative, according to various studies and expert recommendations.

In 2010, the Medical Advisory Secretariat, which advises the Ministry, conducted an evidence-based analysis of CT-Angiogram for detecting and

diagnosing patients with intermediate risk of coronary artery disease. The study found that the main value of CT-Angiogram may be in ruling out significant coronary artery disease. However, this study did not result in significant changes to how Ontario hospitals detect and diagnose coronary artery disease.

Since then, CT-Angiogram has become recognized as a more accurate, non-invasive and cost-effective alternative to cardiac catheterization as well as other non-invasive tests according to various studies and expert recommendations. For example:

- In November 2016, the National Institute for Health and Care Excellence in the UK updated its cardiac guidance, calling for CT-Angiogram to be the diagnostic test used first for chest pain patients to assist with the diagnosis of coronary artery disease. The guidance noted that CT-Angiograms provide more benefits than stress testing, which uses ultrasound or other imaging to monitor the function of the heart while exercising. Examples of the benefits of using CT-Angiogram as the first diagnostic test include:
 - the test is able to accurately rule out coronary artery disease more effectively than a stress test: about 97% of the time for CT-Angiogram compared with about 73% of the time for stress testing;
 - the test reduced the need for an invasive cardiac catheterization as a subsequent, or follow-up, test to confirm or rule out coronary artery disease. Almost 24% of patients who underwent a stress test had to undergo cardiac catheterization in order to rule out coronary artery disease while only about 9% of those given CT-Angiograms had to; and
 - the total cost of diagnosing a patient is lower. Administering a CT-Angiogram results in the total costs of diagnosing a patient being about 20% less than a stress test.
- In September 2020, the Journal of the American College of Cardiology published a report that outlined the benefits of a CT-Angiogram-first strategy. The report reflected the expert consensus of attendees at a 2019 American College

of Cardiology Summit on Technology Advances in Coronary Computed Tomography Angiography. The report provided evidence of the benefits from trials in the UK and the US, as well as reports from the clinical trial by the International Study of Comparative Health Effectiveness with Medical and Invasive Approaches. This evidence suggested that a CT-Angiogram-first strategy can improve outcomes and may lower costs for patients with stable chest pain. The UK and the rest of Europe have chosen to change their guidelines as a result of this evidence.

A CT-Angiogram not only allows for a more accurate diagnosis to be made without going through invasive testing, it also costs less than other types of tests, including stress tests and invasive cardiac catheterization, to diagnose coronary artery disease (see **Figure 20**).

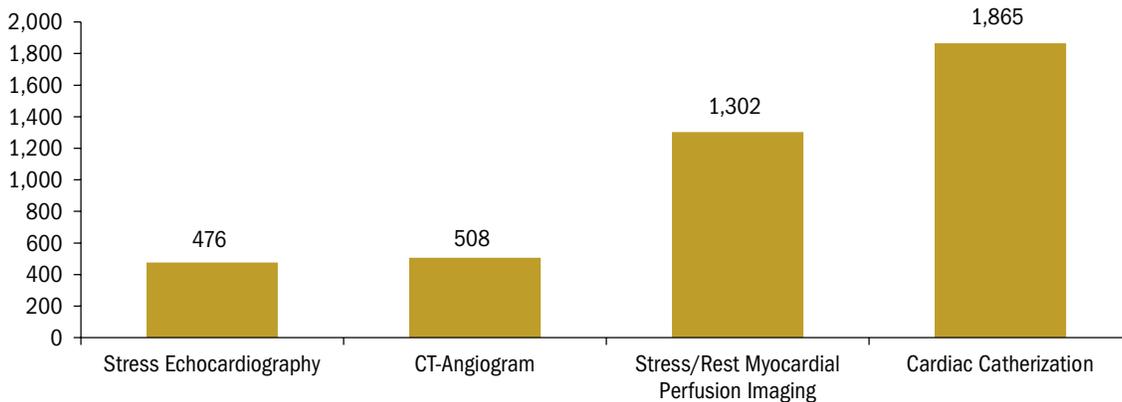
Many hospitals in Ontario have a CT-scanner, which, with the proper software, could be used to perform CT-Angiograms. However, based on information collected by CorHealth and provided by hospitals we spoke with, only the University of Ottawa Heart Institute (UOHI) regularly uses CT-Angiograms to diagnose coronary artery disease. We noted that since 2014, UOHI has regularly used CT-Angiogram to help diagnose (or rule out) coronary artery disease in some of its patients, such as those deemed at a lower-to-intermediate risk of coronary artery disease. UOHI performed CT-Angiograms to rule out coronary artery disease 1,900 times in 2016/17, 1,714 times in 2017/18, 1,194 times in 2018/19, 1,370 times in 2019/20 and 1,943 times in 2020/21.

Thirteen of the 20 cardiac centres responded to our survey question on the use of CT-Angiogram to diagnose coronary artery disease (65% of all cardiac centres). Seven of these 13 centres (54%) reported that CT-Angiograms should be performed to diagnose coronary artery disease. These hospitals identified that this was not currently feasible due to barriers in shifting from other types of diagnostic testing to CT-Angiogram. For example:

- One of the most common barriers identified was the inability to perform a timely CT-Angiogram

Figure 20: Comparison of Cost of Performing CT-Angiogram and Other Coronary Artery Disease Diagnostic Tests (\$)

Source of data: Ministry of Health and University of Ottawa Heart Institute (UOHI)



Note: Total cost incorporates the University of Ottawa Heart Institute's total cost to perform each procedure (not including service contracts on the equipment that perform the tests) as well as Ministry of Health paid fees through the Ontario Health Insurance Plan either to the hospital or the practitioner who performed the test. University of Ottawa Heart Institute's costs were the only hospital included as it is the only hospital in Ontario that uses CT-Angiogram to diagnose coronary artery disease in patients.

because the CT-scanner that could otherwise be used for the CT-Angiograms was needed for other, non-cardiac patients.

- Another barrier relates to the provincial reimbursement system and the relatively more restrictive Ontario Health Insurance Plan (OHIP) funding rules for CT-Angiogram compared with stress testing. For example, for every stress echocardiography, UOHI receives about \$177 from the Ministry through OHIP as part of a technical fee to cover the hospital technician's salary and the capital cost of equipment and overhead, and receives about \$725 and \$703 respectively for every cardiac catherization and stress/rest myocardial perfusion imaging. However, the hospital receives no additional funding when it performs a CT-Angiogram to assist with the diagnosis of coronary artery disease. As a result, the hospitals do not have an incentive to use CT-Angiogram over other diagnostic tests.

Despite benefits to patients and potential cost savings, the Ministry has not taken any further action to encourage hospitals to use CT-Angiograms to diagnose coronary artery disease.

RECOMMENDATION 5

To expand the use of cost-effective diagnostic testing that can reduce the need for more invasive testing to diagnose coronary artery diseases, we recommend the Ministry of Health:

- work with stakeholders (including CorHealth Ontario and Ontario Health) to determine whether computerized tomography coronary angiogram (CT-Angiogram) should be recommended as the primary diagnostic test for certain cardiac patients, such as non-urgent chest pain patients, to help diagnose coronary artery disease; and
- work with hospitals to support the full adoption of CT-Angiogram where deemed appropriate.

MINISTRY RESPONSE

The Ministry appreciates health technology recommendations from the Auditor General, and will work with partners from Health Canada, the Canadian Agency for Drugs and Technologies in Health, the Ontario Health Technology Advisory Committee, and sector partners through the New Technologies Planning Committee run by

CorHealth to make informed and evidence-based decisions on the safe implementation and diffusion of health technologies in Ontario, including on the use of computerized tomography coronary angiogram (CT-Angiogram).

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with this recommendation and continues to work with the Ministry of Health and other system partners to ensure a co-ordinated approach to provincial adoptions, planning and funding of new technologies. The clinical evidence continues to evolve as to which patients are best suited to undergo coronary computed tomography angiography (CCTA) diagnostics versus diagnosis using coronary angiography. CorHealth is currently working with a clinical team at Hamilton Health Sciences on a project that will focus on gaining an understanding of the current wait-times and utilization of CCTA for the detection of coronary artery disease in Ontario. In addition, a review of outcomes from the Hamilton Niagara Haldimand Brant LHIN's CarDIA Study (CCTA to Optimize the Diagnostic Yield of Invasive Angiography in Lower Risk Patients) will be conducted to determine whether this could inform a provincial best-evidence diagnostic pathway using CCTA for low-risk coronary artery disease patients.

4.4 Cardiac Rehabilitation Is Under-used Despite Its Effectiveness in Reducing Deaths and Health-Care Costs

Cardiac rehabilitation is a program of exercise, education and counselling designed to aid recovery after a heart attack or other heart conditions. It is generally provided on an outpatient basis. A lack of centralized tracking or collection of outpatient cardiac rehabilitation data by the Ministry makes it challenging to determine whether all patients who could benefit from cardiac rehabilitation actually receive it, and why patients chose not to participate or dropped-out before completing their prescribed program.

Various studies have shown that participation in cardiac rehabilitation is associated with improved quality of life, reduced mortality, and fewer major adverse cardiac events which, in turn, reduces demand for health-care services and health-care cost. For example, a 2017 study by the University Health Network identified that each cardiac rehabilitation patient that completed at least two-thirds of their program saved the province about \$3,000 per year in health-care costs from a reduction in the need for other health-care services, such as emergency department visits.

While outpatient rehabilitation service providers generally collect information, such as the number of referrals and the number of patients enrolled in the program, there is no requirement to collect or report this information to the Ministry. Due to this lack of centralized tracking, the Ministry and providers do not have useful provincial and regional information to identify areas for improvements to cardiac rehabilitation in Ontario or to determine whether patients complete their prescribed program.

While the Ministry does not regularly collect information on cardiac rehabilitation other than volume of patient visits, we identified studies and asked the six hospitals within our audit scope that are cardiac centres for data on any outpatient cardiac rehabilitation programs they offer. We identified low attendance and completion rates of the programs. For example:

- A study in 2012 that looked at referrals to cardiac rehabilitation at Southlake Regional Health Centre found that less than 45% of referred patients actually attended any cardiac rehabilitation.
- The 2017 University Health Network study found that only 33% of referred patients completed the majority (at least two-thirds) of their prescribed program.
- Thunder Bay Regional Health Sciences Centre reported a 30% attendance rate (of 1,564 referrals, only 473 attended) in 2019 and a 27% attendance rate (of 1,210 referrals, only 328 attended) in 2020. Patients expressed that the main reasons patients did not attend cardiac

rehabilitation was because of their unwillingness to do a six-month program and unwillingness to change their lifestyle.

- University of Ottawa Heart Institute reported that from 2016/17 to 2020/21, its outpatient cardiac rehabilitation program received about 3,200 patient referrals per year but, on average, only about half of those referred actually enrolled in the program. Reasons for refusal include patients not being interested or they did not have time to participate.

In April 2018, the Ministry entered into an agreement with the Canadian Institute for Health Information (CIHI) to support the collection of outpatient rehabilitation data related to hip and knee replacement patients to understand their usage of rehabilitation. CIHI collected data, such as patient condition, services provided, who provided the services, and when the patient left, to understand their usage of rehabilitation and to help make system-wide decisions. However, the Ministry has not sought to collect data about outpatient rehabilitation for cardiac patients. In November 2020, CorHealth began a data strategy to start tracking patient volumes. This strategy was put on pause due to the COVID-19 pandemic but resumed in the summer of 2021/22.

RECOMMENDATION 6

To provide patients with cardiac disease with access to the appropriate amount and the type of rehabilitation that will best meet their needs, we recommend that the Ministry of Health develop and implement a data strategy to begin collecting information on outpatient cardiac rehabilitation to assess why patients with cardiac disease are not completing rehabilitation programs they have been referred to, and take corrective action to increase the adherence rate by raising awareness and understanding through an effective communications strategy.

MINISTRY RESPONSE

The Ministry agrees that rehabilitation is an important aspect of the recovery journey for cardiac patients and will work with partners at CorHealth and Ontario Health to determine next steps for the collection of information from outpatient rehabilitation providers.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with the recommendation and supports efforts to better understand the current state of cardiovascular rehabilitation in Ontario in order to address improvement opportunities. CorHealth has begun to explore with cardiovascular rehabilitation stakeholders the opportunity to advance measurement of cardiovascular rehabilitation in Ontario to support planning, system monitoring and performance measurement. As part of the initial phase, CorHealth will explore the feasibility of data collection for outpatient cardiovascular rehabilitation with its cardiovascular rehabilitation providers and programs.

5.0 Detailed Audit Observations: Stroke Care

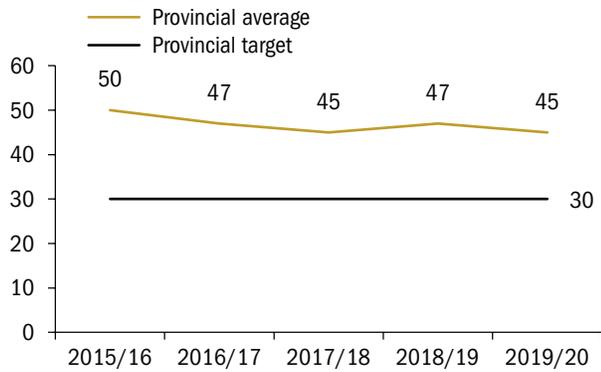
5.1 Emergency Stroke Procedures Not Always Performed on a Timely Basis

5.1.1 Medication to Prevent Permanent Brain Damage for Stroke Patients Frequently Not Administered in a Timely Manner

Strokes require timely interventions to restore blood flow to the brain. According to a 2006 study published in a peer-reviewed medical journal in the United States, every minute an ischemic stroke remains untreated results in nearly two million neurons being destroyed. This quantitative estimate emphasizes the time urgency of stroke treatment, which is often

Figure 21: Door-to-Needle Time for Patients Receiving Tissue Plasminogen Activator (tPA) in Ontario (Minutes), 2015/16–2019/20

Source of data: CorHealth Ontario



Note: At the time of our audit, CorHealth Ontario only received and analyzed data only up to 2019/20.

spoken of as “time is brain” because permanent damage accumulates the longer a stroke progresses.

Tissue plasminogen activator (tPA) is a clot-dissolving intravenous drug used to restore blood flow in the treatment of ischemic stroke. The Ministry and Health Quality Ontario Clinical Handbook for Stroke recommends that all patients with acute ischemic stroke who can be treated within 4.5 hours of symptom onset should be evaluated to determine their eligibility for treatment with intravenous tPA.

Numerous studies over the past 25 years in peer-reviewed medical journals, including ones published in the *Journal of the American Medical Association*, the *Journal of the American Heart Association*, and *The Lancet*, show that tPA reduces the risk of disability and death following an ischemic stroke. For example, a 2012 study published in *The Lancet* concluded that 42 more individuals per 1,000 are alive and independent as a result of receiving tPA compared to those who did not receive it, and that the benefits of tPA were greatest for those who received it within three hours of symptom onset.

CorHealth adopted a provincial target—referred to as the “door-to-needle” time—for patients to receive tPA within 30 minutes of arrival at one of the 47 hospitals in the province that provide this

treatment. This target is based on the national target established in the Canadian Stroke Best Practice Recommendations, whose development were led by Heart & Stroke. While the actual provincial median for door-to-needle time has improved somewhat over the last five years (from 50 minutes in 2015/16 to 45 minutes in 2019/20), the median still remains well above the 30-minute target (see **Figure 21**).

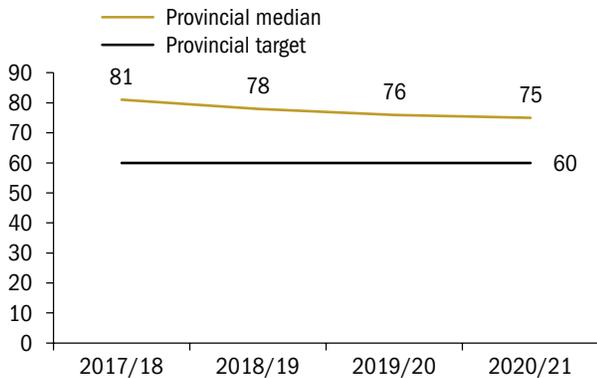
Of the 47 hospitals that provide tPA treatment, only one hospital (Kingston Health Sciences Centre) has ever achieved the 30-minute door-to-needle target and it did so consistently from 2017/18 to 2019/20, which was the last year of data available at the time of our audit. All the other hospitals experienced challenges that prevented them from meeting the 30-minute door-to-needle target.

For example, Health Sciences North acknowledged that it has faced some challenges in meeting hyper-acute stroke care performance timelines. One reason identified was its limited human resources; specifically, having only one stroke neurologist available. Despite its constraints, Health Sciences North prioritized its acute stroke care through a 2018/19 quality improvement initiative that led to revised protocols to reduce variation in processes and care. This initiative contributed to reducing door-to-needle time for tPA by about 15 minutes compared with prior performance. Even with these improvements, meeting the 30-minute target consistently may continue to be difficult without an expansion in human resources dedicated solely to stroke.

Rapid tPA treatment is critical because tPA can be provided only within 4.5 hours of stroke symptom onset. The more time that elapses before a patient arrives at a hospital that provides tPA, the shorter the time that hospital has to administer it. If the patient is too far from a hospital, the window could be missed before the patient reaches an appropriate hospital. In our correspondence with hospitals, we identified patients who could not be treated with tPA in time because it took too long to reach a hospital that is capable of providing tPA. **Appendix 8** provides stories of patients impacted by delays for tPA treatment.

Figure 22: Provincial Median Arrival-to-Arterial Puncture Time for Endovascular Thrombectomy (EVT) Patients (Minutes), 2017/18–2020/21

Source of data: CorHealth Ontario



Note: Because of the lag in reporting, the results for the third and fourth quarter of 2020/21 were not available at the time of our audit. Therefore, the 2020/21 value is based on the results of the first two quarters only.

5.1.2 Emergency Procedure to Treat Strokes Generally Not Performed within Provincial Treatment-Time Targets, Raises Potential Risks to Patients

Apart from administering tPA medication, certain properly equipped hospitals may also provide an endovascular thrombectomy (EVT) procedure for some ischemic stroke patients based on their symptoms and the results of diagnostic imaging.

EVT is a procedure that physicians can perform on ischemic stroke patients to remove a blood clot. In an EVT, the physician uses a catheter inserted in the patient’s groin to access and physically remove the clot from a large vessel in the brain that is causing the stroke. The procedure was performed in Ontario over 1,000 times in 2019/20 and almost 490 times in the first half of 2020/21. Currently, only 11 hospitals in Ontario are equipped to perform EVT procedures (see **Appendix 1**).

CorHealth adopted a provincial target time within which an EVT procedure is initiated. Because an EVT involves a physician puncturing the patient’s groin to insert a catheter, the target is referred to as “arrival-to-arterial puncture.” The target is for the patient’s artery to be punctured within 60 minutes

of arrival at an EVT-capable hospital. The target is based on a national benchmark established in 2016 by Heart & Stroke. While the provincial median arrival-to-puncture time has improved slightly over the last few years, it still remains well above the 60-minute target (see **Figure 22**). Delays in timely care can lead to permanent brain damage or death. **Appendix 8** provides stories of patients impacted by delays for EVT treatment.

Similar to its performance regarding the door-to-needle target related to administration of tPA, of the 11 Ontario hospitals that are equipped to perform EVT, Kingston Health Sciences Centre is the only hospital that has met the arrival-to-arterial puncture target for each year tracked.

RECOMMENDATION 7

To provide emergency care to stroke patients in a timely manner, we recommend that the Ministry of Health:

- direct CorHealth to analyze the critical success factors, and identify the best practices, of hospitals that routinely perform better than the provincial average for the administration of tissue plasminogen activator (tPA) and the performance of endovascular thrombectomy (EVT); and
- require other hospitals to implement the identified best practices from above where possible, and monitor performance to determine whether these practices are being effectively implemented.

MINISTRY RESPONSE

The Ministry receives reporting from CorHealth on performance measurement for stroke hospitals and participates in quarterly calls that CorHealth leads with QBP-funded stroke programs to discuss volume and quality management. The Ministry and CorHealth will engage in these activities to improve administration of tPA and performance of

EVT as well as to encourage the collection and distribution of best practices to relevant hospitals.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth Ontario supports this recommendation and is committed to ensuring performance measurement, monitoring and engagement with the Regional Stroke Networks and hospitals to enable delivery of high quality, including timeliness, stroke care across the province. CorHealth will continue to provide a platform for regular measurement and monitoring of key quality metrics for hyperacute stroke treatment, and to support dialogue and share learnings across the province. The indicators and reports supporting the discussions facilitate the sharing and dissemination of best practices and improvement strategies locally and provincially.

5.2 Patients May Not Go to Hospitals Well-Equipped for Stroke Treatment

5.2.1 Many Patients with Stroke Symptoms Do Not Call An Ambulance, Causing Delay in Timely Treatment

A limited number of hospitals in Ontario are designated stroke centres and/or have designated stroke units that are better equipped to provide appropriate treatment and care to stroke patients. In 2019/20, over 40% of people with stroke symptoms went to a hospital without the assistance of an ambulance. In 2019/20, about 30% of stroke patients presented to hospitals where paramedics generally would not transport stroke patients. In some cases, these patients are transferred to another hospital for appropriate treatment and care.

Hospitals that Are Designated Stroke Centres

As noted in **Appendix 1**, only 28 hospitals in Ontario are designated stroke centres, meaning that they are best equipped to provide stroke treatment and care. Since 2005, Stroke Bypass protocols have been in place for use by paramedics in Ontario. Under

the protocols, when an individual shows signs of an acute stroke, rather than taking them to the nearest hospital, paramedics transport them to the nearest specialized stroke hospital. If a stroke patient is not taken to hospital by ambulance, such as when a family member takes them, they typically simply go to the closest hospital, which may not be able to provide the treatment needed to reverse or stop the stroke. This happens because many people are not aware of which hospitals are better equipped to provide stroke care.

The number of stroke patients arriving at hospital by ambulance has remained stable over the last five years. For example, in 2015/16 about 58% arrived by ambulance and in 2019/20 just over 59% did. This means that more than 40% of stroke patients arrived at hospital without being screened and assessed by paramedics for stroke symptoms to ensure they go to the closest stroke centre.

Of all emergency department visits for stroke reasons in 2020/21, we noted that about 30% of patients (over 11,900) presented to hospitals that are not stroke centres and do not participate in the Ontario Telestroke Program (see **Section 5.3.2**). If a patient arrives at a hospital that does not have a stroke centre, they have to be transferred to a stroke centre to receive appropriate care. Such transfers may result in delays in providing timely stroke care.

In 2019/20, there were over 730 transfers of patients with stroke symptoms to a stroke centre. They had arrived without assistance from an ambulance at a hospital that is not a stroke centre and does not participate in the Ontario Telestroke Program. As discussed in **Section 5.1.1**, stroke requires fast intervention to restore blood flow to the brain because time-is-brain. Any delay in receiving stroke care can result in significant negative long-term consequences, such as disability, and increases the likelihood of death.

Hospitals with Designated Stroke Units

Although most Ontario hospitals are not designated as stroke centres, some hospitals have set up a designated stroke unit with beds attended to by an interprofessional team who specialize in treating

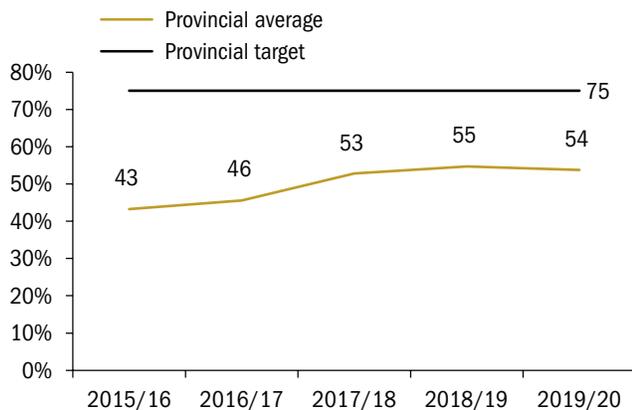
stroke patients. Including the 26 hospitals with stroke centres, there are 40 hospitals in Ontario that have designated stroke units. If a hospital does not have a designated stroke unit, stroke patients may be placed in a general ward bed that is attended to by staff who do not specialize in stroke care.

Stroke patients treated in a designated stroke unit have better recoveries than patients who are treated in the general ward. For example, a study published in an American Heart Association journal identified that receiving treatment and care in a stroke unit was associated with better patient outcomes, which included a 21% reduction in in-hospital mortality, 18% lower mortality one-year after the stroke and 16% increase in the chance that a patient could be discharged home, rather than needing continued care in a facility such as at a long-term care home.

Per CorHealth targets, more than 75% of stroke patients should be treated in a designated stroke unit. While the percentage of Ontario patients treated in designated stroke units increased over the last five years, from 43% in 2015/16 to 54% in 2019/20, the province has not met the 75% target (see **Figure 23**). In 2019/20 the percentage of patients treated on designated stroke units was over

Figure 23: Percentage of Stroke Patients Treated in a Designated Stroke Unit, 2015/16–2019/20

Source of data: CorHealth Ontario



Note: CorHealth Ontario has collected and analyzed information on this indicator only through 2019/20.

72% at stroke centres and under 24% at non-stroke centre hospitals. As identified above, the majority of patients who arrived at hospitals that are not stroke centres or that do not participate in the Ontario Telestroke Program did not ultimately get transferred to a stroke centre. Hospitals informed us this was because the patient did not require acute stroke treatment by the time they presented at the hospital and it was therefore determined that transfer to a stroke centre was not necessary.

If more patients called an ambulance when stroke symptoms occurred, it is likely that they would have been transported directly to a facility that would have been able to provide care in a stroke unit.

5.2.2 Provincial Support for Stroke Awareness Program Stopped, Despite Its Effectiveness in Increasing Public Understanding

Since 2003/04, the Ministry has intermittently funded Heart & Stroke’s media campaigns aimed at delivering materials and information about the signs of stroke to the public through television, radio, digital media and social media channels. The campaigns are designed to increase the public’s understanding of stroke symptoms and awareness of the need to call an ambulance when a stroke appears to be occurring. In 2014/15, Heart & Stroke revised its campaign materials to adopt the internationally recognized “FAST” signs of stroke acronym (see **Figure 24**). The FAST campaign is intended to raise public awareness of key stroke symptoms and of the need for quick action in the event of stroke.

The Ministry provided Heart & Stroke about \$700,000 in 2017/18 and \$1 million in each of 2018/19 and 2019/20 to run the FAST campaign in Ontario, but in 2020/21 the Ministry stopped providing funding for the campaign.

Heart & Stroke identified that in each of 2018/19 and 2019/20, there were about 52 million viewings of the FAST campaign in Ontario. Without Ministry funding, Heart & Stroke was able to run only a small campaign in June 2021 using donations.

In 2018/19 Heart & Stroke performed online polling of 1,000 Ontarians to determine the effectiveness of its annual FAST campaign. The poll result showed that people who recalled seeing the FAST campaign were six times as likely to identify all three symptoms of stroke (see **Figure 24**) compared with people who did not recall seeing the campaign materials. In contrast, Heart & Stroke informed us that since 2015/16, the BC government has provided consistent funding for FAST campaigns in that province.

The Ministry informed us that it is currently conducting work to develop a co-ordinated provincial approach to promote health, prevent chronic disease and improve health outcomes for those living with chronic disease as part of a broader public health sector modernization plan; however, this work has been postponed due to the COVID-19 pandemic.

Figure 24: Heart & Stroke FAST Campaign Elements

Source: Heart & Stroke

Learn the signs of stroke

- F**ace is it drooping?
- A**rms can you raise both?
- S**peech is it slurred or jumbled?
- T**ime to call 9-1-1 right away.

Act **FAST** because the quicker you act, the more of the person you save.

© Heart and Stroke Foundation of Canada, 2017

5.3 Program Changes Are Needed to Provide Patients with Timelier Access to Appropriate Stroke Treatment and Care

5.3.1 Emergency Stroke Procedures Performed on Fewer than Target Number of Patients

As discussed in **Section 5.1**, tPA and EVT are two key emergency stroke procedures. However, they are not provided to the target number of patients who could benefit from these procedures.

Volume of tPA Medication Administered Improved, but Still Slightly Below Provincial Target

Per CorHealth targets, 12% of ischemic stroke patients should receive tPA. The percentage of ischemic stroke patients that received tPA was 10.9% in 2015/16 versus 11.7% in 2019/20 (an increase from about 1,850 patients to about 2,110 patients). These numbers are now almost at the provincial target of 12% (see **Figure 25**).

We also noted that the availability and administration of tPA varies by hospital. Forty-seven hospitals (28 hospitals designated as stroke centres and 19 of the 112 additional hospitals in Ontario) administer tPA.

To ensure effectiveness, tPA must be administered within 4.5 hours of the onset of a stroke to eligible patients (see **Section 5.1.1**). Hospitals that do not administer tPA themselves should screen and select for eligible patients and transfer them to a hospital that does administer it. This additional transfer can result in delay, making it harder to provide the medication within the required treatment time window. We noted that in 2019/20, there were almost 450 stroke patients were transferred from a hospital that does not administer tPA to one that does administer it.

Best Practice Target for Performance of EVT Procedures Not Met

The number of Ontario ischemic stroke patients who receive EVT is about half the number of ischemic stroke patients who could be expected to be candidates for EVT.

Research on EVT has identified that more than 10% of ischemic stroke patients would be suitable candidates for the treatment. For example, a 2016 study published in an American Heart Association journal estimated that 10.5% of patients arriving within six hours of their stroke to a comprehensive stroke hospital would be suitable for EVT. Additionally, Canadian Stroke Best Practice Recommendations identify that a reasonable starting target is more than 10% of all ischemic stroke patients receiving EVT. The target can be modified based on local factors or circumstances.

Ontario’s performance has improved, but it is still quite far from providing EVT to 10% or more of ischemic stroke patients. While the proportion of ischemic stroke patients in Ontario who received EVT increased from 3.8% in 2017/18 to 5.6% in the first two quarters of 2020/21, it is still below the 10% target (see **Figure 26**). In contrast, Ontario’s percentage is lower than the Alberta rate of 7.8% of patients receiving EVT in 2020/21 (7.9% of Alberta patients received it in 2019/20).

Based on our discussions with hospitals we contacted, we identified the following main reasons that hospitals are unable to perform EVT on more ischemic stroke patients:

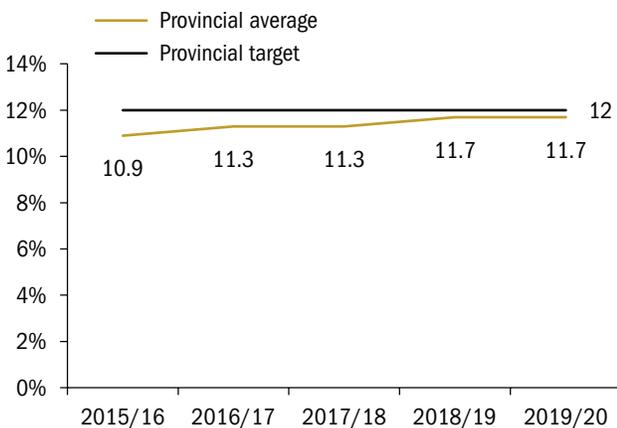
- CT-Perfusion imaging, which helps identify all appropriate patients who should receive EVT, is available only at a limited number of hospitals (see **Section 5.4.1**).
- Patients do not arrive at an appropriate hospital within six hours of the stroke onset (see **Section 5.2**).
- Some hospitals, especially those in Northern Ontario, lack necessary health human resources, such as stroke neurologists, to perform EVT 24/7 so they have to transfer patients to hospitals that can perform EVT more readily.

5.3.2 Calls to Ontario Telestroke Increased 90% in Four Years, but Sustainability of Program is in Jeopardy

The Ontario Telestroke Program (Telestroke) was established in 2002 to provide 24/7 access to emergency stroke treatment for patients living in rural and remote areas of the province that do not have local stroke neurology expertise. Telestroke uses a two-way video conferencing platform and image transferring system to allow stroke neurologists to assess patients visually and offer treatment recommendations to emergency department physicians

Figure 25: Percentage of Ischemic Stroke Patients Receiving Tissue Plasminogen Activator (tPA) in Ontario, 2015/16–2019/20

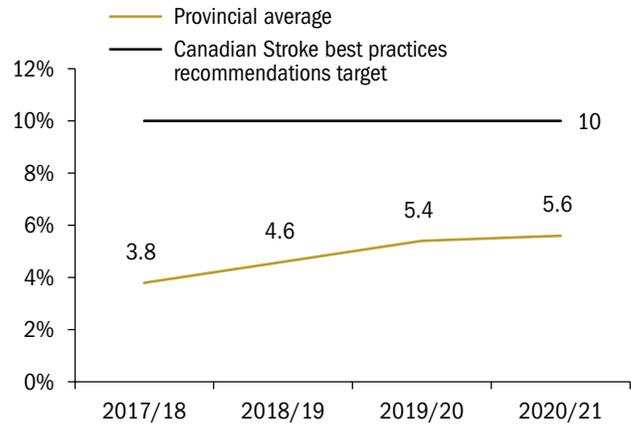
Source of data: CorHealth Ontario



Note: At the time of the audit, CorHealth Ontario had only received and analyzed data up to 2019/20.

Figure 26: Percentage of Ischemic Stroke Patients Receiving an Endovascular Thrombectomy (EVT) Procedure in Ontario, 2017/18–2020/21

Source of data: CorHealth Ontario



Note: CorHealth Ontario started collecting data on this measure in 2017/18. Data for 2020/21 is for the first two quarters only because that is the latest data available at the time of our audit.

virtually. At the time of our audit, there were 32 active Telestroke referring sites that receive consulting support by Telestroke neurologists. This number is expected to grow to 34 by March 31, 2022. Overall, while Telestroke's usage is growing, the number of participating stroke neurologists is not. This fact calls into question the sustainability of the program moving forward.

Telestroke relies on stroke neurologists to identify days when they can devote themselves to the program. When providing Telestroke services they must be prepared to respond to any calls received for an entire 24-hour period. At the time of our audit, there were about 57 stroke neurologists in Ontario. As shown in **Figure 27**, the number of calls received through Telestroke increased almost 90% between 2016/17 and 2019/20 from about 1,600 calls to over 3,000 calls. In the same period, the number of so-called primary stroke neurologists those who work, on average, at least 12 shifts for Telestroke per year remained almost unchanged at about 13 to 15. In 2020/21, despite COVID-19 impacting hospital operations, both call volume and the number of primary stroke neurologists remained fairly consistent.

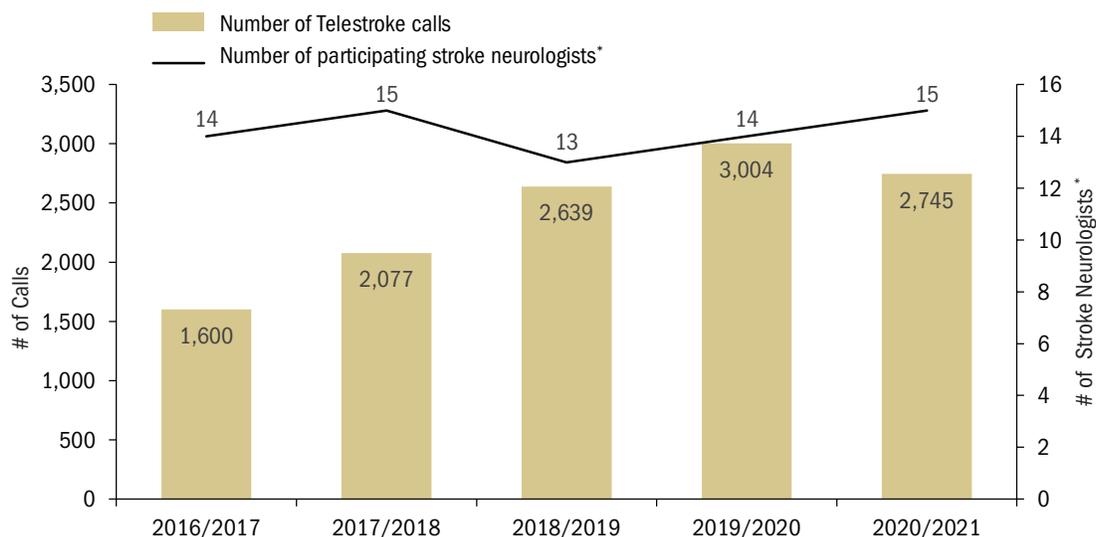
Stroke neurologists we spoke with who are currently participating in Telestroke indicated that the growth in call volume has made it harder for them to continue their participation in the program. They handle, on average, eight calls per shift, with each taking about 60 minutes, in comparison with less than five calls per shift in 2016/17. They indicated that the frequency and complexity of Telestroke calls prevents them from being able to schedule any other clinical activities at their own hospitals when they are on-call at Telestroke. They also indicated that, given the relatively small number of participating neurologists, they doubt the program's ability to continue operating. For example, between 2016/17 and 2019/20, each of the participating stroke neurologists did, on average, 37 shifts per year (including shifts as either the primary or the back-up responder), which amounts to about three shifts per month.

Based on our review of the following analyses done by CorHealth, we noted that compensation is the main reason for low participation of stroke neurologists in Telestroke:

- In May 2020, CorHealth compared stroke neurologists' compensation from Telestroke to their compensation from a typical clinic day. CorHealth

Figure 27: Number of Ontario Telestroke Program Calls and Number of Participating Stroke Neurologists, 2016/17–2020/21

Source of data: Ontario Telemedicine Network



* Only includes stroke neurologists who participated in at least 12 shifts during the year.

found that in 2018/19, Telestroke neurologists were compensated about \$113 less per hour than they would make doing their routine work.

- In June 2020, CorHealth performed a review of Telestroke and concluded that the compensation for neurologists participating in the program was not competitive with other similar remote assistance programs. Primary neurologists participating in Telestroke received \$850 for each 24-hour shift with about eight calls per shift. This is significantly less than the compensation provided under the following similar programs:
 - Ontario's Trauma and Burns Program, which is a regional trauma program where physicians respond to inquiries from other physicians through CritiCall, pays about \$1,000 to \$1,300 per day for an average of only three calls per day.
 - Virtual Critical Care Response Models, which offers critical care services to hospitals in the North Ontario Health Region, pays \$1,560 per day for an average of two calls per day.

RECOMMENDATION 8

To allow for all stroke patients to receive appropriate care in a timely manner, we recommend that the Ministry of Health:

- direct CorHealth to identify the barriers and initiatives to increase the percentage of stroke patients receiving tissue plasminogen activator (tPA) and endovascular thrombectomy (EVT) across the province and implement a plan to achieve the target rates;
- work with CorHealth to develop or provide supports to initiatives or programs (such as funding the FAST campaign run by Heart & Stroke) that increase public awareness of stroke symptoms and appropriate actions (such as the need to call an ambulance) if symptoms of a stroke are occurring;
- evaluate what additional changes (if necessary) are needed to achieve the target percentage of stroke patients treated on stroke units and implement those actions; and

- work with stakeholders, including CorHealth and stroke neurologists, to identify any changes needed, such as changes to the stipend offered to neurologists, to encourage more stroke neurologists to participate in Telestroke.

MINISTRY RESPONSE

The Ministry agrees with the recommendation and supports CorHealth with stroke quality work. Additionally, Telestroke is an important partner in providing high-quality stroke care to all patients in Ontario, and the Ministry continues to work with CorHealth on improving the program. The Ministry will determine the most appropriate way to increase awareness of stroke symptoms and appropriate actions if symptoms of a stroke are occurring and fund such initiatives.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth supports the recommendation and continues to work with the Ministry of Health to ensure stroke patients receive appropriate care in a timely manner. CorHealth in partnership with the Ministry of Health work with stroke regional networks and clinical and administrative leaders to review access to hyperacute services and monitor EVT performance. CorHealth meets with programs to understand contributing factors associated with performance variation. Recognizing that programs are in different states of adoption and expansion of EVT, CorHealth developed a mechanism to support dialogue and share learnings across the province. CorHealth recognizes the importance of increasing public awareness of stroke symptoms to impact survival and better recovery for stroke patients. CorHealth will continue to provide support through its partnerships to support initiatives and programs that drive increased public awareness.

CorHealth agrees that strengthening the Telestroke program in Ontario is a key factor in ensuring patients have equitable access to stroke care. CorHealth will continue to work

with its clinical and system stakeholders to identify improvement opportunities to sustain this valuable resource to Ontarians suffering a stroke. Timely and appropriate access to stroke unit care is also critical to sustain the benefit of any hyperacute treatment and to facilitate recovery and secondary prevention following stroke. CorHealth is undertaking a multi-year initiative to support enhanced access to this essential best practice further supporting better outcomes for patients after stroke.

5.4 Effective Diagnostic Test Can be Expanded Provincially to Determine Appropriate Treatment for More Stroke Patients

Computerized tomography perfusion (CT-Perfusion) imaging is a diagnostic test that can help determine whether ischemic stroke patients are candidates for EVT. Though CorHealth identified 44 hospitals it believed should have CT-Perfusion imaging software, as of July 2021 only 16 of them do and are currently using it.

CT-Perfusion uses X-ray equipment—a CT scanner—to show a patient’s blood flow to the brain and to help health-care practitioners determine the amount of brain tissue that can be recovered if the blood clot is removed. The results of a CT-Perfusion test help the physician determine whether a patient would benefit from the use of EVT, particularly patients who are closer to the end of the 24-hour window from initial stroke onset.

As noted in **Section 5.1.2**, only 11 hospitals in Ontario are equipped to perform EVT procedures. As of July 2021, of these 11 hospitals, only eight of them also perform CT-Perfusion tests (see **Figure 28**).

EVT is most effective and useful when it is performed fairly soon after stroke onset. The Canadian Stroke Best Practice Recommendations identify the time frame within which an EVT should be performed to achieve optimal outcomes. These recommendations were updated in 2018 when it was identified that while performing an EVT within six hours of stroke onset is the preferred time frame, performing EVT within 24 hours of stroke onset is still beneficial for certain patients.

We spoke with all eight hospitals that perform both CT-Perfusion tests and EVT procedures. They

Figure 28: Use of Computerized Tomography Perfusion (CT-Perfusion) by Hospitals/Hospital Groups Able to Perform Endovascular Thrombectomy (EVT)

Sources of data: CorHealth Ontario

11 Hospitals/Hospital Groups that Can Perform EVT	Performs CT-Perfusion?
Hamilton Health Sciences Corporation	✓
Health Sciences North	×
Kingston Health Sciences Centre	✓
London Health Sciences Centre	✓
Sunnybrook Health Sciences Centre	✓
The Ottawa Hospital	✓
Thunder Bay Regional Health Sciences Centre	×
Trillium Health Partners	×
Unity Health Toronto	✓
University Health Network	✓
Windsor Regional Hospital	✓
Number of Above-Listed Hospitals/Hospital Groups that Perform CT-Perfusion	8

Note: Information is as of July 2021.

identified that one of the main benefits of CT-Perfusion is the fact that it can help assess a patient's suitability for EVT more than 12 hours past the onset of their stroke. According to these hospitals, decisions about whether to obtain CT-Perfusion software were made by the hospital.

If a stroke patient arrives within 24 hours of the onset of their stroke at a hospital that does not perform CT-Perfusion, the patient may be transferred to a hospital that does CT-Perfusion imaging. Such transfers can result in delayed treatment. For example, in 2019/20, there were more than 500 transfers of patients from hospitals that do not offer CT-Perfusion to those that do offer CT-Perfusion and also perform the EVT procedure. We also noted instances where a hospital that performs EVT but does not offer CT-Perfusion imaging has to transfer patients to another hospital to have the imaging performed. For example, in 2020/21, Trillium Health Partners transferred four patients to other Greater Toronto Area hospitals to have a CT-Perfusion performed.

We also spoke with hospitals that do not have the necessary software and human resources to perform CT-Perfusion. These hospitals indicated that while they were aware of the value of CT-Perfusion, the hospitals have not prioritized the use of CT-Perfusion against other hospital priorities at this time. Some of these hospitals also identified a concern that staff resources needed to perform CT-Perfusion or to assess the results of CT-Perfusion could be limited, making it hard to use the technology effectively. Some hospitals indicated that they have been actively looking into performing CT-Perfusion in the future.

Of the 44 hospitals that CorHealth identified should use CT-Perfusion, only 16 of them have been doing so. CorHealth is working to expand use of CT-Perfusion to the remaining 28 hospitals it believes have the necessary imaging equipment (CT scanners) but that need the CT-Perfusion software. This would help reduce the number of patient transfers between hospitals to receive the necessary imaging and treatment. This is because, while many of these hospitals do not perform EVT, they regularly receive

and assess stroke patients for appropriate treatment and would therefore benefit from knowing which patients are best suited to transfer to another hospital to receive EVT. In February 2021, CorHealth engaged Mohawk-Medbuy Corporation and Plexxus, which are not-for-profit health supply chain services organizations, to discuss procurement opportunities for CT-Perfusion technology for hospitals that have a role supporting hyperacute stroke treatment (such as hospitals that refer patients for EVTs and hospitals that perform EVTs). Plexxus estimated that hospitals will enter into contracts with the preferred vendor by the end of 2021/22 to allow for more widespread purchasing of CT-Perfusion provincially.

RECOMMENDATION 9

To provide stroke patients with timely access to diagnostic testing that will allow them to receive the most appropriate type of care, we recommend that the Ministry of Health direct CorHealth to:

- complete its procurement of computerized tomography perfusion (CT-Perfusion) imaging technology for all eligible hospitals and provide support to identify and address any barriers that prevent hospitals from using or accessing CT-Perfusion; and
- continue to monitor the need for CT-Perfusion among other hospitals provincially and work with the hospitals to obtain the CT-Perfusion technology.

MINISTRY RESPONSE

The Ministry is supportive of the recommendation and will continue to receive updates from CorHealth on the progress of this initiative related to procurement of CT-Perfusion imaging technology to ensure stroke patients with timely access to diagnostic testing that will allow them to receive the most appropriate type of care.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with the recommendation and continues to work with supply chain

services organizations to procure CT-Perfusion imaging technology for all eligible hospitals in Ontario. CorHealth will engage with Regional Stroke Networks to encourage selected hospitals to participate and identify potential barriers and factors that enable adoption of this new imaging process.

5.5 Not All Stroke Patients Have Timely Access to Appropriate Amount, Type of Rehabilitation Services

5.5.1 Amount of Inpatient Stroke Rehabilitation Is Well Below Best Practice Recommendation

Ontario has adopted a benchmark for the number of daily minutes of therapy provided in inpatient rehabilitation. It is based on a best practice recommendation included in the Canadian Stroke Best Practice Recommendations that was updated in 2019: “Once deemed to be medically and neurologically stable, patients should receive a recommended three hours per day of direct task-specific therapy, five days a week, delivered by the interdisciplinary stroke team; more therapy results in better outcomes.”

This recommendation was informed by studies that showed that people who got at least three hours of inpatient rehabilitation following a stroke had improved function compared to those who received less than three hours a day. This would be a combined 180 minutes of physiotherapy, occupational therapy, and speech language pathology. The median amount of inpatient rehabilitation patients receive has increased from about 57 minutes per day in 2015/16 to 69 minutes per day in 2019/20; however, this is still significantly below the best practice recommendation of 180 minutes (see **Figure 29**). Among inpatient stroke rehabilitation facilities that serve 40 or more patients during the year, the amount of therapy provided varied significantly in 2019/20, from 22 minutes per day to almost 110 minutes per day. **Appendix 9** identifies providers

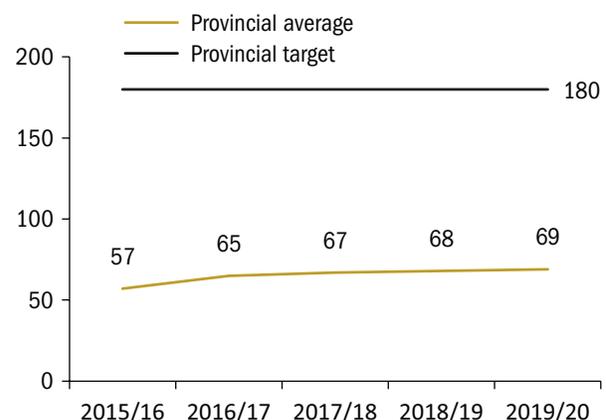
that provided the most and least amount of rehabilitation time per inpatient in 2019/20.

Inpatient rehabilitation providers informed us that a staffing shortage was the main challenge to providing three hours of rehabilitation per patient per day. They also identified the variation in patient needs and targets as another challenge, given that if a patient does not need one type of therapy, such as speech language therapy, another type of therapy must be provided to make up the time. Others noted that, though nurses and rehabilitation assistants may be providing therapy services to a patient, a maximum of one-third of their time may count toward the total rehabilitation intensity time. The remaining two-thirds of the 180-minute rehabilitation target time is required to be provided directly by physiotherapists, occupational therapists, and speech language pathologists.

However, we identified some providers that have found ways of increasing the amount of inpatient rehabilitation they provide without increasing their staffing. For example, St. John’s Rehabilitation in Toronto, which provides an average of about 110 minutes of inpatient rehabilitation per day, schedules shorter rehabilitation sessions for

Figure 29: Minutes of Inpatient Rehabilitation Services Received by Stroke Patients Per Day, 2015/16–2019/20

Source of data: CorHealth Ontario



Note: CorHealth Ontario has collected and analyzed information on this indicator up to 2019/20.

patients with the most severe and complex strokes several times a day, rather than fewer long sessions per day. This ensures that staff time with patients is used optimally because patients are less likely to tire in a shorter session. This type of scheduling could be adopted by other providers to increase the amount and efficiency of the therapy.

5.5.2 Publicly Funded Physiotherapy Services Provided in Community Clinics Not Available to All Ontarians Aged 20 to 64

Patients who have been hospitalized as a result of a stroke generally have a defined pathway to obtaining rehabilitation services. However, patients who suffer a stroke that does not require hospitalization may be declined community physiotherapy services, even if they require them.

Historically, stroke patients aged 20 to 64 who were not hospitalized because their stroke resolved without needing additional acute care, were not all eligible for publicly funded physiotherapy when provided in a community physiotherapy clinic, even though physiotherapy is a common service provided to other stroke patients. To address this, *Bill 9, Improving Post-Stroke Recovery for All Act, 2016* was passed and received royal assent, and the *Ministry of Health and Long-Term Care Act* was amended in 2016 to set out an additional function for the Minister to “oversee and promote an evidence-based approach to the provision of physiotherapy services for post-stroke patients of all ages.”

However, the Ministry still provides funding for physiotherapy delivered in community physiotherapy clinics only to stroke patients who are under the age of 20 or over the age of 64, or if they are admitted to the hospital. So, any adult stroke survivor aged 20 to 64 who is not admitted to hospital is not eligible for publicly funded physiotherapy from community physiotherapy clinics. Based on our discussion with five community physiotherapy clinics, they confirmed that they do receive referrals for patients who fit this description, but they also noted that denying services to such patients also happens “quite often,” in which

case the patients either have to pay out of their own pocket for physiotherapy, use private insurance to cover the cost of the service or go without service.

In 2019/20, 12,361 patients between the ages of 20 and 64 presented to the emergency departments with a stroke condition. This represented 31% of all patients presenting to emergency departments with a stroke condition. Of these 12,361 patients, 7,182 (64%) were not admitted to the hospital, making them ineligible to receive publicly funded post-stroke physiotherapy at community physiotherapy clinics. While not all of these patients may have required physiotherapy services, we are aware of instances where such patients attempted to receive these services at community physiotherapy clinics and were rejected.

The Ministry informed us that adults aged 20 to 64 have more social power, economic independence, and access to resources than children and seniors, and that, while the *Canada Health Act* does not require provinces to fund physiotherapy services outside hospital settings, Ontario has chosen to provide coverage, but limited to patients under 20 or older than 64 years old.

RECOMMENDATION 10

To provide stroke patients with access to appropriate amounts and types of rehabilitation that will best meet their health needs, we recommend that the Ministry of Health:

- work with stakeholders, including CorHealth and rehabilitation providers, to understand challenges in meeting the best practice of providing 180 minutes of inpatient rehabilitation per day;
- take the appropriate action to address these identified challenges; and
- fund physiotherapy services for all stroke patients who need it, regardless of age.

MINISTRY RESPONSE

The Ministry is supportive of the recommendation. The Ministry recognizes the importance of

timely and appropriate amounts of stroke rehabilitation, including physiotherapy, and will work with CorHealth and Ontario Health on next steps.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with the recommendation and acknowledges the importance of rehabilitation intensity in the overall recovery for individuals who suffer a stroke. This attention to intensity should extend beyond inpatient rehab to include community-based programs (in home and outpatient) including early supported discharge models where appropriate. CorHealth will continue to work with the Ministry of Health when requested on the development of provincial standards or programming for inpatient and community-based settings (home and outpatient) in alignment with best practice.

6.0 Detailed Audit Observations: Co-ordination, Oversight and Funding for Cardiac Disease and Stroke Care

6.1 Hospital Beds Are Taken Up by Cardiac and Stroke Patients Who No Longer Require Hospital Acute Care

Patients who no longer require the acute care provided at a hospital may require ongoing care at a different setting, such as their home, inpatient rehabilitation or a long-term-care home, that is better suited to meet their specific care needs. If a bed is not available or transportation to these settings is delayed, the patient will remain in hospital and is deemed Alternate Level of Care (ALC). Patients will remain in hospital as a patient deemed ALC until they are transferred to the more appropriate setting to meet their specific care needs.

In 2019/20, out of about 128,800 cardiac patients, over 5,300 were deemed ALC. These patients received about 82,260 days of additional acute hospital care at an estimated cost of over \$126 million to Ontario hospitals. In the same year, out of about 22,200 stroke patients, over 3,500 were deemed ALC, and they received about 62,520 days of additional acute hospital care at an estimated cost of over \$80 million to Ontario hospitals.

When patients deemed ALC occupy acute care hospital beds, other patients who need hospital care may be unable to be admitted to a bed. This is especially concerning, given that Ontario generally has fewer hospital beds compared with most other Canadian provinces and territories and compared with member countries of the Organisation for Economic Co-operation and Development (OECD). The OECD, an international organization where member countries discuss and develop economic and social policy, tracks the number of hospital beds per thousand people in each member state. In 2019, Ontario had fewer hospital beds per thousand people than all other Canadian provinces and territories with available information except for Yukon (see **Appendix 10**), and fewer than 31 of the 36 OECD member countries that provided data (see **Appendix 11**).

The Ministry does not collect information to identify the specific type of facility each individual cardiac and/or stroke patient is waiting for. But hospital staff informed us that patients deemed ALC are typically waiting to be transferred home (with or without continued support) or for facilities that provide inpatient rehabilitation or long-term care. According to data provided by the Ministry, the average daily cost of providing care for cardiac and stroke patients in hospitals is about \$1,540 and \$1,290 respectively. These are both more than triple the average daily cost of inpatient rehabilitation (about \$399).

Based on information regarding the number of cardiac and stroke patients deemed ALC and the average costs of providing care to these patients, we estimated that if all ALC patients had been transferred out of an acute hospital bed once deemed

ALC, the province could have saved over \$150 million in 2019/20: over \$94 million for cardiac patients and over \$56 million for stroke patients. If there were openings to accommodate all of these patients and all patients deemed ALC had been transferred immediately, more acute hospital beds would have been available for others, such as patients waiting for cardiac procedures.

RECOMMENDATION 11

To give cardiac and stroke patients cost-effective and appropriate care once they no longer require hospitalization, we recommend that the Ministry of Health, in collaboration with Ontario Health:

- require hospitals to report on which type of facility patients deemed Alternate Level of Care are waiting to be admitted to; and
- analyze this information to determine, by region, the need for additional beds in other types of facilities and to identify opportunities for improving co-ordination among hospitals and other facilities.

MINISTRY RESPONSE

The Ministry will review the feasibility and value of collecting Alternate Level of Care (ALC) data by patient type (such as cardiac and stroke patients) to help identify the need for additional beds in other types of facilities. Currently, hospitals do report the intended discharge destination for patients deemed ALC to Ontario Health. The information includes the various facility types/locations that patients are waiting for (e.g., long-term care, rehabilitation, complex continuing care, home with home and community care support services, etc.).

This information is provided to the Ministry in regular monthly performance report and is used by the Ministry in various analyses (planning for specific programs, identifying additional resources required, etc.).

RESPONSE FROM CORHEALTH ONTARIO

CorHealth recognizes the importance of initiatives that ensure patients move through the health-care system to allow for cost-effective and appropriate care. CorHealth will work with Ontario Health and the Ministry as requested to support any new reporting activities related to alternate level of care data for cardiac and stroke patients.

6.2 CorHealth Ontario Faces Constraints and Does Not Have Complete Oversight of Cardiac and Stroke Care

While CorHealth is generally fulfilling its current mandate, its ability to improve cardiac and stroke care in the province is limited because it has no powers to require hospitals to abide by its standards.

As discussed in **Section 2.4.2**, CorHealth's current responsibilities are broadly grouped under three main categories:

- providing evidence-informed guidance and recommendations to the Ministry, Ontario Health, the former Local Health Integration Networks (now part of Ontario Health), and hospitals to improve the quality, efficiency, accessibility and equity of cardiac, stroke and vascular services for Ontario patients;
- conducting data analyses and forecasting to support future provincial policy and funding programs that help deliver a consistent quality of health care across the province; and
- monitoring and reporting on hospital performance against performance indicators it establishes to assess whether performance is improving or declining at the hospital, regional, and provincial levels.

According to cardiac disease and stroke staff at most of the hospitals we contacted, CorHealth has fulfilled its evidence-based advisory role on cardiac disease and stroke care in the province. Specifically:

- CorHealth explores and embraces innovation. For example, CorHealth collaborated with the

Ministry to form the Minimally Invasive Structural Heart Working Group in June 2017; this group has provided expertise to support the Ministry's expansion of new technologies such as TAVI. This group has since transitioned into the New Technologies Planning Committee to incorporate a broader scope of technologies.

- CorHealth helps provide policymakers with clinician and administrator perspectives. For example, CorHealth conducted stakeholder outreach to collect feedback from hospital staff to inform its recommendations for new funding rates for cardiac procedures.
- CorHealth provides evidence-based advice to the Ministry, hospitals, and most of the cardiac, stroke, and vascular system. For example, CorHealth leads initiatives such as working to improve timely access to TAVI for cardiac patients, expanding access to EVT treatment for acute ischemic stroke, and evidence-based care standards implementation for people with heart failure.

However, due to its limited mandate—as described in **Sections 6.2.1, 6.2.2, 6.2.3 and 6.2.4** that follow—by comparison to similar organizations such as Cardiac Services BC and Cancer Care Ontario (which became part of Ontario Health in 2019), CorHealth is limited in what it can do to improve care for Ontarians.

6.2.1 CorHealth Does Not Have Power to Fund Hospitals and Other Service Providers and Require Compliance to Standards or Best Practices

CorHealth makes recommendations on best practices related to cardiac disease and stroke care and performs monitoring and reporting on service provider (specifically hospital) outcomes. However, it does not have the power to require service providers to follow its recommendations or improve their performance, nor does it have the authority to adjust hospital funding to improve their performance. As discussed in **Section 4.2.2**, while CorHealth developed an

Integrated Heart Failure Care Initiative in 2019 that can provide patients better care in the community and potentially achieve better value for money, this initiative has not been widely adopted and CorHealth has no ability to require regions to adopt it.

While CorHealth measures the performance of hospitals in providing cardiac disease and stroke care against provincial targets and reports the performance results to both the Ministry and health-care professionals throughout the province, it has no powers to provide hospitals with funding or incentives that help improve their performance, in contrast with other agencies outside and within Ontario. For example:

- Outside Ontario, British Columbia grants Cardiac Services BC and Stroke Services BC the ability to fund projects and initiatives within an approved funding allocation. In addition to provincially allocated funds, Cardiac Services BC allocates funding to regional health authorities through agreements with these authorities and health-care sites themselves, and has the autonomy to allocate and adjust funding across these organizations. Stroke Services BC manages a provincial budget in support of improving and redesigning the stroke care system and is able to allocate the budget to priority areas.
- Within Ontario, Cancer Care Ontario (now part of Ontario Health) received nearly \$1.9 billion in 2019/20, much of which it can flexibly distribute to hospitals to improve cancer treatment. Cancer Care Ontario routinely ties funding to hospital performance against quality indicators to help drive performance improvement. For example, Cancer Care Ontario will only issue payment for a large portion of activity-based funding when the activity is performed in alignment with evidence-informed practice.
- Cancer Care Ontario also funds initiatives aligned with its ongoing priorities, which include determining how resources are allocated, including performance-based payments, within the constraints and direction outlined in the Ministry's annual funding letter. Cancer Care Ontario even

provides capital funding to purchase and replace specific diagnostic imaging equipment and to replace radiation equipment.

- Cancer Care Ontario may also enact behavioural change measures to address non-compliance with best practices and clinical guidance, including requiring program audits, requiring performance improvement plans, recovering funding when accountability requirements are not met and even withdrawing a facility from a funded program if standards are not met.

At the time of our audit, CorHealth was scheduled to be amalgamated with Ontario Health in late 2021/22. This is similar to what has already occurred to organizations such as Cancer Care Ontario and Health Quality Ontario in December 2019. Ontario Health already has systems in place to act as the custodian and distributor of funds, which could be further leveraged for performance- and initiative-based funding aligned with CorHealth's strategic goals.

6.2.2 CorHealth's Mandate Does Not Cover Preventing Initial Cardiac Disease, Strokes

Prevention can play an important role in reducing an individual's risk of developing cardiac disease or a stroke. But no organization in Ontario is specifically focused on preventing cardiac disease and strokes before they initially occur. In contrast, Cancer Care Ontario (now part of Ontario Health) focuses on cancer prevention as well as on treatment of the cancer. The prevention work was guided by Cancer Care Ontario's inaugural Chronic Disease Prevention Strategy from 2015-2020 and is now guided by Ontario Health's Chronic Disease Prevention Strategy: 2020-2023.

While uncontrollable factors like age, genetics, ethnicity and medical history play a role in determining an individual's risk of developing cardiac disease or stroke, numerous studies have shown that many lifestyle factors within an individual's control can be modified to prevent the occurrence of these illnesses. For example, an international study involving

52 countries identified that 90% of first heart attacks in men and 94% in women may be due to controllable factors. Another international study identified that 90% of strokes were attributed to 10 main risk factors that are controllable, including diet, physical activity, weight, and tobacco and alcohol use.

The Burden of Chronic Diseases in Ontario Report released in 2019 by Public Health Ontario and Cancer Care Ontario, identified that:

- The \$192 million spent on chronic disease prevention in 2016/17 was dwarfed by the \$10.5 billion in annual direct health-care costs incurred to treat chronic diseases, including cardiac disease and stroke. This difference highlights the fact that there are significant opportunities for cost savings if common risk factors for cardiac disease and stroke can be controlled.
- While in 2015 there were 28,195 deaths attributable to cancer (the leading cause of deaths in Ontario), that same year the number of deaths due to cardiovascular disease was 26,012, which is just 8% less than the number of cancer deaths. Notably, in 2016, more than twice as many Ontarians were hospitalized for cardiovascular disease than for cancer. Therefore, it is appropriate for an organization overseeing cardiac disease and stroke care, such as CorHealth, to also have primary prevention as part of its mandate.

CorHealth informed us that, given the limited size of its organization and mandate, it has focused only on secondary prevention activities, which are preventive measures aimed at reducing reoccurrences in patients who have already had signs or symptoms of cardiac, stroke or vascular disease to reduce their reoccurrence and slow disease progression. This is as opposed to primary prevention activities, which target people with no prior signs or symptoms of cardiac, stroke and/or vascular diseases.

In contrast, we identified that Cancer Care Ontario has a specific Prevention Team that oversees a Prevention Program that focuses on the promotion and uptake of policies to decrease exposure to cancer risk factors. This has led to Cancer Care Ontario being involved in a number of prevention initiatives. For

example, between 2015 and 2020 it released four Prevention System Quality Index reports to help policy-makers in governments and non-governmental organizations put in place policies and programs to prevent cancer and in 2015 it launched an online self-assessment tool of cancer risks to help individuals assess their risk of various cancers. In 2020/21, the tool was used to create over 67,000 personalized cancer risk assessments.

6.2.3 CorHealth Does Not Oversee Paediatrics

The majority of cardiac and stroke conditions affect adults, but children and minors can suffer from these conditions as well. For example:

- Congenital heart disease relates to a birth defect where the chambers, walls or valves of the heart, or blood vessels near the heart, do not develop normally before birth. Congenital heart disease affects from one-in-80 to one-in-100 Canadian children. It must be managed throughout the person's lifetime. The Hospital for Sick Children informed us that in 2020/21 it performed 1,002 cardiac procedures, admitted 1,329 paediatric cardiac patients, and was visited 22,482 times by cardiac outpatients.
- While much more common with age, children can still suffer strokes. Heart & Stroke estimated one-in-2,500 newborns suffer a stroke in their first four weeks and from two to five children out of 100,000 suffer a stroke after four weeks but before their 18th birthday. In 2020/21, the Hospital for Sick Children performed 29 stroke procedures, admitted 47 paediatric stroke patients, and was visited 447 times by stroke outpatients.

Oversight of paediatric cardiac disease and stroke care can help lead to the establishment of better standards and can improve patient outcomes provincially. For example, a 2020 study published in the *Canadian Journal of Cardiology* looked at deaths from a common form of congenital heart disease in children born in Ontario between 2009 and 2014 and identified that the heart problem was diagnosed before birth (in other words, prenatally) in more

than 70% of cases in Toronto but in less than 15% of cases in Northern Ontario. The study concluded that prenatal diagnosis of this type of heart disease significantly shortened the time from birth to the time when treatment was provided, which was associated with improved survival. The study also identified that new strategies were needed to improve detection rates outside of Toronto. Additional standards, monitoring, and interventions for paediatric patients could lead to better and more consistent results provincially.

In contrast to a lack of leadership aimed at improving paediatric cardiac disease and stroke care, we noted that a charity called Pediatric Oncology Group of Ontario (POGO), which was founded in 1983 by physicians, focuses on improving cancer care for Ontario's paediatric patients. POGO is the official advisor to the Ministry on childhood cancer care. With about 80% (or about \$8.5 million) of its budget provided by the Ministry, POGO flows just over half to hospitals for direct care and with the remainder, provides leadership, collaboration and oversight to hospitals for cancer-related services for children, youth, survivors and their families. POGO provides paediatric cancer-specific advice directly to the Ministry and collects and maintains Ontario's childhood cancer data.

POGO's activities have been recognized and adopted nationally and internationally and have been proven to improve care for patients. For example, since 2014 POGO developed and has since regularly updated a series of children's cancer-specific clinical practice guidelines that identify evidence-based interventions to prevent and treat nausea and vomiting associated with chemotherapy, both of which have an important impact on a child's nutrition, comfort and ability to continue with treatment. In one study, implementation of the POGO guidelines was associated with reducing the percentage of patients who vomited from 48% to 28%. POGO attributes much of its success to being a standalone entity that does not have to balance priorities and resources between paediatric care and a much larger adult cancer population that has different needs.

Given that the Hospital for Sick Children estimates there are more than 1,000 babies born in Ontario each year who are diagnosed with congenital heart disease, there is value in having an entity focused on oversight of paediatric cardiac disease.

6.2.4 CorHealth’s Monitoring Focuses Mainly on Hospital Care

CorHealth has primarily focused its adoption of targets and performance monitoring on hospital care, even though many aspects of cardiac and stroke care occur outside of hospitals such as management of cardiac disease and stroke conditions by community physicians and outpatient rehabilitation after a cardiac or stroke event.

CorHealth does not collect cardiac and stroke rehabilitation information from health-care providers but some data regarding stroke inpatient and home-based rehabilitation is available from the National Rehabilitation Reporting System and the Ontario Home Care dataset, respectively. CorHealth’s annual stroke report includes indicators related to inpatient and home-based rehabilitation, but there are no quality indicators in place to measure, monitor and benchmark performance of both cardiac disease and stroke outpatient rehabilitation providers.

As a result of the gaps that existed in cardiovascular rehabilitation, in June 2018 CorHealth published a report called Cardiac, Stroke and Vascular Rehabilitation Call-to-Action (Call-to-Action). In preparing the report, CorHealth engaged over 250 individuals who worked in, or participated in, a rehabilitation program. CorHealth’s aim was to develop recommendations to improve cardiac, stroke and vascular rehabilitation.

The Call-to-Action report identified 10 recommendations for various stakeholders, including CorHealth, the Ministry, and LHINs (see **Appendix 12**). The report identified “a provincial and regional oversight structure as a top priority to improve access, patient outcomes and equity in rehab.” Specifically, the report recommended that CorHealth collaborate with rehabilitation providers, patients and caregivers to

identify quality indicators for those receiving rehabilitation and incorporate such indicators in performance measurement and accountability frameworks between the LHINs and rehabilitation service providers.

However, the Ministry informed us that it has not made any progress on implementing the recommendations in the Call-to-Action report. CorHealth informed us that while its recommendations are important and should be implemented, it requires more support and resources from the Ministry to carry out the additional work to implement the recommendations.

RECOMMENDATION 12

To allow for more fulsome oversight and improvement of the entire cardiac disease and stroke care system, we recommend that the Ministry of Health, in collaboration with Ontario Health:

- provide CorHealth the ability to allocate and adjust funding to hospitals and other service providers based on provider performance against established performance targets;
- modify CorHealth’s role to oversee additional aspects of cardiac disease and stroke care, including prevention and non-hospital care, such as recovery and rehabilitation, with the expectation to set standards and to carry out performance monitoring for the entire system;
- centralize co-ordination and oversight of provincial paediatric cardiac disease and stroke care that has funding, priorities, and deliverables distinct from adult cardiac disease and stroke care; and
- establish and execute a plan to implement the recommendations in CorHealth’s Cardiac, Stroke and Vascular Rehabilitation Call-to-Action report.

MINISTRY RESPONSE

The Ministry appreciates CorHealth’s role of providing advice and insight into the clinical aspects and volume allocations of cardiac

programs. Funding for Advanced Cardiac Centres is determined and managed by the Ministry, with advice from the cardiac programs themselves and CorHealth, in order to provide accountability and transparency for provincial funding, but also to ensure that funding to hospitals is not a barrier to Ontarians receiving life-saving treatments when and where they need them.

As CorHealth transitions into Ontario Health, future roles, and responsibilities on additional aspects of cardiac and stroke care, including prevention, non-hospital care, and paediatric cardiac and stroke services, will be considered.

As mentioned in response to other recommendations of this audit, the Ministry will work with CorHealth, Ontario Health, and other sector stakeholders, as required, to develop strategies and standards for rehabilitation for cardiovascular and stroke patients, which CorHealth recommended in its Call to Action.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth appreciates the Auditor General's recommendation to ensure there is increased oversight to drive evidence-based standards and performance monitoring across the entire continuum of care for cardiac and stroke patients, including the paediatric population. CorHealth will work with Ontario Health and

its system stakeholders to support any changes to its role or mandate as directed by the Ministry. CorHealth also supports addressing gaps in rehabilitation to improve outcomes for cardiac, stroke and vascular patients. CorHealth will work with the Ministry as requested to support recommendations outlined in the Rehabilitation Call-to-Action report.

6.3 Procurement Practices and Funding Rates for Cardiac and Stroke Care Need to Be Reviewed and Updated

6.3.1 Provincial Procurement of Equipment and Supplies for Cardiac and Stroke Treatment Would Lead to Cost Savings

Unlike other jurisdictions, such as Alberta and British Columbia, Ontario hospitals are primarily responsible for procuring their own equipment and supplies used for cardiac and stroke procedures. Currently, only certain types of equipment, devices and supplies are procured through an ad hoc group procurement process involving a limited number of hospitals. Given that the same items are used by multiple hospitals in Ontario, potential cost savings can be achieved by participating in a group procurement process. For example, we noted that:

Figure 30: Select Hospitals' Average Cardiac Device and Supply Costs

Source of data: Select Ontario hospitals

Supply/Device	Hospital 1 (\$)	Hospital 2 (\$)	Hospital 3 (\$)	Hospital 4 (\$)	Hospital 5 (\$)	Difference between Highest Cost and Lowest Cost	
						\$	%
Simple ablation catheter	298	446	1,390	444	690	1,092	367
Dual chamber pacemaker	887	3,011	1,493	2,476	896	2,124	239
Single chamber pacemaker	800	1,513	1,176	1,697	676	1,021	151
Heart valve (tissue)	2,401	4,507	3,300	4,326	4,196	2,106	88
Transcatheter aortic valve devices	24,500	21,672	24,574	24,338	25,000	3,328	15
Mitral clip	33,000	35,000	34,848	35,000	33,000	2,000	6

Note: Hospital names have been omitted to ensure terms of their contracts with suppliers are not breached. Average prices are shown as hospitals often have multiple suppliers for the same category of supply/device.

- Group purchasing was organized across 11 hospitals in June 2018 to purchase implantable cardioverter defibrillator (ICD) and cardiac resynchronization therapy (CRT) devices, which are devices that can help detect and correct abnormal heart rhythms. As a result of this procurement, over five years these hospitals will save an estimated \$63 million.
- Some hospitals have organized smaller scale group procurements for various supplies and devices on an ad hoc basis through not-for-profit health-care supply chain organizations such as Plexxus or Mohawk Medbuy Corporation.

Provincial actions to date have not ensured that savings are shared by all hospitals. As a result, there is significant variation between what hospitals are paying for supplies and devices used in cardiac disease treatment. Average costs across hospitals for the same categories of supplies and devices are summarized in **Figure 30**, which shows that the difference in the average cost of certain types of devices between designated cardiac centres can vary by as much as 367%.

Neither the Ministry nor CorHealth routinely track hospital costs for cardiac supplies and devices to determine whether potential savings to the health-care system exists through group procurement. In February 2021, CorHealth engaged Mohawk Medbuy Corporation and Plexxus, to investigate potential procurement opportunities for CT-Perfusion technology. Currently, the Ministry does not provide funding to help hospitals purchase CT-Perfusion imaging software beyond hospital global budgets, which can be used by hospitals on other priorities. Potential savings through group procurement could encourage more hospitals to acquire CT-Perfusion imaging software through their global budgets. Plexxus anticipates that a contract for CT-Perfusion imaging software will be in place between hospitals and a preferred vendor by the end of 2021/22.

In November 2020, the Ontario government created Supply Ontario, a new agency responsible for

“provide[ing] and support[ing] supply chain management on behalf of government entities, broader public sector entities and health sector entities.” Supply Ontario is not yet operational and therefore the extent to which Supply Ontario’s activities may eventually lead to group procurement for cardiac and stroke supplies, equipment and devices, could not be determined at the time of our audit.

Unlike Ontario, we noted that some provinces in Canada have already co-ordinated provincial procurement for cardiac and stroke devices. Specifically:

- Cardiac Services BC conducts province-wide procurement for implantable devices (such as pacemakers), heart valves, balloon catheters and stents used provincially.
- Alberta Health Services is responsible for procurement within the province and so it selects vendors and devices to be used in hospitals and co-ordinates the purchasing and distribution of these devices.

RECOMMENDATION 13

To procure necessary cardiac and stroke supplies, devices and equipment in a cost-effective manner, we recommend that the Ministry of Health, in collaboration with Ontario Health:

- collect cost information on cardiac and stroke equipment and supplies from hospitals, and identify those items where savings can be achieved through group procurement, or direct Supply Ontario to do this; and
- develop and regularly update a schedule, mindful of the need to consider the terms of existing hospital contracts with suppliers, to conduct all identified group procurements in a timely manner, with an aim to co-ordinate with other organizations, including CorHealth, Supply Ontario, and Ontario’s existing shared service organizations, as necessary.

MINISTRY RESPONSE

The Ministry appreciates the recommendation and will work on next steps of collecting cost

information on cardiac and stroke equipment and supplies from hospitals, and conducting group procurement of those items where savings can be achieved.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth will work with the Ministry of Health if requested to support this recommendation.

6.3.2 Funding Rates for Most Cardiac Procedures Outdated; Last Full Update Done Almost 15 Years Ago

In 1997, the Ministry and Ontario's now-defunct Joint Policy and Planning Committee established a Cardiac Funding Working Group (Working Group) to determine the rates the Ministry should pay hospitals to perform various cardiac procedures. The Working Group did so and noted that the funding rates "need to be reviewed ... and re-validated on an annual basis to account for new technologies and changes in costs." Despite this recommendation, the rates have not been reviewed and re-validated on an annual basis.

We found that for diagnostic cardiac catheterization, the most common acute cardiac procedure, the funded rate has not changed since 1997. The rates for two other procedures, permanent pacemaker implantations and electrophysiology studies, have not been updated since 2000. The Ministry indicated that because the Joint Policy and Planning Committee was wound down in 2007, many of the rates have not been updated since then because no other specialized body is responsible for reviewing cardiac funding rates. **Appendix 13** summarizes when the Ministry last updated the funding rate for each cardiac procedure.

In the spring of 2018, the Ministry of Health and Long-Term Care (which was separated into the Ministry of Health and the Ministry of Long-Term Care in June 2019) requested that CorHealth lead an initiative to analyze and propose revisions to the funding model for all funded acute cardiac procedures. In May

2019, CorHealth provided revised funding rates to the Ministry of Health and Long-Term Care based on provincial average costs to perform cardiac procedures. CorHealth found that hospitals were underfunded by about \$28 million annually (or 5% of their actual costs) compared to what it actually cost to treat acute cardiac patients.

Under the existing funding model, there is a misallocation of funding such that, in some cases, hospitals receive less money than it costs them to perform certain procedures and, in other cases, hospitals receive much more funding than it costs them to perform procedures. For example, Kingston Health Sciences Centre reported that in 2018/19 it was funded 39% (or \$21,000) less than its average cost to perform TAVI procedures (as determined by Ontario Case Costing Methodology) while also receiving 79% (or \$14,000) more than its average cost to perform implantable cardioverter defibrillator (ICD) implants. These costs exclude inpatient, pre-surgical and post-surgical follow-up costs.

At the time of our audit, the Ministry had not approved the revised funding rates proposed by CorHealth in May 2019. The Ministry informed us that it was working with CorHealth to update the analysis performed in 2018/19, as the rates identified then may be outdated. The Ministry further informed us that it was still deciding how to best implement revised rates and it intended to provide hospitals with updates later in 2021/22. The Ministry had also not committed to a regular time interval for updating cardiac funding rates.

6.3.3 Insufficient Ministry Funding Prevents Some Ontarians from Receiving Timely Treatment, Leading to Longer Waits and Deaths

The Ministry provides dedicated funding for hospitals to perform cardiac procedures. However, since this funding does not cover the actual costs of these procedures, hospitals have to use other funding sources to cover some of the costs associated with cardiac procedures.

Every year, the Ministry pre-determines the number of cardiac procedures it will fund at each hospital. The Ministry allocates volumes for cardiac procedures each year based on evidence-based estimates of the expected number of procedures that a hospital will perform. Such estimates are made using historical and socio-demographic information for the region the hospital serves. These allocations can be adjusted during the fiscal year as required. If demand for a particular type of procedure exceeds the pre-determined limits the Ministry has set for that type of cardiac procedure at a particular hospital, the hospital can reallocate funding from one type of procedure to another, subject to certain conditions. If there are no more funds to reallocate, the hospital either has to take money from its global budget, which is the amount provided by the Ministry to fund hospital operating expenses, or delay the procedure until the next fiscal year's pool of funding dedicated to such procedures is accessible.

Fifteen of the 20 cardiac centres in Ontario responded to our survey question on the impact of dedicated funding on the cardiac procedures (75% of all cardiac centres). Eight of these 15 cardiac centres (about 53%) identified that the funding constrains the number of cardiac procedures the hospitals perform. In response to these constraints, sometimes hospitals will book procedures at the start of the next fiscal year when additional dedicated funding will be provided rather than the end of the current year.

For example, in 2019/20 one hospital performed 265 TAVI procedures and, given demand at that hospital, it could have performed an additional 60 procedures. However, since funding for these 60 procedures was not available, the hospital deferred these procedures to 2020/21. Similarly, in 2020/21 that hospital completed 291 TAVI procedures and there was demand for an additional 76 procedures but no additional funding was available so these procedures were deferred to 2021/22. The hospital estimated that performing these additional 76 procedures would cost the hospital over \$2.9 million from its global budget, which was instead allocated for other hospital services and operations, as

each TAVI cost the hospital approximately \$38,600 to perform. The hospital told us that deferring TAVI procedures in 2019/20 and 2020/21 has negatively impacted patients. Specifically:

- Twenty-seven patients on the TAVI wait list died before their procedure.
- There were 68 emergency department visits and 42 hospital admissions by individuals on the TAVI wait list. The average time spent by the patients who went to the emergency department was eight hours and an average length of stay of the 42 hospital admissions was about 11 days. The hospital told us that had these patients been provided with an earlier TAVI, all deaths, emergency department visits, and hospital admissions for these individuals could have been avoided or reduced.

The negative consequences reported to us by this hospital are in alignment with other studies on the consequences of deferring TAVI procedures. For example:

- A study published in the American Heart Association's *Circulation* journal in November 2020 found that increasing wait times for TAVI from about 80 days in 2012 to about 110 days in 2018 was associated with an increase in mortality by 170% for those on the wait list.
- Another study published in the *Canadian Journal of Cardiology* in 2014 found that when the TAVI wait time increased from 10 days to 180 days, the one-year mortality rate increased from 31.5% to 41.4% for patients who are not suitable candidates for valve surgery and increased from 24.5% to 32.6% for high-risk surgical patients.

6.3.4 Funding for Stroke Procedures and Care Does Not Cover all Patients Treated, Requiring Hospitals to Reallocate Funding from Other Operations

As discussed in **Section 2.4.1**, hospitals receive quality-based procedure (QBP) funding to perform stroke procedures and care. Unlike cardiac procedure funding (as discussed in **Section 6.3.2** and

Section 6.3.3), QBP funding is intended to cover the total cost of care including not only the procedure, but also all costs associated with the hospital stay. In other words, QBP funding is determined based on the needs of the patient, such as the cost of a hospital admission, rather than only considering the costs involved in performing a specific medical procedure.

While QBP funding helps fund the procedures and care for a given patient, it does not cover the full costs of treating all of stroke patients. With the exception of EVT funding, the QBP funding stream only applies when the following requirements are met:

- the admitted person is an adult Ontarian;
- the hospital admission was necessitated by the stroke, not some other cause; and
- the stroke occurred before the patient was admitted.

CorHealth informed us that these criteria create challenges in the management of resources for stroke care, requiring some hospitals to fund a considerable amount of stroke care from their global budget. CorHealth's data showed that under these criteria, about 7,000 annual stroke hospitalizations (30%) are excluded from QBP funding because the stroke occurred after the patient was admitted to hospital and/or because the stroke is listed as a secondary diagnosis rather than the primary diagnosis that led to admission.

Additionally, hospitals are not funded for many stroke patients who do meet the criteria above. For example, in 2017/18 when funding reconciliations were last completed, there were about 17,600 stroke cases that qualified for QBP funding but hospitals were only allocated funding for about 16,400 cases. While funding can be diverted from other QBP patient groups through a reconciliation process, there were limited opportunities to do so for these 1,200 excess stroke patients because most other patient groups such as cataracts and pneumonia also exceeded their funding allocations.

RECOMMENDATION 14

To better match funding to the hospital care needs of cardiac disease and stroke patients, we recommend that the Ministry of Health, in collaboration with Ontario Health:

- develop and implement a process to update funding rates for cardiac procedures on a regular basis; and
- assess quality-based procedure funding criteria for stroke patients to determine whether the criteria should be expanded to cover treatment costs for more patients, including patients treated through surgical interventions and patients who experience a stroke in hospital.

MINISTRY RESPONSE

The Ministry agrees that this is an important aspect of Ontario's cardiac and stroke care systems and will consider processes for future rate updates and definition changes.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with this recommendation and the importance of updating rates and funding criteria for cardiovascular and stroke procedures. CorHealth continues to provide recommendations and strategic advice to the Ministry of Health on funding models and policies related to cardiac stroke and vascular care to better match funding to the care needs of cardiac and stroke patients.

7.1 Fewer Cardiac Patients Sought and Received Care during COVID-19, Resulting in Growing Wait Times and Backlogs

7.1.1 Delay in Cardiac Procedures Resulted in Longer Wait Lists for Cardiac Procedures and Additional Deaths Among Those Waiting

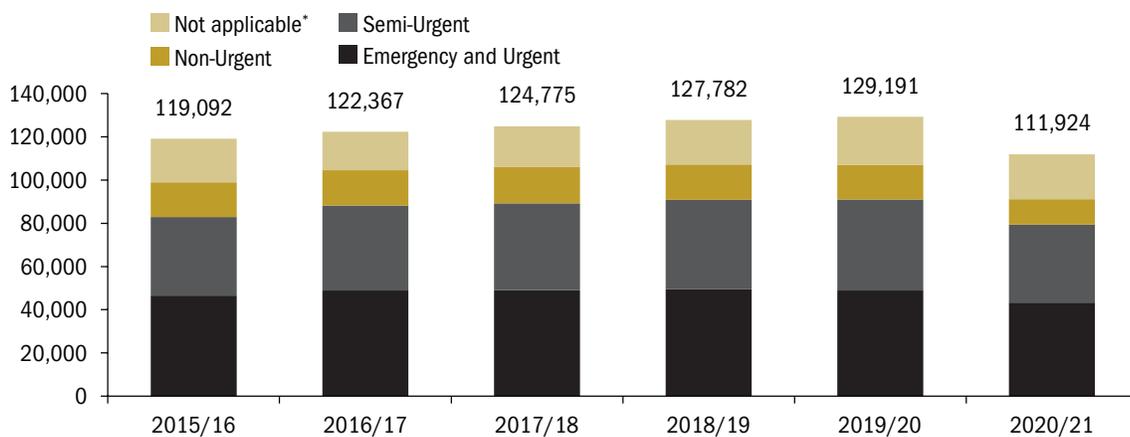
The most direct impacts of COVID-19 on patient care were the result of a directive issued twice by the Chief Medical Officer of Health (CMOH) that all non-essential and elective surgeries should stop or be reduced to minimum levels to ensure that hospitals had sufficient capacity to treat COVID-19 patients. The directive was

first in place from March 19, 2020 to May 26, 2020 and again from April 20, 2021 to May 19, 2021. The directive applied to cardiac procedures so that only the most urgent and those considered emergency were performed during these periods. In comparison with cardiac procedures, the directive had no direct impact on stroke procedures, as all strokes are considered emergencies that must be treated as soon as possible.

Figure 31 outlines the cardiac procedures performed by priority level for each of the past six fiscal years (2015/16–2020/21). Overall, there were significantly fewer cardiac procedures performed in 2020/21 compared to each of the five prior fiscal

Figure 31: Cardiac Procedures Performed by Priority Level, 2015/16–2020/21

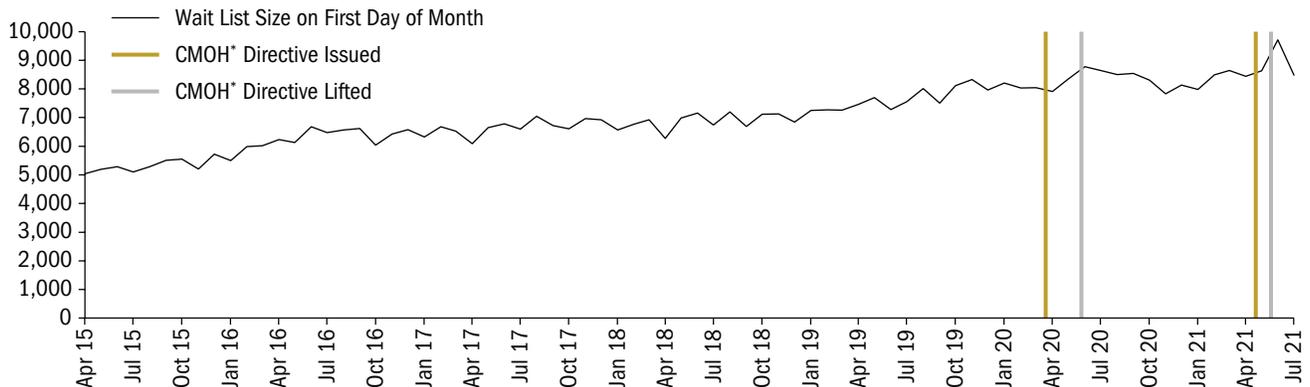
Source of data: CorHealth Ontario



* Certain procedures, such as transcatheter aortic valve implementation (TAVI), do not have priority levels assigned to them and are classified as priority level Not Applicable.

Figure 32: Total Patients on Wait Lists for Cardiac Procedures by Month, April 2015–July 2021

Source of data: CorHealth Ontario



* Chief Medical Officer of Health.

years, with 13% fewer cardiac procedures performed in 2020/21 than 2019/20.

When fewer cardiac procedures are performed, the wait lists for those procedures will typically be longer. From April 1, 2020 to June 1, 2020, province-wide the total number of people on wait lists for cardiac procedures grew by 11% (from 7,911 to 8,778). By November 2020, the province-wide total number of people on wait lists for cardiac procedures was reduced to the level it was before the first directive was issued. The second directive resulted in an increase in the total number on cardiac wait lists again. From April 1, 2021 to June 1, 2021, the number grew by 15% (from 8,442 to 9,715). **Figure 32** shows the total monthly number of Ontarians on cardiac wait lists between April 1, 2015 and July 1, 2021.

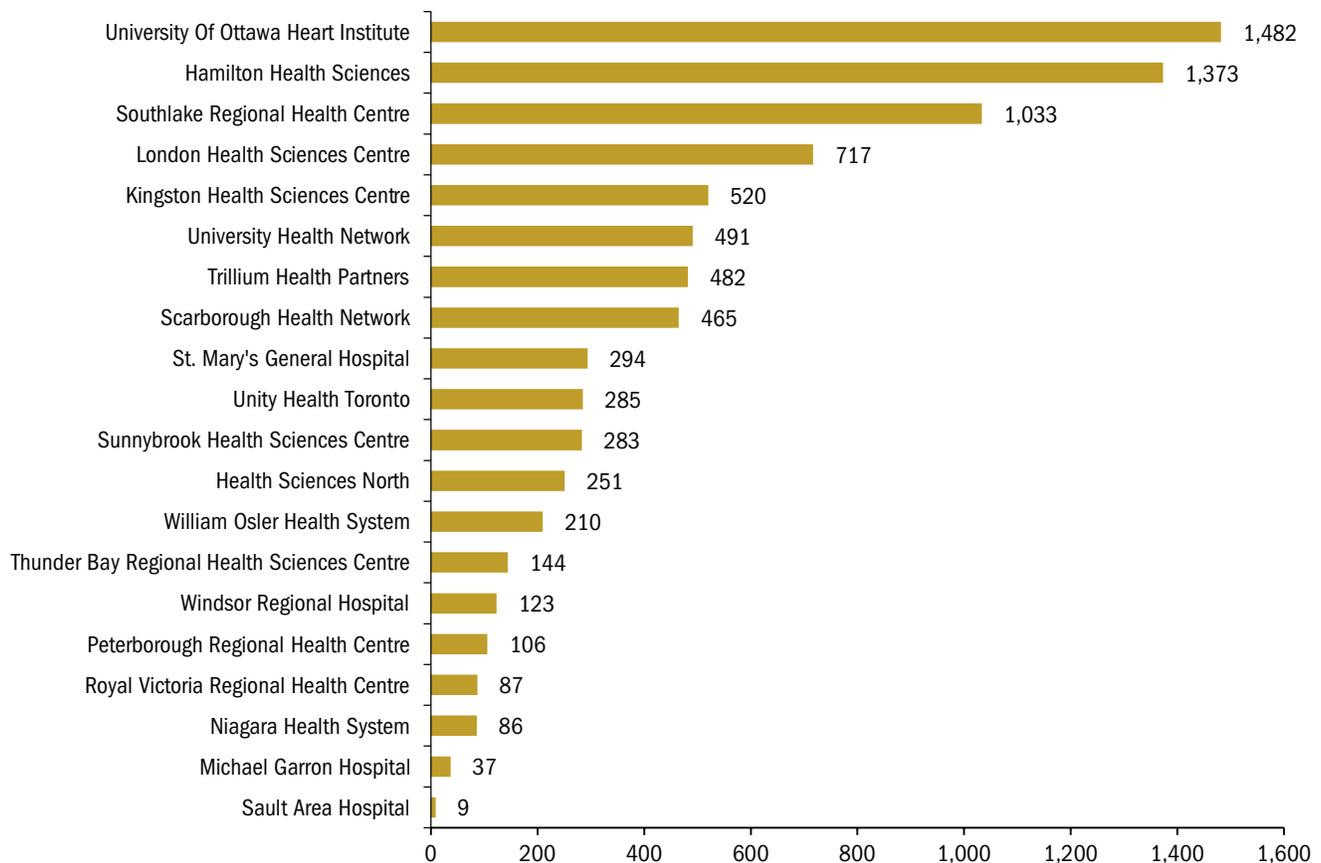
As of July 1, 2021, 8,478 patients in Ontario were still on wait lists for cardiac procedures. Of the 20 hospitals designated as cardiac centres, the

University of Ottawa Heart Institute, Hamilton Health Sciences, Southlake Regional Health Centre, London Health Sciences Centre, and Kingston Health Sciences Centre had the largest wait lists as of July 1, 2021 (see **Figure 33**).

On average, across all cardiac procedures, people waited almost 24 days in 2020/21 from the time of their initial referral compared with an average of 22 days in 2019/20, an increase of about 8%. However, when diagnostic cardiac catheterizations were removed from this analysis, the average wait increased to about 61 days in 2020/21 from almost 53 days in 2019/20, an increase of about 16%. Cardiac catheterizations comprise more than half of all acute cardiac procedures performed and are generally done in a timelier manner relative to other procedures. Eight days of additional waiting may not be of as much concern for some elective procedures, but longer waits coincided with worsened

Figure 33: Total Patients on Wait Lists for Cardiac Procedures at Designated Cardiac Centres, as of July 1, 2021

Source of data: CorHealth Ontario



patient conditions and more deaths among those on these wait lists. **Appendix 8** provides stories of patients who suffered a cardiac event or died while on cardiac wait lists who had their procedures delayed due to the COVID-19 pandemic.

Our Office's 2020 Special Report: *COVID-19 Preparedness and Management: Special Report on Outbreak Planning and Decision-Making* also identified the impacts of deferring surgeries as a result of the issuance of the CMOH's first directive. Specifically, as of June 13, 2020, Ontario had an estimated backlog of over 148,000 surgeries (which included cardiac surgeries) that was expected to take 84 weeks (about 20 months) to clear.

To assist hospitals in addressing pandemic-related surgical backlogs (including cardiac surgical procedures), the Ministry committed to provide additional funding. Specifically:

- On September 25, 2020, the Ministry informed hospitals that it would pay a premium on eligible priority procedures to help address the backlog of scheduled surgeries that accumulated as a result of the first issuance of the directive. This premium includes dedicated funding to perform most cardiac procedures.
- On July 28, 2021, the Ontario government announced its surgical recovery plan, which aims to enable hospitals and community-based service providers to operate in excess of their current capacity. Through this plan, the Ministry aims to invest \$324 million in various initiatives, which include extending operating room hours with the intention to fund 67,000 additional procedures. At the time of our audit, the Ministry was in the process of determining how many of these would be cardiac procedures.

7.1.2 Number of Hospital Visits, Referrals Dropped Due to Patient Reluctance to Visit Health-Care Setting; Patients Who Did Visit Were Sicker

Surveys done by external parties and stakeholders we spoke with, including staff at hospitals that provide

cardiac and stroke care, identified that patients were hesitant to obtain health care during the COVID-19 pandemic, that patients with more mild symptoms were not seeking care during the pandemic, and when people did seek care they were generally sicker. For example:

- Canadian Institute for Health Information (CIHI) data indicates that from March 2020 to June 2020 family physicians provided 22% fewer consultations and visits than the same period in the year before, with 35% fewer visits (in-person and virtual) in April 2020. The decrease in visits for family medicine practitioners removed many opportunities for these practitioners to notice cardiac and stroke symptoms and risk factors. The result of this was that they referred fewer patients for diagnostic procedures and other clinical interventions.
- CIHI data also indicated that from March 1 to December 31, 2020 emergency department visits decreased by 24% compared with the same time period in 2019.
- Heart & Stroke released results of a survey on March 15, 2021, which fell between the two issuances of the Chief Medical Officer of Health's directive stopping or reducing all non-essential and elective surgeries. The survey was limited to people living with heart disease, stroke, and vascular cognitive impairment. The survey found that 61% of these individuals were concerned about having to go to the hospital if they required medical attention.

Claims data provided by the Ministry showed that the number of physician visits decreased by over 10% from about 107 million visits in 2019/20 to under 96 million visits in 2020/21, and the number of visits conducted virtually shifted from about 1% of visits to about 35% over this period. Furthermore, in 2020/21 the number of patients referred by general practitioners to cardiologists decreased by about 20% from 2019/20 while the number of patients referred by general practitioners to neurologists decreased by about 19%. During the same period, the number of patients referred by specialists and

other health practitioners, such as nurse practitioners, decreased by about 10% to both cardiologists and neurologists.

The reduced patient engagement with primary care was further accompanied by patient reluctance to engage acute and post-acute care. For example:

- Hamilton Health Sciences recognized a trend of patients electing to defer cardiac procedures due to fear of visiting a hospital during COVID-19. Based on data tracked from April 17, 2020 to August 17, 2020, the percentage of cardiac disease patients who chose to defer their procedures ranged from 13% to 44%. Data tracked by St. Catharine's General Hospital showed a similar trend. There, the percentage of cardiac disease patients who chose to defer their procedures ranged from 22% to 67%.
- Based on a provincial survey of publicly funded ambulatory rehabilitation providers conducted by the Rehabilitative Care Alliance, an organization established by the Local Health Integration Units in 2013 to strengthen and standardize rehabilitation care in Ontario, during the first quarter of 2020/21, 57% fewer stroke patients received ambulatory rehabilitation than the average number of such patients seen each quarter throughout 2019/20. The same survey showed that during the first quarter of 2020/21, 62% fewer cardiac patients received ambulatory rehabilitation than the average quarterly patient volumes admitted throughout 2019/20.

When patients with less severe needs avoid seeking health care, those who do seek help are generally the most sick and complex patients. Specifically:

- St. Michael's Hospital conducted an analysis using the average acute length of stay for cardiac and vascular surgeries as a proxy for the severity of patient conditions who presented to the hospital. The analysis showed that the average acute length of stay increased from 8.8 days in 2019/20 to 9.5 days during 2020/21.
- A study conducted by Ontario researchers and health specialists, including a cardiologist at

Sunnybrook Health Sciences Centre, identified that people on wait lists for select cardiac procedures were more likely to be hospitalized or die during the early pandemic (March 16, 2020 to September 30, 2020) compared with the pre-pandemic period (January 1, 2015 to March 15, 2020). The study identified that on a risk-adjusted basis (which controls for, among other factors, how long patients wait for treatment):

- Patients on the CABG and TAVI wait lists during the COVID-19 pandemic were 42% and 140% more likely to be hospitalized, respectively, compared with the pre-pandemic period; and
- Patients on the PCI, CABG and TAVI wait lists during the COVID-19 pandemic were 83%, 96%, and 42% more likely to die, respectively, while waiting for care compared with the pre-pandemic period.

Since many patients were not seeking care or diagnostic tests for milder cardiac and stroke conditions during the pandemic, the number of these “missing” patients is unknown, meaning that the wait lists (as described in **Section 4.2.3**) likely under-represent the true growth in the needs of Ontarians during the COVID-19 pandemic. While these “missing” patients' needs for, and impacts to, future cardiac and stroke care have yet to be seen, they will likely increase the burden on Ontario's hospitals.

7.1.3 Temporary Closures of Rehabilitation Providers Resulted in Decreased Patient Visits for Cardiac and Stroke Rehabilitation

The impact of COVID-19 on rehabilitation providers varied by region. For example, of the six stroke rehabilitation providers that we received data from, five of them experienced a closure of in-person services for varying lengths of time, with the most common period of closure from March 2020 to June 2020. During this time, these five providers reported the main causes of the closure being the provincial directive to ramp down non-emergency

activities, and the need to redeploy staff to other areas of need, including critical care, long-term care, and partnering hospitals to address patient care needs. For example, one rehabilitation provider in the East Ontario Health Region closed outpatient stroke rehabilitation from March 16, 2020 to May 2020, primarily as a result of a need to redeploy staff during this time to long-term-care facilities and to other hospitals. Additionally, this provider had to suspend admissions and reduce bed capacity between September 25, 2020 and mid-October 2020 as a result of COVID-19 outbreaks that occurred at the site.

The number of patient visits for outpatient rehabilitation decreased significantly during the COVID-19 pandemic. For example, the number of stroke patient visits to one provider of outpatient rehabilitation services dropped by more than 87% (from 5,000 in 2019/20 to just 611 in 2020/21). Another provider also experienced a drop of about 45% in the number of stroke patient visits (from 12,879 in 2019/20 to 6,919 in 2020/21). When people do not receive rehabilitation, they are at risk of long-term impacts such as reduced mobility for the rest of their lives. Outpatient cardiac rehabilitation was also impacted, as Ministry data for outpatient cardiac rehabilitation visits showed a decrease from 89,245 visits in 2019/20 to 35,866 in 2020/21.

These rehabilitation providers attempted to continue to provide services through increasing the use of virtual care. For the five stroke outpatient rehabilitation providers we received data from for this, they went from almost no virtual care in 2019/20 to about 55% in 2020/21. For the six cardiac outpatient rehabilitation providers we received data from, they went from an average of about 10% virtual care in 2019/20 to about 90% in 2020/21.

Virtual care allowed rehabilitation providers to continue providing rehabilitation safely during the COVID-19 pandemic. Some rehabilitation providers informed us that some of their patients preferred the virtual option, as they did not want to be seen face-to-face. However, from a clinical perspective, virtual care is not always an appropriate mode for stroke

rehabilitation service delivery and may limit the effectiveness of rehabilitation in certain circumstances due to safety concerns and/or no opportunity for hands-on assessment or treatment. There are also concerns with technical challenges including unstable Internet connection, lack of access to devices and equipment that would have been used if rehabilitation was done in-person, and lack of technological expertise of patients or providers in conducting the appointment virtually.

RECOMMENDATION 15

To address the impact of COVID-19 on the provision of cardiac and stroke care, we recommend that the Ministry of Health work with CorHealth Ontario and Ontario Health to:

- assess the prevalence of unidentified cardiac and stroke conditions as a result of the COVID-19 pandemic and determine the impact of these patients on the cardiac disease and stroke system going forward in order to identify additional funding or initiatives that may be needed to address these patient's health-care needs; and
- monitor the impact of the surgical recovery plan by periodically measuring and publicly reporting the cardiac procedure backlog and provide the necessary resources to help hospitals achieve this plan.

MINISTRY RESPONSE

The Ministry regularly receives data on cardiac activity during the COVID-19 pandemic and has participated in CorHealth's stakeholder forums throughout the pandemic, where considerations of patients with deferred or delayed care are discussed.

The Ministry has a Surgical Recovery Strategy and works closely with partners at Ontario Health on recovery initiatives that will maximize system capacity and increase the number of patients being seen within recommended target times as patients

who have had deferred care return to more typical care patterns.

Ontario Health currently publicly reports wait times on cardiac catheterization (angiography), PCI (angioplasty), and cardiac bypass surgery.

RESPONSE FROM CORHEALTH ONTARIO

CorHealth agrees with this recommendation and recognizes the significant impact of the COVID-19 pandemic on the health system including cardiac, stroke and vascular patients. CorHealth remains engaged with its cardiac, stroke and vascular system and clinical stakeholders to understand the challenges in meeting the demands of current and future cardiac, stroke and vascular patient populations. CorHealth will continue to report on the performance of the cardiac, stroke and vascular system and provide data to the Ministry of Health and its partners such as Ontario Health to support COVID-19 recovery planning.

Appendix 1: List of Hospitals/Hospital Groups Designated as Cardiac and/or Stroke Centres by Ontario Health Region

Source: CorHealth Ontario and Ministry of Health

Ontario Health Region	Local Health Integration Network	Facility/Hospital Group Name	20 Cardiac Centres		28 Stroke Centres	
			Perform Base Procedures ¹	Perform Base Procedures and Additional Procedures ²	Administer Tissue Plasminogen Activator (tPA) ³	Administer tPA and Perform Endovascular Thrombectomy (EVT)
Central	Central	Mackenzie Health			✓	
	Central	North York General Hospital				
	Central	Southlake Regional Health Centre		✓		
	Central West	William Osler Health System	✓			
	Mississauga Halton	Trillium Health Partners		✓		✓
	North Simcoe Muskoka	Muskoka Algonquin Healthcare			✓	
	North Simcoe Muskoka	Royal Victoria Regional Health Centre	✓		✓	
	Central East	Lakeridge Health			✓	
	Central East	Peterborough Regional Health Centre	✓		✓	
	Central East	Scarborough and Rouge Hospital	✓			
East	Champlain	Pembroke Regional Hospital			✓	
	Champlain	The Ottawa Hospital				✓
	Champlain	University of Ottawa Heart Institute		✓		
	South East	Kingston Health Sciences Centre		✓		✓
	South East	Quinte Health Care			✓	
	North East	Health Sciences North		✓		✓
	North East	North Bay Regional Health Centre			✓	
	North East	Sault Area Hospital	✓		✓	
	North East	Timmins and District Hospital			✓	
	North West	Thunder Bay Regional Health Sciences Centre	✓			✓
Toronto	Toronto Central	Michael Garron Hospital	✓			
	Toronto Central	St. Michael's Hospital		✓		✓
	Toronto Central	Sunnybrook Health Sciences Centre		✓		✓
	Toronto Central	University Health Network		✓		✓

Ontario Health Region	Local Health Integration Network	Facility/Hospital Group Name	20 Cardiac Centres		28 Stroke Centres	
			Perform Base Procedures ¹	Perform Base Procedures and Additional Procedures ²	Administer Tissue Plasminogen Activator (tPA) ³	Administer tPA and Perform Endovascular Thrombectomy (EVT)
West	Erie St. Clair	Bluewater Health			✓	
	Erie St. Clair	Chatham Kent Health Alliance			✓	
	Erie St. Clair	Windsor Regional Hospital	✓			✓
	Hamilton Niagara Haldimand Brant	Brantford Community Health System			✓	
	Hamilton Niagara Haldimand Brant	Hamilton Health Sciences Centre		✓		✓
	Hamilton Niagara Haldimand Brant	Niagara Health System	✓		✓	
	South West	Grey Bruce Health Services			✓	
	South West	London Health Sciences Centre		✓		✓
	South West	Stratford General Hospital			✓	
	Waterloo Wellington	Grand River Hospital			✓	
	Waterloo Wellington	St. Mary's General Hospital		✓		

Note: There are about 140 hospitals in Ontario. This table only includes hospitals/hospital groups that are designated as cardiac and/or stroke centres. Grey shaded lines indicate hospitals selected for inclusion in our audit scope.

1. Base procedures include cardiac catheterization, percutaneous coronary intervention (PCI), and treatment for heart failure patients.
2. Additional procedures include cardiac surgery, transcatheter aortic valve implantation (TAVI), and implantable cardioverter defibrillators (ICD).
3. These stroke centres also have staff trained to provide stroke care.

Appendix 2: Glossary of Terms

Prepared by the Office of the Auditor General of Ontario

Term	Definition
Ablations (Cardiac)	A catheter or surgical-based procedure that applies heating or freezing to eliminate tissues that cause or conduct abnormal heart rhythms.
Alternate Level of Care (ALC)	Patients who occupy an acute hospital bed even though they are deemed to no longer require the intensity and/or services of the hospital but they cannot be transferred because there are no beds in an alternative setting that can provide the needed level of care.
Aneurysm Clipping	A surgical procedure involves opening the skull, finding the affected artery and then placing a metal clip over the neck of the weakened area in the wall of an artery.
Aneurysm Coiling	A surgical procedure performed to block blood flow into a weakened area in the wall of an artery.
Angiogram	X-ray imaging of coronary arteries and the vessels that supply blood to the heart. A special dye is released into the arteries from a special tube known as a catheter. The procedure evaluates blood flow and identifies narrowing or blockage.
Antiarrhythmics	Medications that prevent and treat abnormal heartbeats.
Anticoagulants	Medications that help prevent clots from forming. Also called "blood thinners."
Aortic valve stenosis	A condition where the aortic valve narrows and does not open fully, which reduce or blocks blood flow from heart to the rest of the body.
Arrhythmia	A term for abnormal heart beats including irregular, slow or rapid heartbeats.
Beta-blockers	Medications that are officially called beta-adrenergic blocking agents, which lower heart rate and blood pressures to help heart work less hard.
Cardiac Catheterization	A technique used with other tests, such as angiography, to assess heart valves, heart function and blood supply to allow doctors to determine whether heart surgery is required. Tubes or wires are inserted into the heart to study blood flow, pressure and electrical signals.
Cardiac resynchronization therapy (CRT)	A treatment that uses a pacemaker to help your heart beat with the right rhythm.
Catheter/Catheterization (CATH)	A thin tube made from medical grade material that is inserted into a body cavity, such as an artery or vein in the groin. The tube is threaded through the blood vessels to the heart to identify any narrow or clogged coronary arteries that are preventing blood from reaching the heart muscle.
Chest X-Ray	An imaging procedure used to identify if a heart is enlarged and or if fluid has been accumulated in the lungs due to a heart attack.
Chronic obstructive pulmonary disorder (COPD)	A lung disease that causes obstructed airflow from the lungs.
Computerized Tomography Coronary Angiogram (CT-Angiogram)	An imaging test that assesses the arteries supplying blood to your heart to diagnose the cause of chest pain and other symptoms. The non-invasive procedure uses X-ray imaging to produce images of your heart and its blood vessels.
Computerized Tomography Perfusion (CT-Perfusion)	Imaging technology that identifies areas of the brain receiving enough blood supply as well as the detailed information on the delivery of blood flow to the brain.
Computerized Tomography/Computed Tomography (CT) Scan	A computerized X-ray imaging procedure that combines a series of X-ray images from different angles creating a cross-sectional image of bones, soft tissues and blood vessels.

Term	Definition
Congenital Heart Disease (CHD)	A heart condition that people are born with where the chambers, walls or valves around the heart do not develop normally prior to birth.
Congestive Heart Failure (CHF)	A condition that occurs when the heart muscles become weakened and are not able to pump enough oxygen-rich blood to the body's organs.
CorHealth Ontario	An Ontario organization that provides strategic leadership and mandates over cardiac, stroke and vascular care to the Ministry of Health and health care facilities within the province.
Coronary Artery Bypass Graft (CABG)	A surgery that redirects blood around a section of blocked or partially blocked arteries in the heart by connecting healthy blood vessels that could be from the patient's legs, arms or chest below or above the blocked arteries.
Coronary Artery Disease (or Atherosclerosis)	A condition where blood vessels in the heart have been narrowed due to ongoing buildup of plaque (usually in the artery wall).
Echocardiogram (ECHO)	A procedure using ultrasound waves to create an image of the heart. The recording imaging of the waves shows the shape, texture and movement of the heart valves.
Electrocardiogram (ECG/ EKG)	A test that assesses how the heart is functioning by measuring the electrical waves that travel through the heart.
Electrophysiology Study	A test used to evaluate the heart's electrical system and to check for abnormal heart rhythms.
Endovascular Thrombectomy (EVT)	A procedure that can be performed on some stroke patients where a physician uses a catheter inserted in a patient's groin to access and physically remove the blood clot.
Exercise Stress Test	A test to measure an individual's heart's electrical activity, blood pressure and heart rate during exercise. The test is usually conducted while the individual is walking on a treadmill.
Heart & Stroke	An independent organization dedicated to improving heart disease, stroke and related conditions by working with healthcare professionals, governments and others to address ongoing concerns and challenges.
Heart Failure	When the heart is too weak, stiff or damaged to properly pump blood, over time the heart becomes unable to keep up with normal demands and medical intervention is required to prolong life and manage symptoms.
Hemorrhagic Stroke	A stroke that results from an artery or blood vessel in the brain bursting and causing blood to spill onto surrounding tissues and interfering with brain functions.
Implantable Cardioverter-Defibrillator (ICD)	A device implanted in the chest that monitors the person's heart rate through wires connected to the heart. When an abnormal heart rhythm occurs, the device sends an electric shock to restore a stable heartbeat.
Ischemic stroke	A blockage in the artery that supplies blood flow to the brain that prevents blood flow from reaching the brain. If blood flow is not restored, potential consequences include irreversible injury and brain death.
Ministry of Health	Government ministry responsible for overseeing the health care system of the entire province with key decision-making and funding mandates.
Mitral Valve Clip	A device that is implanted on the mitral valve to help fix a leakage in a heart valve. It is implanted using a thin tube inserted through a vein in the leg and threaded through the vein to reach the heart.
Myocardial Infarction	Better known as a heart attack, this occurs when blood flow is blocked (STEMI) or partially blocked (Non-STEMI) in a coronary artery as a result of the build-up of fat or cholesterol in the arteries.

Term	Definition
Non-ST-Elevation Myocardial Infarction (Non-STEMI)	A partial blockage of the coronary artery resulting in a heart attack.
Ontario Telestroke Program	A virtual care on call consultation model that allows stroke specialists to provide support to emergency department physicians located in other hospitals from the specialist. The program allows local emergency doctors to provide diagnosis and treatment to stroke patients based on advice of stroke experts who assess the stroke patient using tools including digital video cameras.
Pacemaker	A device implanted under the skin on the patient's chest to monitor their heartbeat and prevent it from beating too slowly.
Percutaneous Coronary Intervention (PCI)	A procedure using a thin flexible tube to place a structure known as a stent to assist in opening up blood vessels in the heart that have been narrowed due to excess buildup of plaque.
Quality-based procedure funding	Health care services for which evidence-based best practices have been defined, and health care providers receive funding for those services based on an established price.
Rehabilitation	The process and action of restoring someone back to normal life after the occurrence of a cardiac event or procedure or stroke events.
ST-Elevation Myocardial Infarction (STEMI)	A heart attack caused by the blockage of the artery that supplies oxygen to the heart muscle.
Stress Echocardiogram	An imaging test that uses ultrasound waves to show how the heart is functioning under the stress of exercise.
Stress/Rest Myocardial Perfusion Imaging	A nuclear cardiology test that shows how well blood flows to the muscle of the heart.
Stroke Centres	Provincially specified hospital facilities that are the best equipped within their region to provide stroke care.
Surgical Aortic Valve Replacement (SAVR)	An open-chest surgery to replace a damaged and/or diseased aortic valve.
Tissue Plasminogen Activator (tPA)	An intravenous drug given to break up clots in ischemic stroke patients to restore blood flow to the brain.
Transcatheter Aortic Valve Implantation (TAVI)	Procedure to replace a narrowed valve in the heart that fails to open properly. The procedure is done using a catheter to place the valve.
Transient Ischemic Attack (TIA)	A temporary stroke that results from a brief blockage of the blood flow to part of the brain.

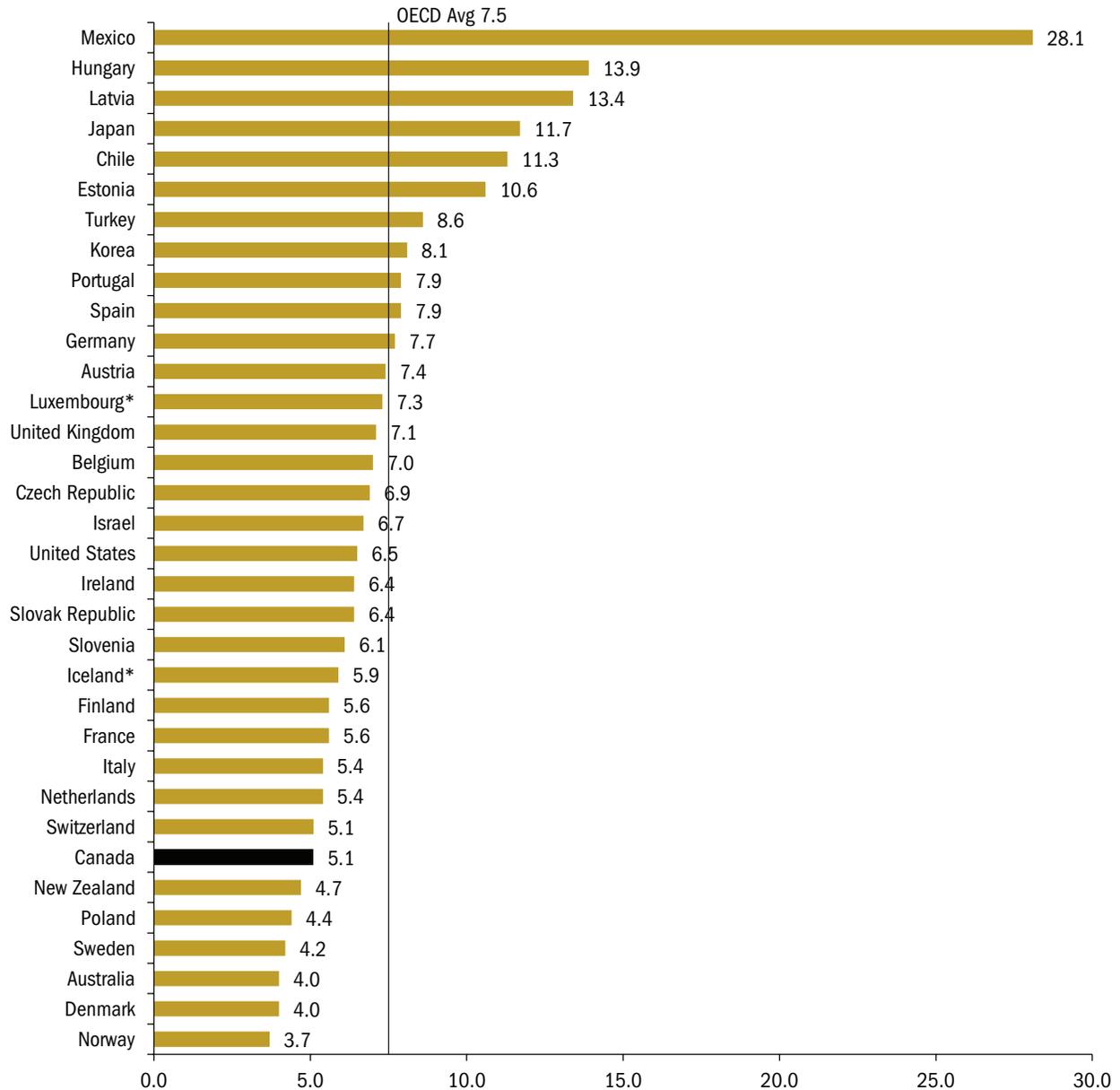
Appendix 3: Common Cardiac Disease and Stroke Conditions

Prepared by the Office of the Auditor General of Ontario

	Condition or Type	Description
Cardiac Disease	Aortic Valve Stenosis	This is one of the most common and serious valve issues involving the narrowing of the aortic valve. The narrowing prevents the valve from opening and closing properly, which puts extra strain on the heart. It can result in breathlessness, swollen ankles, chest pain, dizziness, and blackouts. It is typically treated through open-heart valve surgery (also known as surgical aortic valve replacement, or SAVR), or using the minimally invasive transcatheter aortic valve implantation (TAVI) procedure to replace the aortic valve.
	Arrhythmia (or Abnormal Heartbeat)	This is a catch-all term used for abnormal heartbeats. It can relate to irregular heart beats, slow heart beats (bradycardia) or rapid heart beats (tachycardia). In all cases the result is suboptimal oxygenated and nutrient-rich blood reaching the rest of the body, leading to fatigue, dizziness and, in extreme cases, more significant heart problems. Not all arrhythmia is dangerous, as a person may just temporarily experience bradycardia while sleeping and tachycardia while exercising without negative long-term effects. Arrhythmias are typically controlled through the use of pacemakers and implantable cardioverter defibrillators (ICD), which help regulate irregular heart rhythms.
	Atherosclerosis (or Coronary Artery Disease)	This is the buildup of fats and cholesterol in the arteries, commonly known as plaque. Plaque can cause the arteries to narrow, blocking blood flow. It can also cause arteries to burst, leading to a blood clot. Depending on the condition, atherosclerosis can be treated by either Coronary Artery Bypass Graft (CABG) or Percutaneous Coronary Intervention (also known as Angioplasty) to open up the blocked arteries.
	Heart Failure	This happens when the heart is too weak, stiff or damaged to pump blood efficiently. Eventually the heart is unable to keep up with the normal demands placed on it to pump blood to the rest of the body. This is often a chronic condition that worsens over time, requiring medical interventions to prolong life and manage symptoms.
	Myocardial Infarction (or Heart Attack)	This occurs when blood flow is blocked in a coronary artery because of a buildup of fat or cholesterol in the arteries. This can be a complete blockage, known as ST-Elevation Myocardial Infarction (STEMI), or a partial blockage, known as non-STEMI. "ST-Elevation" refers to a graphical heartbeat segment viewed on an electrocardiogram that is higher than normal. STEMI requires immediate intervention to remove or bypass the obstruction to prevent damage to the heart. Non-STEMI cases can be managed less invasively, such as with blood thinners.
Stroke	Ischemic Stroke	This occurs when a blood clot blocks blood flow to parts of the brain. This prevents oxygen from reaching the brain, and brain tissue will eventually cease to function without oxygen. If oxygen flow is not restored then irreversible injury and brain cell death will occur. This kind of stroke may be treated with medication or non-invasive surgery, such as endovascular thrombectomy (EVT), to help remove the blood clot.
	Hemorrhagic Stroke	This occurs when an artery or a blood vessel in the brain bursts, causing blood to spill onto surrounding tissue and interfering with brain function. The bleeding can occur inside the brain or between the brain and membranes that cover it. This kind of stroke may be treated through surgery.
	Transient Ischemic Attack (or Mini-stroke)	This is a temporary decrease in blood supply to the brain with no permanent damage or lasting symptoms. It often signals an upcoming ischemic stroke. This kind of stroke may be treated with medication.

Appendix 4: 30-day Mortality Rate After Admission to Hospital for a Heart Attack by Member Countries of the Organisation for Economic Co-operation and Development (OECD), 2015

Source of data: OECD Health Statistics

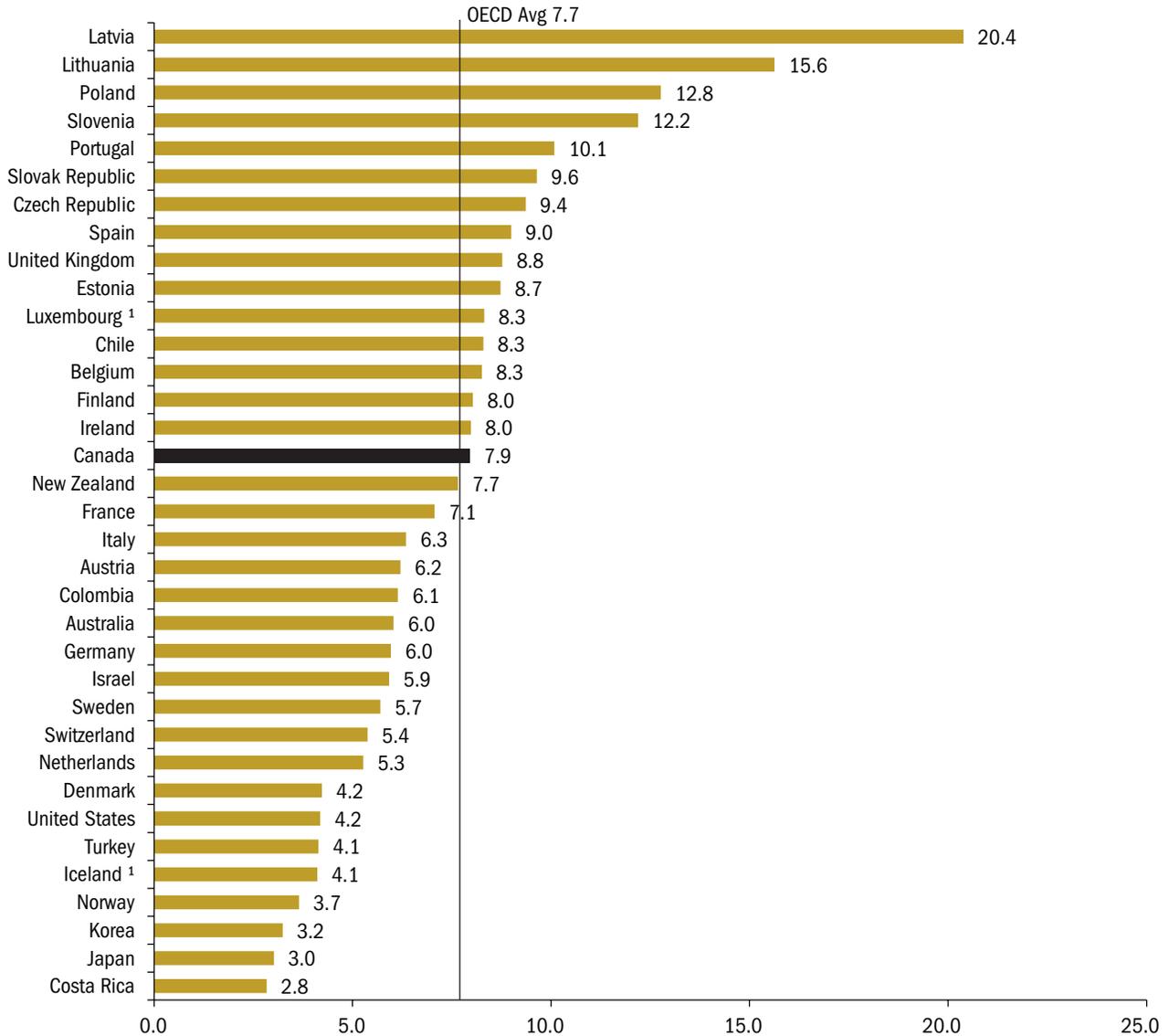


Note: Data is age and sex standardized, meaning that the numbers provided have been adjusted to consider the ages and sex related to the patients treated to make comparison between the countries more useful. Rate is shown per 100 admissions of adults aged 45 years and older. OECD average is only of countries included in comparison (not all OECD countries).

* Represents a three-year average.

Appendix 5: 30-day Mortality rate After Admission to Hospital for an Ischemic Stroke by Member Countries of the Organisation for Economic Co-operation and Development (OECD), 2017

Source of data: OECD Health Statistics



Note: Data is age and sex standardized, meaning that the numbers provided have been adjusted to consider the ages and sex related to the patients treated to make comparison between the countries more useful. Rate is shown per 100 admissions of adults aged 45 years and older. OECD average is only of countries included in comparison (not all OECD countries).

* Represents a three-year average.

Appendix 6: Audit Criteria

Prepared by the Office of the Auditor General of Ontario

-
1. Effective procedures and co-ordination among service providers are in place to ensure patients have timely and equitable access to safe and evidence-based cardiac and stroke care that meets their needs regardless of where they live.
-
2. Roles and responsibilities of all parties involved in the delivery of cardiac and stroke care are clearly defined, and accountability requirements are established, to ensure effective service delivery, co-ordination and oversight.
-
3. Funding and resources are allocated in a timely and equitable manner to service providers based on patient needs, used for the purposes intended, and administered with due regard for economy and efficiency.
-
4. Sufficient, accurate and timely financial and operational data across all cardiac and stroke services are regularly collected and assessed to help guide management decision-making.
-
5. Appropriate performance measures and targets are established, actual results are monitored and publicly reported against targets on a regular basis, and corrective actions are taken in a timely manner when targets are not met.
-

Appendix 7: Additional Hospitals/Hospital Groups and Stakeholders Contacted

Prepared by the Office of the Auditor General of Ontario

Additional Hospitals/Hospital Groups¹

Children's Hospital of Eastern Ontario²

Guelph General Hospital

Health Sciences North

Hôpital Élisabeth Bruyère Hospital³

Kingston General Hospital

McMaster Children's Hospital-Hamilton Health Sciences²

Providence Healthcare³

St. Joseph's Care Group³

St. Joseph's Health Care London³

Sunnybrook Health Sciences Centre

The Hospital for Sick Children²

University Health Network

Stakeholders

Pediatric Oncology Group of Ontario (POGO)⁴

Rehabilitative Care Alliance^{3,5}

1. These hospitals/hospital groups are in addition to the seven that the audit is focused on: Hamilton Health Sciences, London Health Sciences, The Ottawa Hospital, Thunder Bay Health Sciences, Trillium Health Partner, and Unity Health Toronto (specifically, St. Michael's Hospital), and University of Ottawa Heart Institute (see Appendix 1).
2. Contacted to understand paediatric cardiac disease and stroke care.
3. Contacted to understand cardiac disease and stroke rehabilitation care.
4. Pediatric Oncology Group of Ontario (POGO) is a charity that receives Ministry funding. It is responsible for leadership, support and long-term planning for childhood cancer care in Ontario.
5. Rehabilitative Care Alliance is an initiative that receives funding from the Local Health Integration Networks (which are now part of Ontario Health) to work on standardizing rehabilitative care across the province.

Appendix 8: Patient Stories Related to Cardiac Disease and Stroke Treatment Delays

Prepared by the Office of the Auditor General of Ontario

Example	Patient Type	Patient Story
Patient A¹	Stroke – Missed tissue Plasminogen Activator (tPA) Window	Patient A was found on the floor with stroke symptoms, and had last been seen well four hours earlier. They were registered at a hospital 103 minutes later and CT-Angiogram was performed 90 minutes after registration. However, since the 4.5-hour window to provide tPA was missed and attempted endovascular thrombectomy (EVT) was unsuccessful, the patient died nine days later.
Patient B¹	Stroke – Missed tPA Window and Delayed EVT	Patient B experienced a fall and was brought by ambulance to a nearby hospital. The patient was transferred to another hospital to receive necessary stroke treatment. The patient was scanned using CT-Angiogram diagnostic imaging within 10 minutes of arrival at the hospital. Following CT-Angiogram imaging, tPA was not provided because there was too little time left within the 4.5-hour treatment window from onset of their symptoms. An EVT procedure was also not provided until the following day because the patient experienced cardiac instability. The patient died 11 days later.
Patient C²	Stroke – Delayed EVT	Patient C presented to hospital with stroke symptoms. After initial CT Angiogram imaging, tPA was given. As there was no EVT provider available, a transfer was arranged for the patient to go to a hospital out of province. The patient arrived at the second hospital more than five hours later. Upon arrival, CT-Perfusion scanning was completed to determine whether the patient was still eligible for an EVT procedure. Due to the time delay, the patient's stroke had evolved and they were no longer a candidate for EVT. Two days later, the patient had a decline in level of consciousness and had part of their skull removed to relieve pressure in the brain. While the patient survived the surgery, some of the permanent brain damage and complications could potentially have been avoided if the first hospital was equipped to provide EVT for the patient.
Patient D²	Stroke – Delayed EVT	Patient D was being monitored at one hospital due to a history of recurrent transient ischemic attack. The patient suddenly developed significant stroke symptoms and received a standard CT scan that confirmed that a stroke was occurring. The hospital consulted the neurology team at the nearest EVT-capable hospital. The patient was transferred to the EVT hospital, which completed registration minutes after arrival. The patient then rapidly received a CT/CT-Angiogram imaging and was transferred directly to the angiography suite for EVT, where they arrived about 50 minutes after their arrival to the centre. There, the patient successfully received the EVT procedure. Over the next three days the patient showed no significant improvement, remained minimally conscious and the hospital pursued comfort measures prior to the patient's passing. It is expected that installation of CT-Perfusion imaging at the originating hospital along with software to view this imaging from the EVT centre could reduce delays in the consultation process prior to transferring the patient.

Example	Patient Type	Patient Story
Patient E²	Stroke – Delayed EVT	Patient E presented to hospital with stroke symptoms and received tPA 20 minutes after arrival at the emergency department before being transferred to the angiography suite for EVT. CT imaging showed that the patient had an ischemic stroke. An EVT procedure was started nearly two hours after the patient received tPA, and blood flow was successfully restored to the patient about 50 minutes later. The hospital noted that response time may have been slowed by COVID-19 protocols because the patient was deemed to be a high COVID-19 risk, and additional personal protective equipment protocols were required. After receiving the tPA and EVT procedure, the patient's condition deteriorated. Ultimately, the family decided to move toward end of life care.
Patient F³	Cardiac – Wait Time Delay due to COVID-19	Patient F had a significant and long-standing cardiac history and was referred for a valve repair/replacement surgery. While the patient was accepted for surgery, the booking of the surgery was impacted by the operating room restrictions imposed by the issuance of the directive by the Chief Medical Officer of Health (CMOH) during the COVID-19 pandemic. In June 2020, the patient arrived by ambulance to hospital with cardiac arrest before being transferred to another hospital. As a result of a shortage of oxygen to the brain, the patient deteriorated and neurological death was determined three days later.
Patient G³	Cardiac – Wait Time Delay due to COVID-19	Patient G was accepted by a hospital in January 2020 for a complex type of valve replacement surgery. This hospital indicated that the procedure was delayed because daily surgeries were reduced starting the week of March 16 and elective complex cases were paused (however, patients who were classified as hospitalized complex cases did receive their surgeries) in response to the CMOH directive. In May 2020, the hospital attempted to contact the patient to book next-day surgery, but was informed by the patient's daughter that the patient had died twelve days earlier.

1. Patient stories for Section 5.1.1.
2. Patient stories for Section 5.1.2.
3. Patient stories for Section 7.1.1.

Appendix 9: Stroke Inpatient Rehabilitation Providers of the Most/Least Minutes of Rehabilitation per Stroke Patient, 2019/20

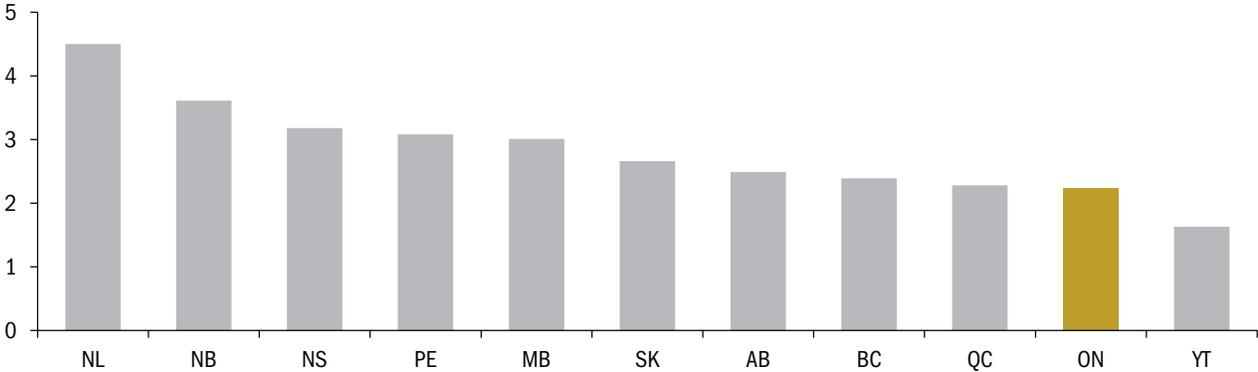
Source of data: CorHealth Ontario

Ontario Health Region	Site Name	# of Stroke Patients	Median Time of Direct Therapy Per Day (in minutes)
Providers of the Most Inpatient Rehabilitation Time			
Toronto	1. St. John's Rehab General	259	109.4
Toronto	2. West Park Health Centre	135	108.3
West	3. Grey Bruce Health Services	114	96.8
East	4. Pembroke Regional Hospital	49	95.6
West	5. Grand River Hospital Rehab	116	94.7
North	6. Timmins & District General Hospital	41	90.8
West	7. St. Thomas Elgin General Hospital	51	90.5
West	8. Huron Perth - Stratford General	112	89.8
East	9. Peterborough Regional Health Centre	77	88.9
West	10. Cambridge Memorial Hospital	56	85.1
Providers of the Least Inpatient Rehabilitation Time			
Central	1. Trillium Health Partners - Mississauga Hospital	169	21.5
Central	2. Southlake Regional Health Centre	124	30.2
Central	3. Brampton Civic Hospital	171	36.5
Central	4. Mackenzie Richmond Hill Hospital	138	38.1
Central	5. Royal Victoria Regional Health Centre	73	40.2
Central	6. Georgian Bay General Hospital	41	42.5
East	7. Lakeridge Health Rehab	212	45.4
North	8. Sault Area Hospital	58	47.2
Central	9. Trillium Health Partners - Credit Valley Hospital	61	50.0
Central	10. Markham Stouffville Hospital	107	50.7

Note: This listing only includes rehabilitation providers who treated at least 40 stroke patients in 2019/20. CorHealth Ontario has collected and analyzed information on this indicator only up to 2019/20.

Appendix 10: Hospital Beds per 1,000 People by Province and Territory*

Prepared by the Office of the Auditor General of Ontario

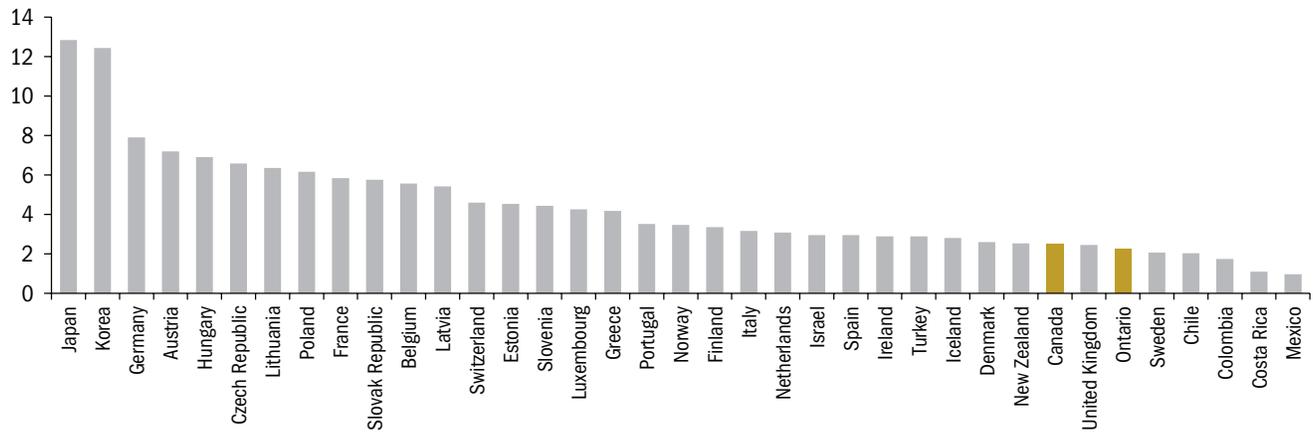


Note: Beds per 1,000 people was calculated using fourth quarter 2019 population estimates available on Statistics Canada and the Canadian Institute for Health Information's 2019-20 Beds Staffed and In Operation data.

* Data used in this figure is based on information from the Canadian Institute for Health Information and Statistics Canada. Data was not available for Northwest Territories or Nunavut.

Appendix 11: Hospital Beds per 1,000 People in Member Countries of the Organisation for Economic Co-operation and Development (OECD)*

Source of data: Organization for Economic Development and Co-operation (OECD)



* The OECD has 38 member countries. The information includes OECD data from 36 countries (no data was available for Australia or the US).

Appendix 12: 10 Recommendations from CorHealth Ontario's Rehabilitation Call-to-Action Report in June 2018

Source: CorHealth Ontario

Example	Action Items
Recommendation 1	<ul style="list-style-type: none"> a. CorHealth Ontario (CorHealth) complete its work on options for an integrated regional structure that spans the full continuum of cardiac, stroke and vascular care and forward to Ministry of Health (Ministry). b. Ministry review options, endorse a preferred option, and work with CorHealth and Local Health Integration Networks (LHIN)s to implement.
Recommendation 2	<ul style="list-style-type: none"> a. CorHealth collaborate with rehab providers, patients, caregivers to identify quality indicators for in- and outpatient, and community-based rehab. b. Ministry direct LHINs to adopt indicators and develop/implement rehab performance measurement and accountability framework (targets, accountabilities, monitor, address performance).
Recommendation 3	<ul style="list-style-type: none"> a. CorHealth collaborate with partners and rehab providers to evaluate the impact of best practices on improving access, patient care, outcomes, and effective use of resources.
Recommendation 4	<ul style="list-style-type: none"> a. CorHealth work with rehab organizations and networks to foster communities of practice that include patients and caregivers. b. Ministry establish a provincial rehab advisory council from across all major clinical areas to develop effective rehab systems, services and funding for all Ontarians.
Recommendation 5	<ul style="list-style-type: none"> a. CorHealth regularly review and update best practice rehab standards and guidelines. b. CorHealth work with/leverage the work of other organizations to adopt, adapt, develop best practice rehab standards and guidelines to meet gaps. c. CorHealth partner with Health Quality Ontario to develop harmonized best practice quality standards and guidelines for rehab.
Recommendation 6	<ul style="list-style-type: none"> a. Ministry assess best practice rehab standards and guidelines in Ontario including their development and implementation (gap analysis and actions to address gaps).
Recommendation 7	<ul style="list-style-type: none"> a. CorHealth work with Ministry and LHINs to align with Ontario's e-referral system; and define principles, best practices, requirements, and enablers for cardiovascular and stroke rehab regional referral. b. Ministry and LHINs develop and implement Ontario-wide e-referral system for all of rehab.
Recommendation 8	<ul style="list-style-type: none"> a. CorHealth and community service orgs/providers at all levels and patients/caregivers define principles, evidence/ consensus-based elements of integrated cardiovascular and stroke community rehab, and advise Ministry. b. Ministry leverage CorHealth work for integrated community programs for all rehab. c. Ministry direct the LHINs to review investments in community integration rehab with view of increasing support for these programs.
Recommendation 9	<ul style="list-style-type: none"> a. CorHealth collaborate with Rehabilitative Care Alliance to develop and/or confirm standard definitions of cardiovascular and stroke rehab services. b. Ministry direct LHINs to maintain current inventories of cardiovascular and stroke rehab services using the standard definitions. c. CorHealth and Ministry conduct provincial assessment of cardiovascular and stroke rehab services in the LHINs every two years; identify gaps, inequities and duplications; LHINs to resolve.
Recommendation 10	<ul style="list-style-type: none"> a. CorHealth and Ministry continue developing patient-based funding models that include rehab.

Appendix 13: Last Time Funding Rates for Various Cardiac Procedures Were Updated

Prepared by Office of the Auditor General of Ontario

Procedure	Description	Last Updated
Left Atrial Appendage Closure	Minimally invasive procedure for patients with an irregular heart rhythm to close part of the heart where blood can clot, potentially leading to a stroke.	2019/20*
Mitral Valve Clip	Minimally invasive procedure that uses a device to narrow the opening of the mitral valve to prevent blood from leaking backwards into the left atrium and damaging the heart over time.	2016/17*
Transcatheter Aortic Valve Implantation (TAVI)	Minimally invasive procedure that expands a functional valve within an existing aortic valve that is too narrow to function properly. This new valve opens and closes normally, restoring regular blood flow and preventing strain on the heart.	2012/13*
Ablations with Advanced Mapping	Ablations that include advanced three-dimensional imaging to better navigate to problematic parts of the heart.	2007/08*
Ablations	Minimally invasive procedure that burns or freezes parts of the heart that are sending irregular electrical impulses that can cause an irregular heartbeat.	2006/07
Coronary Artery Bypass Graft (CABG)	Minimally invasive or surgical (invasive) procedure to reroutes blood flow around a blocked or narrowed artery.	2006/07
Implantable Cardioverter-Defibrillators (ICDs)	Surgical implantation of a battery-powered device that monitors heart rate and delivers an electric shock to restore a normal heart beat if the heart beats too quickly or chaotically.	2006/07
Other Heart Surgery	Heart surgeries other than those funded separately, such as surgeries to remove aneurysms (ballooned arteries caused by weaknesses in the artery wall), blood clots, or tumours from the heart.	2006/07
Percutaneous Coronary Intervention (PCI)	Minimally invasive procedure to break up plaque buildup in narrowed or obstructed blood vessels, while leaving a stent at the site to prevent further narrowing.	2006/07
Valve Replacement	Invasive (surgical) procedure where a diseased aortic valve is removed and replaced with a new functioning valve.	2006/07
Valve Replacement and CABG	When both a valve replacement and CABG (both described above) need to be conducted and are done so simultaneously.	2006/07
Electrophysiology Study	A minimally invasive procedure that threads wires to the heart to measure electric signals and determine which areas in the heart are responsible for abnormal rhythms.	2000
Permanent Pacemaker	Surgical implantation of a battery-powered device that generates electrical impulses to replace or regulate heart function.	2000
Diagnostic Catheterization	Minimally invasive procedure that inserts thin tubes into veins and/or arteries, which are then guided to the heart or blood vessels. This is used to take blood samples, measure blood pressure, and to inject dye to allow X-ray visualization, all of which are used to detect heart disease.	1997

* Year shown for these procedures is the year the Ministry first started funding them.



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ISSN 1911-7078 (Online)
ISBN 978-1-4868-5642-8
(PDF, 2021 ed.)

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