COORDINATION AND SURVEILLANCE OF INTER-REGIONAL CARDIOVASCULAR CARE: THE ONTARIO MODEL, CANADA

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Abstract. The manuscript presents the experience of cardiac diagnostic and invasive therapeutic procedures availability increasing by example of The Ontario model for Cardiac Care / CorHealth Network to maintain and improve medical care for large population and geographic region. New PCI-capable hospitals were created across the province of Ontario and new management guideline for STEMI patients were introduced for the improvement of medical care access and it`s outcomes.

Relevance of the issue

Ontario comprises a population of approximately 14.3 million people, the most populous province in Canada and fourth in terms of geographical area. It is composed of many large metropolitan centers such as Toronto (provincial capital), Ottawa (federal capital), Kingston, Hamilton, London, Windsor, Kitchener, and Sudbury amongst other smaller centers. In addition, given its vast geographical size, there are numerous small communities which are more remote and at considerable distance from major cardiac centers.

In the late 1980s there was crisis in healthcare in Ontario with a number of patients dying whilst waiting for elective or semi-elective cardiac surgical procedures. The Ministry of Health of Ontario launched an investigation into cardiac surgery with Dr. William Sibbald from Victoria Hospital, University of Western Ontario, as one of the lead investigators of this inquiry [1]. As a result, the Ministry supported an urgency rating system to standardize triage for cardiac surgery and recommend maximum waiting times. This led to the expansion of the program, incorporating all provincial hospital networks and a data form was developed to gather standardized demographic and clinical details on all patients awaiting cardiac surgery. A provincial working group was appointed to develop a comprehensive cardiac care scheme for the province. Hence, the provincial adult **Cardiac Care Network** was established in 1990.

The Cardiac Care Network is government sponsored and funded with an independent and separate board from the Ministry of Health, however there is **direct reporting and accountability to the Ministry**.

In 2017 the Cardiac Care Network amalgamated with the Ontario Stroke Network to form **CorHealth Ontario** which is a comprehensive body based in Toronto to oversee cardiac, stroke and vascular care for the province [2]. There is a Board of Directors with representative physicians from the various clinical spheres. A dedicated person at each hospital, specifically a nurse clinician, is appointed to facilitate data collection, referrals, waitlist management and access to care as well as communicate with patients (Regional Cardiac Care Coordinator). Information is hence used prospectively and constructively to facilitate timely scheduling. The information about referrals and procedural outcomes are subsequently forwarded to the CorHealth Centre in Toronto for analysis and quality control/assurance. For the purposes of this article I will focus on the cardiac specific network (formally CCN).

Purpose

The cardiac component of CorHealth Ontario supports the following:

1. Evidence-based practice with a patient-centred approach.

2. Access to cardiac diagnostic and invasive therapeutic procedures as well as resource planning.

3. Measuring and reporting quality care indicators/performance standards

The principle of organization of medical care

Data collection is central and crucial to the implementation of the objectives of CorHealth. Data gathering forms for specific cardiac invasive procedures [i.e. coronary angiography] are completed by the referring doctor (https://www.corhealthontario.ca/resources-for-health-care-planners-&-providers/cath-&-pci/referral-forms/Cath-Referral-Form-LHSC.pdf). This outlines patient demographics, epidemiological details, clinical parameters, especially factors which influence urgency. From this form an **urgency rating score** can be calculated. This helps to guide the timing of the procedure with acceptable wait time and allotment to the appropriate place in the queue. Moreover, it allows for comparison of wait times for patients of similar urgency across other centres in the province. Similar forms for percutaneous coronary intervention, cardiac surgical triage as well as other procedures are available. Through this process, **practical, reliable and efficient timing and scheduling of cardiac procedures for patients** is implemented at the geographically and clinically appropriate centre for that particular individual within the province.

There are 20 medical centres in Ontario with advanced cardiovascular care that provide coronary angiography, percutaneous coronary intervention, cardiac surgery as well as electrophysiologic services. Local Health Integration Networks (LHIN) are regionalization of care within the province and patients within this area are generally referred to the local centre within these geographical areas (Figure 1). There is at least one Regional PCI / Cardiac Surgical Centre within each LHIN.

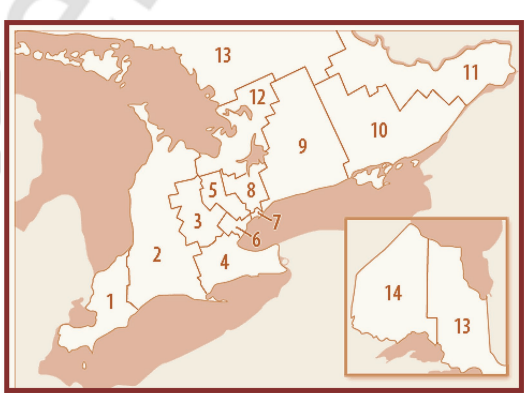

Figure 1.
Local Health Integration Networks (LHIN) in Province of Ontario. (Source: Gov't of Ontario Website)

The following is a comprehensive list of the variables that are gathered, followed and reported by CorHealth with respect to cardiac care:

1. Catheterization laboratory utilization [overall number of cases with breakdown of diagnostic, biopsy and right heart catheterization].

2. Percentage of catheterization studies performed through radial arterial access.

3. PCI wait times broken down into elective, semi-urgent and urgent cases.

4. PCI access times in the setting of STEMI relating to door-to-balloon time (D2B).

5. PCI wait times for elective, semi-urgent and urgent triage cases.

6. Coronary artery bypass utilization and wait times based on elective, semi-urgent and urgent cases.

7. Percentage of revascularization performed from percutaneous or bypass technique [this varies between 2:1 – 6:1 throughout the province].

8. TAVI utilization and wait times.

9. Mitra Clip utilization and wait times.

10. Wait times and utilization for electro-physiologic procedures [heart rhythm implantation, ICD and ablation techniques]

It should be emphasized that this system incorporates not only elective out-patient referrals, but those referred semi-urgently as out-patients, as well as those needing urgent cardiac care. Figure 2 illustrates the process of referral in the various scenarios of cardiac care for coronary artery disease.

The CorHealth Form is completed afterwards and this along with referral and procedural times are important in quality assurance. A Drip-and-Ship Pharmacoinvasive strategy is in place for those who receive thrombolysis at more remote non-PCI centers (or at maximum transfer time of 24 hours following successful thrombolytic reperfusion). For other **ACS presentations**, the CorHealth Form is faxed to the Regional PCI Centre along with telephone confirmation and those at remote centers are transferred via Ambulance through a Short Stay Unit (Flyer). Following angiography +/– PCI they are often repatriated to the local center.

Discussion

Inherent in this process of information gathering is **feedback to the individual centers** to improve cardiac, neurologic and vascular care. As well, the information is utilized

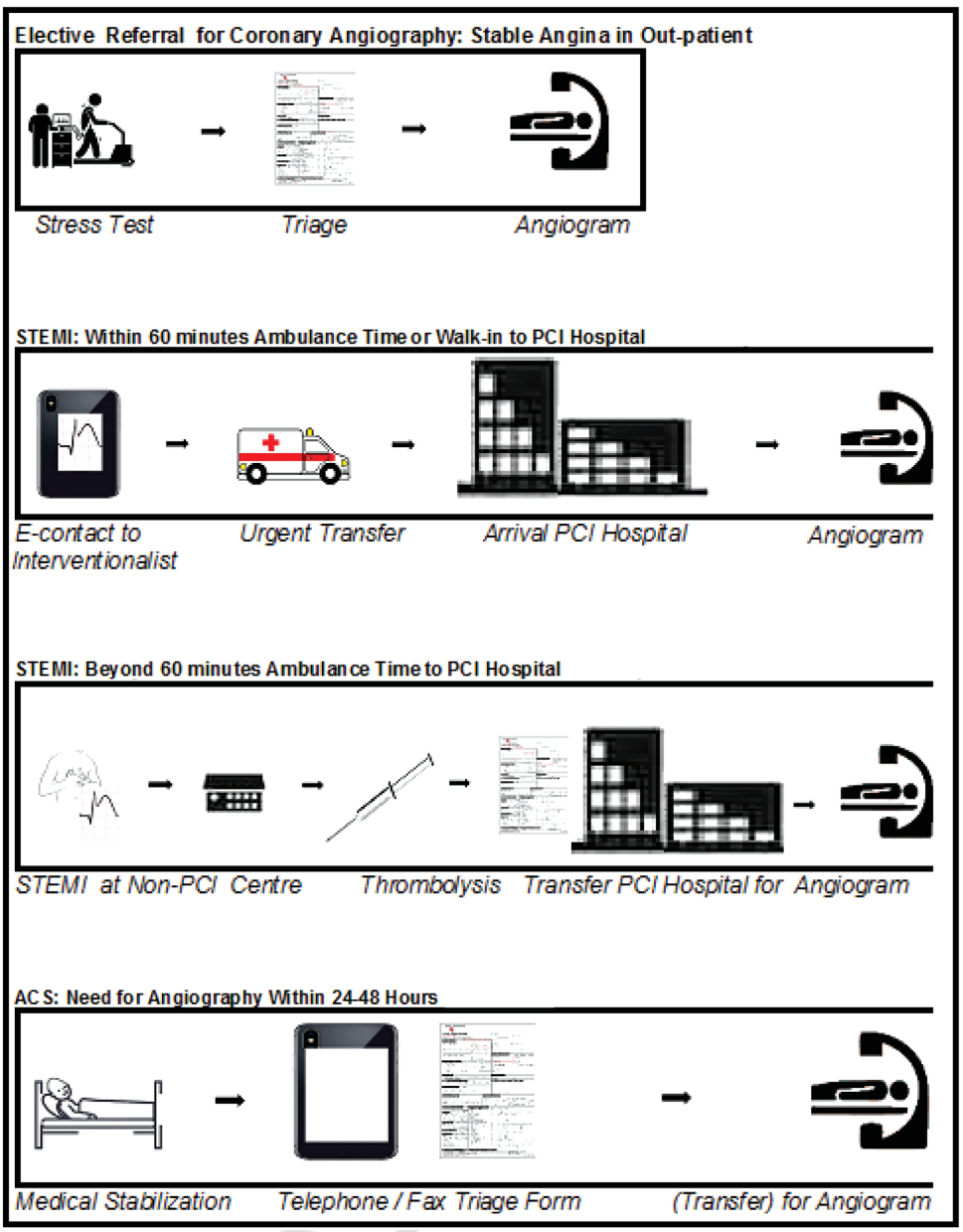

Figure 2.
For Outpatient Referral, the completed CorHealth Form is sent to the Regional PCI Centre for Triage and Scheduling. PCI may be performed *ad hoc* if appropriate. In the case of STEMI there is urgent transfer to a PCI Centre via Ambulance if within 60 minutes

to advise the Ministry of Health, Local Health Integration networks (LHIN), hospitals and care providers with monthly and annual reporting of quality indicators provided in graphic form. This helps the entire system and each individual centre gauge its quality and timeliness of care. Figure 3 illustrates this principle. One of the performance indicators for quality of care in STEMI management is door-to-balloon time < 120 minutes. This information is collected at individual centers and relayed to the CorHealth central office where it is tracked.

This data has also been utilized to help justify **policy statements** on cardiac care and through this the derivation of **quality guidelines**. The data is also invaluable in providing evidence-based justification of resource allocation and expansion. Since its inception, the number of PCI-capable hospitals has increased from eight to twenty across the province of Ontario.

An indication of the power of this data gathering and information sharing throughout the province has been the improvement of access and outcomes with patients with acute ST segment elevation myocardial infarction. In 2011 a STEMI working group composed of cardiologists, interventional cardiologists, emergency room physicians, medical directors, paramedics and administrators was formed to standardize care to the province. In 2013 the Cardiac Care Network published best practices for STEMI in terms of protocols to ensure timely access to treatment [3]. That same year best

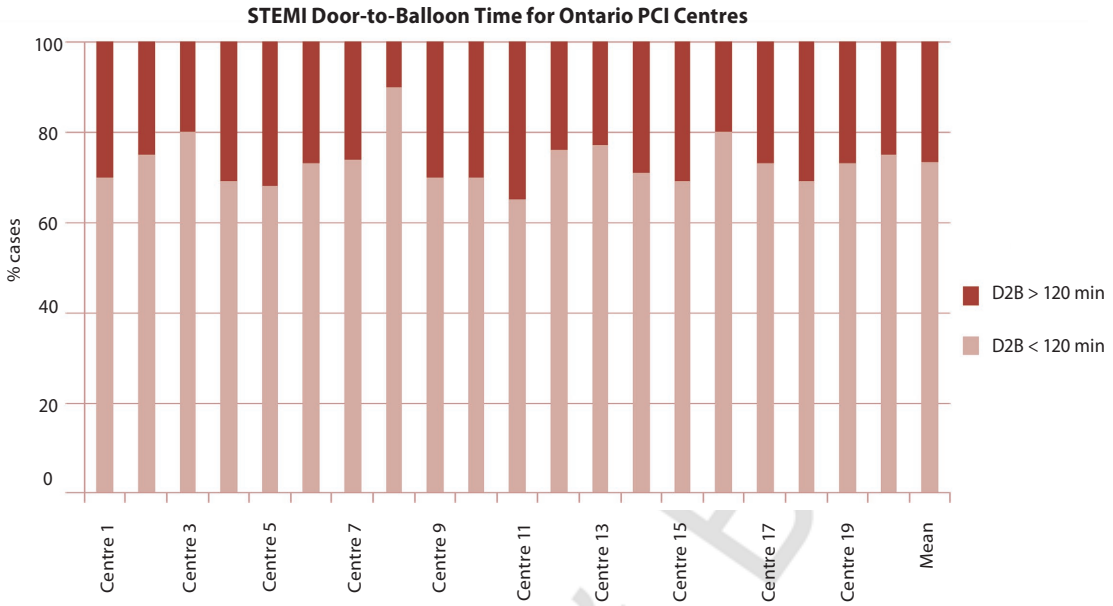

Figure 3. Door-to-Balloon times at PCI Centres in Ontario. Theoretic example of Monthly or Annual Feedback Report from CorHealth comparing percent of STEMI cases which meet the standard within 120 minutes. A provincial mean percentage is also provided. NB – these numbers are for illustration only and do not correspond to any centre in particular

practices for ACS for remote communities were also published [4]. In 2016 an implementation plan for STEMI bypass directly to centres with advanced cardiac care was established [5]. The management guideline target for primary PCI is less than 60 minute drive to a PCI hospital from a non-PCI hospital emergency department targeting a door-to-balloon time of less than 120 minutes. If this cannot be achieved a pharmaco-invasive strategy is recommended when there is greater than 60 minute drive time to a PCI hospital from a non-PCI hospital emergency department. In this scenario the door to needle time for thrombolytic therapy should be less than 30 minutes with recommendation of urgent transfer to a PCI centre in less than 24 hours for coronary angiography. Utilizing this recommendation coupled with the feedback that had been provided on a monthly and annual basis there was a 5% improvement from 2017 to 2018 in these parameters.

Analysis of the CCN database and partnership with the Institute for Clinical Evaluative Sciences (ICES) led to a recent publication on the variation of ratio of PCI:CABG for patients requiring coronary revascularization across the Province of Ontario [6]. Non-emergent multivessel disease accounted for most of the variation in this ratio. It seemed that the mode of revascularization was largely based on the recommendation of the diagnostic angiographic physician-operator and the revascularization philosophy of the treating hospital. Transparency of this information is a strong factor to influence and guide adherence to evidence-based principles and ensure angiographers, interventionalists and cardio-surgeons are involved together in the decision-making process for patients, especially those with multivessel coronary artery disease.

Conclusion

In conclusion, a centralized and coordinated cardiac care program integrating utilization of wait time and outcome data from regional advanced cardiac care centers provides a very practical framework in which to ensure appropriate care through evidence-based principles, reduce regional variation and provide constructive feedback in order to enhance care throughout the province or country. The Ontario model for Cardiac Care / CorHealth Network is an excellent example of this process, which strives to maintain and improve medical care for this large population and geographic region.

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