Cardiac System Activity Monitoring – Technical Specifications

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Purpose of this document

- Requirements confirmation and documentation for CorHealth Analytics and Clinical teams
- Knowledge translation between CorHealth Analytics and Enterprise Analytics and Assets Services (EAAS) to support operationalizing Power BI inputs into CorHealth's Consumption Zone

Overview of Cardiac Activity System Monitoring

Purpose:

- Support analyses of cardiac procedure and waitlist trends over time
- Early-identify short-term changes to cardiac services delivery
- Monitor recovery of cardiac system relative to pre-pandemic baseline

Data Sources:

- CorHealth Data Collection and Information System (DCIS)

Data periods and refresh cadence:

As of FY 2022/23, the Cardiac System Activity Monitoring report:

- includes all months from January 2019 to the most recently available month in the data
- is refreshed on a monthly basis

Indicator 1: Procedure volume

Description	Volumes of cardiac procedures performed

Cohort	Inclusion criteria:
	• Waitlist entries with:
	  • at least one cardiac procedure performed included in Appendix 1[1] indicated among the five procedure fields on the record, regardless of procedure status value[2]
	  • Removal Reason = "Procedure Started (PS)"
	  • Removal Date is within the reporting interval[3]
	• Reporting period is indexed to removal date
	• Entries with procedures mapping to multiple procedure types listed in "Aggregations" below are included in volumes for each procedure type.
	  • E.g., an entry with both Coronary Angiogram and PCI is included in volumes for both Coronary Angiogram and PCI
	  • An exception are entries with cardiac surgery. Each entry with surgery is included in only one of the below mutually exclusive procedure types (refer to footnotes):
	  1. Concomitant CABG and valve surgery[4]
	  2. CABG without valve surgery
	  3. Valve surgery without CABG
	  4. All other cardiac surgery[5]
	  • Entries with both surgery and non-surgery procedures are included in volumes for both surgery and non-surgery procedure types:
	  • E.g., an entry with both CABG without valve surgery and PCI is included in volumes for both procedure types

Aggregations	• Procedure types:
	  • Concomitant CABG and valve surgery
	  • CABG without valve surgery
	  • Valve surgery without CABG
	  • All other cardiac surgery
	  • All cardiac surgery (calculated as sum of four cardiac surgery types above)
	  • PCI
	  • Coronary angiogram
	  • Transcatheter aortic valve implantation
	  • Ablation, standard
	  • Ablation, complex
	  • Ablation, any[6]
	  • Implantable cardioverter defibrillator
	• Service providers:
	  • Province
	  • Hospitals (20)
	  • OH Hospital Regions (6)

Interpretation	• Higher volumes are desired

[1] Refer to appendix 1 for DCIS definitions of **cardiac procedures performed**.
[2] Reported volumes are of procedures performed, not procedures identified as completed. Therefore, procedures with completion status = "Not completed" or "NULL" are included.
[3] For indicator 1, 'reporting interval' is between January 2019 and the month preceding the data pull, inclusive.
[4] entries with both CABG and valve surgery performed as defined in Appendix 1
[5] entries with "Other cardiac surgery" but without CABG or Valve surgery performed as defined in Appendix 1
[6] These are defined as entries with *either* standard or complex ablation, and not the sum of entries with standard ablations and those with complex ablations. However, as of August 2023 there are no entries with both standard and complex ablations, so the results from both definitions are identical.

	• Low monthly volumes relative to the same month in the pre-pandemic baseline (FY 2019/20) will be indicated visually in PowerBI.

Indicator 2a: Wait 1[7] waitlist queue, open cases

Description	Volume of patients waiting to be accepted for a cardiac procedure, i.e., volume of the open Wait 1 waitlist

Cohort	Inclusion criteria:
	• Waitlist entries with:
	  • referral for a cardiac procedure[8] included in Appendix 2
	  • One of the following:
	  • Acceptance Date >= start of the reporting interval[9] *or*
	  • Acceptance Date is null and Removal Date >= start of the reporting interval, *or*
	  • Acceptance Date and Removal Dates are both null, i.e., the patient is still on the Wait 1 waitlist
	• Wait 1 waitlist volume for each data period is calculated using a historical snapshot of the waitlist on midnight of the first day of that period
	• Each waitlist entry is included in all snapshots between their Referral Date (not inclusive) and Wait 1 end date (inclusive)[10]. Wait 1 end date is defined as:
	  • Acceptance Date, if populated
	  • Removal Date, if populated and Acceptance Date is not populated (i.e., the entry was closed amid Wait 1)
	  • There are a very small number of entries for which the Acceptance Date is not populated and the Removal Date is earlier than the Referral Date; for these cases, the Referral Date was used as the Wait 1 End Time
	  • current date if both Acceptance and Removal Dates are not populated (i.e., the patient is still waiting as of the data pull)
	• A single entry can contribute to zero, one, or multiple reporting periods.
	  • Example 1: a patient with Referral Date = January 31, 2023 and Acceptance Date = March 1, 2023 will be included in the February and March 2023 reported volumes
	  • Example 2: a patient with Referral Date = February 1, 2023 and Acceptance Date = March 1, 2023 will be only be included in the March 2023 reported volumes
	  • Example 3: a patient with Referral Date = February 1, 2023 and Acceptance Date = February 15, 2023 will not be included in any reported volumes

Aggregations	• Same 'Procedure types' as for indicator 1 with one more: 'Ablation of unknown indication (Pre-DCIS)'[11]. • Aggregated values for 'Procedure type' = 'Ablation any' is the sum of aggregations for three mutually exclusive procedure types: 'Ablation, complex', 'Ablation, standard' and ' Ablation of unknown indication (Pre-DCIS)' • Same 'Service providers' as for indicator 1
Interpretation	• Lower volumes are desired • High monthly volumes relative to the same month in the pre-pandemic baseline (FY 2019/20) will be indicated visually in PowerBI.

[7] Wait 1 is calculated from Referral Date to Acceptance Date (if populated).
[8] Refer to appendix 2 for DCIS definitions of **referrals for cardiac procedure** used in indicators 2a, 2b and 3.
[9] For indicators 2a, 2b and 3, 'reporting interval' are historical snapshots on first day of the month between January 2019 and the month of the data pull, inclusive.
[10] The reason why entries with an 'end event' date (in this case, the Acceptance Date) matching a snapshot date are included in reporting, but not entries with a 'start event' date (in this case, the Referral Date) is because the snapshot is taken at midnight. In example 2 shown below, this patient would be referred on February 1 after the midnight snapshot, so they would not be included in February's reported volume. The acceptance on March 1 occurred after the midnight snapshot, so this patient – still waiting as of the midnight snapshot – would be included in March's reported volume.
[11] This procedure type only exists among 'open' cases.

Indicator 2b: Wait 2[12] waitlist queue, open cases

Description	Volume of patients waiting for a cardiac procedure, i.e., volume of the open Wait 2 waitlist

Cohort	Inclusion criteria:
	• Waitlist entries with:
	  • referral for a cardiac procedure included in Appendix 2
	  • populated Acceptance Date
	  • One of the following:
	  • Removal Date >= start of the reporting interval *or*
	  • Removal Dates is null, i.e., the patient is still on the Wait 2 waitlist
	• Wait 2 waitlist volume for each data period is calculated using a historical snapshot of the waitlist on midnight of the first day of that period
	• Each waitlist entry is included in all snapshots between their Acceptance Date (not inclusive) and Wait 2 end date (inclusive). Wait 2 end date is defined as:
	  • Removal Date, if populated
	  • current date if Removal Date is not populated (i.e., the patient is still waiting as of the data pull)
	• A single entry can contribute to zero, one, or multiple reporting periods.
	  • Example 1: a patient with Acceptance Date = March 31, 2023 and Removal Date = May 1, 2023 will be included in the April and May 2023 reported volumes
	  • Example 2: a patient with Acceptance Date = April 1, 2023 and Removal Date = May 1, 2023 will be only be included in the May 2023 reported volumes
	  • Example 3: a patient with Acceptance Date = May 1, 2023 and Removal Date = May 15, 2023 will not be included in any reported volumes

Aggregations	Same as for indicator 2a
Interpretation	Same as for Indicator 2a

[12] Wait 2 is calculated from Acceptance Date to Removal Date (if populated).

Indicator 3: Proportion of wait times within target, open cases

Description	Proportion of patients waiting for Coronary Angiogram, CABG or PCI currently within their wait time access target among open cases

Denominator	Inclusion criteria:
	• One of the following:
	  • entries with Priority level of 2, 3, or 4[13] in indicator 2a's cohort with referral for Coronary Angiogram[14]
	  • entries with Priority level of 2, 3, or 4 in indicator 2b's cohort with referral for Coronary Angiogram, CABG without valve surgery or PCI

Numerator	Inclusion criteria:
	• Subset of the denominator whose wait time at snapshot is within the Access Target
	• Wait time at snapshot is calculated as time between the Wait Start Date and snapshot date minus all Dates Affecting Readiness to Treat (DARTs) days up to snapshot in overlapping DARTs[15].
	  • Wait Start Date is defined as:
	  • Referral Date for entries with referral for Coronary Angiogram
	  • Acceptance Date for entries with referral for CABG without valve surgery or PCI
	  • Overlapping DARTs are defined as those with:
	  • Wait Start Date <= DART To Date
	  • DART From Date < snapshot date (a DART on the snapshot date itself is not considered 'overlapping')
	  • For each overlapping DART, the DART days up to snapshot is calculated as the difference between DART start and end dates at snapshot plus one[16], where:
	  • DART start date at snapshot is the later of Wait Start Date and DART From Date
	  • DART end date at snapshot is the earlier of DART To Date and snapshot date minus one[17]
	• Example: consider a patient with referral for CABG without valve surgery and:
	  • Referral Date of December 31, 2023
	  • Acceptance Date of January 31, 2023 (Wait Start Date)
	  • Removal Date of June 15, 2023
	  • DART 1 from January 10 to 19 (10 days)
	  • DART To precedes the Wait Start Date, hence this DART does not overlap with any snapshot and is not used in any calculations.
	  • DART 2 from January 20 to 31 (21 days)
	  • DART 3 from February 15 to March 15 (29 days)
	  • DART 4 from April 10 to June 10 (62 days)
	
	This patient's wait period beginning at Wait Start Date overlapped five snapshots from February 1 to June 1, 2023 (inclusive). The below table shows how their wait time at each snapshot is calculated.

[13] For this indicator, Priority 1 entries are excluded because they do not wait long enough to appear on snapshots, and 'Null' priority entries do not have a target to compare against.

[14] According to business rules, the Access Target is applied to total wait (Wait 1 + Wait 2) for Coronary Angiogram, but Wait 2 only for CABG without valve surgery and PCI. Therefore, people currently in Wait 1 for Coronary Angiogram – but not for any other procedure – are included in this indicator's cohort.

[15] In this context, "overlapping DARTs" refers to those overlapping with snapshots, not DARTS overlapping with each other. This logic assumes that DARTs for the same entry do not overlap with each other.

[16] The "plus one" is to account for DART periods being inclusive of both the "to" and "from" dates; e.g., a DART from January 1 to 5 is considered a period of five days, not four.

[17] Since the snapshot is taken at midnight, the snapshot date itself is not considered part of the wait time, and therefore a DART on the snapshot date is excluded from the calculation.

<table>
<tr><td></td><td>
<table>
<tr><th>Snapshot Date</th><th>Snapshot minus Wait Start date</th><th>DART days up to snapshot</th><th>Total DART days up to snapshot</th><th>Wait time at snapshot (adjusted for DARTs)</th></tr>
<tr><td>Feb 1</td><td>1</td><td>DART 2: Jan 31 to Jan 31 (1 day)</td><td>1</td><td>0 (1 – 1)</td></tr>
<tr><td>Mar 1</td><td>29</td><td>DART 2: Jan 31 to Jan 31 (1 day)
DART 3: Feb 15 to Feb 28 (14 days)</td><td>15 (1 + 14)</td><td>14 (29 – 15)</td></tr>
<tr><td>Apr 1</td><td>60</td><td>DART 2: Jan 31 to Jan 31 (1 day)
DART 3: Feb 15 to March 15 (29 days)</td><td>30 (1 + 29)</td><td>30 (60 – 30)</td></tr>
<tr><td>May 1</td><td>90</td><td>DART 2: Jan 31 to Jan 31 (1 day)
DART 3: Feb 15 to March 15 (29 days)
DART 4: April 10 to April 30 (21 days)</td><td>51 (1 + 29 + 21)</td><td>39 (90 – 51)</td></tr>
<tr><td>Jun 1</td><td>121</td><td>DART 2: Jan 31 to Jan 31 (1 day)
DART 3: Feb 15 to March 15 (29 days)
DART 4: April 10 to May 31 (52 days)</td><td>82 (1 + 29 + 52)</td><td>39 (121 – 82)</td></tr>
</table>
Access Targets are summarized in the below table:
<table>
<tr><th>Priority level</th><th>Coronary Angiogram</th><th>CABG</th><th>PCI</th></tr>
<tr><td>2</td><td>7 days</td><td>14 days</td><td>7 days</td></tr>
<tr><td>3</td><td>28 days</td><td>42 days</td><td>14 days</td></tr>
<tr><td>4</td><td>84 days</td><td>90 days</td><td>28 days</td></tr>
</table>
</td></tr>
<tr><td>Aggregations</td><td>

Procedure types:

Coronary Angiogram
CABG without valve surgery
PCI

Service providers:

Province
Hospitals (20)
OH Hospital Regions (6)

</td></tr>
<tr><td>Interpretation</td><td>Higher proportion values are desired</td></tr>
<tr><td>Notes</td><td>Only the denominator and numerator will be aggregated into final outputs. The proportion within target (numerator divided over denominator) will be calculated in PowerBI.</td></tr>
</table>