Report on Ablations Outcomes in Ontario
April 1, 2012 to March 31, 2016

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About CorHealth Ontario

In 2016, the Cardiac Care Network of Ontario and the Ontario Stroke Network merged to form one organization, with a mandate spanning cardiac, stroke and vascular care in the province. On June 22, 2017, after a year of transition, the new entity became CorHealth Ontario. CorHealth Ontario proudly advises the Ministry of Health and Long-Term Care, Local Health Integration Networks, hospitals, and care providers to improve the quality, efficiency, accessibility and equity of cardiac, stroke and vascular services for patients across Ontario. For more information, visit **corhealthontario.ca.**

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Acknowledgements

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Executive Summary

For this report, CorHealth Ontario worked with ICES to monitor trends in the case-mix and outcomes of patients receiving ablation procedures in Ontario between 2012 and 2016. This report contains provincial aggregate outcomes for all ablations performed across the province. As this report marks the first time ablations outcomes are being reported in Ontario by CorHealth Ontario, hospital specific results were not reported in this initial iteration. The intention of this report, in conjunction with regular dialogue among providers, is to help stimulate quality improvement activities at the provincial level in the province of Ontario.

Key Observations

- A total of 14,348 patients have had an ablation procedure (8,830 standard and 5,518 complex) between the time period of April 1, 2012 and March 31, 2016.
- Out of the 14,348 patients, 88.00% received a single ablation procedure, 10.13% received two ablation procedures and 1.87% received three or more ablation procedures during the time frame of this study.
- 30-day and 1-year post-ablation mortality rates were 0.3% and 1% respectively.
- 0.2% and 0.6% of cases were re-hospitalized for stroke/TIA within 30-days and 1-year of the ablation procedure, respectively.
- 0.1% and 0.5% of cases presented to the emergency department for stroke/TIA within 30-days and 1-year of the ablation procedure respectively.
- The repeat ablation procedure rates at 30-days, 90-days and 1-year were 0.6%, 2.1% and 9.1% respectively.
- When comparing pre-procedural and post-procedural total hospitalizations and emergency department visits by type of ablation procedure, it was observed that overall there was a decrease in hospitalizations and emergency department visits after the procedure except for the first 30 days immediately after the ablation where hospitalization numbers actually increased, presumably due to a period of patient stabilization, which is well known post-procedure.

Background

An ablation is a procedure designed to correct heart rhythm problems, particularly if the irregular rhythm has not responded to medication.[1] There are currently 10 ablation programs in the province. All ablation programs are provincially funded to provide ablation services. All ablation programs contribute data to the CorHealth Ontario Cardiac Registry.

For this report, CorHealth worked with ICES to monitor trends in the case-mix and outcomes of patients receiving ablation procedure in Ontario. This report is based on data that includes all ablation procedures performed in Ontario from April 2012 to March 2016. By linking ablation data from the CorHealth Ontario registry to hospital discharge data from the Canadian Institute for Health Information (CIHI) Discharge Abstract Database (DAD), emergency department data from the CIHI National Ambulatory Care Reporting System (NACRS) and to the Ontario Registered Persons Database (RPDB), outcomes were analyzed at the provincial level.

Ontario Ablation Programs

The following 10 Ablation centers were active during the study period (2012 - 2016):

Facility	Abbreviation	City
Hamilton Health Sciences	HHS	Hamilton
Kingston General Hospital	KGH	Kingston
London Health Sciences Centre	LHSC	London
Rouge Valley Health System	RVHS	Scarborough
Southlake Regional Health Centre	SRHC	Newmarket
St. Michael's Hospital	SMH	Toronto
Sunnybrook Health Sciences Centre	SHSC	Toronto
Trillium Health Partners	THP	Mississauga
University Health Network	UHN	Toronto
University of Ottawa Heart Institute	UOHI	Ottawa

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[1] Hearth and Stroke Foundation. Heart Ablation. Accessed on February 6th 2019. Available at: https://www.heartandstroke.ca/heart/treatments/surgery-and-other-procedures/ablation

Methods

Time Frame 2012 – 2016

This report includes all patients who had ablation between April 1st, 2012 and March 31st, 2016. Data are reported as provincial aggregates across the entire time period.

Data Linkage

Figure 1 outlines the data linkage steps and the processes used to generate the final data sets. Only those records identified with first Ablation procedure using CorHealth Ontario data, between April 1, 2012 and March 31, 2016, were retained for data linkage.

Data linkage between CorHealth records and CIHI discharge abstracts was performed on health card number, institution and procedure date. Provincial health card numbers were converted to a unique ICES encrypted Health Card Number (IKN) and used for data linkage. To create the final analysis data set, records unable to be linked by provincial health card number were excluded. Only records for which a patient received an ablation procedure, as identified in the CorHealth Ontario cardiac registry were analyzed. Data and outcomes were stratified according to the following procedural categories given their clinical relevance as recommended by clinical stakeholders:

- All Ablations
- All Standard Ablations
- All Complex Ablations
- Complex Atrial Fibrillation Ablations
- Complex Paroxysmal Atrial Fibrillation Ablations
- Complex Non-Paroxysmal Atrial Fibrillation Ablations.

A full list of data sources and their description is added in appendix A.

Data supression

When reporting data, with all descriptive and outcomes tables, if the sample size was less than or equal to 5, the values were suppressed and reported in the table as "≤5" according to standards in place to comply with privacy policies. Additional measures were also taken at times to ensure small cells could not be back calculated.

Figure 1: Cohort creation Flowchart
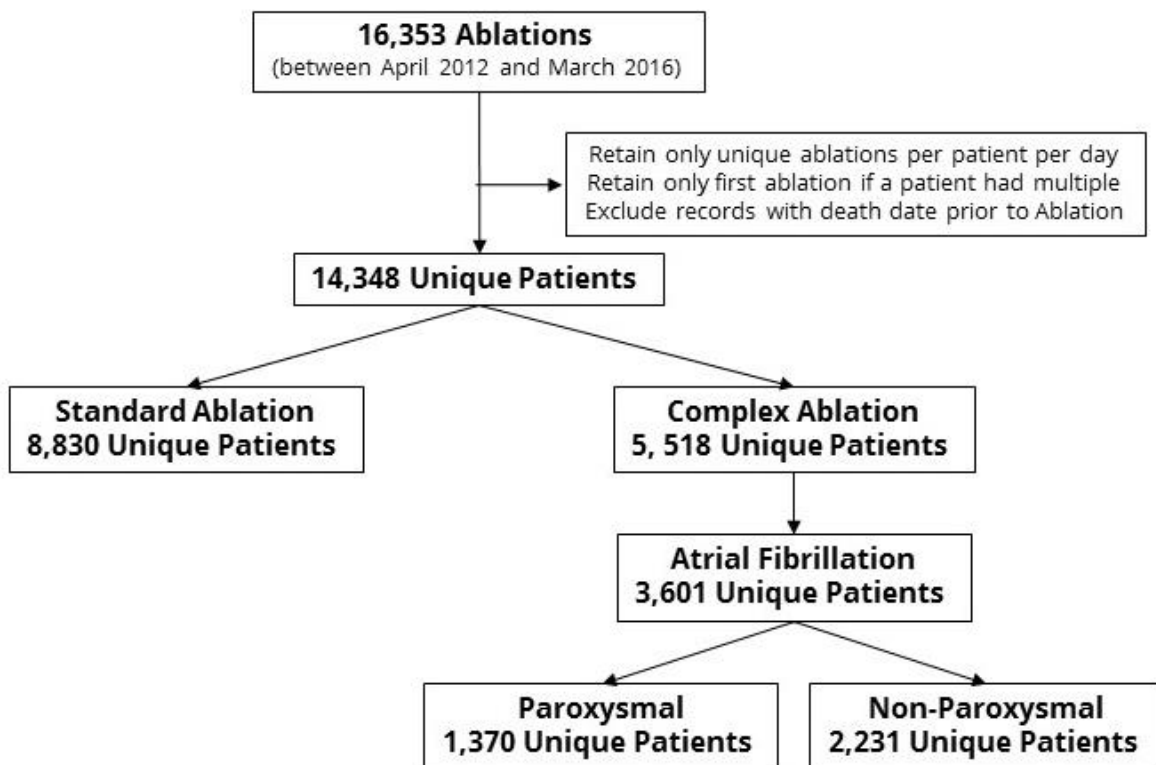
Results

Patient characteristics

Table 1 illustrates the demographics and characteristics of the 14,348 patients who have had an ablation procedure (8,830 standard and 5,518 complex) between April 1st, 2012 and March 31st, 2016. Table 1 demonstrates that there is currently a high level of missing data associated with many ablation patient characteristics in the CorHealth Ontario Cardiac Registry. Patient BMI is missing in almost 90% of the ablation records. A number of patient comorbidities are missing between 15-50% of the time such as diabetes, hypertension. COPD, and heart failure. Also the $CHADS_2$, CHA_2DS_2-Vasc and HATCH scores were missing over half of the time. Understanding that this high level of missing data brings the validity of the data in Table 1 into question, it was felt it was important to highlight this level of missing data as this is the first time ablation data from the CorHealth Ontario Cardiac Registry are being reported on. CorHealth Ontario will work with programs on improving data completeness for future iterations of the report.

Table 1: Characteristics of patients (by individual) that have had an ablation procedure, April 1, 2012 to March 31, 2016

Characteristic	All Ablations (N = 14,348)	All Standard Ablations (N = 8,830)	All Complex Ablations (N = 5,518)	Atrial Fibrillation Complex Ablations (N = 3,601)	Paroxysmal AFib Complex Ablations (N = 1,370)	Non-Paroxysmal AFib Complex Ablations (N= 2,231)
Age						
Mean ± SD	56.87 ± 16.09	56.12 ± 17.67	58.06 ± 13.09	59.96 ± 10.31	60.14 ± 10.57	59.86 ± 10.15
Median (IQR)	59 (48-68)	59 (45-69)	60 (51-67)	61 (54-67)	61 (54-68)	61 (54-67)
Missing	0.06%	0.08%	0.04%	0.06%	0.00%	0.09%
Sex						
F	5,995 (41.8%)	4,040 (45.8%)	1,955 (35.4%)	1,137 (31.6%)	469 (34.2%)	668 (29.9%)
M	8,353 (58.2%)	4,790 (54.2%)	3,563 (64.6%)	2,464 (68.4%)	901 (65.8%)	1,563 (70.1%)
Neighbourhood income quintile						

Q1 (lowest)	2,155 (15.0%)	1,418 (16.1%)	737 (13.4%)	417 (11.6%)	158 (11.5%)	259 (11.6%)
Q2	2,490 (17.4%)	1,569 (17.8%)	921 (16.7%)	562 (15.6%)	228 (16.6%)	334 (15.0%)
Q3	2,765 (19.3%)	1,740 (19.7%)	1,025 (18.6%)	656 (18.2%)	229 (16.7%)	427 (19.1%)
Q4	3,207 (22.4%)	1,971 (22.3%)	1,236 (22.4%)	810 (22.5%)	306 (22.3%)	504 (22.6%)
Q5	3,657 (25.5%)	2,082 (23.6%)	1,575 (28.5%)	1,145 (31.8%)	444 (32.4%)	701 (31.4%)
Missing	74 (0.5%)	50 (0.6%)	24 (0.4%)	11 (0.3%)	<=5	6 (0.3%)
Area of residence						
Urban	12,381 (86.3%)	7,702 (87.2%)	4,679 (84.8%)	2,999 (83.3%)	1,180 (86.1%)	1,819 (81.5%)
Rural	1,952 (13.6%)	1,119 (12.7%)	833 (15.1%)	597 (16.6%)	187 (13.6%)	410 (18.4%)
Missing	15 (0.1%)	9 (0.1%)	6 (0.1%)	<=5	<=5	<=5
Patient BMI (kg/m²)						
Mean ± SD	29.40 ±7.49	29.37 ± 7.00	29.44 ± 8.14	30.69 ±10.76	30.01 ± 6.11	31.05 ± 12.53
Median (IQR)	28 (25-33)	28 (25-33)	28 (25-32)	29 (26-33)	28 (26-33)	29 (26-33)
Missing	89.93%	90.40%	89.18%	93.14%	93.80%	92.74%
Chronic comorbidities						
Diabetes	2,911 (20.3%)	1,903 (21.6%)	1,008 (18.3%)	600 (16.7%)	242 (17.7%)	358 (16.0%)
Hypertension	7,365 (51.3%)	4,269 (48.3%)	3,096 (56.1%)	2,137 (59.3%)	801 (58.5%)	1,336 (59.9%)
Congestive heart failure	2,758 (19.2%)	1,554 (17.6%)	1,204 (21.8%)	690 (19.2%)	247 (18.0%)	443 (19.9%)
COPD	2,188 (15.2%)	1,412 (16.0%)	776 (14.1%)	476 (13.2%)	175 (12.8%)	301 (13.5%)
Prior myocardial infarction (MI)	473 (3.3%)	329 (3.7%)	144 (2.6%)	62 (1.7%)	23 (1.7%)	39 (1.7%)
Prior stroke/TIA	190 (1.3%)	107 (1.2%)	83 (1.5%)	61 (1.7%)	24 (1.8%)	37 (1.7%)
Congenital Heart Disease						
Yes	49 (0.3%)	10 (0.1%)	39 (0.7%)	7 (0.2%)	-	7 (0.3%)
No	2,038 (14.2%)	1,249 (14.1%)	789 (14.3%)	483 (13.4%)	94 (6.9%)	389 (17.4%)
Unknown	2,087 (14.5%)	1,445 (16.4%)	642 (11.6%)	501 (13.9%)	163 (11.9%)	338 (15.2%)

Missing	10,174 (70.9%)	6,126 (69.4%)	4,048 (73.4%)	2,610 (72.5%)	1,113 (81.2%)	1,497 (67.1%)
Previous procedures						
Previous PCI	1,022 (7.1%)	574 (6.5%)	448 (8.1%)	228 (6.3%)	82 (6.0%)	146 (6.5%)
Previous CABG	693 (4.8%)	467 (5.3%)	226 (4.1%)	70 (1.9%)	30 (2.2%)	40 (1.8%)
Creatinine level						
Mean ± SD	87.27 ± 49.62	87.53 ± 55.93	86.99 ± 41.83	85.41 ± 27.14	84.59 ± 19.65	85.81 ± 30.16
Median (IQR)	79 (68-94)	77 (67-94)	81 (70-95)	82 (72-95)	82 (72-94)	82 (72-95)
Missing	69.12%	74.05%	61.22%	61.07%	66.13%	57.96%
LV function - Grade						
Grade 1 (≥50%)	5,001 (34.9%)	2,393 (27.1%)	2,608 (47.3%)	1,992 (55.3%)	731 (53.4%)	1,261 (56.5%)
Grade 2 (35-49%)	584 (4.1%)	254 (2.9%)	330 (6.0%)	195 (5.4%)	52 (3.8%)	143 (6.4%)
Grade 3 (20-34%)	390 (2.7%)	194 (2.2%)	196 (3.6%)	67 (1.9%)	10 (0.7%)	57 (2.6%)
Grade 4 (<20%)	104 (0.7%)	54 (0.6%)	50 (0.9%)	17 (0.5%)	8 (0.6%)	9 (0.4%)
Unknown/N	2,666 (18.6%)	1,680 (19.0%)	986 (17.9%)	707 (19.6%)	267 (19.5%)	440 (19.7%)
Missing	5,603 (39.1%)	4,255 (48.2%)	1,348 (24.4%)	623 (17.3%)	302 (22.0%)	321 (14.4%)
****Anticoagulant use***						
Any anticoagulant use (derived)						
Y	4,461 (31.1%)	1,598 (18.1%)	2,863 (51.9%)	2,475 (68.7%)	877 (64.0%)	1,598 (71.6%)
N	3,774 (26.3%)	2,752 (31.2%)	1,022 (18.5%)	347 (9.6%)	123 (9.0%)	224 (10.0%)
Missing	6,113 (42.6%)	4,480 (50.7%)	1,633 (29.6%)	779 (21.6%)	370 (27.0%)	409 (18.3%)
Coumadin	1,128 (7.9%)	481 (5.4%)	647 (11.7%)	452 (12.6%)	130 (9.5%)	322 (14.4%)
Dabigatran	971 (6.8%)	257 (2.9%)	714 (12.9%)	660 (18.3%)	229 (16.7%)	431 (19.3%)
Low molecular weight heparin (LMWH)	48 (0.3%)	18 (0.2%)	30 (0.5%)	21 (0.6%)	6 (0.4%)	15 (0.7%)
Heparin	36 (0.3%)	22 (0.2%)	14 (0.3%)	7 (0.2%)	*1 - 5	*1 - 5

Rivaroxaban	1,118 (7.8%)	332 (3.8%)	786 (14.2%)	734 (20.4%)	277 (20.2%)	457 (20.5%)
Apixaban	606 (4.2%)	254 (2.9%)	352 (6.4%)	311 (8.6%)	108 (7.9%)	203 (9.1%)
CHADs score						
0	3,632 (25.3%)	1,840 (20.8%)	1,792 (32.5%)	1,290 (35.8%)	470 (34.3%)	820 (36.8%)
1	1,741 (12.1%)	701 (7.9%)	1,040 (18.8%)	840 (23.3%)	283 (20.7%)	557 (25.0%)
2	884 (6.2%)	448 (5.1%)	436 (7.9%)	324 (9.0%)	120 (8.8%)	204 (9.1%)
3+	443 (3.1%)	253 (2.9%)	190 (3.4%)	140 (3.9%)	45 (3.3%)	95 (4.3%)
Missing	7,648 (53.3%)	5,588 (63.3%)	2,060 (37.3%)	1,007 (28.0%)	452 (33.0%)	555 (24.9%)
CHADs-Vasc						
0	1,607(11.2%)	712 (8.1%)	895 (16.2%)	690 (19.2%)	242 (17.7%)	448 (20.1%)
1	1,571(10.9%)	745 (8.4%)	826 (15.0%)	614 (17.1%)	205 (15.0%)	409 (18.3%)
2	1,729(12.1%)	919 (10.4%)	810 (14.7%)	569 (15.8%)	199 (14.5%)	370 (16.6%)
3	947 (6.6%)	430 (4.9%)	517 (9.4%)	399 (11.1%)	154 (11.2%)	245 (11.0%)
4+	916 (6.4%)	495 (5.6%)	421 (7.6%)	323 (9.0%)	119 (8.7%)	204 (9.1%)
Missing	7,578 (52.8%)	5,529 (62.6%)	2,049 (37.1%)	1,006 (27.9%)	451 (32.9%)	555 (24.9%)
HATCH score						
0	3,819(26.6%)	1,940(22.0%)	1,879 (34.1%)	1,344 (37.3%)	496 (36.2%)	848 (38.0%)
1	1,803(12.6%)	761 (8.6%)	1,042 (18.9%)	855 (23.7%)	302 (22.0%)	553 (24.8%)
2	569 (4.0%)	293 (3.3%)	276 (5.0%)	195 (5.4%)	58 (4.2%)	137 (6.1%)
3+	575 (4.0%)	303 (3.4%)	272 (4.9%)	201 (5.6%)	63 (4.6%)	138 (6.2%)
Missing	7,582 (52.8%)	5,533 (62.7%)	2,049 (37.1%)	1,006 (27.9%)	451 (32.9%)	555 (24.9%)
Current Intracardiac Device						
Y	268 (1.9%)	147 (1.7%)	121 (2.2%)	36 (1.0%)	7 (0.5%)	29 (1.3%)
N	1,803 (12.6%)	1,055 (11.9%)	748 (13.6%)	493 (13.7%)	166 (12.1%)	327 (14.7%)

Unknown	225 (1.6%)	136 (1.5%)	89 (1.6%)	69 (1.9%)	7 (0.5%)	62 (2.8%)
Missing	12,052 (84.0%)	7,492 (84.8%)	4,560 (82.6%)	3,003 (83.4%)	1,190 (86.9%)	1,813 (81.3%)

*Data source: CorHealth Cardiac Registry, Registered Persons Database, Statistics Canada 2016 Census; * Data suppressed where counts are between 1 and 5; additional suppression may be applied where counts are greater than 5 to prevent residual disclosure of suppressed values.*

Table 2 illustrates the total number of ablations each patient received within the 4-year time frame - April 1st 2012 to March 31st, 2016. Ablation procedures that happen outside of this timeframe will not be captured and will not contribute to the presented numbers in this table.

Table 2: Number of ablations each patient received, April 1, 2012 to March 31, 2016

Number of ablation procedures	Number of patients	%
1	12630	88.0
2	1484	10.3
3	196	1.4
4+	38	0.3
Total	**14348**	

Data source: CorHealth Cardiac Registry

Ablation procedure characteristics

Out of all ablation procedure cases performed, standard ablation procedures constituted 61.5%. A breakdown of the indication for these standard ablations is provided in table 3A.

Table 3A: Indications for Standard Ablation Procedures, April 1, 2012 to March 31, 2016

Characteristic	Standard Ablation Total N = 8,830
Atrioventricular Nodal Re-entrant Tachycardia (AVRNT)	3,864 (43.8%)
Atrioventricular Re-entrant or Reciprocating Tachycardia (AVRT-WPW)	1,295 (14.7%)
Atrial Flutter Typical	2,933 (33.2%)
Atrioventricular (AV) Node Ablation	634 (7.2%)
Standard - Other	227 (2.6%)

*Data source: CorHealth Ontario Cardiac Registry; * Data suppressed where counts are between 1 and 5; additional suppression may be applied where counts are greater than 5 to prevent residual disclosure of suppressed values.*

Complex ablation procedures constituted 38.5% of the ablation procedures performed. A breakdown of the complex ablation procedure characteristics is provided in table 3B.

Table 3B: Indications and Procedure Characteristics for Complex Ablation Procedures, April 1, 2012 to March 31, 2016

Characteristic	All Complex Ablations (N = 5,518)	All Atrial Fibrillation Complex Ablations (N = 3,601)	Paroxysmal AFib Ablations (N = 1,370)	Non-Paroxysmal AFib Ablations (N= 2,231)
Indication for Complex Ablations				
Atrial Fibrillation	3,365 (61.0%)	-	1,289 (94.1%)	2,076 (93.1%)
Atrial Fibrillation with Atrial Flutter	258 (4.7%)	-	91 (6.6%)	167 (7.5%)
Atrial Tachycardia (AT)	432 (7.8%)	-	-	*1 - 5
AFL Atypical	225 (4.1%)	-	6 (0.4%)	14 (0.6%)
Ventricular Arrhythmia	996 (18.1%)	-	-	*1 - 5
Prior Complex Ablation	86 (1.6%)	-	7 (0.5%)	31 (1.4%)
AFIB Paroxysmal (diagnosed at time of procedure)	-	1,313 (36.5%)	-	-
AFIB Persistent (diagnosed at time of procedure)	-	733 (20.4%)	-	-
Sinus (diagnosed at time of procedure)	-	1,227 (34.1%)	-	-
Type of Atrial Fibrillation				
PVI + CFE	-	151 (4.2%)	21 (1.5%)	130 (5.8%)
PVI + Cardiotricuspid Isthmus Line	-	244 (6.8%)	62 (4.5%)	182 (8.2%)
PVI + Lines	-	209 (5.8%)	68 (5.0%)	141 (6.3%)
PVI + Other	-	194 (5.4%)	81 (5.9%)	113 (5.1%)
PVI	-	1,897 (52.7%)	714 (52.1%)	1,183 (53.0%)
Missing	-	906 (25.2%)	424 (30.9%)	482 (21.6%)
Ablation Procedure is First or Repeat				
Denovo (First Time)	2,420 (43.9%)	2,420 (67.2%)	849 (62.0%)	1,571 (70.4%)
First Redo	205 (3.7%)	205 (5.7%)	71 (5.2%)	134 (6.0%)
Second Redo	36 (0.7%)	36 (1.0%)	11 (0.8%)	25 (1.1%)
Third Redo or More	34 (0.6%)	34 (0.9%)	15 (1.1%)	19 (0.9%)
Missing	2,823 (51.2%)	906 (25.2%)	424 (30.9%)	482 (21.6%)
Congenital Heart Arrhythmia	125 (2.3%)	*1 - 5	*1 - 5	*1 - 5

*Data source: CorHealth Ontario Cardiac Registry; * Data suppressed where counts are between 1 and 5; additional suppression may be applied where counts are greater than 5 to prevent residual disclosure of suppressed values.*

Outcomes

Table 4 outlines the procedure complication/adverse event rate following ablations in Ontario. Reported complications following ablation procedures over the time frame of the study were low with most cell counts having to be suppressed to comply with privacy legislation. The "No complication reported" category in the table includes both a) complications that are not reported since they did not occur and b) complications that occurred but were not reported (i.e. missing data). It is unclear if complication rates are actually this low or if complications are being underreported in the CorHealth Ontario Cardiac Registry as there is currently no way for CorHealth Ontario to validate if the "No complication reported" category in the table is truly complications that did not occur or whether in some instances complications occurred but were not reported (i.e. missing data) .

Table 4: Ablation Procedural Complication/Adverse Event, April 1, 2012 to March 31, 2016

Characteristic	All Ablations Total (N = 14,348)	All Standard Ablations (N = 8,830)	All Complex Ablations (N = 5,518)	All Atrial Fibrillation Complex Ablations (N = 3,601)	Paroxysmal AFib Ablations (N = 1,370)	Non-Paroxysmal AFib Ablations (N= 2,231)
Procedural complication						
Cardiac Tamponade	*36 - 40	-	*36 - 40	*22 - 26	8 (0.6%)	*13 - 17
Bleeding with > 10 unit drop in hemoglobin	*1 - 5	-	*1 - 5	-	-	-
Symptomatic Fluid Overload/CHF	*1 - 5	-	*1 - 5	*1 - 5	-	*1 - 5
No complication reported	14,242 (99.3%)	8,810 (99.8%)	5,432 (98.4%)	3,550 (98.6%)	1,354 (98.8%)	2,196 (98.4%)

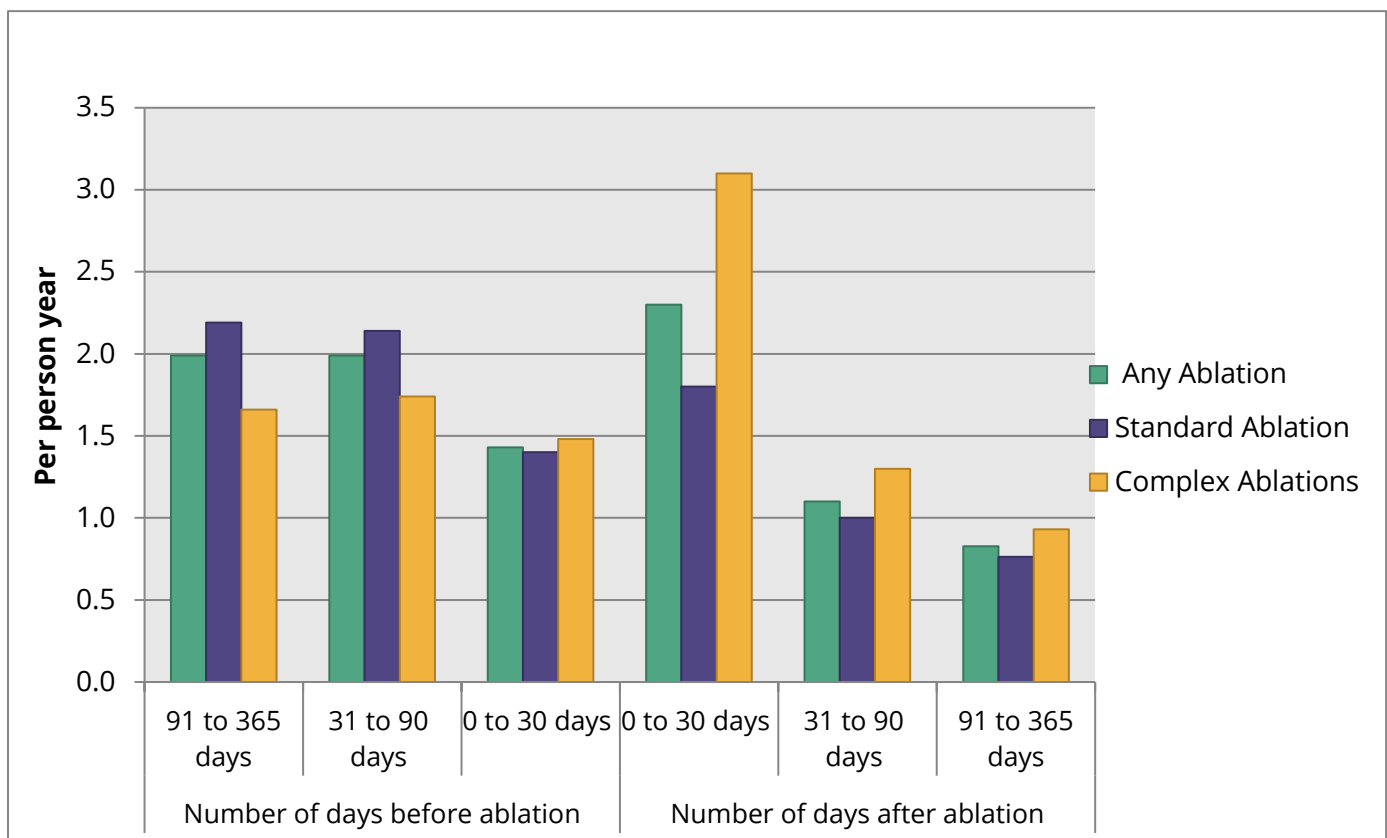*Data source: CorHealth Ontario Cardiac Registry*

Table 5: Mortality, stroke/TIA and repeat procedure rates by ablation procedure type, April 1, 2012 to March 31, 2016

Outcome	All Ablations Total (N = 14,348)	All Standard Ablations (N = 8,830)	All Complex Ablations (N = 5,518)	All Atrial Fibrillation Complex Ablations (N = 3,601)	Paroxysmal AFib Ablations (N = 1,370)	Non-Paroxysmal AFib Ablations (N= 2,231)
Mortality after ablation procedure — n (%)						
30-days	50 (0.3%)	35 (0.4%)	15 (0.3%)	<=5	<=5	-
1-year	268 (1.9%)	181 (2.0%)	87 (1.6%)	17 (0.5%)	6 (0.4%)	11 (0.5%)
Stroke/TIA after ablation procedure — n (%)						
30-days re-hospitalization	27 (0.2%)	10 (0.1%)	17 (0.3%)	*11 - 15	*1 - 5	*6 - 10
1-year re-hospitalization	80 (0.6%)	40 (0.5%)	40 (0.7%)	27 (0.7%)	10 (0.7%)	17 (0.8%)
30-days ED visit	18 (0.1%)	*1 - 5	*13 - 17	8 (0.2%)	<=5	<=5
1-year ED visit	76 (0.5%)	37 (0.4%)	39 (0.7%)	26 (0.7%)	13 (0.9%)	13 (0.6%)
Repeat ablation procedure — n (%)						
30-days	84 (0.6%)	45 (0.5%)	39 (0.7%)	8 (0.2%)	<=5	<=5
90-days	306 (2.1%)	177 (2.0%)	129 (2.3%)	49 (1.4%)	17 (1.2%)	32 (1.4%)
1-year	1,303 (9.1%)	570 (6.5%)	733 (13.3%)	492 (13.7%)	194 (14.2%)	298 (13.4%)

Data Source: Registered Person Database, National Ambulatory Care Reporting System, Discharge Abstract Database, CorHealth Ontario Cardiac Registry

Figure 2 compares the rate of emergency department visits pre- and post-ablation for standard and complex ablations. There was a slight decline in the rate of emergency department visits for both standard and complex ablations in the 30 days leading up to the ablation as compared to the previous 11 months. In the first 30-days following the ablation there was a transient increase in the emergency department visit rate, and this increase was much greater for complex ablation patients than standard. Following the first 30 days post-ablation there was a decrease in the emergency department visit rate for both types of ablations to below pre-ablation rates.

Figure 2: Rate of emergency department visits prior to and after the index ablation procedure per person year, April 1, 2012 to March 31, 2016 (by type of Ablation procedure)

Data Source: CorHealth Ontario Cardiac Registry and National Ambulatory Care Reporting System; For specific numbers graphed in this figure refer to Appendix C.

Figure 3 shows the emergency department visit rate specifically for atrial fibrillation complex ablations. Similar to the trend observed for overall standard and complex ablations there was an initial transient increase in the emergency department visit rate in the first 30-days post-ablation for both paroxysmal and non-paroxysmal atrial fibrillation complex ablations which then decreased to below pre-ablation rates following 30 days.
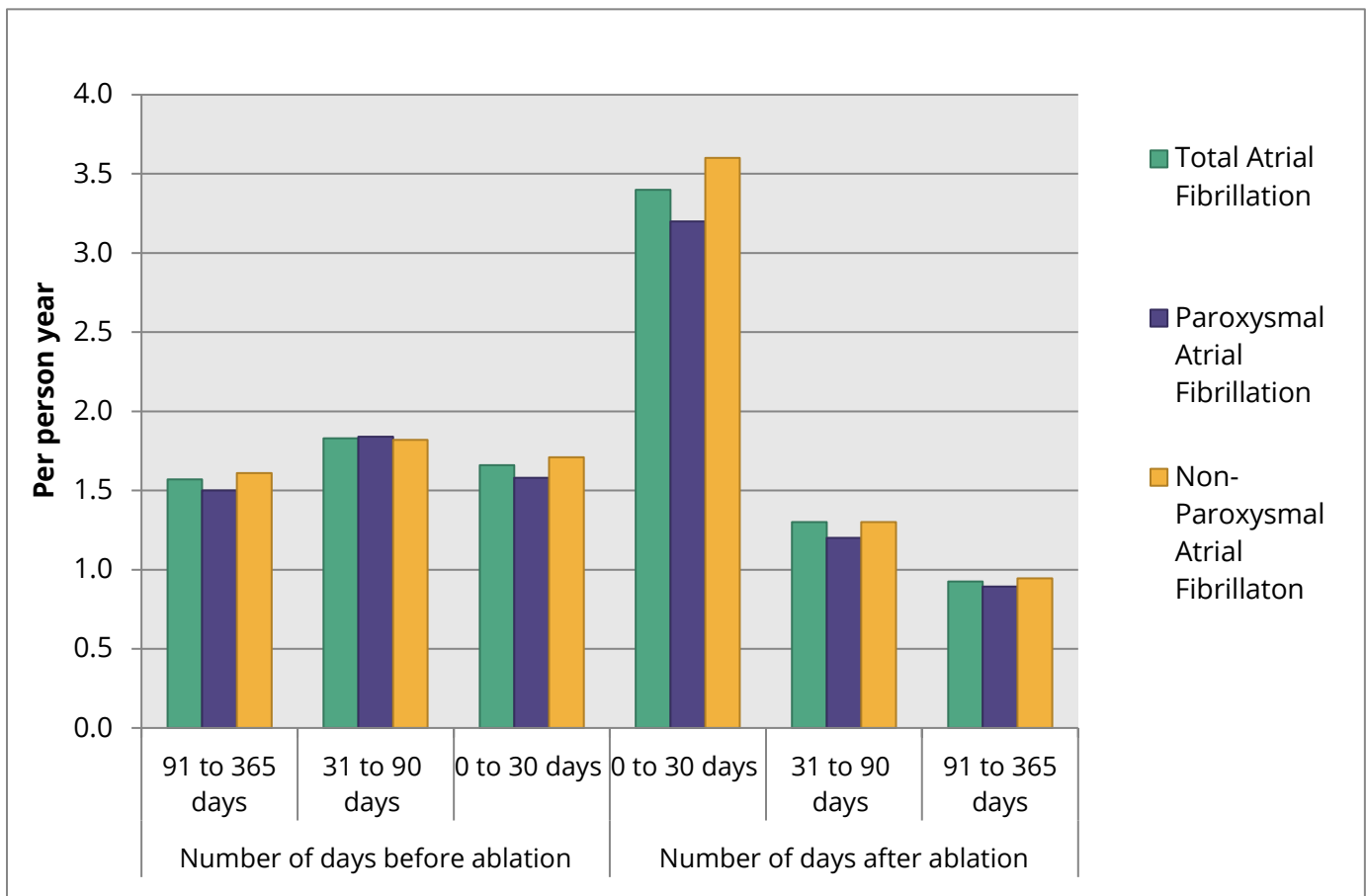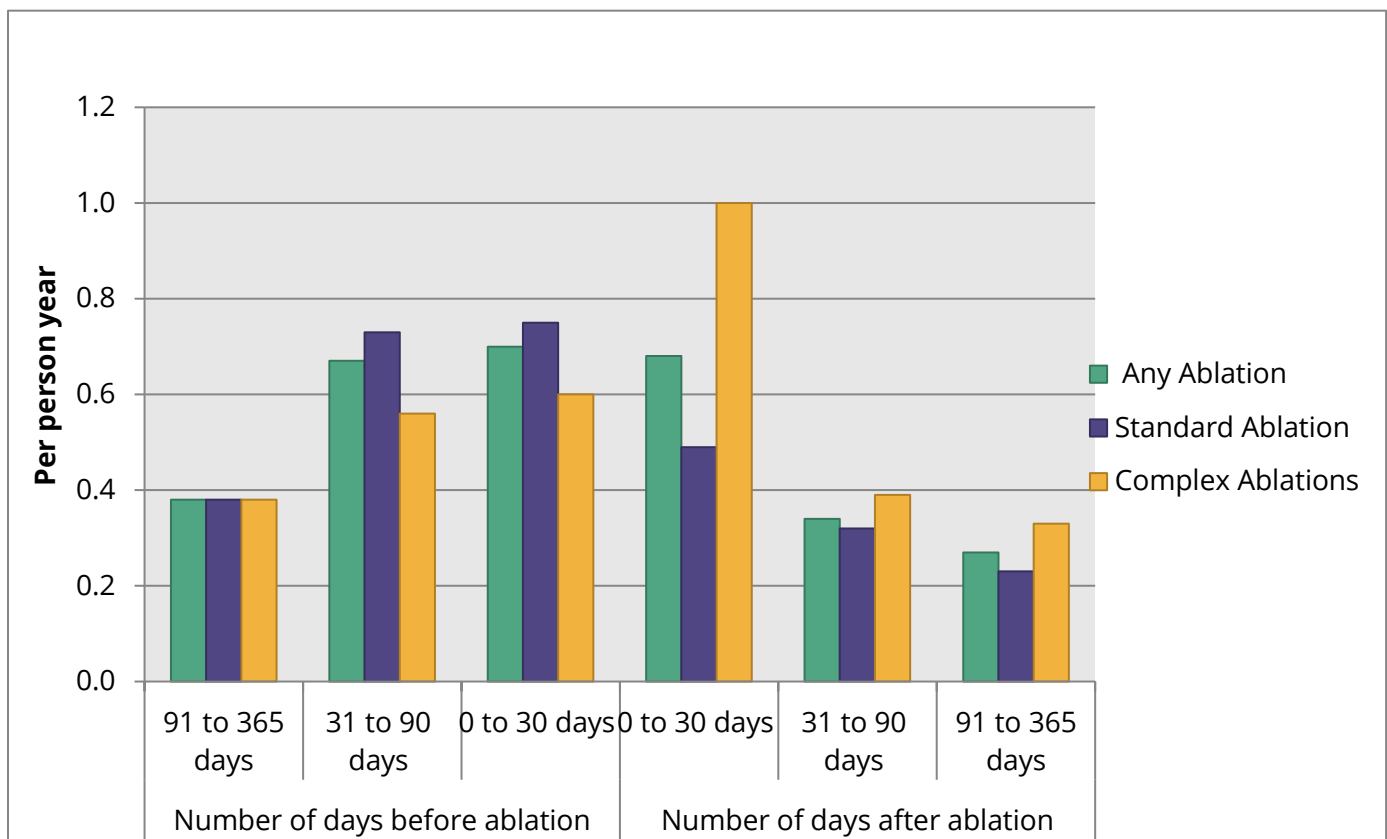
Figure 3: Rate of emergency department visits prior to and after the index ablation procedure per person year, April 1, 2012 to March 31, 2016 (by type of complex Ablation procedure)

Data Source: CorHealth Ontario Cardiac Registry and National Ambulatory Care Reporting System; For specific numbers graphed in this figure refer to Appendix C.

Figure 4 illustrates the comparison of hospitalization rates for ablation patients before and after an ablation. It should be noted that the rate of hospital admissions for these patients is much lower than the rate of ED visits portrayed in Figures 2 and 3. The rate of hospitalizations for these patients tends to increase closer to the date of the ablation. There is an observed decrease in the hospitalization of standard ablation patients following the ablation and the rate of hospitalization continues to decrease over time. Following complex ablations, there is an initial transient increase in the hospitalization rate over the first 30 days, which then decreases over the rest of the first year post-procedure.

Figure 4: Rate of hospitalizations prior to and after the index ablation procedure per person year, April 1, 2012 to March 31, 2016 (by type of Ablation procedure)

Data Source: CorHealth Cardiac Registry and Discharge Abstract Database; For specific numbers graphed in this figure refer to Appendix C.

Figure 5 shows the comparison of pre- and post-ablation hospitalization rates for complex atrial fibrillation ablation patients, both with paroxysmal and non-paroxysmal atrial fibrillation. For all types of atrial fibrillation complex ablations there was a transient increase in hospitalizations in the first 30 days post-procedure.
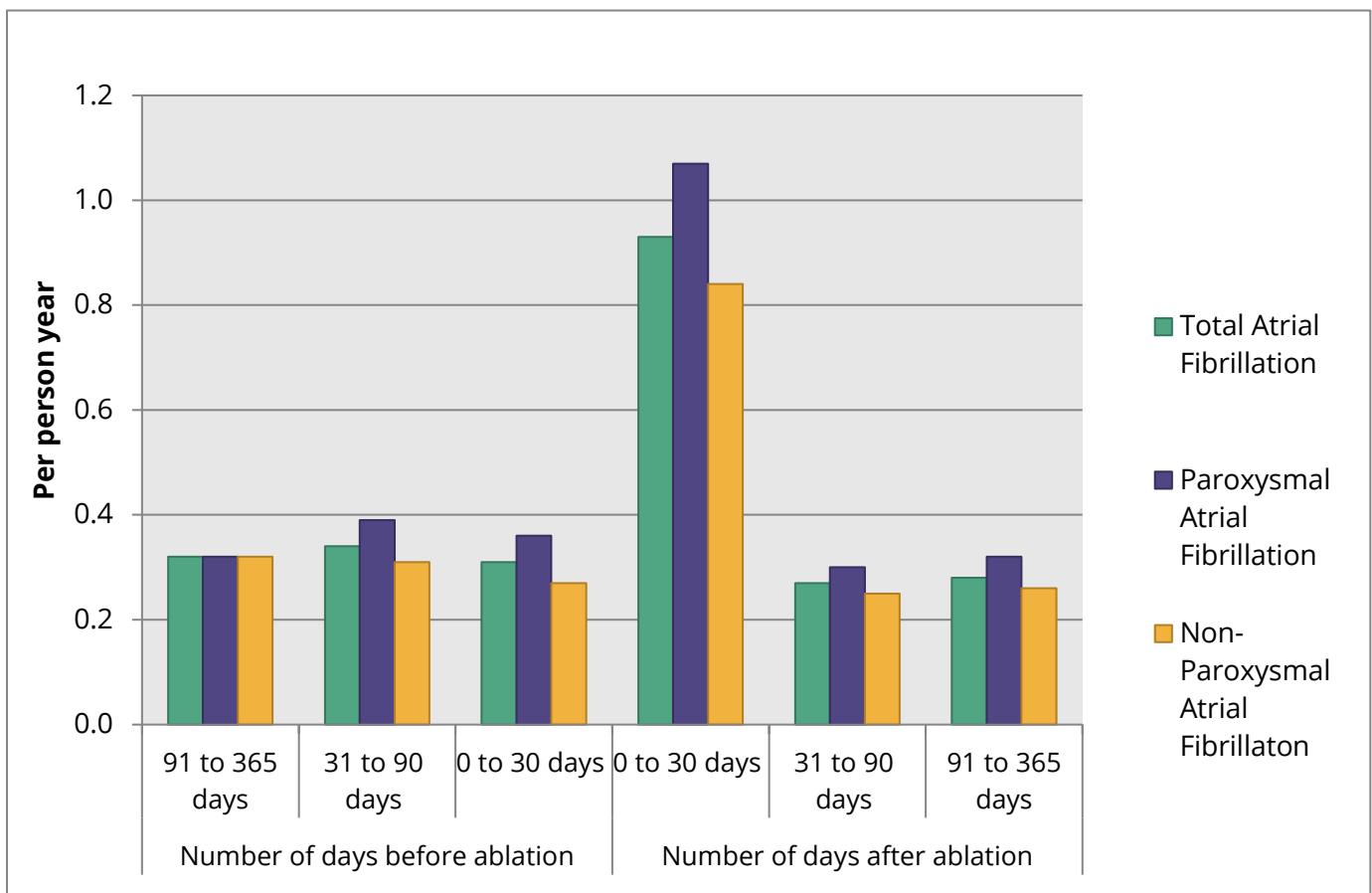
Figure 5: Rate of hospitalizations prior to and after the index ablation procedure per person year, April 1, 2012 to March 31, 2016 (by type of complex Ablation procedure)

Data Source: CorHealth Ontario Cardiac Registry and Discharge Abstract Database; For specific numbers graphed in this figure refer to Appendix C.

Discussion and Limitations

In this inaugural report on unadjusted outcomes following ablation procedures in Ontario we present provincial baseline data in order to trigger discussions on quality improvement at the provincial level. As a first step, this initial report contains only aggregate outcomes at the provincial level and not the individual program level. As we socialize ablations outcome reporting in Ontario and receive program feedback on the indicator methodology, CorHealth Ontario will continue to refine ablations outcomes reporting to provide programs with site specific outcomes in order to foster quality improvement at individual programs across the province.

Overall, we found that there was a total of 14,348 patients who had an ablation procedure out of which 8,830 were standard procedures and 5,518 were complex procedures between April 1st, 2012 and March 31th, 2016. Approximately 12% of patients received more than one ablation during the 4 years of this study with 1.7% of those receiving 3 or more (Table 2). Table 5 illustrates that many of these repeat ablations are for complex ablation patients with 13% of complex ablation patients required a repeat ablation within 1 year.

Overall, mortality and stroke following ablation in Ontario are relatively low. For all ablations, the 1-year post-procedure mortality rate was 1.9% and 0.6% and 0.5% of patients had been re-hospitalized or required an emergency department visit for a stroke or a TIA respectively (Table 5). While public reporting of ablation outcomes does not seem to be common among other jurisdictions there are published reports that can put these results in context. A large multi-year study of 1-year outcomes following ablation for Atrial Fibrillation in Medicare Beneficiaries in the USA reported a 1-year all-cause mortality rate of 0.8% and a 1-year stroke/TIA rates of 0.8%.[2] In Ontario the mortality rate specifically for Atrial Fibrillation Ablations was 0.5% and the rate of hospitalization or ED visit for stroke were both 0.7%.

For many acute cardiac procedures an important outcome to measure is post-procedural hospital readmission rates. When planning this analysis, it was hypothesized that post-procedural hospital readmission rates may end up being high for this patient population however, it was also expected that this patient population most likely had a high hospital admission rate prior to the procedure. To this end we presented the data in a way that illustrates the change in hospital admissions following the ablation as

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[2] Outcomes of Medicare Beneficiaries Undergoing Catheter Ablation for Atrial Fibrillation, JP Piccini et al., Circulation. 2012; 126:2200-2207.

compared to the rate before the procedure. Also, it was hypothesized that this patient population wouldn't necessarily always be admitted to the hospital hence it would be important to look at changes in the rate of emergency department visits from before to after the ablation procedure.

Figures 2-5 demonstrate this change in hospital utilization. For complex ablations patients and specifically for atrial fibrillation complex ablation patients, a transient increase in both hospital admissions and emergency department visits are observed in the first 30 days following the index ablation. This increased health care utilization in the first 30-days post-ablation is known for the AF ablation population. Post-ablation, there is a "healing" or stabilization phase when more AF recurrences can occur. Diversion of these patients away from ER or inpatient hospitalization could serve as a focus for future quality improvement initiatives.

This report has some limitations that are worth noting. First, this analysis reveals a significant amount of missing data for ablations records in the CorHealth Ontario Cardiac Registry. Table 1 illustrates the characteristics of patients receiving ablations in this province and Table 3b provides descriptive procedural details for complex ablations performed. Both tables reveal a number of elements with very high rates of missing data. This analysis offers CorHealth Ontario and the ablations programs in Ontario an opportunity to visualize which elements within the CorHealth Ontario Cardiac Registry are important to support ablations outcome reporting and subsequently inform quality improvement practices.

Another key consideration to highlight is that there are number of important outcomes that were not able to be included in this report because of data availability. The indicators presented in this report focus on hard outcomes such as mortality, stroke and hospital readmission. We lack data on patient symptoms post-ablation. A successful ablation should eliminate the underlying arrhythmia however we do not currently have access to data of this nature, such as symptomatic relief or quality of life.

Conclusion

This initial outcome report on ablations is meant to be a baseline which summarizes provincial performance and that constitutes the foundation for more reporting in the ablation procedure domain. CorHealth is committed to continue refining the methodology of our indicators to support provincial quality improvement efforts and to work towards providing program level outcomes that allow comparison among peer programs and the rest of the province. We will continue to work with hospitals to improve data quality and support performance measurement efforts. We look forward to continuing to work with stakeholders to ensure that Ontarians have access to the highest possible quality of cardiac care.

Appendix A: Data Sources

CorHealth Ontario Cardiac Registry

The CorHealth Ontario Cardiac Registry is collected and maintained by the Cardiac Care Network and serves as a waiting list management system which is used to facilitate and monitor access to many acute cardiac services. All 20 in Ontario that perform at minimum adult cardiac catheterization participate in this registry. A patient is added to the list when s/he is referred for a cardiac procedure and removed from the list at the time of procedure, death, or a decision not to pursue treatment.

Registered Persons Database files (RPDB)

The RPDB provides basic demographic information (age, sex, location of residence, date of birth, and date of death for deceased individuals) for those issued an Ontario health insurance number. The RPDB also indicates the time periods for which an individual was eligible to receive publicly funded health insurance benefits and the best known postal code for each registrant on July 1st of each year.

Discharge Abstract Database (DAD)

The DAD is compiled by the Canadian Institute for Health Information and contains administrative, clinical (diagnoses and procedures/interventions), demographic, and administrative information for all admissions to acute care hospitals, rehab, chronic, and day surgery institutions in Ontario. At ICES, consecutive DAD records are linked together to form 'episodes of care' among the hospitals to which patients have been transferred after their initial admission.

National Ambulatory Care Reporting System (NACRS)

The NACRS is compiled by the Canadian Institute for Health Information and contains administrative, clinical (diagnoses and procedures), demographic, and administrative information for all patient visits made to hospital- and community-based ambulatory care centres (emergency departments, day surgery units, hemodialysis units, and cancer care clinics). At ICES, NACRS records are linked with other data sources (DAD, OMHRS) to identify transitions to other care settings, such as inpatient acute care or psychiatric care.

Ontario Diabetes Dataset (ODD)

The Ontario Diabetes Database is an ICES-derived cohort and is created using algorithms applied to inpatient hospitalization (DAD) records, same day surgery (SDS)

records, and physician billing claims (OHIP) data to determine the diagnosis date for incident cases of diabetes in Ontario. For adults aged 19 years and greater, the definition for diabetes is 2 physician billing claims with a diagnosis for diabetes (OHIP diagnosis code: 250) or 1 inpatient hospitalization or same day surgery record with a diagnosis for diabetes (ICD-9 diagnosis code: 250; ICD-10 diagnosis codes: E10, E11, E13, E14; in any diagnostic code space) within a 2 year period. Physician claims and hospitalizations with a diagnosis of diabetes occurring within 120 prior to and 180 days after a gestational hospitalization record were excluded.

Ontario Hypertension Dataset (HYPER)

The Ontario Hypertension Database is an ICES-derived cohort and created using a definition of ≥2 physician billing claims with a diagnosis of hypertension (OHIP diagnosis codes: 401-405) and/or ≥1 inpatient hospitalization or same day surgery record with a diagnosis of hypertension (ICD-9 diagnosis codes: 401-405; ICD-10 diagnosis codes: I10-I13, I15; in any diagnostic code space) in a two-year period applied to hospitalization (DAD), same day surgery (SDS), and physician billing claims (OHIP) data to determine the diagnosis date for incident cases of hypertension in Ontario. Physician claims and hospitalizations with a diagnosis of hypertension occurring within 120 prior to and 180 days after a gestational hospitalization record are excluded.

Ontario Congestive Heart Failure dataset (CHF)

The Ontario Congestive Heart Failure Database is an ICES-derived cohort that was created using a definition of ≥2 physician billing claims with a diagnosis of CHF (OHIP diagnosis code: 428) and/or ≥1 inpatient hospitalization or same day surgery record with a diagnosis of CHF (ICD-9 diagnosis code: 428; ICD-10 diagnosis code: I50; in the primary diagnostic code space) in a two-year period applied to hospitalization (DAD), same day surgery (SDS), and physician billing claims (OHIP) data to determine the diagnosis date for incident cases of CHF in Ontario.

Ontario Chronic Obstructive Pulmonary Disease Dataset (COPD)

The Ontario COPD Database is an ICES-derived cohort that is created using two separate algorithms applied to inpatient hospitalization (DAD), same day surgery (SDS) records, and physician billing claims (OHIP) data to determine the diagnosis date for incident cases of COPD in Ontario. In an algorithm which maximizes sensitivity, the definition for COPD is any physician billing claim with a diagnosis for COPD (OHIP diagnosis codes: 491, 492, 496) or any inpatient hospitalization or same day surgery record with a diagnosis for COPD (ICD-9 diagnosis codes: 491, 492, 496; ICD-10 diagnosis codes: J41-J44; in any diagnostic code space).

Appendix B: Abbreviations

MOHLTC	Ministry of Health and Long Term Care
LHINs	Local Health Integration Networks
CIHI	Canadian Institute of Health Information
DAD	Discharge Abstract Database
RPDB	Registered Persons Database
NACRS	National Ambulatory Care Reporting System
ODD	Ontario Diabetes Dataset
HYPER	Ontario Hypertension Dataset
CHF	Ontario Congestive Heart Failure dataset
COPD	Ontario Chronic Obstructive Pulmonary Disease Dataset
CHADS$_2$	Estimates stroke risk in patients with Atrial Fibrillation C̲HF history (1 point), H̲ypertension (1 point), A̲ge ≥75 (1 point), D̲iabetes (1 point), S̲troke or TIA previously (2 points)
CHA$_2$DS$_2$-VASc	Estimates stroke risk in patients with Atrial Fibrillation C̲HF history (1 point), H̲ypertension (1 point), A̲ge ≥75 (2 points), D̲iabetes (1 point), S̲troke or TIA previously (2 points), V̲ascular Disease (1 point), A̲ge 65-74 (1point), S̲ex c̲ategory female (1 point)
HATCH	Stratifies patients with paroxysmal AF according to their risk for progression to sustained AF within 1-year. 1 x (H̲ypertension+ 1) x (A̲ge ≥75 +2) x T̲ransient ischemic attack or stroke +1) x (C̲OPD +2) x H̲eart Failure

Appendix C: Additional Data Tables

Table C1: Characteristics of patients (by ablation procedure) that have had an ablation procedure between April 1, 2012 to March 31, 2016

| Characteristic | Any Ablation

Total
(N = 14,348) | Standard Ablation

Total
(N = 8,830) | Complex Ablations | | | |
			Total (N = 5,518)	Total Atrial Fibrillation (N = 3,601)	Paroxysmal Atrial Fibrillation (N = 1,370)	Non-Paroxysmal Atrial Fibrillation (N= 2,231)
Age						
Mean ± SD	57.0 ± 15.9	56.2 ± 17.7	58.0 ± 13.0	60.0 ± 10.2	60.18 ± 10.4	59.9 ± 10.1
Median (IQR)	59 (48-68)	59 (45-70)	60 (51-67)	61 (54-67)	61 (54-68)	61 (54-67)
Missing	0.06%	0.07%	0.03%	0.04%	0.00%	0.07%
Sex						
F	6,756 (41.3%)	4,309 (45.9%)	2,447 (35.2%)	1,420 (31.5%)	586 (34.6%)	834 (29.6%)
M	9,586 (58.7%)	5,077 (54.1%)	4,509 (64.8%)	3,088 (68.5%)	1,107 (65.4%)	1,981 (70.4%)
Neighbourhood income quintile						
Q1 (lowest)	2,454 (15.0%)	1,500 (16.0%)	954 (13.7%)	533 (11.8%)	196 (11.6%)	337 (12.0%)

Q2	2,826 (17.3%)	1,667 (17.8%)	1,159 (16.7%)	695 (15.4%)	273 (16.1%)	422 (15.0%)
Q3	3,126 (19.1%)	1,848 (19.7%)	1,278 (18.4%)	815 (18.1%)	280 (16.5%)	535 (19.0%)
Q4	3,626 (22.2%)	2,093 (22.3%)	1,533 (22.0%)	1,004 (22.3%)	376 (22.2%)	628 (22.3%)
Q5	4,226 (25.9%)	2,226 (23.7%)	2,000 (28.8%)	1,448 (32.1%)	561 (33.1%)	887 (31.5%)
Missing	84 (0.5%)	52 (0.6%)	32 (0.5%)	13 (0.3%)	7 (0.4%)	6 (0.2%)
Area of residence						
Urban	14,032 (85.9%)	8,164 (87.0%)	5,868 (84.4%)	3,761 (83.4%)	1,458 (86.1%)	2,303 (81.8%)
Rural	2,294 (14.0%)	1,212 (12.9%)	1,082 (15.6%)	742 (16.5%)	232 (13.7%)	510 (18.1%)
Missing	16 (0.1%)	10 (0.1%)	6 (0.1%)	<=5 (0.1%)	<=5 (0.2%)	<=5 (0.1%)
Patient BMI (kg/m²)						
Mean ± SD	29.4 ±7.3	29.4 ± 6.9	29.4 ± 7.7	30.5 ± 9.9	30.0 ± 6.3	30.8 ± 11.3
Median (IQR)	28 (25-33)	28 (25-33)	28 (25-33)	29 (26-33)	28 (26-33)	29 (26-33)
Missing	89.7%	90.3%	88.9%	92.9%	93.6%	92.5%
Patient height (cm)						
Mean ± SD	172.2 ± 10.2	171.1 ± 10.1	173.5 ± 10.2	174.6 ± 10.5	174.4 ± 9.9	174.7 ± 10.8
Median (IQR)	173 (165-180)	172 (165-178)	175 (168-180)	175 (168-182)	175 (168-183)	177 (170-182)
Missing	89.7%	90.3%	88.8%	92.8%	93.6%	92.4%

Patient weight (kg)						
Mean ± SD	87.5 ± 21.1	86.2 ± 21.3	89.1 ± 20.7	93.3 ± 22.0	91.9 ± 22.1	94.0 ± 22.0
Median (IQR)	85 (73-100)	84 (72-98)	87 (75-101)	91 (78-104)	90 (76-104)	91 (79-104)
Missing	89.4%	90.0%	88.6%	92.7%	93.6%	92.2%
Chronic comorbidities						
Diabetes	3,302 (20.2%)	2,037 (21.7%)	1,265 (18.2%)	758 (16.8%)	289 (17.1%)	469 (16.7%)
Hypertension	8,498 (52.0%)	4,581 (48.8%)	3,917 (56.3%)	2,681 (59.5%)	987 (58.3%)	1,694 (60.2%)
Congestive heart failure	3,264 (20.0%)	1,694 (18.0%)	1,570 (22.6%)	886 (19.7%)	315 (18.6%)	571 (20.3%)
COPD	2,529 (15.5%)	1,524 (16.2%)	1,005 (14.4%)	608 (13.5%)	227 (13.4%)	381 (13.5%)
Prior myocardial infarction (MI)	531 (3.2%)	348 (3.7%)	183 (2.6%)	75 (1.7%)	27 (1.6%)	48 (1.7%)
Prior stroke/TIA	226 (1.4%)	122 (1.3%)	104 (1.5%)	75 (1.7%)	26 (1.5%)	49 (1.7%)
Congenital Heart Disease						
Yes	53 (0.3%)	10 (0.1%)	43 (0.6%)	7 (0.2%)	-	7 (0.2%)
No	2,325 (14.2%)	1,320 (14.1%)	1,005 (14.4%)	625 (13.9%)	120 (7.1%)	505 (17.9%)
Unknown	2,283 (14.0%)	1,525 (16.2%)	758 (10.9%)	599 (13.3%)	192 (11.3%)	407 (14.5%)
Missing	11,681 (71.5%)	6,531 (69.6%)	5,150 (74.0%)	3,277 (72.7%)	1,381 (81.6%)	1,896 (67.4%)
Congenital Anomalies						

ARVD	*1 - 5	<=5	-	-	-	-
Hypertrophic cardiomyopathy	*6 - 10	<=5	*4 - 8	<=5 (0.1%)	-	<=5 (0.2%)
Other	*12 - 16	<=5	*10 - 14	<=5 (0.0%)	*1 - 5	-
Long QT syndrome	*1 - 5	-	*1 - 5	<=5 (0.0%)	-	<=5 (0.0%)
Missing	16,314 (99.8%)	9,376 (99.9%)	6,938 (99.7%)	4,501 (99.8%)	*1,688 - 1,692	2,809 (99.8%)
Previous procedures						
Previous PCI	1,179 (7.2%)	614 (6.5%)	565 (8.1%)	286 (6.3%)	98 (5.8%)	188 (6.7%)
Previous CABG	771 (4.7%)	497 (5.3%)	274 (3.9%)	83 (1.8%)	36 (2.1%)	47 (1.7%)
Creatine level						
Mean ± SD	86.9 ± 49.6	87.4 ± 56.2	86.4 ± 43.0	84.7 ± 25.3	83.8 ± 19.3	85.2 ± 27.8
Median (IQR)	79 (68-94)	77 (67-93)	81 (70-95)	82 (72-94)	82 (72-94)	82 (72-95)
Missing	67.4%	73.7%	58.8%	58.6%	63.4%	55.7%
LV function - Grade						
Grade 1 (≥50%)	5,940 (36.3%)	2,521 (26.9%)	3,419 (49.2%)	2,616 (58.0%)	955 (56.4%)	1,661 (59.0%)
Grade 2 (35-49%)	689 (4.2%)	277 (3.0%)	412 (5.9%)	244 (5.4%)	65 (3.8%)	179 (6.4%)
Grade 3 (20-34%)	459 (2.8%)	203 (2.2%)	256 (3.7%)	80 (1.8%)	13 (0.8%)	67 (2.4%)
Grade 4 (<20%)	121 (0.7%)	56 (0.6%)	65 (0.9%)	26 (0.6%)	10 (0.6%)	16 (0.6%)

Unknown/N	3,050 (18.7%)	1,800 (19.2%)	1,250 (18.0%)	881 (19.5%)	329 (19.4%)	552 (19.6%)
Missing	6,083 (37.2%)	4,529 (48.3%)	1,554 (22.3%)	661 (14.7%)	321 (19.0%)	340 (12.1%)
Anticoagulant use						
Any anticoagulant use (derived)						
Y	5,549 (34.0%)	1,728 (18.4%)	3,821 (54.9%)	3,243 (71.9%)	1,149 (67.9%)	2,094 (74.4%)
N	4,148 (25.4%)	2,908 (31.0%)	1,240 (17.8%)	399 (8.9%)	142 (8.4%)	257 (9.1%)
Missing	6,645 (40.7%)	4,750 (50.6%)	1,895 (27.2%)	866 (19.2%)	402 (23.7%)	464 (16.5%)
Coumadin	1,334 (8.2%)	519 (5.5%)	815 (11.7%)	565 (12.5%)	160 (9.5%)	405 (14.4%)
Dabigatran	1,284 (7.9%)	274 (2.9%)	1,010 (14.5%)	915 (20.3%)	306 (18.1%)	609 (21.6%)
Low molecular weight heparin (LMWH)	55 (0.3%)	18 (0.2%)	37 (0.5%)	25 (0.6%)	7 (0.4%)	18 (0.6%)
Heparin	43 (0.3%)	23 (0.2%)	20 (0.3%)	9 (0.2%)	*1 - 5	*1 - 5
Rivaroxaban	1,427 (8.7%)	368 (3.9%)	1,059 (15.2%)	964 (21.4%)	364 (21.5%)	600 (21.3%)
Apixaban	738 (4.5%)	269 (2.9%)	469 (6.7%)	401 (8.9%)	148 (8.7%)	253 (9.0%)
LA (left atrium) diameter (within 12 months of referral)						
LA diameter acquired	3,836 (23.5%)	1,125 (12.0%)	2,711 (39.0%)	2,334 (51.8%)	761 (44.9%)	1,573 (55.9%)
Not measured or unknown	1,794 (11.0%)	590 (6.3%)	1,204 (17.3%)	1,061 (23.5%)	442 (26.1%)	619 (22.0%)
Method of measurement						

Computed Tomography CT	112 (0.7%)	8 (0.1%)	104 (1.5%)	101 (2.2%)	28 (1.7%)	73 (2.6%)
Echocardiography	3,725 (22.8%)	1,117 (11.9%)	2,608 (37.5%)	2,234 (49.6%)	733 (43.3%)	1,501 (53.3%)
Missing	12,505 (76.5%)	8,261 (88.0%)	4,244 (61.0%)	2,173 (48.2%)	932 (55.1%)	1,241 (44.1%)
LA (left atrium) diameter (at time of procedure)						
Method of measurement						
Computed Tomography CT	176 (1.1%)	-	176 (2.5%)	173 (3.8%)	68 (4.0%)	105 (3.7%)
Echocardiogarphy	1,499 (9.2%)	*13 - 17	1,483 (21.3%)	1,460 (32.4%)	665 (39.3%)	795 (28.2%)
3D Mapping	136 (0.8%)	*1 - 5	132 (1.9%)	120 (2.7%)	26 (1.5%)	94 (3.3%)
Missing	14,531 (88.9%)	9,366 (99.8%)	5,165 (74.3%)	2,755 (61.1%)	934 (55.2%)	1,821 (64.7%)
Not measured or unknown						
Y	1,480 (9.1%)	148 (1.6%)	1,332 (19.1%)	1,082 (24.0%)	174 (10.3%)	908 (32.3%)
Missing	3,896 (23.8%)	2,394 (25.5%)	1,502 (21.6%)	952 (21.1%)	446 (26.3%)	506 (18.0%)
CHADs score						
0	4,375 (26.8%)	1,962 (20.9%)	2,413 (34.7%)	1,735 (38.5%)	637 (37.6%)	1,098 (39.0%)
1	2,111 (12.9%)	754 (8.0%)	1,357 (19.5%)	1,075 (23.8%)	361 (21.3%)	714 (25.4%)
2	1,070 (6.5%)	486 (5.2%)	584 (8.4%)	436 (9.7%)	155 (9.2%)	281 (10.0%)
3+	511 (3.1%)	270 (2.9%)	241 (3.5%)	174 (3.9%)	57 (3.4%)	117 (4.2%)

Missing	8,275 (50.6%)	5,914 (63.0%)	2,361 (33.9%)	1,088 (24.1%)	483 (28.5%)	605 (21.5%)
CHADs Vasc						
0	1,981 (12.1%)	756 (8.1%)	1,225 (17.6%)	946 (21.0%)	329 (19.4%)	617 (21.9%)
1	1,888 (11.6%)	806 (8.6%)	1,082 (15.6%)	795 (17.6%)	278 (16.4%)	517 (18.4%)
2	2,057 (12.6%)	971 (10.3%)	1,086 (15.6%)	753 (16.7%)	255 (15.1%)	498 (17.7%)
3	1,124 (6.9%)	466 (5.0%)	658 (9.5%)	506 (11.2%)	189 (11.2%)	317 (11.3%)
4+	1,100 (6.7%)	536 (5.7%)	564 (8.1%)	424 (9.4%)	160 (9.5%)	264 (9.4%)
Missing	8,192 (50.1%)	5,851 (62.3%)	2,341 (33.7%)	1,084 (24.0%)	482 (28.5%)	602 (21.4%)
HATCH score						
0	4,601 (28.2%)	2,068 (22.0%)	2,533 (36.4%)	1,810 (40.2%)	666 (39.3%)	1,144 (40.6%)
1	2,185 (13.4%)	813 (8.7%)	1,372 (19.7%)	1,115 (24.7%)	391 (23.1%)	724 (25.7%)
2	681 (4.2%)	323 (3.4%)	358 (5.1%)	244 (5.4%)	73 (4.3%)	171 (6.1%)
3+	679 (4.2%)	327 (3.5%)	352 (5.1%)	255 (5.7%)	81 (4.8%)	174 (6.2%)
Missing	8,196 (50.2%)	5,855 (62.4%)	2,341 (33.7%)	1,084 (24.0%)	482 (28.5%)	602 (21.4%)
Current Intracardiac Device						
Y	319 (2.0%)	168 (1.8%)	151 (2.2%)	44 (1.0%)	8 (0.5%)	36 (1.3%)
N	2,039 (12.5%)	1,114 (11.9%)	925 (13.3%)	595 (13.2%)	182 (10.8%)	413 (14.7%)

Unknown	248 (1.5%)	144 (1.5%)	104 (1.5%)	81 (1.8%)	8 (0.5%)	73 (2.6%)
Missing	13,736 (84.1%)	7,960 (84.8%)	5,776 (83.0%)	3,788 (84.0%)	1,495 (88.3%)	2,293 (81.5%)

Table C2. Number of hospitalizations prior to and after the index ablation procedure per person year, April 1, 2012 to March 31, 2016

		Any Ablation	Standard Ablation	Complex Ablations			
Outcome		**Total (N = 14,348)**	**Total (N = 8,830)**	**Total (N = 5,518)**	**Total Atrial Fibrillation (N = 3,601)**	**Paroxysmal Atrial Fibrillation (N = 1,370)**	**Non-Paroxysmal Atrial Fibrillation (N = 2,231)**
Number of hospitalizations prior to index ablation — per person year							
Number of days before ablation	91 to 365 days	0.38	0.38	0.38	0.32	0.32	0.32
	31 to 90 days	0.67	0.73	0.56	0.34	0.39	0.31
	0 to 30 days	0.70	0.75	0.60	0.31	0.36	0.27
Number of hospitalizations after index ablation — per person year							
Number of days after ablation	0 to 30 days	0.68	0.49	1.0	0.93	1.1	0.84
	31 to 90 days	0.34	0.32	0.39	0.27	0.30	0.25
	91 to 365 days	0.27	0.23	0.33	0.28	0.32	0.26

Table C3. Number of emergency department visits prior to and after the index ablation procedure per person year, April 1, 2012 to March 31, 2016

Outcome	Any Ablation Total (N = 14,348)	Standard Ablation Total (N = 8,830)	Complex Ablations			
			Total (N = 5,518)	Total Atrial Fibrillation (N = 3,601)	Paroxysmal Atrial Fibrillation (N = 1,370)	Non-Paroxysmal Atrial Fibrillaton (N = 2,231)
Number of emergency department (ED) visits prior to index ablation (excludes ED visits that led to hospitalization) — per person year						
Number of days before ablation — 91 to 365 days	2.0	2.2	1.7	1.6	1.5	1.6
31 to 90 days	2.0	2.1	1.7	1.8	1.8	1.8
0 to 30 days	1.4	1.4	1.5	1.7	1.6	1.7
Number of emergency department (ED) visits after index ablation (excludes ED visits that led to hospitalization) — per person year						
Number of days after ablation — 0 to 30 days	2.3	1.8	3.1	3.4	3.2	3.6
31 to 90 days	1.1	1.0	1.3	1.3	1.2	1.3
91 to 365 days	0.83	0.76	0.93	0.93	0.89	0.95