Online-only supplementary materials for

Association of neighborhood-level material deprivation with atrial fibrillation care in a single-payer healthcare system: a population-based cohort study

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Table S1: Indicators used to develop the material deprivation dimension of the Ontario marginalization index. This has been adapted from the 2016 Ontario Marginalization Index User guide, which is available at https://www.publichealtontario.ca/-/media/documents/o/2017/on-marg-userguide.pdf

| Indicator                                                                                     |
|---------------------------------------------------------------------------------------------|
| Proportion of the population aged 25 to 64 without a certificate, diploma, or degree          |
| Proportion of families who are lone parent families                                           |
| Proportion of total income from government transfer payments for population aged 15+         |
| Proportion of the population aged 15+ who are unemployed                                     |
| Proportion of the population considered low-income                                           |
| Proportion of households living in dwellings that are in need of major repair                 |
Table S2: Definition of variables included as predictors in regression models. AF= atrial fibrillation, CIHI= Canadian Institute for Health Information, DAD= Discharge Abstract Database, NACRS= National Ambulatory Care Reporting System, ED= Emergency Department, OHIP= Ontario Health Insurance Plan.

| Variable                     | Method of determination                                                                                                                                 |
|------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------|
| Age                          | Based on index date, and the birth date documented in the Registered Persons Database                                                                  |
| Sex                          | As documented in the Registered Persons Database                                                                                                         |
| Source of AF diagnosis       |                                                                                                                                                    |
| Hospitalization              | If qualifying diagnosis made from CIHI DAD record                                                                                                       |
| Emergency Department         | If qualifying diagnosis made from CIHI NACRS ED record                                                                                                   |
| Outpatient                   | If qualifying diagnosis made from OHIP billing                                                                                                          |
| Year of diagnosis            | Based on date of qualifying AF diagnosis                                                                                                                 |
| Rural residence              | Rural communities were defined as those with <= 10,000 individuals                                                                                       |
| Recent immigration           | Immigrated to Canada after 1984 as per the Immigration, Refugees and Citizenship Canada database                                                          |
| Heart Failure                | One diagnostic code indicating an in-hospital diagnosis of heart failure, or ≥2 diagnostic codes for heart failure within 365 days in NACRS or OHIP |
| Hypertension                 | One Hypertension diagnosis on one DAD entry, or an OHIP claim followed within 2 years by a confirmatory diagnosis in DAD or OHIP                           |
| Condition                                      | Criteria                                                                                           |
|-----------------------------------------------|---------------------------------------------------------------------------------------------------|
| Diabetes                                      | One Diabetes diagnosis on one DAD entry, or an OHIP claim followed within 2 years by a confirmatory diagnosis in DAD or OHIP (excluding 120 d before/ 180 d after pregnancy) |
| Stroke/transient ischemic attack              | One DAD record indicative of stroke or transient ischemic attack                                   |
| Vascular disease                              | Composite of Ischemic heart disease or peripheral vascular disease, as defined below                |
| Ischemic heart disease                        | Ischemic heart disease diagnosis on one DAD entry, or an OHIP claim followed within one year by a confirmatory diagnosis in DAD or OHIP |
| Peripheral vascular disease                   | One record in DAD or NACRS indicative of peripheral vascular disease, or one peripheral revascularization procedure code |
| Prior bleeding                                | One record in DAD or NACRS indicative of prior bleeding; only DAD was considered for diagnoses of haemorrhagic stroke |
| Liver dysfunction                             | One record in DAD indicative of liver dysfunction or cirrhosis                                     |
| Chronic obstructive pulmonary disease         | One DAD/ same day surgery summary diagnosis or one OHIP claim with a COPD diagnosis               |
| Chronic kidney disease                        | One diagnostic code for in DAD/ NACRS or any OHIP billing claims for chronic kidney disease        |
| Cancer                                        | Any entry in the Ontario Cancer Registry in the prior 5 years                                      |
| Health system contact for alcohol use         | One diagnostic code in DAD or NACRS                                                               |
| Health system contact for recreational drug use | One diagnostic code in DAD, NACRS, OMHRS or any OHIP billing claims                                |
| **Hospital frailty score** | Determined from diagnostic codes in DAD using the approach described by Gilbert *et al.* ([https://doi.org/10.1016/S0140-6736(18)30668-8](https://doi.org/10.1016/S0140-6736(18)30668-8)) |
|--------------------------|----------------------------------------------------------------------------------------------------------|
| **Per capita cardiologist supply** | Number of cardiologists whose primary practice address is in the Local Health Integration Network subregion, divided by estimated population in that subregion |
Table S3: Baseline characteristics of the subset diagnosed with atrial fibrillation after 2012, stratified based on receipt of ablation. Std diff= standardized difference

|                              | Received ablation  | No ablation           | Std diff |
|------------------------------|--------------------|-----------------------|----------|
|                              | (n= 319)           | (n= 185,399)          |          |
| Age, median (IQR)            | 70 (68-73)         | 78 (72-85)            | 1.40     |
| Female Sex, n(%)             | 141 (44.2%)        | 89,998 (48.5%)        | 0.09     |
| Rural residence, n(%)        | 44 (13.8%)         | 23,987 (12.9%)        | 0.03     |
| Recent immigrant (immigrated to Canada after 1984), n(%) | 22 (6.9%)         | 13,367 (7.2%)        | 0.01     |
| Regional per capita cardiologist supply in the LHIN sub-region, median (IQR) | 4 (2-7)         | 4 (2-6)              | <0.01    |
| Neighborhood material deprivation quintile |                      |                       |          |
| Quintile 1 (least deprived)  | 95 (29.8%)         | 36,433 (19.7%)        | 0.24     |
| Quintile 2                    | 72 (22.6%)         | 36,749 (19.8%)        | 0.07     |
| Quintile 3                    | 68 (21.3%)         | 36,671 (19.8%)        | 0.04     |
| Quintile 4                    | 51 (16.0%)         | 38,267 (20.6%)        | 0.12     |
| Quintile 5 (most deprived)   | 33 (10.3%)         | 37,279 (20.1%)        | 0.27     |
| Neighborhood immigration & visible minority concentration quintile |                      |                       |          |
| Quintile 1 (least minorities) | 78 (24.5%)         | 43,525 (23.5%)        | 0.02     |
| Quintile 2                    | 72 (22.6%)         | 39,557 (21.3%)        | 0.03     |
| Quintile 3                    | 68 (21.3%)         | 35,436 (19.1%)        | 0.06     |
| Quintile 4                    | 49 (15.4%)         | 33,294 (18.0%)        | 0.07     |
| Quintile 5 (most minorities) | 52 (16.3%)         | 33,587 (18.1%)        | 0.05     |
| Source of index event, n(%)  |                    |                       |          |
| Hospitalization               | 9 (2.8%)           | 54,043 (29.1%)        | 0.77     |
| Emergency Department          | 116 (36.4%)        | 54,356 (29.3%)        | 0.15     |
| Out of hospital (through physician billing codes) | 194 (60.8%)         | 77,000 (41.5%)        | 0.39     |
| Congestive heart failure, n(%) | 43 (13.5%)         | 53,068 (28.6%)        | 0.38     |
| Hypertension, n(%)            | 213 (66.8%)        | 155,700 (84.0%)       | 0.41     |
| Diabetes, n(%)                | 69 (21.6%)         | 65,641 (35.4%)        | 0.31     |
| Non-hemorrhagic stroke/TIA, n(%) | <6*               | *10672-10676          | 0.32     |
| Ischemic heart disease, n(%)  | 63 (19.7%)         | 56,165 (30.3%)        | 0.25     |
| Myocardial infarction, n(%)   | 7 (2.2%)           | 14,641 (7.9%)         | 0.26     |
| Percutaneous coronary intervention, n(%) | 8 (2.5%)         | 8,690 (4.7%)         | 0.12     |
| Coronary artery bypass surgery, n(%) | 0 (0.0%)         | 6,975 (3.8%)         | 0.28     |
| Peripheral vascular disease, n(%) | <6*               | *4808-4812           | 0.19     |
| Chronic obstructive pulmonary disease, n(%) | 65 (20.4%)         | 56,121 (30.3%)        | 0.23     |
| Chronic kidney disease, n(%)  | 16 (5.0%)          | 29,861 (16.1%)        | 0.37     |
| Median estimated glomerular filtration rate, mL/min/1.73m2 (IQR) | 74 (63-85)         | 66 (49-81)            | 0.47     |
| Liver dysfunction (including cirrhosis), n(%) | 0 (0.0%)          | 1,392 (0.8%)         | 0.12     |
| Dementia, n(%)                | <6*                | *18305-18309          | 0.40     |
| Prior cancer, n(%)            | 13 (4.1%)          | 21,642 (11.7%)        | 0.29     |
| Health system contact for alcohol use, n(%) | <6*               | *3656-3660           | 0.12     |
| Health system contact for recreational drug use, n(%) | 6 (1.9%) | 4,502 (2.4%) | 0.04 |
|---------------------------------------------------------------|---------|--------------|------|
| Bleeding diagnoses during prior hospitalizations, n(%) | 15 (4.7%) | 22,543 (12.2%) | 0.27 |

* Cells with less than 6 individuals are suppressed to reduce risk of re-identification as per ICES policies
Table S4: Baseline characteristics of individuals with atrial fibrillation residing in neighborhoods with lowest and the highest quintile of material deprivation, who were matched based on the propensity score derived from the variables listed in this table. Std= standardized difference

|                          | Q1 (Least deprived) | Q5 (Most deprived) | Std diff |
|--------------------------|---------------------|--------------------|----------|
|                          | N=44,186            | N=44,186           |          |
| Age, median (IQR)        | 79.0 (73.0-85.0)    | 79.0 (73.0-85.0)   | 0.003    |
| Female Sex, n(%)         | 22,052 (49.9%)      | 22,154 (50.1%)     | 0.005    |
| Rural residence, n(%)    | 4,494 (10.2%)       | 4,467 (10.1%)      | 0.002    |
| Recent immigrant (immigrated to Canada after 1984), n(%) | 2,163 (4.9%)      | 2,258 (5.1%)      | 0.01    |
| Regional per capita cardiologist supply in the LHIN sub-region, median (IQR) | 4.0 (1.6-6.3) | 4.0 (1.6-6.4) | 0.006 |
| Neighborhood immigration and visible minority concentration quintile |                |                    |          |
| Quintile 1 (least minorities) | 9,218 (20.9%) | 9,331 (21.1%) | 0.006 |
| Quintile 2               | 10,669 (24.1%)     | 10,507 (23.8%)    | 0.009    |
| Quintile 3               | 10,630 (24.1%)     | 10,561 (23.9%)    | 0.004    |
| Quintile 4               | 9,566 (21.6%)      | 9,686 (21.9%)     | 0.007    |
| Quintile 5 (most minorities) | 4,103 (9.3%)  | 4,101 (9.3%)      | <0.001  |
| Source of index event, n(%) |                |                    |          |
| Hospitalization          | 13,334 (30.2%)     | 13,252 (30.0%)    | 0.004    |
| Emergency Department     | 12,485 (28.3%)     | 12,586 (28.5%)    | 0.005    |
| Out of hospital (through physician billing codes) | 18,367 (41.6%) | 18,348 (41.5%) | 0.001 |
| Congestive heart failure, n(%) | 13,313 (30.1%) | 13,306 (30.1%) | <0.001 |
| Hypertension, n(%)       | 36,918 (83.6%)     | 37,045 (83.8%)    | 0.008    |
| Diabetes, n(%)           | 14,771 (33.4%)     | 14,838 (33.6%)    | 0.003    |
| Non-hemorrhagic stroke/TIA, n(%) | 2,588 (5.9%) | 2,597 (5.9%) | 0.001 |
| Ischemic heart disease, n(%) | 14,974 (33.9%) | 15,022 (34.0%) | 0.002 |
| Myocardial infarction, n(%) | 3,673 (8.3%)      | 3,673 (8.3%)      | <0.001  |
| Percutaneous coronary intervention , n(%) | 1,896 (4.3%) | 1,874 (4.2%) | 0.002 |
| Coronary artery bypass surgery, n(%) | 1,693 (3.8%) | 1,688 (3.8%) | 0.001 |
| Peripheral vascular disease, n(%) | 1,293 (2.9%) | 1,337 (3.0%) | 0.006 |
| Chronic obstructive pulmonary disease, n(%) | 13,935 (31.5%) | 13,954 (31.6%) | 0.001 |
| Stages of chronic kidney disease, n(%) |                |                    |          |
| > 90 mL/min per 1.73m2   | 2,472 (5.6%)       | 2,417 (5.5%)      | 0.002    |
| >60 to 90 mL/min per 1.73m2 | 16,383 (37.1%)   | 16,394 (37.1%)    | 0.001    |
| >30 to 60 mL/min per 1.73m2 | 11,106 (25.1%)   | 11,087 (25.1%)    | 0.004    |
| 15 to 30 mL/min per 1.73m2 | 1,697 (3.8%)      | 1,729 (3.9%)      | 0.002    |
| <15 mL/min per 1.73m2 or dialysis | 531 (1.2%)  | 522 (1.2%)        | 0.005    |
| Undetermined             | 11,997 (27.2%)     | 12,037 (27.2%)    | 0.001    |
| Liver dysfunction (including cirrhosis) , n(%) | 269 (0.6%) | 276 (0.6%) | 0.002 |
| Dementia, n(%)           | 4,254 (9.6%)       | 4,255 (9.6%)      | <0.001  |
|                               | Group 1     | Group 2     | p-value |
|-------------------------------|-------------|-------------|---------|
| Prior cancer, n(%)           | 5,050 (11.4%) | 5,081 (11.5%) | 0.002   |
| Health system contact for alcohol use, n(%) | 922 (2.1%)    | 920 (2.1%)    | <0.001  |
| Health system contact for recreational drug use, n(%) | 1,146 (2.6%)   | 1,148 (2.6%)   | <0.001  |
| Bleeding diagnoses during prior hospitalizations, n(%) | 5,343 (12.1%)  | 5,350 (12.1%)  | <0.001  |
Figure S1: Flow Diagram

646,679 individuals with AF documented Apr 2007 - Mar 2019

4,311 aged <18 or >105 years
3,824 missing/invalid key data
78,259 with AF diagnosis before 2007
25,712 long-term care residents
20,520 valvular disease
163,701 aged <66 years
2,720 missing deprivation quintile data

347,632 eligible individuals aged ≥66 years with valid key data
who were first documented with AF during accrual period

185,718 diagnosed on or after Jan 2013
(subgroup used for DOAC/ablation analyses)
Figure S2: Sensitivity analysis for adverse outcomes within a year of first AF documentation by material deprivation of individuals’ neighborhood, utilizing the date of the fourth physician billing as the index date. Hazard ratios are relative to individuals living in neighborhoods in the first quintile (least deprived), and are adjusted for age, sex, source of AF diagnosis (hospitalization, ED, outpatient), year of diagnosis, rural residence, immigration status, HF, hypertension, diabetes, stroke/transient ischemic attack, vascular disease, prior bleeding, liver dysfunction, chronic obstructive pulmonary disease, chronic kidney disease, cancer, excessive alcohol use, recreational drug use, hospital frailty score, and per capita cardiologist supply.
Figure S3: Sensitivity analysis for AF-related clinical services within a year of first AF documentation by material deprivation of individuals’ neighborhood, utilizing the date of the fourth physician billing as the index date. Hazard ratios are relative to individuals living in neighborhoods in the first quintile (least deprived), and are adjusted for age, sex, source of AF diagnosis (hospitalization, ED, outpatient), year of diagnosis, rural residence, immigration status, HF, hypertension, diabetes, stroke/transient ischemic attack, vascular disease, prior bleeding, liver dysfunction, chronic obstructive pulmonary disease, chronic kidney disease, cancer, excessive alcohol use, recreational drug use, hospital frailty score, and per capita cardiologist supply.
Figure S4: Sensitivity analysis for AF-related interventions within a year of first AF documentation by material deprivation of individuals’ neighborhood, utilizing the date of the fourth physician billing as the index date. Hazard ratios are relative to individuals living in neighborhoods in the first quintile (least deprived), and are adjusted for age, sex, source of AF diagnosis (hospitalization, ED, outpatient), year of diagnosis, rural residence, immigration status, HF, hypertension, diabetes, stroke/transient ischemic attack, vascular disease, prior bleeding, liver dysfunction, chronic obstructive pulmonary disease, chronic kidney disease, cancer, excessive alcohol use, recreational drug use, hospital frailty score, and per capita cardiologist supply.

| Outcome                       | Adjusted Hazard Ratio (95% CI) |
|-------------------------------|--------------------------------|
| **Anticoagulation**           |                                |
| Q2 vs. Q1                    | 1.00 (0.98, 1.02)              |
| Q3 vs. Q1                    | 1.00 (0.98, 1.02)              |
| Q4 vs. Q1                    | 0.99 (0.98, 1.01)              |
| Q5 vs. Q1                    | 0.98 (0.96, 1.00)              |
| **Full-dose DOAC**            |                                |
| Q2 vs. Q1                    | 0.98 (0.95, 1.01)              |
| Q3 vs. Q1                    | 0.96 (0.94, 0.99)              |
| Q4 vs. Q1                    | 0.97 (0.94, 1.00)              |
| Q5 vs. Q1                    | 0.99 (0.96, 1.02)              |
| **Reduced-dose DOAC**         |                                |
| Q2 vs. Q1                    | 1.02 (0.98, 1.06)              |
| Q3 vs. Q1                    | 1.00 (0.97, 1.04)              |
| Q4 vs. Q1                    | 1.03 (1.00, 1.07)              |
| Q5 vs. Q1                    | 1.03 (0.99, 1.06)              |
| **Anticoagulation Non-persistence** |                                |
| Q2 vs. Q1                    | 1.00 (0.98, 1.03)              |
| Q3 vs. Q1                    | 1.01 (0.98, 1.04)              |
| Q4 vs. Q1                    | 1.00 (0.97, 1.03)              |
| Q5 vs. Q1                    | 1.03 (1.00, 1.05)              |
| **Anti-arrhythmic Medication** |                                |
| Q2 vs. Q1                    | 0.98 (0.94, 1.01)              |
| Q3 vs. Q1                    | 1.00 (0.96, 1.03)              |
| Q4 vs. Q1                    | 0.98 (0.94, 1.02)              |
| Q5 vs. Q1                    | 0.95 (0.91, 0.98)              |
| **Cardioversion**            |                                |
| Q2 vs. Q1                    | 0.90 (0.85, 0.95)              |
| Q3 vs. Q1                    | 0.89 (0.84, 0.95)              |
| Q4 vs. Q1                    | 0.90 (0.85, 0.95)              |
| Q5 vs. Q1                    | 0.79 (0.74, 0.84)              |
| **Ablation**                 |                                |
| Q2 vs. Q1                    | 0.81 (0.58, 1.13)              |
| Q3 vs. Q1                    | 0.78 (0.56, 1.08)              |
| Q4 vs. Q1                    | 0.62 (0.43, 0.90)              |
| Q5 vs. Q1                    | 0.46 (0.30, 0.69)              |
Figure S5: Post-hoc analysis for adverse outcomes within a year of first AF documentation by material deprivation of individuals’ neighborhood, incorporating visits to a cardiologist as a time-varying covariate. Hazard ratios are relative to individuals living in neighborhoods in the first quintile (least deprived), and are also adjusted for age, sex, source of AF diagnosis (hospitalization, ED, outpatient), year of diagnosis, rural residence, immigration status, HF, hypertension, diabetes, stroke/transient ischemic attack, vascular disease, prior bleeding, liver dysfunction, chronic obstructive pulmonary disease, chronic kidney disease, cancer, excessive alcohol use, recreational drug use, hospital frailty score, and per capita cardiologist supply.
Figure S6: Post-hoc analysis for AF-related clinical services within a year of first AF documentation by material deprivation of individuals’ neighborhood, incorporating visits to a cardiologist as a time-varying covariate. Hazard ratios are relative to individuals living in neighborhoods in the first quintile (least deprived), and are also adjusted for age, sex, source of AF diagnosis (hospitalization, ED, outpatient), year of diagnosis, rural residence, immigration status, HF, hypertension, diabetes, stroke/transient ischemic attack, vascular disease, prior bleeding, liver dysfunction, chronic obstructive pulmonary disease, chronic kidney disease, cancer, excessive alcohol use, recreational drug use, hospital frailty score, and per capita cardiologist supply.
**Figure S7:** Post-hoc analysis for AF-related interventions within a year of first AF documentation by material deprivation of individuals’ neighborhood, incorporating visits to a cardiologist as a time-varying covariate. Hazard ratios are relative to individuals living in neighborhoods in the first quintile (least deprived), and are also adjusted for age, sex, source of AF diagnosis (hospitalization, ED, outpatient), year of diagnosis, rural residence, immigration status, HF, hypertension, diabetes, stroke/transient ischemic attack, vascular disease, prior bleeding, liver dysfunction, chronic obstructive pulmonary disease, chronic kidney disease, cancer, excessive alcohol use, recreational drug use, hospital frailty score, and per capita cardiologist supply.