**SUPPLEMENTARY MATERIAL**

**COVID-19 Vaccine Effectiveness among a Population-based Cohort of People Living with HIV in Ontario, Canada**

**Figure S1.** Participant flowchart

**N=21,023**

People living with HIV aged ≥19 years in Ontario as of Dec. 14, 2020

**N=7,461**

(N=9,962 test episodes)

Tested for SARS-CoV-2 between Dec. 14, 2020 and Nov. 21, 2021

**N=195 excluded\***

* *Received ≥1 out-of-province or Janssen vaccine dose (n≤5)*
* *Received 3+ doses of COVID-19 (n=30)*
* *Positive for SARS-CoV-2 prior to Dec. 14, 2020 (n=106)*
* *Missing data for ≥1 covariate (n=63)*

**N=7,266**

(N=9,680 test episodes)

Included in analysis

**N=6,465 unique individuals**

(N=8,879 test episodes)

Test-negative controls

**N=801 unique individuals**

(N=801 test episodes)

Test-positive cases

***Any infection***

***Severe outcomes***

**N=877 unique individuals**

(N=985 test episodes)

Symptomatic test-negative controls

**N=101 unique individuals**

(N=101 test episodes)

Severe COVID-19 outcomes

**N=131 unique individuals**

(N=131 test episodes)

Symptomatic test-positive cases

***Symptomatic infection***

\* Categories are not mutually exclusive

**Table S1.** Participant characteristics by case status among people living with HIV tested for SARS-CoV-2 infection between December 14, 2020 and November 21, 2021 with COVID-19 symptoms at time of testing, Ontario, Canada

|  | **Test-positive** **cases** | **Test-negative controls** | **SD** |
| --- | --- | --- | --- |
| **N** | **%** | **N** | **%** |
| Total | 131 | 100.0 | 985 | 100.0 |  |
| Number of COVID-19 vaccine doses (at time of test) |  |  |  |  |  |
| 0 | 99 | 75.6 | 451 | 45.8 | 0.64 |
| 1 | 24 | 18.3 | 130 | 13.2 | 0.14 |
| 2 | 8 | 6.1 | 404 | 41.0 | 0.90 |
| Age group (years) |  |  |  |  |  |
| 19-29 | 14 | 10.7 | 99 | 10.1 | 0.02 |
| 30-39 | 31 | 23.7 | 221 | 22.4 | 0.03 |
| 40-49 | 33 | 25.2 | 218 | 22.1 | 0.07 |
| 50-59 | 37 | 28.2 | 274 | 27.8 | 0.01 |
| ≥60 | 16 | 12.2 | 173 | 17.6 | 0.15 |
| Sex |  |  |  |  |  |
| Male | 92 | 70.2 | 746 | 75.7 | 0.12 |
| Female | 39 | 29.8 | 239 | 24.3 | 0.12 |
| Year-month of specimen collection |  |  |  |  |  |
| 2020-12 | 7 | 5.3 | 45 | 4.6 | 0.04 |
| 2021-01 | 18 | 13.7 | 103 | 10.5 | 0.10 |
| 2021-02 | 11 | 8.4 | 85 | 8.6 | 0.01 |
| 2021-03 | 19 | 14.5 | 100 | 10.2 | 0.13 |
| 2021-04 | 31 | 23.7 | 90 | 9.1 | 0.40 |
| 2021-05 | 19 | 14.5 | 80 | 8.1 | 0.20 |
| 2021-06 | ≤5 | - | 55 | 5.6 | - |
| 2021-07 | ≤5 | - | 59 | 6.0 | - |
| 2021-08 | 9 | 6.9 | 82 | 8.3 | 0.05 |
| 2021-09 | ≤5 | - | 100 | 10.2 | - |
| 2021-10 | ≤5 | - | 110 | 11.2 | - |
| 2021-11 | ≤5 | - | 76 | 7.7 | - |
| Pandemic wave |  |  |  |  |  |
| Wave 2: Dec. 14, 2020 to Mar. 6, 2021 | 43 | 32.8 | 253 | 25.7 | 0.16 |
| Wave 3: Mar. 7, 2021 to Jun. 26, 2021 | 66 | 50.4 | 300 | 30.5 | 0.41 |
| Wave 4: Jun. 27, 2021 to Nov. 21, 2021 | 22 | 16.8 | 432 | 43.9 | 0.62 |
| Public health region |  |  |  |  |  |
| Toronto | 55 | 42.0 | 425 | 43.1 | 0.02 |
| Central East | ≤5 | - | 43 | 4.4 | - |
| Central West | 20 | 15.3 | 111 | 11.3 | 0.12 |
| Durham | ≤5 | - | 27 | 2.7 | - |
| Eastern | ≤5 | - | 41 | 4.2 | - |
| Northern | 7 | 5.3 | 68 | 6.9 | 0.07 |
| Ottawa | ≤5 | - | 20 | 2.0 | - |
| Peel | 23 | 17.6 | 93 | 9.4 | 0.24 |
| South West | 16 | 12.2 | 136 | 13.8 | 0.05 |
| York | ≤5 | - | 21 | 2.1 | - |
| No. of tests in 3 months before Dec. 14, 2020 |  |  |  |  |  |
| 0 | 106 | 80.9 | 692 | 70.3 | 0.25 |
| 1 | 20-24 | - | 214 | 21.7 | - |
| 2+ | ≤5 | - | 79 | 8.0 | - |
| Receipt of 2019/20 or 2020/21 flu vaccine |  |  |  |  |  |
| Neither season | 81 | 61.8 | 530 | 53.8 | 0.16 |
| Either season | 29 | 22.1 | 265 | 26.9 | 0.11 |
| Both seasons | 21 | 16.0 | 190 | 19.3 | 0.09 |
| Number of comorbidities |  |  |  |  |  |
| 0 | 73 | 55.7 | 448 | 45.5 | 0.21 |
| 1 | 37 | 28.2 | 288 | 29.2 | 0.02 |
| 2+ | 21 | 16.0 | 249 | 25.3 | 0.23 |
| Comorbidities |  |  |  |  |  |
| Chronic respiratory disease | 27 | 20.6 | 277 | 28.1 | 0.18 |
| Hypertension | 23 | 17.6 | 230 | 23.4 | 0.14 |
| Diabetes | 18 | 13.7 | 132 | 13.4 | 0.01 |
| Frailty/dementia | 10 | 7.6 | 86 | 8.7 | 0.04 |
| Chronic heart disease | 7 | 5.3 | 95 | 9.6 | 0.16 |
| Chronic kidney disease/dialysis | 6 | 4.6 | 71 | 7.2 | 0.11 |
| Advanced liver disease | 9 | 6.9 | 36 | 3.7 | 0.14 |
| Autoimmune disorders | ≤5 | - | 61 | 6.2 | - |
| History of stroke/TIA | ≤5 | - | 15 | 1.5 | - |
| Neighbourhood-level essential workers quintile |  |  |  |  |  |
| 1 (0-32.5%) | 12 | 9.2 | 259 | 26.3 | 0.46 |
| 2 (32.5-42.3%) | 27 | 20.6 | 188 | 19.1 | 0.04 |
| 3 (42.3-49.8%) | 27 | 20.6 | 167 | 17.0 | 0.09 |
| 4 (50.0-57.5%) | 25 | 19.1 | 166 | 16.9 | 0.06 |
| 5 (57.5-100%) | 40 | 30.5 | 205 | 20.8 | 0.22 |
| Neighbourhood-level average number of persons per dwelling quintile |  |  |  |  |  |
| 1 (0-2.1) | 30 | 22.9 | 386 | 39.2 | 0.36 |
| 2 (2.2-2.4) | 20 | 15.3 | 188 | 19.1 | 0.10 |
| 3 (2.5-2.6) | 14 | 10.7 | 103 | 10.5 | 0.01 |
| 4 (2.7-3.0) | 34 | 26.0 | 167 | 17.0 | 0.22 |
| 5 (3.1-5.7) | 33 | 25.2 | 141 | 14.3 | 0.28 |
| Neighbourhood-level proportion of persons self-identifying as visible minority quintile |  |  |  |  |  |
| 1 (0.0-2.2%) | ≤5 | - | 102 | 10.4 | 0.26 |
| 2 (2.2-7.5%) | 10-14 | - | 140 | 14.2 | 0.13 |
| 3 (7.5-18.7%) | 19 | 14.5 | 165 | 16.8 | 0.06 |
| 4 (18.7-43.5%) | 35 | 26.7 | 275 | 27.9 | 0.03 |
| 5 (43.5-100%) | 59 | 45.0 | 303 | 30.8 | 0.30 |
| Neighbourhood-level median income quintile |  |  |  |  |  |
| 1 (lowest) | 59 | 45.0 | 325 | 33.0 | 0.25 |
| 2 | 33 | 25.2 | 234 | 23.8 | 0.03 |
| 3 | 19 | 14.5 | 183 | 18.6 | 0.11 |
| 4 | 13 | 9.9 | 104 | 10.6 | 0.02 |
| 5 (highest) | 7 | 5.3 | 139 | 14.1 | 0.30 |

SD=standardized difference

**Table S2.** Participant characteristics by whether or not COVID-19 symptoms were recorded at time of test among people living with HIV tested for SARS-CoV-2 infection between December 14, 2020 and November 21, 2021, Ontario, Canada

|  | **No symptoms recorded** | **Symptoms recorded** | **SD** |
| --- | --- | --- | --- |
| **N** | **%** | **N** | **%** |
| Total | 8564 | 100.0 | 1116 | 100.0 |  |
| Number of COVID-19 vaccine doses (at time of test) |  |  |  |  |  |
| 0 | 4725 | 55.2 | 550 | 49.3 | 0.12 |
| 1 | 1360 | 15.9 | 154 | 13.8 | 0.06 |
| 2 | 2479 | 28.9 | 412 | 36.9 | 0.17 |
| Age group (years) |  |  |  |  |  |
| 19-29 | 617 | 7.2 | 113 | 10.1 | 0.10 |
| 30-39 | 1640 | 19.1 | 252 | 22.6 | 0.08 |
| 40-49 | 1991 | 23.2 | 251 | 22.5 | 0.02 |
| 50-59 | 2546 | 29.7 | 311 | 27.9 | 0.04 |
| ≥60 | 1770 | 20.7 | 189 | 16.9 | 0.10 |
| Sex |  |  |  |  |  |
| Male | 6404 | 74.8 | 838 | 75.1 | 0.01 |
| Female | 2160 | 25.2 | 278 | 24.9 | 0.01 |
| Year-month of specimen collection |  |  |  |  |  |
| 2020-12 | 635 | 7.4 | 52 | 4.7 | 0.12 |
| 2021-01 | 1042 | 12.2 | 121 | 10.8 | 0.04 |
| 2021-02 | 868 | 10.1 | 96 | 8.6 | 0.05 |
| 2021-03 | 1097 | 12.8 | 119 | 10.7 | 0.07 |
| 2021-04 | 1041 | 12.2 | 121 | 10.8 | 0.04 |
| 2021-05 | 798 | 9.3 | 99 | 8.9 | 0.02 |
| 2021-06 | 532 | 6.2 | 59 | 5.3 | 0.04 |
| 2021-07 | 527 | 6.2 | 60 | 5.4 | 0.03 |
| 2021-08 | 570 | 6.7 | 91 | 8.2 | 0.06 |
| 2021-09 | 560 | 6.5 | 104 | 9.3 | 0.10 |
| 2021-10 | 557 | 6.5 | 115 | 10.3 | 0.14 |
| 2021-11 | 337 | 3.9 | 79 | 7.1 | 0.14 |
| Pandemic wave |  |  |  |  |  |
| Wave 2: Dec. 14, 2020 to Mar. 6, 2021 | 2787 | 32.5 | 296 | 26.5 | 0.13 |
| Wave 3: Mar. 7, 2021 to Jun. 26, 2021 | 3156 | 36.9 | 366 | 32.8 | 0.09 |
| Wave 4: Jun. 27, 2021 to Nov. 21, 2021 | 2621 | 30.6 | 454 | 40.7 | 0.21 |
| Public health region |  |  |  |  |  |
| Toronto | 4423 | 51.6 | 480 | 43.0 | 0.17 |
| Central East | 257 | 3.0 | 45 | 4.0 | 0.06 |
| Central West | 1158 | 13.5 | 131 | 11.7 | 0.05 |
| Durham | 224 | 2.6 | 30 | 2.7 | 0.00 |
| Eastern | 257 | 3.0 | 42 | 3.8 | 0.04 |
| Northern | 302 | 3.5 | 75 | 6.7 | 0.15 |
| Ottawa | 686 | 8.0 | 22 | 2.0 | 0.28 |
| Peel | 405 | 4.7 | 116 | 10.4 | 0.22 |
| South West | 590 | 6.9 | 152 | 13.6 | 0.22 |
| York | 262 | 3.1 | 23 | 2.1 | 0.06 |
| No. of tests in 3 months before Dec. 14, 2020 |  |  |  |  |  |
| 0 | 5797 | 67.7 | 798 | 71.5 | 0.08 |
| 1 | 1595 | 18.6 | 234 | 21.0 | 0.06 |
| 2+ | 1172 | 13.7 | 84 | 7.5 | 0.20 |
| Receipt of 2019/20 or 2020/21 flu vaccine |  |  |  |  |  |
| Neither season | 4490 | 52.4 | 611 | 54.7 | 0.05 |
| Either season | 2197 | 25.7 | 294 | 26.3 | 0.02 |
| Both seasons | 1877 | 21.9 | 211 | 18.9 | 0.07 |
| Number of comorbidities |  |  |  |  |  |
| 0 | 4112 | 48.0 | 521 | 46.7 | 0.03 |
| 1 | 2462 | 28.7 | 325 | 29.1 | 0.01 |
| 2+ | 1990 | 23.2 | 270 | 24.2 | 0.02 |
| Comorbidities |  |  |  |  |  |
| Chronic respiratory disease | 2189 | 25.6 | 304 | 27.2 | 0.04 |
| Hypertension | 1983 | 23.2 | 253 | 22.7 | 0.01 |
| Diabetes | 1126 | 13.1 | 150 | 13.4 | 0.01 |
| Frailty/dementia | 815 | 9.5 | 96 | 8.6 | 0.03 |
| Chronic heart disease | 731 | 8.5 | 102 | 9.1 | 0.02 |
| Chronic kidney disease/dialysis | 599 | 7.0 | 77 | 6.9 | 0.00 |
| Advanced liver disease | 363 | 4.2 | 45 | 4.0 | 0.01 |
| Autoimmune disorders | 385 | 4.5 | 65 | 5.8 | 0.06 |
| History of stroke/TIA | 156 | 1.8 | 19 | 1.7 | 0.01 |
| Neighbourhood-level essential workers quintile |  |  |  |  |  |
| 1 (0-32.5%) | 2843 | 33.2 | 271 | 24.3 | 0.20 |
| 2 (32.5-42.3%) | 1505 | 17.6 | 215 | 19.3 | 0.04 |
| 3 (42.3-49.8%) | 1388 | 16.2 | 194 | 17.4 | 0.03 |
| 4 (50.0-57.5%) | 1452 | 17.0 | 191 | 17.1 | 0.00 |
| 5 (57.5-100%) | 1376 | 16.1 | 245 | 22.0 | 0.15 |
| Neighbourhood-level average number of persons per dwelling quintile |  |  |  |  |  |
| 1 (0-2.1) | 3944 | 46.1 | 416 | 37.3 | 0.18 |
| 2 (2.2-2.4) | 1403 | 16.4 | 208 | 18.6 | 0.06 |
| 3 (2.5-2.6) | 831 | 9.7 | 117 | 10.5 | 0.03 |
| 4 (2.7-3.0) | 1347 | 15.7 | 201 | 18.0 | 0.06 |
| 5 (3.1-5.7) | 1039 | 12.1 | 174 | 15.6 | 0.10 |
| Neighbourhood-level proportion of persons self-identifying as visible minority quintile |  |  |  |  |  |
| 1 (0.0-2.2%) | 606 | 7.1 | 107 | 9.6 | 0.09 |
| 2 (2.2-7.5%) | 745 | 8.7 | 153 | 13.7 | 0.16 |
| 3 (7.5-18.7%) | 1473 | 17.2 | 184 | 16.5 | 0.02 |
| 4 (18.7-43.5%) | 2812 | 32.8 | 310 | 27.8 | 0.11 |
| 5 (43.5-100%) | 2928 | 34.2 | 362 | 32.4 | 0.04 |
| Neighbourhood-level median income quintile |  |  |  |  |  |
| 1 (lowest) | 3136 | 36.6 | 384 | 34.4 | 0.05 |
| 2 | 1784 | 20.8 | 267 | 23.9 | 0.07 |
| 3 | 1503 | 17.6 | 202 | 18.1 | 0.01 |
| 4 | 1060 | 12.4 | 117 | 10.5 | 0.06 |
| 5 (highest) | 1081 | 12.6 | 146 | 13.1 | 0.01 |

SD=standardized difference

**Table S3.** Vaccine effectiveness estimates for receipt of 2 doses ≥7 days before index date stratified by covariates among people living with HIV tested for SARS-CoV-2 infection between December 14, 2020 and November 21, 2021, Ontario, Canada

|  | **Any infection** | **Symptomatic infection** |
| --- | --- | --- |
|  | **Unadjusted** | **Adjusted****[[1]](#footnote-1)** | **Unadjusted** | **Adjusted1** |
| **VE (95%CI)** | **VE (95%CI)** | **VE (95%CI)** | **VE (95%CI)** |
| Age group |  |  |  |  |
| <50 years | 84 (77, 89) | 80 (69, 87) | 87 (71, 94) | 91 (72, 97) |
| ≥50 years | 87 (80, 92) | 85 (74, 91) | 97 (78, 100) | 98 (82, 100) |
| Sex |  |  |  |  |
| Male | 85 (79, 89) | 80 (70, 87) | 91 (78, 96) | 93 (79, 98) |
| Female | 89 (80, 94) | 87 (74, 93) | 91 (60, 98) | 95 (71, 99) |
| Pandemic wave |  |  |  |  |
| Wave 2: Dec. 14, 2020 to Mar. 6, 2021 | 85 (, 12, 98) | 81 (-42, 97) | 94 (84, 98) | 93 (79, 98) |
| Wave 3: Mar. 7, 2021 to Jun. 26, 2021 | 84 (69, 91) | 82 (65, 91) | 100 | 100 |
| Wave 4: Jun. 27, 2021 to Nov. 21, 2021 | 83 (73, 89) | 81 (69, 88) | 94 (84, 98) | 93 (79, 98) |
| Region |  |  |  |  |
| Greater Toronto Area | 89 (84, 92) | 85 (77, 91) | 91 (78, 97) | 93 (78, 98) |
| East | 71 (35, 87) | 63 (13, 84) | NE | NE |
| West | 79 (62, 88) | 72 (48, 85) | 90 (58, 98) | 94 (67, 99) |
| North | 90 (23, 99) | 89 (18, 99) | 100 | 100 |
| Tested for SARS-CoV-2 in 3 months before Dec. 14, 2020 |  |  |  |  |
| No | 86 (81, 90) | 82 (72, 88) | 88 (75, 94) | 92 (76, 97) |
| Yes | 84 (72, 90) | 82 (69, 90) | 100 | 100 |
| Receipt of 2019/20 or 2020/21 flu vaccine |  |  |  |  |
| Neither season | 86 (79, 90) | 82 (72, 89) | 91 (75, 97) | 94 (77, 98) |
| Either season | 84 (72, 91) | 80 (63, 89) | 89 (52, 97) | 93 (60, 99) |
| Both seasons | 86 (74, 93) | 82 (65, 91) | 91 (58, 98) | 94 (65, 99) |
| Number of comorbidities |  |  |  |  |
| 0 | 85 (78, 90) | 80 (69, 87) | 88 (72, 95) | 91 (72, 97) |
| 1 | 87 (77, 93) | 83 (68, 91) | 92 (67, 98) | 94 (70, 99) |
| 2+ | 87 (74, 94) | 85 (67, 93) | 100 | 100 |

1. Adjusted for age group, sex, public health region, calendar time (restricted cubic spline for week of specimen collection), number of SARS-CoV-2 test episodes in 3 months prior to Dec. 14, 2020, received influenza vaccine in 2019/20 or 2020/21 seasons, number of comorbidities, and neighbourhood-level SES indicators. [↑](#footnote-ref-1)