

## SUPPLEMENTAL MATERIAL

### APPENDIX

**Title:** The effect of back problems on health care utilization and costs in Ontario, Canada: A population-based matched cohort study

**Running title:** The effect of back problems on health care utilization and costs

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**Appendix I.** Billing and procedural codes related to a) low back pain and spinal imaging; and b) thoracic and rib pain from health administrative data

**a) Low back pain:**

| Type   | Codes | Description  |
|--------|-------|--|
| ICD-10 | M4726 | Other spondylosis with radiculopathy, lumbar region                    |
|        | M4727 | Other spondylosis with radiculopathy, lumbosacral region               |
|        | M4728 | Other spondylosis with radiculopathy, sacral and sacrococcygeal region |
|        | M4786 | Other spondylosis, lumbar region                                       |
|        | M4787 | Other spondylosis, lumbosacral region                                  |
|        | M4788 | Other spondylosis, sacral and sacrococcygeal region                    |
|        | M4796 | Spondylosis, unspecified, lumbar region                                |
|        | M4797 | Spondylosis, unspecified, lumbosacral region                           |
|        | M4798 | Spondylosis, unspecified, sacral and sacrococcygeal region             |
|        | M4806 | Spinal stenosis, lumbar region   |
|        | M4807 | Spinal stenosis, lumbosacral region                                    |
|        | M4808 | Spinal stenosis, sacral and sacrococcygeal region                      |
|        | M4886 | Other specified spondylopathies, lumbar region                         |
|        | M4887 | Other specified spondylopathies, lumbosacral region                    |
|        | M4888 | Other specified spondylopathies, sacral and sacrococcygeal region      |
|        | M4896 | Spondylopathy, unspecified, lumbar region                              |
|        | M4897 | Spondylopathy, unspecified, lumbosacral region                         |
|        | M4898 | Spondylopathy, unspecified, sacral and sacrococcygeal region           |
|        | M510  | Lumbar and other intervertebral disc disorders with myelopathy         |
|        | M511  | Lumbar and other intervertebral disc disorders with radiculopathy      |
|        | M512  | Other specified intervertebral disc displacement                       |
|        | M513  | Other specified intervertebral disc degeneration                       |
|        | M519  | Intervertebral disc disorder, unspecified                              |
|        | M533  | Sacrococcygeal disorders, not elsewhere classified                     |
|        | M5386 | Other specified dorsopathies, lumbar region                            |
|        | M5387 | Other specified dorsopathies, lumbosacral region                       |
|        | M5388 | Other specified dorsopathies, sacral and sacrococcygeal region         |
|        | M5410 | Radiculopathy, multiple sites in spine                                 |
|        | M5416 | Radiculopathy, lumbar region   |
|        | M5417 | Radiculopathy, lumbosacral region                                      |
|        | M5418 | Radiculopathy, sacral and sacrococcygeal region                        |
|        | M5419 | Radiculopathy, unspecified site  |
|        | M543  | Sciatica   |
|        | M544  | Lumbago with sciatica  |
|        | M545  | Low back pain  |
|        | M548  | Other dorsalgia  |
|        | M549  | Dorsalgia, unspecified site  |

| Type   | Codes | Description   |
|--------|-------|---|
|        | M9983 | Other biomechanical lesions, lumbar region                                  |
|        | M9993 | Biomechanical lesion, unspecified, lumbar region                            |
|        | M9903 | Segmental and somatic dysfunction, lumbar region                            |
|        | M9984 | Other biomechanical lesions, sacral region                                  |
|        | M9994 | Biomechanical lesion, unspecified, sacral region                            |
|        | M9904 | Segmental and somatic dysfunction, sacral region                            |
|        | S335  | Sprain and strain of lumbar spine   |
|        | S336  | Sprain and strain of sacroiliac joint                                       |
|        | S337  | Sprain and strain of other and unspecified parts of lumbar spine and pelvis |
|        | S338  | Sprain of other parts of lumbar spine and pelvis                            |
| ICD-9  | 7213  | LUMBOSACRAL SPONDYLOSIS   |
|        | 72210 | LUMBAR DISC DISPLACEMENT  |
|        | 72252 | LUMB/LUMBOSAC DISC DEGEN  |
|        | 72293 | DISC DIS NEC/NOS-LUMBAR   |
|        | 72273 | LUMB DISC DIS W MYEOPAT   |
|        | 72283 | POSTLAMINECT SYND-LUMBAR  |
|        | 72402 | SPINAL STENOSIS-LUMBAR  |
|        | 7243  | SCIATICA  |
|        | 7242  | LUMBAGO   |
|        | 7245  | BACKACHE NOS  |
|        | 7246  | DISORDERS OF SACRUM   |
|        | 72470 | DISORDER OF COCCYX NOS  |
|        | 72471 | HYPERMOBILITY OF COCCYX   |
|        | 72479 | DISORDER OF COCCYX NEC  |
|        | 7248  | OTHER BACK SYMPTOMS   |
|        | 7249  | BACK DISORDER NOS   |
|        | 7393  | SOMAT DYSFUNC LUMBAR REG  |
|        | 7394  | SOMAT DYSFUNC SACRAL REG  |
|        | 8460  | SPRAIN LUMBOSACRAL  |
|        | 8461  | SPRAIN SACROILIAC   |
|        | 8462  | SPRAIN SACROSPINATUS  |
|        | 8463  | SPRAIN SACROTUBEROUS  |
|        | 8468  | SPRAIN SACROILIAC NEC   |
|        | 8469  | SPRAIN SACROILIAC NOS   |
|        | 8472  | SPRAIN LUMBAR REGION  |
|        | 8473  | SPRAIN OF SACRUM  |
|        | 8474  | SPRAIN OF COCCYX  |
|        | 8479  | SPRAIN OF BACK NOS  |
| DXCODE | 724   | Lumbar strain, lumbago, or sciatica   |
|        | 846   | Sprains and strains of sacroiliac region                                    |

ICD - International Classification of Diseases

## a) Spinal imaging:

| Type             | Codes   | Description  |
|------------------|---------|--|
| OHIP<br>FEEDCODE | X025    | Cervical spine - two or three views  |
|                  | X202    | Cervical spine - four or five views  |
|                  | X203    | Cervical spine - six or more views   |
|                  | X027    | Thoracic spine - two views   |
|                  | X204    | Thoracic spine - three or more views   |
|                  | X028    | Lumbar or lumbosacral spine - two or three views   |
|                  | X205    | Lumbar or lumbosacral spine - four or five views   |
|                  | X206    | Lumbar or lumbosacral spine - six or more views  |
|                  | X032    | Entire spine (scoliosis series) - four views   |
|                  | X033    | Entire spine (scoliosis series) - single view  |
|                  | X031    | Entire spine (scoliosis series) - two or more views  |
|                  | X034    | Sacrum and/or coccyx - two views   |
|                  | X207    | Sacrum and/or coccyx - three or more views   |
|                  | X035    | Sacro-iliac joints - three or more views   |
|                  | X208    | Sacro-iliac joints - four or more views  |
| CCI              | 3SC10KM | Xray, spinal vertebrae with physically induced stress (with or without fluoroscopy)                  |
|                  | 3SC10VA | Xray, spinal vertebrae without contrast  |
|                  | 3SC10VN | Xray, spinal vertebrae with fluoroscopy  |
|                  | 3SE10VK | Xray, intervertebral disc following intradiscal injection of contrast (with or without fluoroscopy)  |
|                  | 3SC12AY | Fluoroscopy, spinal vertebrae with cine/video recording  |
|                  | 3SC12VA | Fluoroscopy, spinal vertebrae without contrast   |
|                  | 3SE12VA | Fluoroscopy, intervertebral disc without contrast  |
|                  | 3SE12VK | Fluoroscopy, intervertebral disc following intradiscal injection of contrast                         |
|                  | 3SF12VA | Fluoroscopy, sacrum and coccyx without contrast  |
|                  | 3SF12VL | Fluoroscopy, sacrum and coccyx following intraarticular injection of contrast                        |
|                  | 3SF10VA | Xray, sacrum and coccyx without contrast   |
|                  | 3SF10VL | Xray, sacrum and coccyx following intraarticular injection of contrast (with or without fluoroscopy) |

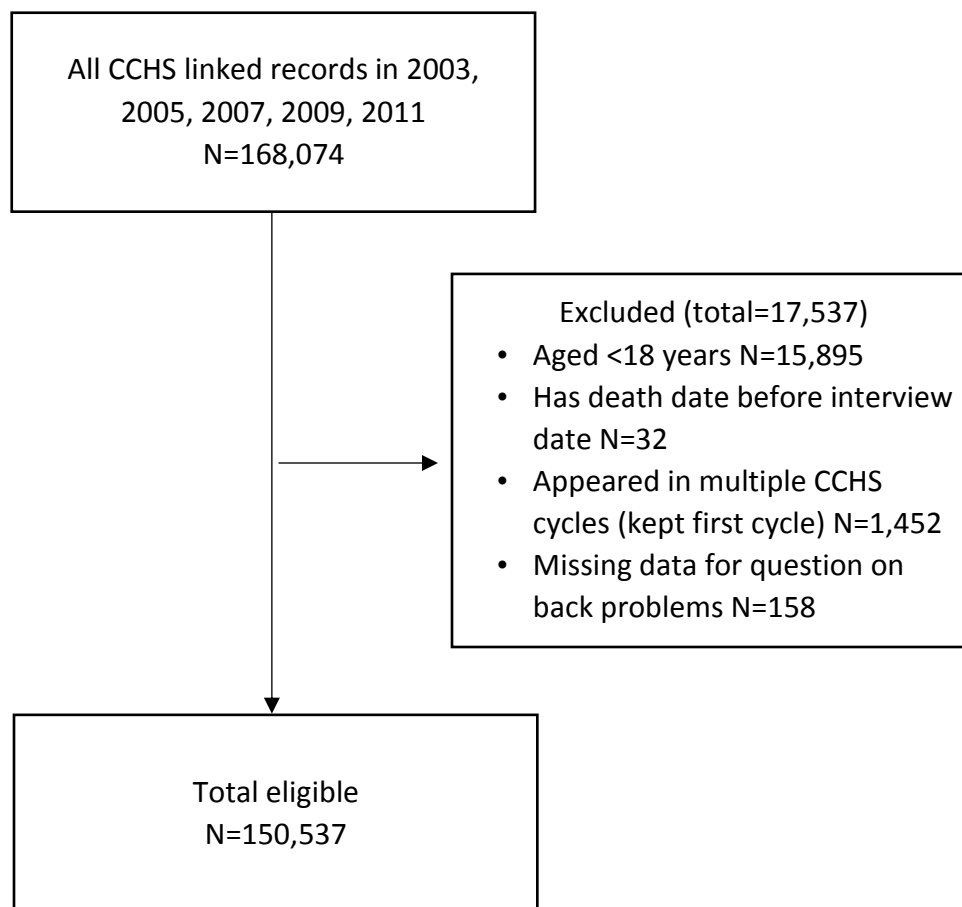
CCI – Canadian Classification of Health Interventions; OHIP – Ontario Health Insurance Plan

**b) Thoracic and rib pain codes**

| <b>Type</b> | <b>Codes</b> | <b>Description</b>                                       |
|-------------|--------------|--|
| ICD-10      | M546         | Pain in thoracic spine                                   |
|             | M9902        | Segmental and somatic dysfunction of thoracic region     |
|             | S233         | Sprain of ligaments of thoracic spine, initial encounter |
|             | M5384        | Other specified dorsopathies, thoracic region            |
|             | M5385        | Other specified dorsopathies, thoracolumbar region       |
|             | M6283        | Muscle spasm of back                                     |
|             | M9908        | Segmental and somatic dysfunction of rib cage            |
|             | S2341        | Sprain of ribs, initial encounter                        |
| ICD-9       | 7241         | Pain in thoracic spine                                   |
|             | 7392         | Nonallopathic lesions, thoracic region                   |
|             | 8471         | Sprain of thoracic                                       |
|             | 7398         | Nonallopathic lesions, rib cage                          |

ICD - International Classification of Diseases

**Appendix II.** Flow diagram for Canadian Community Health Survey (CCHS) respondents from Ontario individually linked to provincial health administrative data from 2003 to 2012



**Appendix IIIa.** Baseline characteristics (weighted) of 1) adults with and without back problems; and 2) propensity-score matched cohort when using combined self-report and diagnostic information to define the exposure, pooled participants surveyed from 2003 to 2012 and followed to 2018, Canadian Community Health Survey, Ontario, Canada<sup>a</sup>

| Variable                                  | Adults with back problems<br>n=8,833 | Adults without back problems<br>n=141,704 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=8,832 | Adults without back problems (propensity-score matched cohort)<br>n=8,832 | Absolute standardized difference | Variance ratio |
|---|--------------------------------------|---|----------------------------------|----------------|--|---|----------------------------------|----------------|
| <b>Hard match variable</b>                |                                      |   |                                  |                |  |   |                                  |                |
| Female sex (%)                            | 56.98                                | 50.87                                     | 0.14                             | 0.96           | 56.97  | 57.48   | <0.01                            | 1.00           |
| <b>Propensity score variables</b>         |                                      |   |                                  |                |  |   |                                  |                |
| Age at index date in years, mean (median) | 52.50 (51.46)                        | 43.75 (43.75)                             | 0.35                             | 0.82           | 52.50 (51.46)  | 52.30 (51.63)   | 0.05                             | 0.91           |
| <b>Location of residence</b>              |                                      |   |                                  |                |  |   |                                  |                |
| Rural (%)                                 | 15.33                                | 14.35                                     | <0.01                            | 1.00           | 15.33  | 15.82   | <0.01                            | 0.99           |
| <b>Income quintile (%)</b>                |                                      |   |                                  |                |  |   |                                  |                |
| 1 (lowest)                                | 19.94                                | 14.10                                     | 0.19                             | 1.38           | 19.94  | 20.38   | 0.03                             | 1.04           |
| 2   | 16.69                                | 15.06                                     | 0.06                             | 1.12           | 16.69  | 17.15   | 0.01                             | 0.98           |
| 3   | 17.86                                | 17.10                                     | <0.01                            | 1.01           | 17.86  | 17.69   | 0.02                             | 0.97           |
| 4   | 17.56                                | 20.70                                     | 0.08                             | 0.88           | 17.56  | 17.12   | 0.01                             | 1.03           |
| 5 (highest)                               | 17.38                                | 22.60                                     | 0.16                             | 0.78           | 17.38  | 17.67   | 0.01                             | 1.01           |
| Unknown                                   | 10.57                                | 10.45                                     | 0.01                             | 0.96           | 10.57  | 9.99  | 0.03                             | 0.92           |
| <b>Education (%)</b>                      |                                      |   |                                  |                |  |   |                                  |                |
| Less than secondary                       | 10.66                                | 5.85                                      | 0.19                             | 1.49           | 10.66  | 10.03   | <0.01                            | 1.00           |
| Secondary graduate                        | 12.52                                | 10.39                                     | 0.04                             | 1.09           | 12.52  | 12.57   | 0.03                             | 0.95           |
| More than secondary                       | 71.65                                | 77.86                                     | 0.16                             | 1.14           | 71.64  | 72.98   | 0.02                             | 0.99           |

| Variable                                  | Adults with back problems<br>n=8,833 | Adults without back problems<br>n=141,704 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=8,832 | Adults without back problems (propensity-score matched cohort)<br>n=8,832 | Absolute standardized difference | Variance ratio |
|---|--------------------------------------|---|----------------------------------|----------------|--|---|----------------------------------|----------------|
| Unknown                                   | 5.17                                 | 5.90                                      | 0.03                             | 0.88           | 5.17   | 4.42  | <0.01                            | 1.02           |
| <b>Immigrant status (%)</b>               |                                      |   |                                  |                |  |   |                                  |                |
| Immigrant                                 | 31.65                                | 32.12                                     | 0.01                             | 1.01           | 31.65  | 31.00   | 0.01                             | 1.01           |
| Canadian-born                             | 67.00                                | 66.16                                     | <0.01                            | 1.00           | 67.00  | 67.68   | 0.01                             | 1.01           |
| Unknown                                   | 1.35                                 | 1.72                                      | 0.02                             | 0.79           | 1.35   | 1.32  | <0.01                            | 1.04           |
| <b>Body mass index (%)</b>                |                                      |   |                                  |                |  |   |                                  |                |
| Obese, $\geq 30$ kg/ m <sup>2</sup>       | 35.18                                | 32.69                                     | 0.16                             | 1.25           | 35.18  | 35.52   | 0.01                             | 1.00           |
| Overweight, 25-29.9 kg/ m <sup>2</sup>    | 22.34                                | 15.97                                     | 0.01                             | 1.00           | 22.33  | 22.73   | 0.03                             | 0.98           |
| Normal weight 18.5-24.9 kg/m <sup>2</sup> | 36.34                                | 44.33                                     | 0.13                             | 0.93           | 36.34  | 35.60   | 0.01                             | 1.01           |
| Unknown                                   | 6.14                                 | 7.00                                      | 0.03                             | 0.90           | 6.14   | 6.14  | 0.01                             | 0.97           |
| <b>Physical activity (%)</b>              |                                      |   |                                  |                |  |   |                                  |                |
| Active/moderately active                  | 40.12                                | 49.87                                     | 0.22                             | 0.96           | 40.12  | 39.82   | <0.01                            | 1.00           |
| Inactive                                  | 57.39                                | 47.97                                     | 0.22                             | 0.98           | 57.39  | 57.87   | 0.01                             | 1.00           |
| Unknown                                   | 2.49                                 | 2.17                                      | 0.01                             | 1.08           | 2.49   | 2.31  | 0.01                             | 0.95           |
| <b>Alcohol consumption (%)</b>            |                                      |   |                                  |                |  |   |                                  |                |
| Heavy/moderate drinker                    | 25.44                                | 28.96                                     | 0.12                             | 0.89           | 25.43  | 26.86   | 0.02                             | 0.98           |
| Light/never drinker                       | 72.60                                | 69.71                                     | 0.12                             | 0.88           | 72.60  | 70.95   | 0.01                             | 0.99           |
| Unknown                                   | 1.97                                 | 3.64                                      | 0.01                             | 0.95           | 1.96   | 2.19  | 0.05                             | 0.71           |



| Variable                             | Adults with back problems<br>n=8,833 | Adults without back problems<br>n=141,704 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=8,832 | Adults without back problems (propensity-score matched cohort)<br>n=8,832 | Absolute standardized difference | Variance ratio |
|--------------------------------------|--------------------------------------|---|----------------------------------|----------------|--|---|----------------------------------|----------------|
| <b>Smoking status (%)</b>            |                                      |   |                                  |                |  |   |                                  |                |
| Former or current smoker             | 53.77                                | 42.23                                     | 0.20                             | 0.98           | 53.77  | 54.42   | <0.01                            | 1.00           |
| Never smoker                         | 42.40                                | 54.12                                     | 0.21                             | 0.94           | 42.40  | 40.99   | <0.01                            | 1.00           |
| Unknown                              | 3.83                                 | 3.64                                      | 0.02                             | 1.09           | 3.83   | 4.59  | 0.01                             | 0.96           |
| <b>Self-rated general health (%)</b> |                                      |   |                                  |                |  |   |                                  |                |
| Excellent/very good/good             | 65.38                                | 88.85                                     | 0.58                             | 2.00           | 65.38  | 66.56   | 0.02                             | 1.01           |
| Fair/poor                            | 34.51                                | 11.08                                     | 0.58                             | 2.01           | 34.50  | 33.38   | 0.02                             | 1.01           |
| Unknown                              | 0.12                                 | 0.07                                      | 0.02                             | 1.86           | 0.12   | 0.06  | 0.02                             | 1.62           |
| Chronic disease(s) (%)               | 49.45                                | 34.36                                     | 0.31                             | 1.01           | 49.45  | 48.99   | 0.01                             | 1.00           |
| ADG score, mean (median)             | 9.40 (5.78)                          | 4.89 (1.72)                               | 0.40                             | 1.25           | 9.40 (5.78)  | 8.99 (4.95)   | 0.03                             | 1.01           |
| <b>CCHS cycle (%)</b>                |                                      |   |                                  |                |  |   |                                  |                |
| 2003-2004                            | 18.56                                | 18.94                                     | <0.01                            | 1.00           | 18.56  | 18.58   | <0.01                            | 1.00           |
| 2005-2006                            | 18.96                                | 19.44                                     | 0.01                             | 0.98           | 18.96  | 18.95   | <0.01                            | 1.00           |
| 2007-2008                            | 22.05                                | 19.94                                     | 0.04                             | 1.06           | 22.05  | 21.97   | 0.01                             | 1.02           |
| 2009-2010                            | 21.49                                | 20.57                                     | 0.01                             | 0.99           | 21.49  | 20.94   | 0.04                             | 0.95           |
| 2011-2012                            | 18.94                                | 21.11                                     | 0.02                             | 0.97           | 18.94  | 19.55   | 0.03                             | 1.04           |

ADG – Aggregated Diagnosis Groups; CCHS – Canadian Community Health Survey

<sup>a</sup>Data were derived from the Ontario components of Canadian Community Health Survey (2003–2012) linked to health administrative databases. All estimates were weighted using Canadian Community Health Survey sampling weights to provide population estimates.

**Appendix IIIb.** Rate ratios (RR) for health care utilization and health care costs in adults with back problems compared to propensity-score matched adults without back problems when using combined self-report and diagnostic information to define the exposure, pooled participants surveyed from 2003 to 2012 and followed to 2018, Canadian Community Health Survey, Ontario, Canada<sup>a</sup>

|  | <b>Adults with back problems<br/>n=5,416 females, n=3,416 males</b> | <b>Propensity-score matched adults<br/>without back problems<br/>n=5,416 females, n=3,416 males</b> | <b>Effect estimate, 95% CI</b>        |
|--|---|---|---------------------------------------|
| <b>Cause-specific visits (number of visits per person-year)</b>      |   |   |                                       |
| Women  | 0.81 (95% CI 0.75, 0.88)  | 0.27 (95% CI 0.24, 0.30)  | RR 3.03 (95% CI 2.67, 3.44)           |
| Men  | 0.86 (95% CI 0.77, 0.96)  | 0.19 (95% CI 0.17, 0.21)  | RR 4.60 (95% CI 3.98, 5.31)           |
| <b>All-cause physician visits (number of visits per person-year)</b> |   |   |                                       |
| Women  | 16.39 (95% CI 15.87, 16.93)   | 13.10 (95% CI 12.54, 13.68)   | RR 1.25 (95% CI 1.18, 1.32)           |
| Men  | 12.98 (95% CI 12.26, 13.73)   | 10.61 (95% CI 9.94, 11.33)  | RR 1.22 (95% CI 1.12, 1.34)           |
| <b>All-cause ED visits (number of visits per person-year)</b>        |   |   |                                       |
| Women  | 0.72 (95% CI 0.68, 0.76)  | 0.50 (95% CI 0.46, 0.54)  | RR 1.45 (95% CI 1.32, 1.59)           |
| Men  | 0.64 (95% CI 0.60, 0.68)  | 0.45 (95% CI 0.41, 0.80)  | RR 1.41 (95% CI 1.26, 1.58)           |
| <b>All-cause hospitalizations (number of visits per person-year)</b> |   |   |                                       |
| Women  | 0.40 (95% CI 0.39, 0.42)  | 0.28 (95% CI 0.26, 0.30)  | RR 1.47 (95% CI 1.35, 1.59)           |
| Men  | 0.39 (95% CI 0.36, 0.42)  | 0.29 (95% CI 0.26, 0.32)  | RR 1.37 (95% CI 1.21, 1.56)           |
| <b>Health care costs, \$CAD</b>                                      |   |   |                                       |
| Women  | 31,656.22 (95% CI 30,023.93, 33,377.59)                             | 18,881.41 (95% CI 17,394.77, 20,495.10)   | 1.68 (95% CI 1.52, 1.85) <sup>b</sup> |
| Men  | 21,504.85 (95% CI 19,969.53, 23,158.33)                             | 13,049.93 (95% CI 11,539.34, 14,758.26)   | 1.65 (95% CI 1.43, 1.90) <sup>b</sup> |

CI – confidence interval; ED – emergency department; OHIP – Ontario Health Insurance Plan; NACRS – National Ambulatory Care Reporting System; RR – rate ratio

<sup>a</sup>Estimates based on Canadian Community Health Survey sampling weights and variance estimates based on bootstrap weights computed using balanced repeated replication.

<sup>b</sup>Estimates based on linear (log-transformed) regression models

**Appendix IV.** Baseline characteristics (weighted) of 1) adults with and without back problems; and 2) propensity-score matched cohort when using combined self-report and diagnostic information to define the exposure (including thoracic and rib pain), pooled participants surveyed from 2003 to 2012 and followed to 2018, Canadian Community Health Survey, Ontario, Canada<sup>a</sup>

| Variable                                  | Adults with back problems<br>n=8847 | Adults without back problems<br>n=141,690 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=8847 | Adults without back problems (propensity-score matched cohort)<br>n=8847 | Absolute standardized difference | Variance ratio |
|---|-------------------------------------|---|----------------------------------|----------------|---|--|----------------------------------|----------------|
| <b>Hard match variable</b>                |                                     |   |                                  |                |   |  |                                  |                |
| Female sex (%)                            | 57.02                               | 50.87                                     | 0.14                             | 0.96           | 57.01   | 57.26  | <0.01                            | 1.00           |
| <b>Propensity score variables</b>         |                                     |   |                                  |                |   |  |                                  |                |
| Age at index date in years, mean (median) | 52.49<br>(51.44)                    | 45.63<br>(43.76)                          | 0.35                             | 0.82           | 52.49<br>(51.44)  | 53.03<br>(52.96)   | 0.07                             | 0.89           |
| <b>Location of residence</b>              |                                     |   |                                  |                |   |  |                                  |                |
| Rural (%)                                 | 15.34                               | 14.35                                     | <0.01                            | 1.00           | 15.34   | 14.85  | <0.01                            | 1.00           |
| <b>Income quintile (%)</b>                |                                     |   |                                  |                |   |  |                                  |                |
| 1 (lowest)                                | 19.92                               | 14.10                                     | 0.19                             | 1.38           | 19.92   | 20.51  | 0.01                             | 1.02           |
| 2   | 16.68                               | 15.06                                     | 0.06                             | 1.12           | 16.68   | 16.00  | <0.01                            | 1.00           |
| 3   | 17.85                               | 17.10                                     | <0.01                            | 1.01           | 17.85   | 17.28  | 0.01                             | 0.98           |
| 4   | 17.57                               | 20.70                                     | 0.09                             | 0.88           | 17.57   | 18.11  | <0.01                            | 1.00           |
| 5 (highest)                               | 17.38                               | 22.60                                     | 0.16                             | 0.78           | 17.38   | 17.21  | 0.02                             | 1.04           |
| Unknown                                   | 10.60                               | 10.45                                     | 0.01                             | 0.96           | 10.61   | 10.89  | 0.03                             | 0.91           |
| <b>Education (%)</b>                      |                                     |   |                                  |                |   |  |                                  |                |
| Less than secondary                       | 10.66                               | 5.85                                      | 0.19                             | 1.49           | 10.66   | 11.26  | 0.03                             | 0.96           |
| Secondary graduate                        | 12.56                               | 10.39                                     | 0.04                             | 1.09           | 12.56   | 12.50  | 0.02                             | 0.96           |

| Variable                                  | Adults with back problems<br>n=8847 | Adults without back problems<br>n=141,690 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=8847 | Adults without back problems (propensity-score matched cohort)<br>n=8847 | Absolute standardized difference | Variance ratio |
|---|-------------------------------------|---|----------------------------------|----------------|---|--|----------------------------------|----------------|
| More than secondary                       | 71.58                               | 77.86                                     | 0.16                             | 1.14           | 71.58   | 71.90  | 0.03                             | 0.98           |
| Unknown                                   | 5.20                                | 5.90                                      | 0.03                             | 0.88           | 5.20  | 4.34   | 0.02                             | 1.10           |
| <b>Immigrant status (%)</b>               |                                     |   |                                  |                |   |  |                                  |                |
| Immigrant                                 | 31.65                               | 32.12                                     | 0.01                             | 1.01           | 31.65   | 32.01  | 0.01                             | 1.01           |
| Canadian-born                             | 67.00                               | 66.16                                     | <0.01                            | 1.00           | 66.99   | 66.67  | 0.01                             | 1.01           |
| Unknown                                   | 1.35                                | 1.72                                      | 0.02                             | 0.80           | 1.35  | 1.32   | <0.01                            | 1.00           |
| <b>Body mass index (%)</b>                |                                     |   |                                  |                |   |  |                                  |                |
| Obese, $\geq 30$ kg/ m <sup>2</sup>       | 22.32                               | 15.98                                     | 0.16                             | 1.25           | 22.31   | 22.89  | 0.02                             | 1.02           |
| Overweight, 25-29.9 kg/ m <sup>2</sup>    | 35.15                               | 32.69                                     | 0.01                             | 1.00           | 35.15   | 34.79  | 0.03                             | 0.98           |
| Normal weight 18.5-24.9 kg/m <sup>2</sup> | 36.40                               | 44.33                                     | 0.13                             | 0.94           | 36.40   | 35.74  | 0.02                             | 1.01           |
| Unknown                                   | 6.14                                | 7.00                                      | 0.03                             | 0.90           | 6.14  | 6.58   | 0.01                             | 0.96           |
| <b>Physical activity (%)</b>              |                                     |   |                                  |                |   |  |                                  |                |
| Active/moderately active                  | 40.08                               | 49.87                                     | 0.22                             | 0.96           | 40.08   | 39.33  | 0.01                             | 0.99           |
| Inactive                                  | 57.43                               | 47.96                                     | 0.22                             | 0.98           | 57.43   | 58.12  | 0.02                             | 0.99           |
| Unknown                                   | 2.49                                | 2.17                                      | 0.01                             | 1.08           | 2.49  | 2.55   | 0.02                             | 0.90           |
| <b>Alcohol consumption (%)</b>            |                                     |   |                                  |                |   |  |                                  |                |
| Heavy/moderate drinker                    | 25.44                               | 28.96                                     | 0.12                             | 0.89           | 25.44   | 25.55  | 0.12                             | 0.88           |
| Light/never drinker                       | 72.59                               | 69.71                                     | 0.12                             | 0.88           | 72.60   | 72.59  | 0.02                             | 0.98           |

| Variable                             | Adults with back problems<br>n=8847 | Adults without back problems<br>n=141,690 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=8847 | Adults without back problems (propensity-score matched cohort)<br>n=8847 | Absolute standardized difference | Variance ratio |
|--------------------------------------|-------------------------------------|---|----------------------------------|----------------|---|--|----------------------------------|----------------|
| Unknown                              | 1.97                                | 1.34                                      | 0.01                             | 0.96           | 1.96  | 1.86   | 0.05                             | 0.72           |
| <b>Smoking status (%)</b>            |                                     |   |                                  |                |   |  |                                  |                |
| Former or current smoker             | 53.80                               | 42.23                                     | 0.20                             | 0.98           | 53.80   | 53.10  | 0.21                             | 0.94           |
| Never smoker                         | 42.37                               | 54.13                                     | 0.21                             | 0.94           | 42.37   | 42.84  | 0.02                             | 0.99           |
| Unknown                              | 3.83                                | 3.64                                      | 0.02                             | 1.09           | 3.83  | 4.06   | <0.01                            | 1.00           |
| <b>Self-rated general health (%)</b> |                                     |   |                                  |                |   |  |                                  |                |
| Excellent/very good/good             | 65.40                               | 88.85                                     | 0.58                             | 2.00           | 65.41   | 65.77  | 0.02                             | 1.01           |
| Fair/poor                            | 34.48                               | 11.08                                     | 0.58                             | 2.01           | 34.48   | 34.14  | 0.02                             | 1.01           |
| Unknown                              | 0.12                                | 0.07                                      | 0.02                             | 1.86           | 0.12  | 0.09   | <0.01                            | 1.08           |
| Chronic disease(s) (%)               | 49.42                               | 34.36                                     | 0.31                             | 1.01           | 49.42   | 50.02  | 0.01                             | 1.00           |
| ADG score, mean (median)             | 9.39 (5.77)                         | 4.89 (1.72)                               | 0.40                             | 1.24           | 9.39 (5.77)   | 9.17 (5.28)  | 0.03                             | 1.01           |
| <b>CCHS cycle (%)</b>                |                                     |   |                                  |                |   |  |                                  |                |
| 2003-2004                            | 18.57                               | 18.94                                     | <0.01                            | 0.98           | 18.58   | 19.21  | 0.01                             | 0.99           |
| 2005-2006                            | 18.96                               | 19.44                                     | 0.01                             | 0.98           | 18.96   | 19.70  | 0.01                             | 0.98           |
| 2007-2008                            | 22.04                               | 19.94                                     | 0.04                             | 1.05           | 22.03   | 21.84  | 0.01                             | 1.01           |
| 2009-2010                            | 21.51                               | 20.57                                     | <0.01                            | 0.99           | 21.51   | 20.29  | 0.02                             | 0.98           |
| 2011-2012                            | 18.92                               | 21.11                                     | 0.02                             | 0.97           | 18.92   | 18.96  | 0.02                             | 1.04           |

ADG – Aggregated Diagnosis Groups; CCHS – Canadian Community Health Survey

<sup>a</sup>Data were derived from the Ontario components of Canadian Community Health Survey (2003–2012) linked to health administrative databases. All estimates were weighted using Canadian Community Health Survey sampling weights to provide population estimates.

**Appendix V.** Baseline characteristics (weighted) of 1) pool of adults with and without back problems; and 2) propensity-score matched cohort for sensitivity analysis that includes ethnicity as covariate, pooled participants surveyed from 2003 to 2012 and followed to 2018, Canadian Community Health Survey, Ontario, Canada<sup>a</sup>

| Variable                                  | Adults with back problems<br>n=36,806 | Adults without back problems<br>n=113,731 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=36,806 | Adults without back problems (propensity-score matched cohort)<br>n=36,806 | Absolute standardized difference | Variance ratio |
|---|---------------------------------------|---|----------------------------------|----------------|---|--|----------------------------------|----------------|
| <b>Hard match variable</b>                |                                       |   |                                  |                |   |  |                                  |                |
| Female sex (%)                            | 53.91                                 | 50.45                                     | 0.06                             | 0.99           | 53.91   | 53.63  | <0.01                            | 1.00           |
| <b>Propensity score variables</b>         |                                       |   |                                  |                |   |  |                                  |                |
| Age at index date in years, mean (median) | 50.86 (49.79)                         | 44.66 (42.56)                             | 0.32                             | 0.82           | 50.86 (49.79)   | 50.84 (49.83)  | 0.04                             | 0.88           |
| <b>Location of residence</b>              |                                       |   |                                  |                |   |  |                                  |                |
| Rural (%)                                 | 16.56                                 | 13.82                                     | 0.04                             | 1.06           | 16.56   | 16.33  | 0.01                             | 0.99           |
| <b>Income quintile (%)</b>                |                                       |   |                                  |                |   |  |                                  |                |
| 1 (lowest)                                | 17.00                                 | 13.69                                     | 0.14                             | 1.30           | 17.00   | 16.57  | 0.03                             | 1.05           |
| 2   | 15.16                                 | 15.13                                     | 0.04                             | 1.09           | 15.16   | 15.47  | 0.02                             | 1.04           |
| 3   | 18.05                                 | 16.89                                     | 0.01                             | 1.01           | 18.05   | 17.49  | 0.02                             | 0.97           |
| 4   | 19.77                                 | 20.75                                     | 0.05                             | 0.93           | 19.77   | 20.44  | 0.01                             | 0.98           |
| 5 (highest)                               | 20.19                                 | 22.91                                     | 0.12                             | 0.84           | 20.19   | 20.21  | 0.02                             | 0.97           |
| Unknown                                   | 9.83                                  | 10.62                                     | 0.01                             | 0.98           | 9.83  | 9.82   | 0.01                             | 1.03           |
| <b>Education (%)</b>                      |                                       |   |                                  |                |   |  |                                  |                |

| Variable                                  | Adults with back problems<br>n=36,806 | Adults without back problems<br>n=113,731 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=36,806 | Adults without back problems (propensity-score matched cohort)<br>n=36,806 | Absolute standardized difference | Variance ratio |
|---|---------------------------------------|---|----------------------------------|----------------|---|--|----------------------------------|----------------|
| Less than secondary                       | 8.81                                  | 5.36                                      | 0.16                             | 1.44           | 8.81  | 8.60   | 0.01                             | 1.02           |
| Secondary graduate                        | 11.82                                 | 10.15                                     | 0.03                             | 1.07           | 11.82   | 11.81  | 0.02                             | 0.97           |
| More than secondary                       | 73.92                                 | 78.52                                     | 0.13                             | 1.12           | 73.92   | 74.38  | <0.01                            | 1.00           |
| Unknown                                   | 5.45                                  | 5.97                                      | 0.02                             | 0.90           | 5.45  | 5.21   | <0.01                            | 1.02           |
| <b>Immigrant status (%)</b>               |                                       |   |                                  |                |   |  |                                  |                |
| Immigrant                                 | 28.83                                 | 32.98                                     | 0.04                             | 0.94           | 28.83   | 28.32  | 0.01                             | 1.02           |
| Canadian-born                             | 69.73                                 | 65.25                                     | 0.05                             | 0.93           | 69.73   | 70.13  | 0.01                             | 1.02           |
| Unknown                                   | 1.44                                  | 1.78                                      | 0.02                             | 0.80           | 1.44  | 1.55   | <0.01                            | 1.02           |
| <b>Ethnicity (%)</b>                      |                                       |   |                                  |                |   |  |                                  |                |
| White                                     | 81.73                                 | 74.59                                     | 0.08                             | 0.82           | 81.73   | 82.95  | 0.05                             | 1.16           |
| Visible minority                          | 15.73                                 | 23.62                                     | 0.13                             | 0.70           | 15.73   | 14.83  | 0.04                             | 1.16           |
| Unknown                                   | 2.54                                  | 1.79                                      | 0.06                             | 1.44           | 2.54  | 2.22   | 0.03                             | 1.21           |
| <b>Body mass index (%)</b>                |                                       |   |                                  |                |   |  |                                  |                |
| Obese, $\geq 30$ kg/ m <sup>2</sup>       | 21.07                                 | 15.01                                     | 0.15                             | 1.24           | 21.07   | 20.79  | 0.03                             | 1.03           |
| Overweight, 25-29.9 kg/ m <sup>2</sup>    | 34.76                                 | 32.29                                     | 0.04                             | 1.03           | 34.76   | 34.27  | <0.01                            | 1.00           |
| Normal weight 18.5-24.9 kg/m <sup>2</sup> | 37.75                                 | 45.60                                     | 0.15                             | 0.93           | 37.75   | 38.44  | 0.03                             | 0.99           |
| Unknown                                   | 6.42                                  | 7.10                                      | 0.02                             | 0.95           | 6.42  | 6.50   | <0.01                            | 1.00           |
| <b>Physical activity (%)</b>              |                                       |   |                                  |                |   |  |                                  |                |

| Variable                             | Adults with back problems<br>n=36,806 | Adults without back problems<br>n=113,731 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=36,806 | Adults without back problems (propensity-score matched cohort)<br>n=36,806 | Absolute standardized difference | Variance ratio |
|--------------------------------------|---------------------------------------|---|----------------------------------|----------------|---|--|----------------------------------|----------------|
| Active/moderately active             | 43.49                                 | 50.96                                     | 0.17                             | 0.99           | 43.49   | 43.78  | 0.01                             | 1.00           |
| Inactive                             | 54.01                                 | 46.94                                     | 0.17                             | 1.00           | 54.01   | 53.80  | 0.01                             | 1.00           |
| Unknown                              | 2.49                                  | 2.10                                      | 0.02                             | 1.17           | 2.49  | 2.42   | <0.01                            | 0.98           |
| <b>Alcohol consumption (%)</b>       |                                       |   |                                  |                |   |  |                                  |                |
| Heavy/moderate drinker               | 28.69                                 | 28.80                                     | 0.05                             | 0.96           | 28.69   | 28.90  | 0.02                             | 0.98           |
| Light/never drinker                  | 69.70                                 | 69.89                                     | 0.05                             | 0.95           | 69.70   | 69.45  | 0.02                             | 0.98           |
| Unknown                              | 1.61                                  | 1.31                                      | 0.01                             | 1.12           | 1.62  | 1.65   | 0.01                             | 0.95           |
| <b>Smoking status (%)</b>            |                                       |   |                                  |                |   |  |                                  |                |
| Former or current smoker             | 52.10                                 | 40.32                                     | 0.20                             | 0.99           | 52.10   | 51.62  | 0.01                             | 1.00           |
| Never smoker                         | 44.20                                 | 56.04                                     | 0.21                             | 0.96           | 44.20   | 44.61  | 0.01                             | 0.99           |
| Unknown                              | 3.70                                  | 3.64                                      | 0.01                             | 1.04           | 3.70  | 3.77   | <0.01                            | 1.01           |
| <b>Self-rated general health (%)</b> |                                       |   |                                  |                |   |  |                                  |                |
| Excellent/very good/good             | 75.44                                 | 90.95                                     | 0.44                             | 2.08           | 75.44   | 76.44  | 0.03                             | 1.03           |
| Fair/poor                            | 24.46                                 | 8.98                                      | 0.44                             | 2.09           | 24.46   | 23.50  | 0.03                             | 1.03           |
| Unknown                              | 0.09                                  | 0.07                                      | 0.02                             | 1.93           | 0.09  | 0.06   | 0.01                             | 1.45           |
| Chronic disease(s) (%)               | 44.57                                 | 32.58                                     | 0.24                             | 1.04           | 44.57   | 43.58  | <0.01                            | 1.00           |
| ADG score, mean (median)             | 7.33 (3.62)                           | 4.53 (1.51)                               | 0.27                             | 1.14           | 7.33 (3.62)   | 7.11 (3.27)  | 0.01                             | 0.94           |



| <b>Variable</b>       | <b>Adults with back problems<br/>n=36,806</b> | <b>Adults without back problems<br/>n=113,731</b> | <b>Absolute standardized difference</b> | <b>Variance ratio</b> | <b>Adults with back problems (propensity-score matched cohort)<br/>n=36,806</b> | <b>Adults without back problems (propensity-score matched cohort)<br/>n=36,806</b> | <b>Absolute standardized difference</b> | <b>Variance ratio</b> |
|-----------------------|---|---|---|-----------------------|---|--|---|-----------------------|
| <b>CCHS cycle (%)</b> |   |   |   |                       |   |  |   |                       |
| 2003-2004             | 19.27   | 18.82   | 0.01                                    | 1.01                  | 19.27   | 19.74  | 0.02                                    | 0.98                  |
| 2005-2006             | 19.07   | 19.51   | 0.02                                    | 0.97                  | 19.07   | 19.27  | <0.01                                   | 0.99                  |
| 2007-2008             | 21.36   | 19.69   | 0.05                                    | 1.07                  | 21.36   | 21.55  | 0.02                                    | 1.02                  |
| 2009-2010             | 20.75   | 20.58   | 0.01                                    | 0.99                  | 20.75   | 20.46  | 0.01                                    | 0.98                  |
| 2011-2012             | 19.54   | 21.40   | 0.03                                    | 0.95                  | 19.54   | 18.98  | 0.02                                    | 1.03                  |

ADG – Aggregated Diagnosis Groups; CCHS – Canadian Community Health Survey

<sup>a</sup>Data were derived from the Ontario components of Canadian Community Health Survey (2003–2012) linked to health administrative databases. All estimates were weighted using Canadian Community Health Survey sampling weights to provide population estimates.

**Appendix VI.** Baseline characteristics (weighted) of 1) adults with and without back problems; and 2) propensity-score matched cohort to assess opioid use, participants surveyed from 2011/2012 and followed to 2018, Canadian Community Health Survey, Ontario, Canada<sup>a</sup>

| Variable                                  | Adults with back problems<br>n=6,754 | Adults without back problems<br>n=22,240 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=6,753 | Adults without back problems (propensity-score matched cohort)<br>n=6,753 | Absolute standardized difference | Variance ratio |
|---|--------------------------------------|--|----------------------------------|----------------|--|---|----------------------------------|----------------|
| <b>Hard match variable</b>                |                                      |  |                                  |                |  |   |                                  |                |
| Female sex (%)                            | 56.00                                | 50.18                                    | 0.05                             | 0.99           | 56.00  | 53.36   | <0.01                            | 1.00           |
| <b>Propensity score variables</b>         |                                      |  |                                  |                |  |   |                                  |                |
| Age at index date in years, mean (median) | 52.97 (52.52)                        | 45.21 (43.54)                            | 0.40                             | 0.75           | 52.96 (52.52)  | 53.93 (54.14)   | 0.06                             | 0.89           |
| <b>Location of residence</b>              |                                      |  |                                  |                |  |   |                                  |                |
| Rural (%)                                 | 17.27                                | 14.22                                    | 0.06                             | 1.07           | 17.27  | 16.96   | <0.01                            | 1.00           |
| <b>Income quintile (%)</b>                |                                      |  |                                  |                |  |   |                                  |                |
| 1 (lowest)                                | 21.35                                | 17.51                                    | 0.17                             | 1.31           | 21.34  | 20.41   | 0.04                             | 1.06           |
| 2   | 20.30                                | 19.08                                    | 0.06                             | 1.10           | 20.30  | 19.87   | 0.01                             | 1.01           |
| 3   | 20.07                                | 19.53                                    | 0.01                             | 0.99           | 20.07  | 21.38   | 0.03                             | 0.97           |
| 4   | 20.33                                | 21.82                                    | 0.06                             | 0.91           | 20.33  | 19.61   | 0.01                             | 0.99           |
| 5 (highest)                               | 17.96                                | 22.06                                    | 0.15                             | 0.80           | 17.96  | 18.72   | 0.01                             | 0.97           |
| <b>Education (%)</b>                      |                                      |  |                                  |                |  |   |                                  |                |
| Less than secondary                       | 8.01                                 | 4.12                                     | 0.16                             | 1.53           | 8.01   | 6.55  | 0.01                             | 1.03           |
| Secondary graduate                        | 12.60                                | 9.72                                     | 0.06                             | 1.13           | 12.60  | 12.81   | 0.02                             | 0.96           |
| More than secondary                       | 73.93                                | 80.07                                    | 0.03                             | 0.89           | 73.93  | 75.30   | <0.01                            | 1.00           |
| Unknown                                   | 5.46                                 | 6.09                                     | 0.03                             | 0.89           | 5.46   | 5.34  | 0.01                             | 1.07           |
| <b>Immigrant status (%)</b>               |                                      |  |                                  |                |  |   |                                  |                |
| Immigrant                                 | 30.21                                | 34.19                                    | 0.03                             | 0.95           | 30.21  | 31.04   | 0.02                             | 1.03           |

| Variable                                  | Adults with back problems<br>n=6,754 | Adults without back problems<br>n=22,240 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=6,753 | Adults without back problems (propensity-score matched cohort)<br>n=6,753 | Absolute standardized difference | Variance ratio |
|---|--------------------------------------|--|----------------------------------|----------------|--|---|----------------------------------|----------------|
| Canadian-born                             | 69.22                                | 65.21                                    | 0.03                             | 0.95           | 69.22  | 68.34   | 0.02                             | 1.03           |
| Unknown                                   | 0.56                                 | 0.60                                     | 0.01                             | 1.14           | 0.56   | 0.61  | 0.02                             | 1.28           |
| <b>Body mass index (%)</b>                |                                      |  |                                  |                |  |   |                                  |                |
| Obese, $\geq 30$ kg/ m <sup>2</sup>       | 22.59                                | 16.34                                    | 0.16                             | 1.25           | 22.59  | 20.98   | 0.01                             | 1.01           |
| Overweight, 25-29.9 kg/ m <sup>2</sup>    | 33.77                                | 32.12                                    | 0.01                             | 1.01           | 33.77  | 36.22   | 0.02                             | 0.99           |
| Normal weight 18.5-24.9 kg/m <sup>2</sup> | 35.47                                | 44.25                                    | 0.16                             | 0.92           | 35.47  | 34.22   | 0.01                             | 0.99           |
| Unknown                                   | 8.17                                 | 7.29                                     | 0.01                             | 1.04           | 8.17   | 8.57  | 0.01                             | 0.96           |
| <b>Physical activity (%)</b>              |                                      |  |                                  |                |  |   |                                  |                |
| Active/moderately active                  | 44.92                                | 54.56                                    | 0.22                             | 1.00           | 44.93  | 45.63   | 0.02                             | 1.00           |
| Inactive                                  | 52.03                                | 43.70                                    | 0.20                             | 1.02           | 52.03  | 51.58   | 0.02                             | 1.00           |
| Unknown                                   | 3.05                                 | 1.74                                     | 0.06                             | 1.47           | 3.05   | 2.80  | 0.01                             | 0.97           |
| <b>Alcohol consumption (%)</b>            |                                      |  |                                  |                |  |   |                                  |                |
| Heavy/moderate drinker                    | 27.14                                | 28.47                                    | 0.06                             | 0.95           | 27.14  | 27.65   | 0.02                             | 0.98           |
| Light/never drinker                       | 70.96                                | 70.25                                    | 0.07                             | 0.93           | 70.96  | 70.48   | 0.02                             | 0.98           |
| Unknown                                   | 1.89                                 | 1.29                                     | 0.04                             | 1.29           | 1.89   | 1.87  | <0.01                            | 1.02           |
| <b>Smoking status (%)</b>                 |                                      |  |                                  |                |  |   |                                  |                |
| Former or current smoker                  | 50.55                                | 37.88                                    | 0.25                             | 1.01           | 50.55  | 49.96   | 0.02                             | 1.00           |
| Never smoker                              | 45.82                                | 58.24                                    | 0.24                             | 0.97           | 45.82  | 46.83   | 0.03                             | 0.99           |
| Unknown                                   | 3.63                                 | 3.88                                     | <0.01                            | 0.98           | 3.63   | 3.20  | 0.01                             | 1.06           |

| Variable                             | Adults with back problems<br>n=6,754 | Adults without back problems<br>n=22,240 | Absolute standardized difference | Variance ratio | Adults with back problems (propensity-score matched cohort)<br>n=6,753 | Adults without back problems (propensity-score matched cohort)<br>n=6,753 | Absolute standardized difference | Variance ratio |
|--------------------------------------|--------------------------------------|--|----------------------------------|----------------|--|---|----------------------------------|----------------|
| <b>Self-rated general health (%)</b> |                                      |  |                                  |                |  |   |                                  |                |
| Excellent/very good/good             | 74.07                                | 91.24                                    | 0.49                             | 2.24           | 74.07  | 75.02   | 0.06                             | 1.05           |
| Fair/poor                            | 25.73                                | 8.66                                     | 0.48                             | 2.25           | 25.73  | 24.76   | 0.06                             | 1.05           |
| Unknown                              | 0.20                                 | 0.10                                     | 0.04                             | 2.37           | 0.20   | 0.22  | 0.02                             | 1.50           |
| Chronic disease(s) (%)               | 51.13                                | 35.83                                    | 0.29                             | 0.97           | 51.13  | 51.68   | 0.02                             | 1.01           |
| ADG score, mean (median)             | 8.25 (4.15)                          | 4.80 (1.57)                              | 0.34                             | 1.19           | 8.25 (4.15)  | 8.20 (3.94)   | 0.02                             | 0.97           |

ADG – Aggregated Diagnosis Groups; CCHS – Canadian Community Health Survey

<sup>a</sup>Data were derived from the Ontario components of Canadian Community Health Survey (2003–2012) linked to health administrative databases. All estimates were weighted using Canadian Community Health Survey sampling weights to provide population estimates.

**Appendix VII.** Quantitative bias analysis to assess the potential impact of residual confounding from unmeasured or unknown confounders as allied health care utilization in the form of A) chiropractic or B) community-based physiotherapy among women and men<sup>a</sup>

**A) Chiropractic care**

**Women - RR=1.4**

| Variable Names |               |  | Bias Parameters |      |
|----------------|---------------|--|-----------------|------|
| Outcome        | HCU           |  | p(Allied+ BP+)  | 0.31 |
| Exposure       | BP            |  | p(Allied+ BP-)  | 0.09 |
| Confounder     | Allied<br>HCU |  | RR(Allied-HCU)  | 0.92 |

|       | BP +  |   | BP -  |   |
|-------|-------|---|-------|---|
| HCU + | 14252 | a | 10389 | b |
|       |       |   |       |   |
| HCU - | 6802  | c | 10665 | d |
|       |       |   |       |   |

**Men - RR=1.49**

| Variable Names |               |  | Bias Parameters |      |
|----------------|---------------|--|-----------------|------|
| Outcome        | HCU           |  | p(Allied+ BP+)  | 0.31 |
| Exposure       | BP            |  | p(Allied+ BP-)  | 0.09 |
| Confounder     | Allied<br>HCU |  | RR(Allied-HCU)  | 0.92 |

|       | BP + |   | BP - |   |
|-------|------|---|------|---|
| HCU + | 9522 | a | 6525 | b |
|       |      |   |      |   |
| HCU - | 6230 | c | 9227 | d |
|       |      |   |      |   |

**B) Physiotherapy****Women – RR 1.38**

| Variable Names |               |  | Bias Parameters |      |
|----------------|---------------|--|-----------------|------|
| Outcome        | HCU           |  | p(Allied+ BP+)  | 0.16 |
| Exposure       | BP            |  | p(Allied+ BP-)  | 0.09 |
| Confounder     | Allied<br>HCU |  | RR(Allied-HCU)  | 0.92 |

|       | BP +  |   | BP -  |   |
|-------|-------|---|-------|---|
| HCU + | 14252 | a | 10389 | b |
|       |       |   |       |   |
| HCU - | 6802  | c | 10665 | d |
|       |       |   |       |   |

**Men – RR 1.47**

| Variable Names |               |  | Bias Parameters |      |
|----------------|---------------|--|-----------------|------|
| Outcome        | HCU           |  | p(Allied+ BP+)  | 0.31 |
| Exposure       | BP            |  | p(Allied+ BP-)  | 0.09 |
| Confounder     | Allied<br>HCU |  | RR(Allied-HCU)  | 0.92 |

|       | BP + |   | BP - |   |
|-------|------|---|------|---|
| HCU + | 9522 | a | 6525 | b |
|       |      |   |      |   |
| HCU - | 6230 | c | 9227 | d |
|       |      |   |      |   |

HCU – health care utilization; BP – back problems

<sup>a</sup>Input for parameters informed by previous literature<sup>1,2,3</sup>

**Reference for Supplemental File**

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2. Davis MA, Yakusheva O, Gottlieb DJ, Bynum JP. Regional supply of chiropractic care and visits to primary care physicians for back and neck pain. *J Am Board Fam Med* 2015; 1;28(4):481-90.
3. Bath B, Lawson J, Ma D, Trask C. Self-reported use of family physician, chiropractor and physiotherapy services among adult Canadians with chronic back disorders: an observational study. *BMC Health Serv Res* 2018; 1;18(1):970.