

**Supplemental Table 1.** Checklist for the modified Standards for Reporting of Diagnostic accuracy (STARD) criteria, recommended for assessing the quality of validation studies of health administrative data.

|                                                                                         | YES                                                                                                                                                                                                                   | NO | UNCERTAIN | NOT APPLICABLE |
|-----------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----|-----------|----------------|
| <b>TITLE, KEYWORDS, ABSTRACT</b>                                                        |                                                                                                                                                                                                                       |    |           |                |
| Identify article as study of assessing diagnostic accuracy                              | Abstract                                                                                                                                                                                                              |    |           |                |
| Identify article as study of administrative data                                        | Title, Abstract                                                                                                                                                                                                       |    |           |                |
| <b>INTRODUCTION:</b>                                                                    |                                                                                                                                                                                                                       |    |           |                |
| State disease identification & validation one of goals of study                         | yes                                                                                                                                                                                                                   |    |           |                |
| <b>METHODS:</b>                                                                         |                                                                                                                                                                                                                       |    |           |                |
| <i>Participants in validation cohort:</i>                                               |                                                                                                                                                                                                                       |    |           |                |
| Describe validation cohort (Cohort of patients to which reference standard was applied) | In this study, the validation cohort serves as the reference standard. Individuals either have AIS (AIS+) or they do not (AIS-). The index test measures the algorithm's ability to distinguish between AIS+ and AIS- |    |           |                |
| • Age                                                                                   | 10-17 years.                                                                                                                                                                                                          |    |           |                |
| • Disease                                                                               | Scoliosis                                                                                                                                                                                                             |    |           |                |
| • Severity                                                                              | Curve magnitude                                                                                                                                                                                                       |    |           |                |
| • Location/Jurisdiction                                                                 | ON                                                                                                                                                                                                                    |    |           |                |
| Describe recruitment procedure of validation cohort                                     |                                                                                                                                                                                                                       |    |           |                |
| • Inclusion criteria                                                                    | Detailed                                                                                                                                                                                                              |    |           |                |
| • Exclusion criteria                                                                    | Detailed                                                                                                                                                                                                              |    |           |                |
| Describe patient sampling (random, consecutive, all, etc.)                              | Consecutive (AIS+)<br>Algorithm-derived (AIS-)                                                                                                                                                                        |    |           |                |
| Describe data collection                                                                |                                                                                                                                                                                                                       |    |           |                |
| • Who identified patients and did selection adhere to patient recruitment criteria      | First author                                                                                                                                                                                                          |    |           |                |
| • Who collected data                                                                    | First author                                                                                                                                                                                                          |    |           |                |
| • <i>A priori</i> data collection form                                                  | Yes, required for REB                                                                                                                                                                                                 |    |           |                |
| • Disease classification                                                                | Curve magnitude                                                                                                                                                                                                       |    |           |                |
| • Split sample (i.e. re-validation using a separate cohort)                             |                                                                                                                                                                                                                       |    |           |                |

|                                                                                                                                                                     |                                                |  |  |                                                             |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--|--|-------------------------------------------------------------|
| <b>METHODS (cont.):</b>                                                                                                                                             |                                                |  |  |                                                             |
| <i>Test Methods:</i>                                                                                                                                                |                                                |  |  |                                                             |
| Describe number, training and expertise of persons reading reference standard                                                                                       |                                                |  |  | X- the validation cohort was used as the reference standard |
| If >1 person reading reference standard, quote measure of consistency (e.g. kappa)                                                                                  |                                                |  |  | X                                                           |
| Blinding of interpreters of reference standard to results of classification by administrative data<br><br>e.g. Chart abstractor blinded to how that chart was coded | Yes                                            |  |  |                                                             |
| <i>Statistical Methods:</i>                                                                                                                                         |                                                |  |  |                                                             |
| Describe methods of calculating/comparing diagnostic accuracy                                                                                                       | Yes                                            |  |  |                                                             |
| <b>RESULTS:</b>                                                                                                                                                     |                                                |  |  |                                                             |
| <i>Participants:</i>                                                                                                                                                |                                                |  |  |                                                             |
| Report when study done, start/end dates of enrollment                                                                                                               | 2012-2021<br><br>Data collected from 2003-2021 |  |  |                                                             |
| Describe number of people who satisfied inclusion/exclusion criteria                                                                                                | Table 1                                        |  |  |                                                             |
| Study flow diagram                                                                                                                                                  | Figure 1                                       |  |  |                                                             |
| <i>Test results:</i>                                                                                                                                                |                                                |  |  |                                                             |
| Report distribution of disease severity                                                                                                                             | Yes                                            |  |  |                                                             |
| Report cross-tabulation of index tests by results of reference standard                                                                                             | Table 1                                        |  |  |                                                             |
| <i>Estimates:</i>                                                                                                                                                   |                                                |  |  |                                                             |
| Report at least 4 estimates of diagnostic accuracy                                                                                                                  | Table 2                                        |  |  |                                                             |

|                                                                                                                         |                   |   |  |  |
|-------------------------------------------------------------------------------------------------------------------------|-------------------|---|--|--|
| Diagnostic Accuracy Measures Reported:                                                                                  |                   |   |  |  |
| • Sensitivity                                                                                                           | yes               |   |  |  |
| • Spec                                                                                                                  | yes               |   |  |  |
| • PPV                                                                                                                   | yes               |   |  |  |
| • NPV                                                                                                                   | yes               |   |  |  |
| • Likelihood ratios                                                                                                     | no                |   |  |  |
| • Kappa                                                                                                                 | no                |   |  |  |
| • Area under the ROC curve / c-statistic                                                                                | Figure 2          |   |  |  |
| • Accuracy/agreement                                                                                                    |                   |   |  |  |
| • Other (specify)                                                                                                       |                   |   |  |  |
| Report accuracy for subgroups (e.g. age, geography, different sex, etc.)                                                |                   | X |  |  |
| If PPV/NPV reported, ratio of cases/controls of validation cohort approximate prevalence of condition in the population | Yes (~5.3%)       |   |  |  |
| Report 95% confidence intervals for each diagnostic measure                                                             | Yes, Table 2      |   |  |  |
| <b>DISCUSSION:</b>                                                                                                      |                   |   |  |  |
| Discuss the applicability of the validation findings                                                                    | Yes<br>Conclusion |   |  |  |

**Supplemental Table 2. Description of ICES data holdings used in this study**

| Database                                          | Description                                                                                                                                                             | Relevance to study                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|---------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Registered Person's Database (RPDB)               | Contains demographic information on anyone that has ever received an Ontario health card.                                                                               | <p><b>Study eligibility</b><br/>Eligible for Ontario health insurance at least one year prior to date of scoliosis or fracture diagnosis</p> <p><b>Participant demographics</b><br/>Identification of participant sex and age at time of diagnosis</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| National Ambulatory Care Reporting System (NACRS) | Contains data for all hospital-based and community-based ambulatory care including same-day surgery, outpatient and community-based clinics, and emergency departments. | <p><b>Algorithm validation</b><br/>AIS- cohort creation<br/><u>Inclusion:</u><br/>ICD-10 DXCODE1-30<br/>S525/distal radius fracture<br/>S526/distal ulna and radius fracture<br/><u>Exclusion:</u><br/>ICD-10 DXCODE1-30<br/>M08/Juvenile arthritis<br/>M09/Juvenile arthritis<br/>M484/Fatigue fracture of vertebra<br/>M80/Osteoporosis with pathological fracture<br/>M844/Pathological fracture, not elsewhere classified, multiple sites<br/>M907/Fracture of bone in neoplastic disease<br/>M908/Osteopathy in other diseases classified elsewhere<br/>Q780/Osteogenesis Imperfecta<br/>T740/ Neglect or abandonment<br/>T741/Physical abuse</p> <p><b>Algorithm derivation:</b><br/>DX10CODE1-30<br/>M41/Scoliosis or<br/>M41.1 (M41.10-M41.19) or<br/>M41.2 (M41.20-M41.29) or<br/>M41.9 (M41.90-M41.99)</p> |

|                                                                             |                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Canadian Institute for Health Information-Discharge Abstract Database (DAD) | Information abstracted from hospital records containing administrative, demographic and clinical data (diagnosis and procedure codes), includes discharge details. | <p><b>Algorithm derivation:</b><br/> DX10CODE1-30<br/> M41/Scoliosis or<br/> M41.1 (M41.10-M41.19) or<br/> M41.2 (M41.20-M41.29) or<br/> M41.9 (M41.90-M41.99)</p> <p><b>Sensitivity analysis</b><br/> Spine surgery cohort:<br/> DX10CODE1-30<br/> M41/Scoliosis or<br/> M41.1 (M41.10-M41.19) or<br/> M41.2 (M41.20-M41.29) or<br/> M41.9 (M41.90-M41.99)<br/> <b>AND</b><br/> INCODE1-10<br/> 1SC75PFxxx/Spinal fusion</p> |
| Ontario Health Insurance Plan (OHIP) claims database                        | Contains all reimbursement claims made by fee-for-service physicians, community laboratories, and radiology facilities.                                            | <p><b>Algorithm derivation</b><br/> Diagnosis codes:<br/> 737/Scoliosis<br/> Fee codes:<br/> X027/thoracic spine, 2 views<br/> X028/ lumbar/lumbosacral, 2/3 views<br/> X031/ entire spine, 2 views<br/> Specialist codes:<br/> Considered any code other than 00/family medicine</p>                                                                                                                                         |

**Supplemental Table 3.** Algorithm specification table

| Physician Billing Code for Scoliosis (OHIP <sup>a</sup> ) | Billing Code By Specialist <sup>b</sup> | Logical operator | Spine X-ray (Feecode <sup>c</sup> ) | Look-back Period <sup>d</sup> | Code Description                                                      |
|-----------------------------------------------------------|-----------------------------------------|------------------|-------------------------------------|-------------------------------|-----------------------------------------------------------------------|
| 1                                                         |                                         |                  |                                     |                               | 1 OHIP                                                                |
| 1                                                         | Yes                                     |                  |                                     |                               | 1 OHIP code by any specialist                                         |
|                                                           |                                         |                  | 1                                   |                               | 1 Feecode                                                             |
| 1                                                         |                                         | or               | 1                                   |                               | 1 OHIP or 1 Feecode                                                   |
| 1                                                         | Yes                                     | or               | 1                                   |                               | 1 OHIP by any specialist or 1 Feecode                                 |
| 1                                                         |                                         | and              | 1                                   |                               | 1 OHIP and 1 Feecode                                                  |
| 1                                                         | Yes                                     | and              | 1                                   |                               | 1 OHIP by any specialist and 1 Feecode                                |
| 1                                                         |                                         | and              | 1                                   | 1-year                        | 1 OHIP and 1 Feecode in 1 year                                        |
| 1                                                         | Yes                                     | and              | 1                                   | 1-year                        | 1 OHIP by any specialist and 1 Feecode in 1-year                      |
| 1                                                         |                                         | and              | 1                                   | 2-years                       | 1 OHIP and 1 Feecode in 2-years                                       |
| 1                                                         | Yes                                     | and              | 1                                   | 2-years                       | 1 OHIP by any specialist and 1 Feecode in 2-year                      |
| 1                                                         |                                         | and              | 1                                   | 3-years                       | 1 OHIP and 1 Feecode in 3-years                                       |
| 1                                                         | Yes                                     | and              | 1                                   | 3-years                       | 1 OHIP by any specialist and 1 Feecode in 3-years                     |
| 2                                                         |                                         |                  |                                     | 1-year                        | 2 OHIP in 1-year                                                      |
| 2                                                         |                                         | or               | 1                                   | 1-year                        | 2 OHIP in 1-year or 1 Feecode                                         |
| 2                                                         | at least 1                              |                  |                                     | 1-year                        | 2 OHIP in 1-year by any specialist                                    |
| 2                                                         | Yes                                     |                  |                                     | 1-year                        | 2 OHIP in 1-year by any specialist                                    |
| 2                                                         |                                         | and              | 1                                   | 1-year                        | 2 OHIP and 1 Feecode in 1-year                                        |
| 2                                                         | at least 1                              | and              | 1                                   | 1-year                        | 2 OHIP in 1-year at least 1 by any specialist and 1 Feecode in 1-year |
| 2                                                         | Yes                                     | and              | 1                                   | 1-year                        |                                                                       |
| 2                                                         |                                         | and              | 2                                   | 1-year                        |                                                                       |
| 2                                                         | at least 1                              | and              | 2                                   | 1-year                        |                                                                       |
| 2                                                         | Yes                                     | and              | 2                                   | 1-year                        |                                                                       |
| 2                                                         |                                         |                  |                                     | 2-years                       | 2 OHIP in 2-years                                                     |
| 2                                                         | at least 1                              |                  |                                     | 2-years                       | 2 OHIP in 2-years at least 1 OHIP code by any specialist              |
| 2                                                         | Yes                                     |                  |                                     | 2-years                       | 2 OHIP in 2-years by any specialist                                   |
| 2                                                         |                                         | and              | 1                                   | 2-years                       | 2 OHIP and 1 Feecode in 2-years                                       |
| 2                                                         |                                         | and              | 2                                   | 2-years                       |                                                                       |
| 2                                                         |                                         |                  |                                     | 3-years                       | 2 OHIP in 3-years                                                     |
| 2                                                         | at least 1                              |                  |                                     | 3-years                       | 2 OHIP in 3-years at least 1 OHIP code by any specialist              |
| 2                                                         | Yes                                     |                  |                                     | 3-years                       | 2 OHIP in 3-years by any specialist                                   |
| 2                                                         |                                         | and              | 1                                   | 3-years                       | 2 OHIP and 1 Feecode in 3-years                                       |
| 2                                                         |                                         |                  |                                     | 90-days                       |                                                                       |

|   |            |     |   |         |                                                     |
|---|------------|-----|---|---------|-----------------------------------------------------|
| 2 | at least 1 |     |   | 90-days |                                                     |
| 2 | Yes        |     |   | 90-days |                                                     |
| 2 | at least 1 |     | 1 | 90-days |                                                     |
| 2 | Yes        |     | 2 | 90-days |                                                     |
| 2 |            |     | 1 | 90-days |                                                     |
| 2 |            |     | 2 | 90-days |                                                     |
| 2 |            |     |   | ever    | 2 OHIP                                              |
| 3 |            | or  | 1 | 1-year  | 3 OHIP in 1-year or 1 Feecode                       |
| 3 |            |     |   | 1-year  | 3 OHIP in 1-year                                    |
| 3 | at least 1 |     |   | 1-year  | 3 OHIP in 1-year at least 1 OHIP by any specialist  |
| 3 | at least 2 |     |   | 1-year  | 3 OHIP in 1-year at least 2 OHIP by any specialist  |
| 3 | Yes        |     |   | 1-year  | 3 OHIP in 1-year by any specialist                  |
| 3 |            | and | 1 | 1-year  | 3 OHIP and 1 Feecode in 1-year                      |
| 3 |            |     |   | 2-years | 3 OHIP in 2-years                                   |
| 3 | at least 1 |     |   | 2-years | 3 OHIP in 2-years at least 1 OHIP by any specialist |
| 3 | at least 2 |     |   | 2-years | 3 OHIP in 2-years at least 2 OHIP by any specialist |
| 3 | Yes        |     |   | 2-years | 3 OHIP in 2-years by any specialist                 |
| 3 |            | and | 1 | 2-years | 3 OHIP and 1 Feecode in 2-years                     |
| 3 |            |     |   | 3-years | 3 OHIP in 3-years                                   |
| 3 | at least 1 |     |   | 3-years | 3 OHIP in 3-years at least 1 OHIP by any specialist |
| 3 | at least 2 |     |   | 3-years | 3 OHIP in 3-years at least 2 OHIP by any specialist |
| 3 | Yes        |     |   | 3-years | 3 OHIP in 3-years by any specialist                 |
| 3 |            | and | 1 | 3-years | 3 OHIP and 1 Feecode in 3-years                     |
| 4 |            |     |   | 1-year  | 4 OHIP in 1-year                                    |
| 4 |            | and | 1 | 1-year  | 4 OHIP and 1 Feecode in 1-year                      |
| 4 |            |     |   | 2-years | 4 OHIP in 2-years                                   |
| 4 |            | and | 1 | 2-years | 4 OHIP and 1 Feecode in 2-years                     |
| 4 |            |     |   | 3-years | 4 OHIP in 3-years                                   |
| 4 |            | and | 1 | 3-years | 4 OHIP and 1 Feecode in 3-years                     |
| 5 |            |     |   | 1-year  | 5 OHIP in 1-year                                    |
| 5 |            | and | 1 | 1-year  | 5 OHIP and 1 Feecode in 1-year                      |
| 5 |            |     |   | 2-years | 5 OHIP in 2-years                                   |
| 5 |            | and | 1 | 2-years | 5 OHIP and 1 Feecode in 2-years                     |
| 5 |            |     |   | 3-years | 5 OHIP in 3-years                                   |
| 5 |            | and | 1 | 3-years | 5 OHIP and 1 Feecode in 3-years                     |
| 6 |            |     |   | 2-years | 6 OHIP in 2-years                                   |
| 6 |            |     |   | 3-years | 6 OHIP in 3-years                                   |
| 7 |            |     |   | 2-years | 7 OHIP in 2-years                                   |

|    |  |  |   |         |                      |
|----|--|--|---|---------|----------------------|
| 7  |  |  |   | 3-years | 7 OHIP in 3-years    |
| 8  |  |  |   | 2-years | 8 OHIP in 2-years    |
| 8  |  |  |   | 3-years | 8 OHIP in 3-years    |
| 9  |  |  |   | 2-years | 9 OHIP in 2-years    |
| 9  |  |  |   | 3-years | 9 OHIP in 3-years    |
| 10 |  |  |   | 2-years | 10 OHIP in 2-years   |
| 10 |  |  |   | 3-years | 10 OHIP in 3-years   |
|    |  |  | 2 | 1-year  | 2 Feecode in 1-year  |
|    |  |  | 3 | 1-year  | 3 Feecode in 1-year  |
|    |  |  | 4 | 1-year  | 4 Feecode in 1-year  |
|    |  |  | 5 | 1-year  | 5 Feecode in 1-year  |
|    |  |  | 2 | 2-years | 2 Feecode in 2-years |
|    |  |  | 3 | 2-years | 3 Feecode in 2-years |
|    |  |  | 4 | 2-years | 4 Feecode in 2-years |
|    |  |  | 5 | 2-years | 5 Feecode in 2-years |
|    |  |  | 2 | 3-years | 2 Feecode in 3-years |
|    |  |  | 3 | 3-years | 3 Feecode in 3-years |
|    |  |  | 4 | 3-years | 4 Feecode in 3-years |
|    |  |  | 5 | 3-years | 5 Feecode in 3-years |

Bonus algorithms for quality assurance <sup>e</sup>

|                                                                                       |                  |
|---------------------------------------------------------------------------------------|------------------|
| Hospital admission related to scoliosis                                               | 1 CIHI           |
| Emergency room visit related to scoliosis                                             | 1 NACRS          |
| Hospital admission related to scoliosis or emergency room visit related to scoliosis  | 1 CIHI or NACRS  |
| Hospital admission related to scoliosis and emergency room visit related to scoliosis | 1 CIHI and NACRS |

**Abbreviations:** OHIP, Ontario Health Insurance Plan; CIHI, Canadian Institution for Health Information- Discharge

Abstract Data; NACRS, National Ambulatory Care Reporting

<sup>a</sup>Diagnosis code from OHIP= 737/scoliosis, kyphosis, lordosis

<sup>b</sup>Specialist code from OHIP= any specialty code other than 00/family medicine

<sup>c</sup> Feecode from OHIP= X027/thoracic spine x-ray, 2 views, X028/lumbar/lumbosacral x-ray, 2/3views or X031/entire spine x-ray, 2 views)

<sup>d</sup> Look-back window started the day prior to index date (i.e., first tertiary pediatric spine clinic visit, tertiary-care (AIS+) or date of fracture (AIS-))

<sup>e</sup> Bonus algorithms were tested to ensure that the inclusion of unlikely codes, such as hospitalizations and emergency room visits related to scoliosis were not going to enhance overall algorithm performance, which they did not