Evaluation of the quality of published SCI clinical practice guidelines using the AGREE II instrument: Results from Can-SCIP expert panel

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Introduction: Spinal cord injury (SCI) is a traumatic event that impacts an individual’s quality of life, sensory, motor and autonomic function, and social independence.1 Worldwide, the incidence of traumatic SCI is estimated to range from 10 to 83 people per million.2 Studies have estimated the worldwide prevalence of traumatic SCI to range from 8 to 246 per million.3 The direct lifetime costs for SCI onset at age 25 range from USD $2.1 to 5.4 million depending on injury severity.4 The estimated incidence of traumatic SCI is 1,785 cases in Canada...

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each year.2 Thus, traumatic SCI is a complex condition, with substantial adverse personal, social and economic impacts necessitating evidence-informed inter-professional care.

A consistent finding within health services research is that the translation of research knowledge into practice is a “slow and haphazard process.”55 Clinical practice guidelines (CPGs) play an important role in bridging this knowledge gap. Field and Lohr6 define CPGs as “systematically developed statements to assist practitioners’ and patients’ decisions about appropriate health care for specific clinical circumstances”. CPGs have the ability to improve the quality and consistency of health care provided by clinicians leading to improvements in patient health outcomes.7 However, the identification of rigorously developed CPGs is a “daunting task” for clinicians, policymakers and other stakeholders.5 The AGREE instrument was developed by an international group of guideline developers and researchers in 2003 to assess the ‘Quality of guidelines’ or “the confidence that the potential biases of guideline development have been addressed adequately and that the recommendations are both internally and externally valid and are feasible for practice.”8

Within the field of traumatic SCI, existing CPGs focus on specific health complications9,10 or care within specific segments of the care continuum11,12 and do not address all the important clinical questions which arise during care provision. As SCI is a complex condition that results in multimorbidity13 and requires health monitoring and intervention across the lifespan, a rigorously developed CPG that addresses high-quality, interprofessional comprehensive care is needed. Recognizing these challenges and limitations, we sought to form an interprofessional panel of experts in SCI to develop the Canadian Spinal Cord Injury Best Practice (Can-SCIP) Guideline. The Can-SCIP Guideline is the first comprehensive living guideline for adults with SCI in Canada that is adapting, updating, integrating 585 recommendations from 41 CPGs (Table 1) and has validated the content of existing SCI guidelines with stakeholders for implementation in Canada.

The objective of this study, therefore, is to evaluate the quality of the development process and methodological rigour of published CPGs within SCI across the care continuum from pre-hospital to community-based care.

Methods

Guideline search and selection

A scoping review was undertaken for CPGs focused on treatment and evidence-based recommendations for individuals with traumatic SCI. The Can-SCIP steering committee consulted with the Health Sciences Librarian at the University of British Columbia (UBC) to assist with the construction of the search. Thirteen electronic health databases and indexes were searched to identify CPGs within SCI. These include but were not limited to: PubMed, Medline, Embase, CINAHL, and PsycINFO, NCCIH Clearinghouse,52 Clinical Key,53 Trip Medical database,54 DynaMed Plus,55 Scottish Intercollegiate Guidelines Network,56 CADTH Grey Matters tool,57 Guidelines International Network,58 and Physiotherapy Evidence Database Ratings (PEDro).59

The key search terms included ‘spinal cord injury,’ ‘spinal cord dysfunction,’ ‘tetraplegia,’ ‘quadriplegia,’ ‘paraplegia,’ ‘spinal cord impaired,’ ‘spinal cord lesion’ (including truncations of these SCI terms) and ‘clinical practice guidelines.’ The inclusion criteria for the CPGs included:

- Adults (> 18 years of age)
- CPG published in last 9 years (2011–2020)
- Written by 4 or more authors
- Written in English or French language
- Inclusion of specific evidence-based recommendations
- Applicable to the Canadian health care setting

Systematic reviews and shorter evidence-based documents were excluded. However, the reference lists from key evidence-based documents were hand-searched to identify any additional CPGs for inclusion. CPGs published prior to 2011 were only selected for inclusions in topics areas where there was a paucity of CPGs published after 2011 within a specific topic area (i.e. nutrition).

Quality Appraisal

The Appraisal of Guidelines for Research and Evaluation (AGREE II) instrument was used to evaluate eligible guidelines. The AGREE instrument is composed of twenty-three items organized in six quality domains: (1) scope and purpose, (2) stakeholder involvement, (3) rigour of development, (4) clarity of presentation, (5) applicability, and (6) editorial independence. An additional item rates the overall quality of the guideline when considering the criteria within the six domains. Each domain is specific to a unique dimension of guideline quality. Each item within the instrument is rated on a 7-point scale. A score of 1 (“strongly disagree”) is given when the concept is “very poorly reported,” or the appraiser cannot find any information relevant to a particular AGREE II item, or the guideline authors indicate that a specific criterion was not met. A score of 7 (“strongly agree”)...
| Guideline Name                                                                 | Abbreviation | Year | Phase of Care | Topic Area(s) Covered | Country of Origin |
|--------------------------------------------------------------------------------|--------------|------|---------------|-----------------------|-------------------|
| Spinal Cord Injury (2009) Evidence-Based Nutrition Practice Guideline          | NUTR         | 2009 | Cross-Continuum | Nutrition             | United States     |
| Sexuality and Reproductive Health in Adults with SCI                           | CSM          | 2010 | Rehab/Community | Sexuality             | United States     |
| Home Mechanical Ventilation: A Canadian Thoracic Society CPG                   | CTS          | 2011 | Community      | Respiratory           | Canada            |
| Evidence-Based Guideline Update: Intraoperative Spinal Monitoring with Somatosensory and Transcranial Electrical Motor Evoked Potentials | NUWER        | 2011 | Acute Care    | Surgical Monitoring   | United States     |
| Urinary Incontinence in Neurological Disease: Management of Lower Urinary Tract Dysfunction in Neurological Disease | NICE         | 2012 | Cross-Continuum | Bladder               | United Kingdom    |
| Canadian BPG for the Prevention and Management of Pressure Ulcers in People with SCI: A Resource Handbook for Clinicians | PU-ONF       | 2013 | Cross-Continuum | Skin                  | Canada            |
| Clinical Guideline for Standing in Adults Following Spinal Cord Injury         | CGFS         | 2013 | Rehab/Community | Standing Therapy      | United Kingdom & Ireland |
| Development of Clinical Guidelines for the Prescription of a Seated Wheelchair or Mobility Scooter for People with TBI or SCI | OTA          | 2013 | Cross-Continuum | Wheelchair/ Mobility Device | Australia |
| Management of Acute Combination Fractures of the Atlas and Axis in Adults       | ATL-ATX      | 2013 | Acute         | Surgical Management   | United States     |
| Initial Closed Reduction of Cervical Spinal Fracture-Dislocation Injuries      | CNS-FXDIS    | 2013 | Acute         | Fracture Treatment    | United States     |
| Deep Venous Thrombosis and Thromboembolism in Patients with Cervical SCI        | CNS-DVT      | 2013 | Cross-Continuum | Venous Thrombo-Embolism (VTE) | United States |
| Guidelines for the Management of Acute Cervical Spine and Spinal Cord Injuries: 2013 Update | CNS          | 2013 | Acute         | Medical/Surgical Management | United States |
| Pressure Ulcer Prevention and Treatment Following SCI, 2nd edition              | NICE         | 2014 | Cross-Continuum | Community             | United States     |
| Prevention and Treatment of Pressure Ulcers: Individuals with Spinal Cord Injury | NPUPA        | 2014 | Cross-Continuum | Skin                  | United States     |
| Prevention of Venous Thromboembolism in Individuals with SCI                   | CSM          | 2016 | Cross-Continuum | VTE                   | United States     |
| The CanPain SCI CPG for Rehab Management of Neuropathic Pain after SCI: Recommendations Treatment | CANPAIN TREAT | 2016 | Cross-Continuum | Pain                | Canada            |
| The CanPain SCI CPG for Rehab Management of Neuropathic Pain after SCI: Screening and Diagnosis Recommendations | CANPAIN DIAG | 2016 | Cross-Continuum | Pain                | Canada            |
| The CanPain SCI CPG for Rehab Management of Neuropathic Pain after SCI: Recommendations for Model Systems of Care | CANPAIN SYS CARE | 2016 | Cross-Continuum | Pain                | Canada            |
| Provincial Guidelines for Spinal Cord Assessment                               | CCO          | 2016 | Cross-Continuum | Medical               | Canada            |
| Spinal injury: Assessment and Initial Management                                | NICE         | 2016 | Acute         | Medical/Surgical      | United Kingdom    |
| A Review and Update on the Guidelines for the Acute Management of Cervical SCI – Part I | REVIEW PAR | 2016 | Acute         | Medical/Surgical      | United States     |
| Evidence-based Scientific Exercise Guidelines for Adults with SCI: An Update and a New Guideline | GINIS        | 2017 | Rehab/Community | Exercise             | Canada & United Kingdom |
| CPG for the Management of Patients With Acute SCI and Central Cord Syndrome: Recommendations on the Timing (≤24 h Versus >24 h) of Decompressive Surgery | DECOM        | 2017 | Acute         | Surgical             | International     |
| CPG for the Management of Patients With Acute SCI: Recommendations on the Use of Methylprednisolone Sodium Succinate | MSS          | 2017 | Acute         | Medical Management    | International     |

Continued
is assigned when all criteria and considerations in the AGREE User Manual are met. A score between 2 and 6 is given when the information related to a specific item does not meet the full criteria and consideration discussed in the AGREE User Manual. The AGREE II instrument has demonstrated construct validity, inter-rater reliability and was found to be a significant positive predictor of guideline adoption.

Each CPG was independently evaluated by three to five appraisers from the Can-SCIP expert panel (Appendix A). Each expert panel member was required to disclose to the Can-SCIP steering committee if they have developed or served as an external reviewer of any of the CPGs within SCI. Each panel member was assigned approximately four or five CPGs to appraise. Expert panel members who participated in the development of an included CPG or served as an external reviewer for the CPG were asked to rate other CPGs. As described in the AGREE II User Manual, the six domains scores are independent and were not combined into a single score. For each CPG, a standardized score was calculated using the following formula for each domain:

\[
\text{Standardized Score} = \left( \frac{\text{Obtained Score} - \text{Minimum Possible Score}}{\text{Maximum Possible Score} - \text{Minimum Possible Score}} \right) \times 100\% 
\]
Intra-class correlation coefficients (2-way random model) were used to assess appraiser agreement. As the AGREE User Manual does not specify a minimum score that is considered ‘low-quality,’ the Can-SCIP steering committee set a benchmark of 40% for inclusion, whereby scores higher than 40% represent higher quality, and scores below 40% represent poorer quality.

Results
Included Guidelines
The systematic search yielded 1,305 documents in addition to thirty-three grey literature documents. Of the 1338 documents, 216 full-text documents were reviewed, and 48 were shortlisted for evaluation. The experts continued to scan literature and became aware that the Paralyzed Veterans of America was in the final stages of completing 3 CPGs that were to be published in 2020, and these CPGs were evaluated after the initial set. A total of forty-one CPGs met the inclusion criteria. Figure 1 provides an output of the search process.

Table 1 provides an overview of the included guidelines, the topics covered and the phase of the continuum of care involved. Fifteen originated in the United States, eight CPGs originated in Canada, six from the United Kingdom, one CPG was from Australia, one was from Norway, one joint collaboration of Canada and the United Kingdom, and 9 CPGs were international collaborations. There was a total of 925 recommendations within the forty-one CPGs. The CPGs fit under 24 health domains (Table 1).

Quality Appraisal
Table 2 outlines the standardized domain scores. “Rigor of development” is considered one of the most important indicators of methodological quality as it indicates the link between the strength of the clinical

Figure 1 PRISMA study flow diagram.
### Table 2  Standardized domain scores (%).

| Domains   | Domain 1 – Scope & Purpose | Domain 2 – Stakeholder Involvement | Domain 3 – Rigour of Development | Domain 4 – Clarity of Presentation | Domain 5 – Applicability | Domain 6 – Editorial Independence |
|-----------|---------------------------|------------------------------------|----------------------------------|-----------------------------------|--------------------------|----------------------------------|
| ANTICOAG 2017 | 91.11 | 88.89 | 80.00 | 95.56 | 71.67 | 81.67 |
| ATLAS AXIS 2013 | 75.00 | 45.83 | 60.94 | 79.17 | 42.71 | 68.75 |
| BMD 2019 | 94.44 | 77.78 | 86.81 | 96.30 | 87.50 | 61.11 |
| CANPAIN DIAG 2016 | 81.94 | 65.28 | 78.13 | 77.78 | 65.63 | 79.17 |
| CANPAIN SYSCARE 2016 | 84.44 | 64.44 | 64.58 | 80.00 | 56.67 | 61.67 |
| CANPAIN TREAT 2016 | 89.81 | 7.80 | 76.63 | 94.44 | 53.47 | 72.22 |
| CCO 2016 | 70.83 | 51.39 | 61.98 | 68.06 | 54.17 | 64.58 |
| CGFS 2013 | 77.78 | 72.22 | 79.69 | 79.17 | 50.00 | 56.25 |
| CNS 2013 | 86.11 | 38.89 | 38.54 | 70.83 | 17.71 | 85.42 |
| CNS-DVT 2013 | 59.72 | 23.61 | 44.27 | 84.72 | 21.88 | 50.00 |
| CNS-FXDIS 2013 | 80.56 | 69.44 | 71.35 | 87.50 | 61.46 | 85.42 |
| CSCM 2010 | 91.67 | 69.44 | 84.90 | 90.28 | 35.42 | 56.25 |
| CSCM 2016 | 81.94 | 66.67 | 84.90 | 96.30 | 35.42 | 87.50 |
| CTS 2011 | 95.56 | 75.56 | 90.42 | 93.33 | 76.67 | 100.00 |
| CUJ 2019 | 88.89 | 83.33 | 66.67 | 94.44 | 59.72 | 83.33 |
| DECOM 2017 | 83.33 | 72.22 | 81.25 | 86.11 | 68.75 | 66.67 |
| MSCC 2017 | 90.28 | 70.83 | 55.73 | 30.56 | 38.54 | 68.75 |
| GINIS 2017 | 100.00 | 98.61 | 96.88 | 93.06 | 87.50 | 89.58 |
| MRI 2017 | 84.72 | 84.72 | 92.71 | 97.22 | 70.83 | 85.42 |
| MSS 2017 | 84.72 | 70.83 | 87.76 | 87.50 | 64.06 | 83.33 |
| NASH 2018 | 91.11 | 88.89 | 80.00 | 95.56 | 71.67 | 81.67 |
| NICE 2012 | 75.00 | 45.83 | 60.94 | 79.17 | 42.71 | 68.75 |
| NICE 2016 | 81.94 | 65.28 | 78.13 | 77.78 | 65.63 | 79.17 |
| NICE PU 2014 | 84.44 | 64.44 | 64.58 | 80.00 | 56.67 | 61.67 |
| NOR 2017 | 89.81 | 7.80 | 76.63 | 94.44 | 53.47 | 72.22 |
| NPUAP 2014 | 87.50 | 81.94 | 82.81 | 94.44 | 68.75 | 97.92 |
| NUTR 2009 | 70.83 | 51.39 | 61.98 | 68.06 | 54.17 | 64.58 |
| NUWER 2011 | 77.78 | 72.22 | 79.69 | 79.17 | 50.00 | 56.25 |
| OTA 2013 | 86.11 | 38.89 | 38.54 | 70.83 | 17.71 | 85.42 |
| PALRM 2018 | 59.72 | 23.61 | 44.27 | 84.72 | 21.88 | 50.00 |
| PU-OINF 2013 | 80.56 | 69.44 | 71.35 | 87.50 | 61.46 | 85.42 |
| PU-PVA 2014 | 91.67 | 69.44 | 84.90 | 90.28 | 35.42 | 56.25 |
| REVIEW PAR 2016 | 81.94 | 66.67 | 84.90 | 98.61 | 35.42 | 87.50 |
| TIME 2017 | 95.56 | 75.56 | 90.42 | 93.33 | 76.67 | 100.00 |
| URO 2017 | 88.89 | 83.33 | 66.67 | 94.44 | 59.72 | 83.33 |
| WHO 2017 | 83.33 | 72.22 | 81.25 | 86.11 | 68.75 | 66.67 |
| WHO INT 2013 | 90.28 | 70.83 | 55.73 | 30.56 | 38.54 | 68.75 |
| WOUNDCAN 2017 | 100.00 | 98.61 | 96.88 | 93.06 | 87.50 | 89.58 |
| PVA BOWEL 2020 | 100.00 | 66.67 | 85.58 | 100.00 | 79.17 | 91.7 |
| PVA AD 2020 | 100.00 | 83.33 | 79.17 | 100.00 | 54.17 | 83.33 |
| PVA EBW 2020 | 88.89 | 72.22 | 81.25 | 94.44 | 58.33 | 91.67 |
| Median | 85.32 | 65.03 | 73.90 | 84.81 | 55.55 | 75.83 |

### Table 3  Appraiser agreement.

| Domain | Scope & Purpose | Stakeholder Involvement | Rigour of Development | Clarity of Presentation | Applicability | Editorial Independence |
|--------|----------------|-------------------------|----------------------|------------------------|--------------|------------------------|
| ICC    | 0.93           | 0.87                    | 0.91                 | 0.81                   | 0.80         | 0.74                   |
trial evidence that supports each recommendation. The median score for “rigor of development” was 79.17%. Thirty-nine CPGs achieved a domain score greater than 40%, and 2 guidelines achieved a score below 40%.

**Domains with High Scores**

Domains scores were relatively higher for “rigor of development”, “clarity of presentation,” “editorial independence,” and “stakeholder involvement,” with mean scores of 73.90%, 84.81% and 75.83%, 65.03, respectively. The highest domain score was achieved in domain 1, “scope and purpose,” with a median score of 85.32%.

**Domains with Low Scores**

Standardized scores for domain 5 of the AGREE II tool (“applicability”) were low, with a median of 56.67. “Applicability” had the greatest number of standardized domain scores less than 40% (n=10). Three CPGs had a standardized “applicability” domain score between 30 and 39 percent, one CPG between 20 and 29 percent and one CPG with a score between 10 and 19 percent. The lowest standardized domain scores were under “stakeholder involvement” (domain 2) at 7.8% for two CPGs.

**Interrater Reliability.**

Interrater reliability score was measured using the Interclass Correlation Coefficient (ICC). All ICCs indicated high agreement (ICC > 0.80), except for one domain, which indicated was moderate agreement (ICC < 0.80) among expert panel members with varied clinical expertise across all guidelines assessed. The table below shows the interrater reliability for each domain (Table 3).

**Discussion**

To our knowledge, this is the first comprehensive search and evaluation of the methodological quality of published CPGs across the SCI care continuum from prehospital and emergency care to community-based rehabilitation. CPGs are an important tool to improve the quality of medical care and assist healthcare professionals in making clinical decisions based on evidence. Based on the standardized domains scores, the CPGs that scored the highest rating within all six domains included Wounds Canada Best Practice Recommendations, Evidence-Based Scientific Exercise Guidelines for Adults with SCI, Home Mechanical Ventilation: A Canadian Thoracic Society CPG, CPG for the Management of Patients With Acute SCI: Recommendations on the Type and Timing of Rehabilitation, and Management of Neurogenic Bowel Dysfunction in Adults after SCI: CPG for Health Care Providers. Further, an important domain within the AGREE II tool for clinicians is “rigor of development.” Twenty-seven CPGs (65%) achieved a standardized domain score of over 70%. The findings are similar to Hurdowar and colleagues (2007) who noted that 62% of evaluated CPGs received a standardized domain score of over 74%. The domain scores achieved are higher than previous CPG assessments. Cranney and colleagues appraised the quality of osteoporosis guidelines that received a “rigor of development” score of 23%. Graham and colleagues (2001) assessed the quality of drug therapy CPGs and received a “rigor of development” score of 30%. Variation in the other AGREE standardized domain scores within the other categories was also observed. Similar to Hurdowar and others, the mean and median scores on stakeholder involvement and applicability domains were lower. Future guideline development groups should clearly describe the facilitators and barriers to implementing the CPG, tools and resources to facilitate dissemination and implementation of the CPG, and the strategies used to incorporate the views and preferences of persons with lived experience throughout the CPG development process. Further, only 3 CPGs presented the cost implications (i.e. economic evaluation, drug acquisition costs for each treatment) of applying the recommendations. This finding is similar to previous studies, which noted that economic evaluations are overlooked. Additional research on the resource implications and cost-effectiveness during CPG development and implementation is needed. Future CPG development groups should also consider incorporating the evaluation content within each AGREE II domain to develop high-quality CPGs using a systematic and rigorous process.

The evaluation of recently published CPGs with SCI highlighted several gaps in the literature. There is a paucity of CPGs that address community-based specialized rehabilitation and community reintegration. As well, only several community-based studies that address the needs of people with SCI over their lifetime are available. In addition, many CPGs only focus on a single impairment or organ system at a particular time point in the care continuum (i.e. specialized rehabilitation).

As SCI is a complex condition that results in multimorbidity and requires health monitoring and intervention across the lifespan, a rigorously developed CPG that addresses high-quality, interprofessional comprehensive care is needed. The Can-SCIP Guideline was
developed to address the gaps in the literature. The Guideline is the first comprehensive living guideline for adults with SCI in Canada that is adapting, updating, integrating, and validating the content of existing SCI guidelines with stakeholders for implementation in Canada. The Guideline has been explicitly adapted to align with the Canadian health care environment, providing a set of recommendations that cover the continuum from pre-hospital to community-based care.

**Study Strengths & Limitations**

One of the strengths of the study is that a high interrater reliability score was achieved (mean ICC = 0.84) among expert panel members. As well, the CPGs included for evaluation were published within the last 9 years and represent the most recent literature in SCI. A known limitation is that the AGREE instrument does not provide benchmark cutoff values, and the values selected in this study (benchmark of 40%) were selected by the Can-SCIP steering committee. Other CPG appraisers may interpret the AGREE domain scores differently. Furthermore, the inclusion of only CPGs in English may have excluded high-quality CPGs. Further, there are several factors that may influence the interpretation of the AGREE II appraisal. One factor that may alter scores is that CPGs that are published within large peer-reviewed journals may not have disclosed all methodology because of page and word limitations, which may have affected the ability of the Can-SCIP expert panel to find the level of detail required to receive a score of ‘7’ using the AGREE II tool.

**Conclusions**

While there are many published SCI guidelines, no single CPG provides recommendations that cover the optimal system of care across the continuum from pre-hospital, acute, rehabilitation and community care, and we did not find a CPG that covered all SCI complications deemed important by individuals with SCI and other relevant stakeholders. About two-thirds of CPGs were developed using a rigorous methodology, although there was variability, and few guidelines provide tools for implementation and applicability. The Can-SCIP Guideline will aim to address these gaps in the currently published guidelines.

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