Accuracy of SNOMED-CT Chief Presenting Complaint Codes: an audit of 1,000 cases

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ABSTRACT

AIM: The Systematised Nomenclature of Medicine—Clinical Terms (SNOMED-CT) coding system has been introduced to emergency departments in New Zealand, starting with the patient's chief presenting complaint (CPC). However, it is not known how accurate CPC coding at triage is, or whether coding accuracy varies by patient characteristics. The aim of this study was to determine the accuracy of CPC coding.

METHOD: We compared the real-time triage recorded CPC with the presenting complaints recorded in medical notes by the treating clinician. Agreement was determined by exact CPC matches and the kappa statistic.

RESULTS: From 1,000 consecutive presentations 852 were eligible (89 CPCs). Real-time CPC agreed with clinical notes in 514/852 (60.3%) cases. When real-time free text comments were included, agreement was 732/852 (85.9%). There were no differences by age, sex or ethnicity. Agreement for the common CPCs: ‘trauma’ (21%); ‘abdominal pain’ (11%), ‘chest pain’ 87 (10%) and ‘shortness of breath’ (8%) was substantial, k=0.66 (95% CI: 0.61, 0.70). Use of non-specific CPC such as ‘referral for investigation’ (5%) and ‘general weakness/fatigue/unwell’ (2%) was uncommon but associated with poor agreement.

CONCLUSION: The accuracy of real-time coding for CPC using SNOMED-CT was reasonable, except for non-specific CPCs, which should be avoided where possible.
Method

This was a retrospective chart review.

Setting
ACH is an urban tertiary academic centre that has an annual census of approximately 76,000 patients 15 years or older.

Case selection
One thousand consecutive presentations to ED were selected, between the dates 19 July 2019 and 23 July 2019. The start date was arbitrarily chosen to give staff sufficient time (four months) to get used to using SNOMED-CT.

Recording of presenting complaints

Triage CPC
CPC was recorded in real-time as soon as possible on patient arrival at ED. This is done by trained triage nurses for all ED presentations, except those ambulance patients requiring immediate resuscitation, or primary care referrals to inpatient teams. Clerical staff record the CPC for patients referred by their primary care provider or patients requiring immediate resuscitation (while clinical staff provide immediate care). A single CPC is recorded from the MOH reference set into the electronic patient management system (Triage CPC). There is provision within the system to add free text comments about the CPC or mention other presenting complaints if there are multiple (Triage Comments).

Auditor CPC
Treating clinicians typically begin their clinical notes stating the presenting complaint and history of presenting complaints. These notes were audited, and the auditor recorded what the clinician stated as the presenting complaints (Auditor CPC). The first presenting complaint mentioned in the clinical notes was recorded as the first Auditor CPC. Up to five Auditor CPC were recorded if there were multiple presenting complaints. The auditors were a senior emergency nurse and a trained final year medical student. The lead author reviewed the first few cases with the auditors, until satisfied that data collection was reliable. No formal check of data accuracy was performed. Where there was uncertainty about the CPC in a particular case the auditors discussed with the lead author and resolved by consensus. Only the date/time of presentation, visit number and NHI were provided to the auditors. Patient records were then accessed by the auditors using the clinical records systems Concerto (Orion Health, Auckland, New Zealand) and 3M™ ChartView™ (3M Company, Salt Lake City, Utah, US) using a password-protected computer based within the ED. Electronic clinical notes for all patients were reviewed independently by an auditor blinded to the real-time CPC. The auditor recorded CPC based on the first treating clinician’s clinical notes onto a purpose-built electronic data collection form in Microsoft Excel® (Microsoft Corporation, Redmond, Washington, US). The first treating clinician was either an independent nurse practitioner or doctor. When there was more than one presenting complaint recorded by the first treating clinician the auditor could record up to five presenting complaints.

Outcomes
The primary outcome was the agreement between triage CPC and the first recorded auditor CPC. Secondary analyses were differences between patient groups, and overall agreement between triage CPC plus triage comments and all recorded auditor CPCs.

Data collection
The following data was retrieved from the hospital data warehouse: event number, NHI, date/time of presentation; age, sex, ethnicity, CPC and free text triage comments fields. This was received by one author in the form of a .csv file and stored in a password-protected computer in a locked office in the ED.

Data handling
Once all data was collected the two data sources were merged into one file for analysis by one author.

Data analysis
Auditor’s CPC was compared directly to the triage CPC and triage comments. The proportion exact matches between triage CPC or triage comments and auditor CPC was recorded as n, % 95% CI. The 95% CI was calculated using Graphpad QuickCalcs (http://www.graphpad.com/quickcalcs/confInterval1/), San Diego, CA, US. Tests for differences between groups were done using Chi2, using Open Epi.5 A two-tailed p<0.05 was considered statistically significant.
Ethics and institutional approval

As an audit of the data quality undertaken by staff in the department where this data was collected and no identifying data would be reported, this study did not meet the threshold to require ethical approval. Institutional approval was obtained from the ADHB research office (A+8678).

Results

The case selection process is shown in Figure 1. Of 1,000 consecutive presentations, 852 were seen in ED and had notes available for the analysis (85%). The demographic details for the cases are shown in Table 1. There were 89 different presenting complaints recorded in real-time of 144 possible (62%) from the original MOH reference set. The most common CPC were related to trauma, with all ‘injury’ related CPC 175/852 (20.5%), ‘abdominal pain’ 94 (11.0%), ‘chest pain’ 87 (10.2%), ‘shortness of breath’ 66 (7.7%), ‘referral for investigation’ 43 (5.0)%, and ‘fever symptoms’ 30 (3.5%).

Figure 2 shows the auditor’s first CPC agreement with the triage CPC, which was 514/852, 60.3% (95% CI 57–64%).

When triage free text comments were also considered, the agreement between

![Diagram: Case selection process](image)

Table 1: Demographics of sample population.

<table>
<thead>
<tr>
<th>Variable</th>
<th>n, % (n=852)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>Mean (SD)</td>
<td>46.6 (21.8)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>433, 50.8%</td>
</tr>
<tr>
<td></td>
<td>Male</td>
<td>419, 49.2%</td>
</tr>
<tr>
<td>Ethnicity</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Asian</td>
<td>191, 22.4%</td>
</tr>
<tr>
<td></td>
<td>European</td>
<td>407, 47.8%</td>
</tr>
<tr>
<td></td>
<td>Māori</td>
<td>100, 11.7%</td>
</tr>
<tr>
<td></td>
<td>Pacific</td>
<td>120, 14.1%</td>
</tr>
<tr>
<td></td>
<td>Other</td>
<td>34, 4.0%</td>
</tr>
</tbody>
</table>

SD = standard deviation, CI = confidence interval.
Figure 2: Agreement between auditor and real-time SNOMED-CT CPC

SNOMED-CT = Systematised Nomenclature of Medicine – Clinical Terms, CPC = chief presenting complaint.
Figure 3: Agreement between auditor and real-Time SNOMED-CT CPC + triage comments

SNOMED-CT = Systematised Nomenclature of Medicine – Clinical Terms, CPC = chief presenting complaint.
the auditor’s CPCs derived from the first clinician’s notes and the triage presenting complaints was 732/852, 85.9% (95% CI 83–88%) of cases (Figure 3).

There was disagreement between either real-time CPC and triage comment and any auditor selected for 186 patients across 51 CPC.

For the common clinical complaints related to trauma, ‘abdominal pain’, ‘chest pain’ and ‘shortness of breath’, there was substantial agreement between the auditor’s primary CPC and the real-time CPC, 661/852=77.5%, \(k=0.66\) (0.61, 0.70), as shown in Table 2.

The worst agreement was for CPC that were non-specific. Agreement for ‘referral for investigation’ was (6/43, 14%). For this CPC, the auditors recorded an alternative more specific CPC in 37/43 (86%) cases (Figure 4). When triage comments were included in the comparisons, the level of agreement increased to 24/43 (56%).

Similarly, for ‘fever symptoms’ there was only 17/29, 57% agreement on CPC which improved to 24/29 (80%) with triage comments included. For ‘general weakness/fatigue/unwell’ there was no agreement on CPC, 0/16 (0%). This improved to 8/16 (50%) when triage comments were included.

There were occasional disagreements for many CPC: For example, eight patients with injuries who were coded as having ‘pain in body part (no recent injury)’ and three patients with ‘fall(s) no significant injury’ when injuries were present. Similarly, 11 patients had injury-related CPC who were coded as pain without injury by the auditors. Also, many CPC overlap, such as ‘collapse/syncope’ and ‘fall(s) no significant injury’ (four cases coded either way in real-time or by auditor); for acute toxicological presentations CPC may also overlap, for example ‘alcohol intoxication’, ‘drug intoxication’, ‘overdose of drug’ or ‘ingestion of harmful substance’ (seven cases with variable coding either in real-time or by auditors).

Table 3 shows the agreement based on demographic characteristics. There was no difference in the rate of agreement on CPC by age category or sex. There was a difference for different ethnicities which bordered statistical significance. The most agreement was for Pacific peoples, 66% (95% CI 57–74) and least for Māori, 51% (95%CI 41-61). This difference was not evident when triage comments were also considered in the agreement calculation (Table 3).

**Discussion**

This is the first audit of the accuracy of CPC coding using SNOMED-CT compared to first treating clinician documentation of presenting complaints in the New Zealand ED setting. The overall accuracy was reasonable in our view, with good agreement for the majority of CPC, especially when triage comments were also considered. Differences observed between different age groups, sex or ethnicity were trivial.

Accuracy for the CPC ‘general weakness/fatigue/unwell’ and ‘referral for investigation’ CPCs were poor, with three quarters...
Figure 4: Clinician CPC compared to triage CPC ‘referral for investigation’.

Green indicates agreement between auditor and real-time CPC, red indicates auditor CPC when real-time CPC was ‘referral for investigation’. CPC = chief presenting complaint.

Table 3: Agreement on CPC by demographic variable.

<table>
<thead>
<tr>
<th>Variable</th>
<th>CPC agreement n, % (n=852)</th>
<th>p</th>
<th>CPC + comments agreement n, % (n=852)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15–29</td>
<td>147/241, 61.0%</td>
<td>0.348</td>
<td>217/241, 90.0%</td>
<td>0.154</td>
</tr>
<tr>
<td>30–44</td>
<td>122/196, 62.2%</td>
<td></td>
<td>167/196, 85.2%</td>
<td></td>
</tr>
<tr>
<td>45–59</td>
<td>97/156, 62.2%</td>
<td></td>
<td>129/156, 82.7%</td>
<td></td>
</tr>
<tr>
<td>60–74</td>
<td>82/132, 62.1%</td>
<td></td>
<td>115/132, 87.1%</td>
<td></td>
</tr>
<tr>
<td>75+</td>
<td>66/127, 52.0%</td>
<td></td>
<td>104/127, 81.9%</td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>265/433, 61.2%</td>
<td>0.597</td>
<td>379/433, 87.5%</td>
<td>0.169</td>
</tr>
<tr>
<td>Male</td>
<td>249/419, 59.4%</td>
<td></td>
<td>353/419, 84.2%</td>
<td></td>
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<tr>
<td>Ethnicity</td>
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<td></td>
</tr>
<tr>
<td>Asian</td>
<td>105/191, 55.0%</td>
<td>0.053</td>
<td>161/191, 84.3%</td>
<td>0.964</td>
</tr>
<tr>
<td>European</td>
<td>259/407, 63.6%</td>
<td></td>
<td>352/407, 86.5%</td>
<td></td>
</tr>
<tr>
<td>Māori</td>
<td>51/100, 51.0%</td>
<td></td>
<td>86/101, 86.0%</td>
<td></td>
</tr>
<tr>
<td>Pacific</td>
<td>79/120, 65.8%</td>
<td></td>
<td>104/120, 85.3%</td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td>20/34, 58.8%</td>
<td></td>
<td>104/123, 86.7%</td>
<td></td>
</tr>
</tbody>
</table>
or more of these having more specific CPC recorded by the treating clinician. As a result of this audit we have fed back to triage staff to avoid using more general CPCs where possible. The ‘referral for investigation’ CPC was used for many primary care referrals and for those patients brought by ambulance direct to the resuscitation room—for these patients it was expedient for clerks who entered the patients into the hospital information system to use this code. The other feedback provided was to avoid trying to label patients with a diagnosis using the CPC presumptive diagnoses can be placed in the free text comments if required.

Given that patients often present to ED with more than one presenting complaint, histories evolve over time and that the emphasis given by patients or clinicians to a particular presenting complaint when more than one symptom is present may differ, the accuracy observed in this study was considered reasonable, and compares well to that previously reported in Australia by research staff determining CPC from free text. In the study by Waghohlikar and colleagues, agreement between two research assistants extrapolating CPC from free text is reported for the five most common CPC (abdominal pain, chest pain, shortness of breath, trauma and other, n=364). Using the raw data provided, it was possible to estimate the overall interobserver agreement in their study: $k=0.56$ (0.50, 0.617), n=364,6 which is moderate agreement. In our audit using the same five categories there was substantial agreement.7

It is clear that when using the CPC for audit of particular conditions to determine the denominator of interest, or for disease surveillance more than one CPC needs to be flagged to maximise the sensitivity of searches. This was evident for the trauma-related CPC where patients may be coded by the location of their injury or the symptoms caused; education is required such that trauma presentations should not be coded as ‘pain in body part (no injury)’. In the case of SARS-Cov-2 (or future viral respiratory pandemics) the relevant CPC may be ‘fever symptoms’; ‘shortness of breath’; ‘cough’; ‘sore throat’ or ‘exposure to communicable disease’. Simply screening for one of these will miss relevant cases.

Having a short but comprehensive list of searchable presenting complaints is a vast improvement for our department. Our previous system of free text data entry for presenting complaints made any form of clinical audit based on presenting complaints very difficult, due to the myriad of variations of spellings, misspelling, acronym use and other abbreviations that were possible for each and every presenting complaint. Ongoing audit and education will be important to improve/maintain real-time coding accuracy for CPC.

The next steps for our department are to introduce the reference sets for ED procedures and diagnosis. Once this is embedded at a national level, we will for the first time have a real picture of the demand for and the opportunity to determine the value added by ED care in New Zealand.8

**Conclusion**

The accuracy of SNOMED-CT CPC was reasonable in our department, although several areas for improvement were identified, most importantly the need to avoid using more general CPC when a specific CPC is available. Use of CPC for research or disease surveillance will require careful consideration of local coding practice and use of multiple CPC in searches to maximise sensitivity.
Competing interests:
Prof Jones is the clinical lead at the Ministry of Health for the Shorter Stays in Emergency Departments health target and on the sector advisory group for implementation of SNOMED-CT.

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