Specifying ICD9, ICPC and ATC codes for the STOPP/START criteria: a multidisciplinary consensus panel

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Abstract

Background: the STOPP/START criteria are a promising framework to increase appropriate prescribing in the elderly in clinical practice. However, the current definitions of the STOPP/START criteria are rather non-specific, allowing undesirable variations in interpretation and thus application. The aim of this study was to design specifications of the STOPP/START criteria into international disease and medication codes to facilitate computerised extraction from medical records and databases.

Methods: a three round consensus procedure with a multidisciplinary expert panel was organised to prepare, judge and agree on the design of the STOPP/START criteria specifications in corresponding international disease codes (ICD9 and ICPC) and medication codes (ATC).

Results: after two rounds consensus was reached for 74% of the STOPP criteria and for 73% of the START criteria. After three rounds full consensus was reached resulting in a specification of 61 out of 62 STOPP criteria and 26 START criteria with their corresponding codes. One criterion could not be specified and for some criteria corresponding disease codes were lacking or imperfect.

Conclusion: this study showed the necessity of a consensus procedure as even experts frequently differed on how to specify the STOPP/START criteria. This specification enables next steps such as prognostic validation of these criteria on adverse outcomes and studying the impact of improving appropriate prescribing in the elderly.

Keywords: STOPP/START criteria, inappropriate prescribing, specification, computerised extraction, older people
**Introduction**

The STOPP/START criteria are a promising framework to identify both potentially inappropriate prescribing and potentially prescribing omissions in clinical practice. However, the current definitions of the STOPP/START criteria are rather non-specific, allowing undesirable variations in interpretation and thus application [1]. Also current manual application is time consuming and requires a high level of familiarity. The creators of STOPP/START suggest the option of computerised extraction of STOPP/START which will likely facilitate identification of inappropriate prescribing in the elderly [1]. However, to allow such computerised extraction, current STOPP/START definitions need further specification.

Many drugs that can be prescribed safely and effectively to younger patients are potentially inappropriate for the elderly as a result of physiological changes and increased comorbidity [2]. Potentially inappropriate prescribing encompasses (i) the use of medications in a situation in which the risk of an adverse drug event (ADE) outweighs the clinical benefit, particularly when safer or more effective alternatives are available, and (ii) the omission of clinically indicated medications in the absence of contra-indication in patients with significant life expectancy [3,4,5].

Inappropriate prescribing is highly prevalent in the elderly [1,5–10] and has been associated with ADEs [11–13], hospitalisation [14,15], death [10, 16] and increased healthcare utilisation [14, 15]. With increasing proportions of the elderly worldwide, inappropriate prescribing has become an important public-health issue [1,5,7]. A screening tool can be useful for detecting potentially inappropriate medications (PIMs) and potentially prescribing omissions (PPOs) in the elderly [2] and consequently in preventing adverse outcomes. The Beers’ list [4,10–20] and the STOPP/START criteria [21] are commonly used tools for identifying inappropriate prescribing with the aim to improve the quality of pharmacological management in older people [3,4]. However, the Beers criteria have been criticised because up to 50% of the prescribed drugs are not listed in European formulations [5,6] and they do not include criteria relating to potential prescribing omissions [22]. The STOPP/START criteria are thereby more sensitive and identify more medications associated with ADEs than the 2002 version of the Beers criteria [22]. The potential benefits of application of the STOPP/START criteria as an intervention have been shown by Gallagher et al., they demonstrated that medication appropriateness significantly improved after rigorous application of STOPP/START at a single-time point [3]. This is why the 2012 Dutch Multidisciplinary Guideline Polypharmacy in the elderly states that is preferable to use the STOPP/START criteria to identify inappropriate prescribing in the Dutch elderly population [23].

Although inter-rater reliability was reported to be good [1], differences between physicians in interpretation and application of the criteria may occur. For example, classification of second-generation antihistamines as first-generation antihistamines [1], the definition of long-acting benzodiazepines or the definition of peripheral vascular symptoms all can be interpreted rather differently across clinicians. It is likely that a specification of the criteria in corresponding diseases or symptoms and medicines will decrease variation in interpretation and subsequently increase the inter-rater reliability. Thereby, a clear defined specification is a necessary prerequisite to allow computerised extraction of the STOPP/START criteria from medical records and might thus greatly facilitate rapid identification of potentially inappropriate prescribing. Therefore, the aim of this study was to design specifications of the STOPP/START criteria into international disease and medication codes to facilitate computerised extraction from medical records and databases.

**Methods**

**STOPP/START criteria**

The STOPP/START criteria consist of two components; the first to halt inappropriate or unnecessary medicines in older patients (STOPP, Screening Tool of Older Person’s Prescriptions), the second is used to consider medicine appropriateness when initiating treatment (START, Screening Tool to Alert doctors to Right Treatment). STOPP comprises 65 indicators of potentially inappropriate prescribing, including drug–drug and drug–disease interactions, unnecessary therapeutic duplication and drugs which can increase the risks of cognitive decline and falls in older people [21]. START incorporates 22 evidence-based indicators of prescribing omissions in older people [21]. The specification of the STOPP/START criteria was carried out using the Dutch version [23], adjusted to Dutch clinical guidelines. This set was chosen to enable implementation in Dutch clinical practice and includes only minor adjustments compared with the original Irish STOPP/START criteria, e.g. STOPP criteria regarding the use of aspirin or NSAID without gastric protection are transferred into START criteria; starting with gastric protection when using aspirin or a NSAID, because stopping these indicated medications is not assumed appropriate [2]. For an overview of the differences between the original and Dutch version, please see Supplementary data available in *Age and Aging* online, Appendix 1.

**Consensus procedure**

To define the specifications of the STOPP/START criteria, we conducted a multidisciplinary expert consensus procedure in order to create a solid base for a future implementation. The consensus procedure was performed in three rounds.

**First round: preparation panel**

In the first round, a preparation panel that consisted of a geriatrician (J.v.C.), clinical pharmacologist (J.H.), a junior doctor (M.d.V.) and a final year medical student (D.d.G.) prepared a draft specification of all criteria on the basis of Dutch treatment guidelines, scientific literature [23–27] and the clinical expertise of the panel. Diseases and symptoms were coded according to the International Classification of Disease; version 9 (ICD9).
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[28] and International Classification of Primary Care (ICPC–codes version1) [29] to facilitate extractions in both hospital and general practice. Medications or medication groups were coded according to the ATC Classifications System formulated by the World Health Organization Collaborating Centre for Drug Statistics Methodology [30]. All three classifications are part of the World Health Organisation Family of International Classifications (WHO-FIC) and are used worldwide. Besides mono (single ingredient) preparations, combination preparations containing the active ingredient mentioned in the criteria were also included in the definition. If possible, international medication groups were included regardless of its availability on the Dutch market. Besides the specification in disease and medication codes, we designed a specification that represents a comprehensible interpretation of the criteria, e.g. 'dipyridamole as monotherapy for cardiovascular secondary prevention' should be interpreted as stop dipyridamole if not combined with aspirin. If the preparation panel was uncertain about corresponding disease or medication codes, all possible options were displayed in a considerations section.

Second round: expert panel

In the second round, the authors of the Dutch translation of STOPP/START, a geriatrician-clinical pharmacologist (R.v.M.) and a hospital pharmacist-clinical pharmacologist (A.V.), were consulted to review this draft specification. R.v.M. was also the chairman of the Dutch multidisciplinary guideline committee ‘Polypharmacy in the elderly’. A third expert panel member, a general practitioner (P.E.) was consulted because of her specific expertise on the ICPC coding system and knowledge of the general practitioner guidelines. These reviewing experts received the draft specifications of STOPP/START, the ICPC checklist and the links to the ATC and ICD9 database accompanied by a guideline and an explaining call of the first author (D.d.G., member of the preparation panel). They were asked to check all the ICD9, ICPC and ATC codes as well as the interpretation of the criteria. If they did not agree with one or more aspects of the specifications they were asked to write down their arguments and possible solutions. The modifications and suggestions for improvement were send back to the first author.

Third round

A summary of the modifications and suggestions was made and send to the panelists of the preparation and expert panel. A final consensus meeting (teleconference) with all panelists of the preparation and expert panel was organised to discuss disagreements on the criteria and to agree on the best option for specification.

Results

Expert consensus

In the first round all 62 STOPP and 26 START criteria were specified in a draft by the preparation panel according to clinical guidelines, scientific literature and the clinical expertise of the panel. In the second round, this specification was reviewed by the three expert panelists. This resulted in disagreement of the specification of 16 out of 62 STOPP criteria (26%) and 7 out of 26 START criteria (27%). Because of repetition of some diseases and medication in multiple criteria, the disagreement comprised a total of 13 different diagnostic or medication topics. In the third round, the expert panel modifications and suggestions for improvement were send to the first author and discussed in a consensus meeting (teleconference) with panelists of both the preparation and expert panel. After the third round, full consensus was reached for all STOPP/START criteria. The second and third round results and reason for disagreement are presented in Table 1.

Specifications

During the process of specifying the criteria, we encountered a few difficulties and obstacles, e.g. imperfect or lacking corresponding ICD9/ICPC/ATC codes, how to specify variables as blood pressure, interpretation and specification of diseases as, for example, peripheral vascular disease, incorporating international medication and no specification possible for a criterion. Please see Supplementary data available in Age and Ageing online, Appendix 2 for the final specifications of the STOPP/START criteria after three consensus rounds with corresponding ICD9, ICPC and ATC codes. Table 2 presents the diagnoses or symptoms for which no (perfect) corresponding ICD9, ICPC or ATC code could be found. As, for example, ankle oedema, there is a corresponding ICPC code that describes oedema of the ankle but no corresponding ICD9 code exists.

Some criteria contain variables as, for example, biochemical data, clinical information such as blood pressure or patients’ age and severity or chronic aspect of a disease. Because these variables cannot be specified in an ICD9 or ICPC code, they are shown in a separate column [considerations/solutions and other variables] in the specification (Supplementary data are available in Age and Ageing online, Appendix 2). Some criteria contain diagnoses or medication of which the interpretation can be difficult because the definition or classification is not clear, for example, which ICD9 and ICPC codes belong to history of falling or tendency to fall and which benzodiazepines are considered to be long-acting. The five most difficult diagnoses and medications to specify in corresponding codes are shown in Table 3.

For the majority of the criteria international medication could be included in corresponding ATC codes, however, for a few medication groups this was not completely possible, e.g. NSAIDS, thiazide diuretics (combinations), first-generation antihistaminic drugs and antihypertensives. For example, Bosentan belongs to the ATC group of antihypertensives but the indication for Bosentan is pulmonary hypertension and not essential hypertension and should therefore not be included. To prevent these kinds of
Incorrect inclusions of medication codes pharmacotherapeutical information was required which was obtained from the Dutch pharmacotherapeutical database [26]. Hence, only medication available on the Dutch market could be included. We chose not to specify STOPP criterion J concerning any duplicate drug class prescription. If criterion J would be specified as the first five identical characters in an ATC code many false-positive alerts would show up because many duplicate drug class prescriptions are considered to be appropriate, as, for example, double antibiotics, antidepressants or epileptics.

### Table 1. Results expert panel consensus procedure second and third round

<table>
<thead>
<tr>
<th>Criteria lacking consensus</th>
<th>Diagnosis</th>
<th>Medication</th>
<th>Reason for disagreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>STOPP</td>
<td>START</td>
<td>16/62</td>
<td>7/26</td>
</tr>
<tr>
<td>A10</td>
<td>A4, A9, F2</td>
<td>Coronary, cerebral or peripheral vascular disease/symptoms</td>
<td>Exclusion of atherosclerosis, arterial embolism and thrombosis, atheroembolism (ICD9 440, 444, 445 ICPC K91)</td>
</tr>
<tr>
<td>A1</td>
<td>Impaired renal function</td>
<td>Acute kidney failure (ICD9 584) should also be included</td>
<td></td>
</tr>
<tr>
<td>B1, F1, I1</td>
<td>Dementia</td>
<td>Inclusion of alcohol/drug induced persisting amnestic disorder/dementia and other cerebral degenerations (ICD9 291.1/2, 292/83, 331)</td>
<td></td>
</tr>
<tr>
<td>B8, C3</td>
<td>Parkinsonism</td>
<td>Dementia with lewy bodies, PSP, MSA, corticobasal degeneration (ICD9 331.82, 333.0, 331.6) should also be included</td>
<td></td>
</tr>
<tr>
<td>B13, H3</td>
<td>First generation antihistaminic drugs</td>
<td>Addition to antihistaminic drugs which are considered to be first generation</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>Vascular thrombo-embolism</td>
<td>Specification of theophylline as monotherapy</td>
<td></td>
</tr>
<tr>
<td>H1–H5</td>
<td>History of increased risk for falling</td>
<td>Portal vein thrombosis and cerebral sinus thrombosis (ICD9 452, 325) should also be included</td>
<td></td>
</tr>
<tr>
<td>J</td>
<td>Double medication</td>
<td>‘Other accidental falls from one level to another’ (ICD9 E884) should also be included</td>
<td></td>
</tr>
<tr>
<td>A5</td>
<td>Hypertension</td>
<td>Inclusion of hypertensive heart disease and/or chronic kidney disease (ICD9 402–404)</td>
<td></td>
</tr>
<tr>
<td>D1</td>
<td>Gastro-oesophageal acid reflux disease</td>
<td>Exclusion of heartburn/pyrosis (ICD9 787.1)</td>
<td></td>
</tr>
<tr>
<td>D2a</td>
<td>History of complication from peptic ulcer disease</td>
<td>Inclusion of gastro-intestinal or oesophageal haemorrhage (ICD9 578, 530.82)</td>
<td></td>
</tr>
<tr>
<td>E3</td>
<td>(risk for) osteoporosis</td>
<td>Inclusion of risk factors as fractures and acquired kyphosis</td>
<td></td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>2/62</strong></td>
<td><strong>1/26</strong></td>
<td></td>
</tr>
</tbody>
</table>

### Table 2. Criteria with imperfect or lacking corresponding ICD9, ICPC or ATC code

<table>
<thead>
<tr>
<th>STOPP Topic</th>
<th>Lacking code</th>
<th>START Topic</th>
<th>Lacking code</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ankle oedema</td>
<td>ICD9</td>
<td>Contra-indication for oral anti-coagulants</td>
<td>ATC</td>
</tr>
<tr>
<td>Non-iatrogenic hyponatraemia (na &lt; 130 mmol) last 2 months</td>
<td>ICPC</td>
<td>Sinus rhythm</td>
<td>ICD9, ICPC</td>
</tr>
<tr>
<td>Urinary catheter in situ</td>
<td>ICD9, ICPC</td>
<td>Chronic respiratory failure</td>
<td>ICPC</td>
</tr>
<tr>
<td>Intact uterus</td>
<td>ICD9, ICPC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mild-to-moderate pain</td>
<td>ICD9, ICPC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Moderate severe chronic pain or palliative care</td>
<td>ICPC</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Duplicate drug class prescription</td>
<td>ATC</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Table 3. Five most difficult diagnoses and medication to specify (all consensus rounds)

<table>
<thead>
<tr>
<th>Diagnoses</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary, cerebral or peripheral vascular symptoms/disease</td>
<td>Long-acting benzodiazepines</td>
</tr>
<tr>
<td>Dementia</td>
<td>First-generation antihistaminic drugs</td>
</tr>
<tr>
<td>Parkinsonism</td>
<td>Antimuscarinic drugs</td>
</tr>
<tr>
<td>History of falling/tendency to fall</td>
<td>Vasodilator drugs</td>
</tr>
<tr>
<td>(risk for) Osteoporosis</td>
<td>Antihypertensives</td>
</tr>
</tbody>
</table>

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Discussion

Main findings

In this study, we designed specifications of the STOPP/START criteria into disease and medication codes. After three rounds consensus was reached for the specification of 61 out of 62 STOPP criteria and all 26 START criteria. We chose not to specify one STOPP criterion, criterion J, because the many exceptions on duplicate drug class prescription would lead to many false-positive alerts. Furthermore, we encountered a few difficulties with imperfect or lacking corresponding codes and the interpretation and specification of some diseases and medication groups. The relative low initial agreement after round two showed that the STOPP/START criteria in its current form leave room for various interpretations. Although many criteria were easy to apply, some criteria contain diagnoses which can be interpreted differently because of their broad definition. ‘Cerebral, coronary or peripheral vascular symptoms/disease’ involves such a broad definition with unclear criteria of which diagnoses belong to this group. As, for example, atherosclerosis it was decided to exclude from this group because atherosclerosis without clinical manifestations requires no medical intervention. Many criteria needed further literature and guideline research for a correct specification. For example (an increased risk of) osteoporosis appeared hard to specify because many risk factors exist. Medication groups are sometimes hard to distinguish, e.g. for long-acting benzodiazepines, it was unclear from which elimination half-life benzodiazepines are considered to be long-acting. Decided was to enhance a half of life of 15 h based on the literature [27] and clinical expertise of the panel.

Strengths and limitations

This is the first study conducted to design specifications of the STOPP/START criteria. Although literature research shows several published studies using STOPP/START no specification of the criteria has been published before. Another strength of this study is the multidisciplinarity of the preparation and expert panel members and the expertise of the expert panel on the STOPP/START criteria. The consensus specification of this study might decrease variation in interpretation and thus increase the inter-rater reliability of the STOPP/START criteria. As all criteria are now specified according to international coding systems used in general practice and hospitals, this could facilitate computerised extractions for application in clinical practice or research. Our specification is currently being applied to an electronic prescribing system for general practice which is currently being tested by general practitioners, this provides the clinical benefit of our research. It is important to emphasise that no changes have been made regarding to the content of the criteria as the aim of the study was to design an applicable specification and not to design a new criteria set.

Besides these strengths, our study also has some limitations. First, the specification is designed on perfect coding which will not always occur in clinical practice, as for example in general practice palpitations can be coded instead of atrial fibrillation. Thereby, not all the criteria could be specified in corresponding ICD9 and ICPC codes which will provide omissions in computerised extractions and gives the possibility that false-positive results are obtained. However, this concerns just a few criteria and may be overcome by the use of alternative data, as, for example, biochemical data for STOPP criterion B12. The expert panelists all come from a single country and the Dutch translation of the STOPP/START criteria was used for this specification which comprises only small adjustments compared with the original Irish version. The majority of the criteria contain international medication. Just for a few criteria, we were only able to include the Dutch medication which can cause possible incomplete medication coding for other countries. Also, under specific circumstances some inappropriate medications might be appropriately indicated. Therefore, we would like to emphasise that the STOPP/START criteria are designed to be used as a screening tool and should not be considered as an absolute guiding principle.

Conclusion and implications

This study designed a specification of the STOPP/START criteria which can increases the inter-rater reliability and is a necessary pre-requisite for computerised extraction. Our specification is currently being applied to an electronic prescribing system for general practice. Further research is required to study the prognostic value of the criteria on adverse outcomes and the impact of improvement of appropriate prescribing in the elderly.

Key points

- The STOPP/START criteria are a promising framework to increase appropriate prescribing in the elderly.
- A specification of the STOPP/START criteria into international disease and medication codes was designed.
- This can increase inter-rater reliability and is a necessary pre-requisite for computerised extraction.

Conflicts of interest

None declared.

Supplementary data

Supplementary data mentioned in the text is available to subscribers in Age and Ageing online.
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References


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