Improving care of vulnerable elders through computerized clinical decision support

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Chapter 3

For which clinical rules do doctors want decision support, and why? A survey of Dutch general practitioners


IN PREPARATION
Abstract

**Background:** Despite the promise of decision support for improving care, alerts are often overridden or ignored. We evaluated Dutch general practitioners’ intention to accept decision support in a proposed implementation based on clinical rules regarding care for elderly patients, and their reasons for wanting or not wanting support.

**Methods:** A survey was developed based on alert acceptance literature and structured interviews. All doctors receiving support in the proposed implementation were invited to complete the resulting online survey (n=43), using twenty clinical rules relating to medication management.

**Results:** The survey consisted of six questions for each clinical rule. The response rate was 65%; 47% completed the survey in full. Wanting support was associated with: feeling that the rule represents minimal care, that the rule should generally be followed, and a perceived need to improve care. The reasons given included: feeling responsible, concerns about forgetting to perform the action, and concerns about harm for the patient. Reasons for declining support included: feeling that the action would not be forgotten, concerns about interruption, and feeling that only others need support (e.g. nurses).

**Conclusions:** A new survey instrument is presented for assessing clinicians’ intention to accept decision support. Doctors’ reasons for wanting decision support appear to center around a perceived need to improve quality and avoid errors. Despite concerns about interruption, doctors tended to choose pop-ups over other forms of support, implying that asking doctors to choose the type of support (interruptive vs. non-interruptive) prior to implementation may not accurately reflect their preferences in the real system.

Introduction

Computerized clinical decision support is any computerized tool designed to help clinicians make clinical decisions [1]. Decision support often takes the form of a computer-generated alert in response to a user’s action, e.g. a warning which is displayed if the user prescribes a medication to a patient with a known allergy to that medication. It is one of the most promising strategies for improving patient care [2] and the ability to provide such support is viewed as one of the important benefits of using a computerized patient record system [62]. However, this benefit is often not fully realized in practice. Alerts are often overridden, in the Netherlands [63] and elsewhere [36, 57, 64].

There are many reasons why a clinician might override an alert. Clinicians may generally dislike guidelines and clinical rules, due to a sense of loss of autonomy [31, 65, 66] or concern that their use will lead to “cookbook medicine” [31, 65]. Previous experience with dysfunctional decision support systems can contribute to poor acceptance of new alerts [66]. Also, the presence of too many alerts can lead to ignoring all alerts (“alert fatigue”) [33, 63], especially too many false positive alerts [37]. The use of less-interruptive styles of decision support for some alerts has been proposed to help reduce alert fatigue [40], which may be particularly important in light of the possible adverse effects of interruption on the quality of care [38].

Dutch general practitioners (GPs) were among the first to widely adopt electronic patient
records [67], and today some form of clinical decision support is used in 89% of Dutch general practices [68]. The HAG-net-AMC (General Practice-network Academic Medical Center), a regional network of GPs participating in research and education, is planning to implement decision support based on a set of 81 “if-then” clinical rules pertaining to geriatric medicine. The rules were selected using a Delphi method for their relevance to Dutch general practice and are in the form of “condition-action” rules (e.g. “If a (vulnerable) elder is prescribed an ACE inhibitor” (condition), “then s/he should have serum creatinine and potassium monitored within 2 weeks after initiation of therapy and at least yearly thereafter” (action)) [69]. The clinical rules serve as concrete examples of clinical tasks proposed for decision support.

We developed and administered a survey to learn which of these rules doctors want supported, and the reasons behind their choices. The aim is to gain insight into the motivation for prospectively accepting or declining support, as well as gain information to assist in designing support that better suits the doctors’ workflow and expectations.

**Methods**

**Selection of clinical rules for the survey**

The complete set of 81 rules had been prioritized for the decision support implementation by a focus group of 8 doctors from the practice group, and the decision was made to focus on medication-related rules. Twenty-three rules mentioned medications or specific medications. Three rules were eliminated because they were conceptually very similar, leaving 20 rules to include in the survey. This selection was checked to ensure that it included rules which had been rated as both high and low priority by the focus group.

**Survey Development**

A survey was developed to assess which rules the doctors want supported, and to gain insight as to why they did or did not want support for particular rules. Because we expected that general attitudes and previous experience with clinical rules and decision support could globally influence their decisions, we also administered an “Attitudes and Experience” questionnaire, the details of which have been published previously [70].

The survey was developed by conducting structured interviews with two medical informatics experts, a hospital specialist, a hospital resident, and two general practitioners. The interviews were structured in three parts: Part 1 of the interview consisted of five questions about positive and negative attitudes, experiences and expectations regarding decision support. Part 2 of the interview asked three questions about each of four example clinical rules: “Would you want regular feedback or decision support based on this rule?,” “Why or why not?” and “What factors do you think about when considering your decision?” In part 3 of the interview, the interviewee was asked to fill in a draft survey. The draft survey used the same four clinical rules and posited reasons for wanting or not wanting support derived from the literature [31, 66, 71] and input from an expert in medical psychology. Interviewees were asked to write down their answers and the
interviewer noted any verbal comments. The four rules used in the interviews were selected to be representative of rules relating to medication management [72]. We did not record the interviews, because our clinical advisors felt this would likely lead to social desirability bias. All interviews were conducted by one researcher (SM), with the first three interviews observed by a second researcher (SE). Results from the interviews were discussed in meetings with four medical informaticians (SM, SE, MA and AA) and used to identify new reasons not found in the literature, and eliminate reasons which interviewees said were not relevant. Comments reflecting general attitudes or experience were added to the “Attitudes and Experience” questionnaire [70].

Content validity of the resulting survey was assessed by conducting a second set of interviews. Doctors who had not participated in the previous interviews were asked to “think aloud” while filling in the survey, using the four example rules. At the end of each section, subjects were also asked specifically if they would like to add or change anything. Any changes suggested would then be incorporated into the survey for use in the next interview. The process would end after three consecutive interviews with no changes to the survey.

Deploying the survey

The survey was translated to the Dutch language and deployed as an anonymous, online survey among all GPs participating in the HAG-net-AMC. Participants were invited by an email from the secretary of the steering committee of the HAG-net-AMC on 6 July 2011, and reminded with two follow-up emails two and four weeks later. Responses were collected up to 3 months after the initial email. To preserve anonymity, we did not attempt to identify participants. To eliminate potential bias due to the order of presentation of the rules, the order was randomized for each participant.

Analysis

All statistical analyses were performed using R 3.0.1 [73]. The difference in medians was assessed with the exact Wilcoxon Mann-Whitney rank sum test [74], and difference in proportions with Pearson’s Chi-squared Test. Multivariate analysis was performed using logistic regression models. Adjusted odds ratios (aOR) are adjusted for all potential confounders, unless otherwise noted. Generalized estimating equations (GEE) with logistic regression were used to account for the effect of clustering by user, with results reported as the odds ratio (OR) [75]. The binomial test was used to determine if the choice of reasons for wanting or not wanting support differed significantly from chance. Free text comments were assessed separately by two researchers (SM and SE), and agreement assessed using Cohen’s $\kappa$ [76]. with disagreements resolved by a third researcher (AA).

Results

Survey Instrument

The resulting survey consisted of 6 questions for each clinical rule. The first three questions establish whether the respondent agrees in principle with the need to improve
performance: “This rule describes minimal care that every general practitioner should know,” “This rule should be followed for —% of patients”, and “This rule is followed for —% of patients,” where respondents can give an estimate in 10% intervals (0%, 10%, ... 90%, 100%) using a drop-down menu. The fourth question addresses concerns about alert design: the respondent is asked to choose between two or three types of support, with at least one less-interruptive option offered for each rule (e.g. the subject can choose a pop-up or an item added to a to-do list). Finally, the respondent was asked to decide if they would turn support for this rule “on or off,” and choose from a list of reasons why they made this decision. Space was also provided to fill in comments or additional reasons. The complete instrument is provided as Appendix 1.

Results from survey of GPs

In total, 43 general practitioners were invited to complete the survey, of which 28 completed all questions for at least one clinical rule (65%), and 20 completed the survey (47%). Those who completed the survey filled in a response for 96% of the clinical rules presented to them. The demographics of respondents are representative of the study population: 60% female with a median age category of 50-60 years. Subjects who completed the survey tended to be older than those who finished only part of the survey (median age categories 50-60 years vs. 40-50 years, 95% confidence interval (CI) = -20 – 0, p = 0.02).

Choice of clinical rules to support

More than 50% of respondents indicated that they wanted support “on” for 17/20 rules. Responses per rule ranged from 28% to 88% in favor of support. Responses were not significantly different between those who did and did not complete the survey (64% positive for those who completed the survey, versus 76% for those who did not (aOR = 0.90, CI = 0.67–1.20, p = 0.47)). The proportion of rules selected to be supported was not significantly associated with responses to the Attitudes and Experiences questionnaire [70] (aOR=1.02, CI = 0.99–1.05, p = 0.18).

Type of support

For each clinical rule, at least two different types of support were suggested, including at least one option for a more interruptive form of support (e.g. a pop-up) and one for a less interruptive form of support (e.g. adding the item to a task list). More than one answer was allowed, and respondents were allowed to choose a type of support whether or not they wanted support for the rule. More interruptive forms of support were chosen significantly more often than less interruptive forms of support (in 54% of rules, only an interruptive form of support was selected, 35% had only a noninterruptive form selected; in 12% both were selected; $\chi^2 = 23$, $p < 0.0001$). However, this varied significantly between rules ($\chi^2 = 43$, $p = 0.001$), ranging from 75% interruptive and 10% noninterruptive (15% both) to 7% interruptive and 80% noninterruptive (13% both). Noninterruptive options were preferred for four rules. A type of support was chosen in 95% of responses where support was wanted and 58% of responses where support was declined. A noninterruptive option was selected in 51% of answers when support was wanted and
40% when support was not wanted, though this difference was not significant (OR = 0.638, CI = 0.35–1.16, p = 0.14, clustered by user).

**Establishing the need to improve performance**

For the question “This rule describes minimal care that every general practitioner should know,” respondents agreed in 90% of all responses, with the percentage of respondents agreeing per rule varying from 66% to 100%. For the question of how often the rule should be followed, respondents chose the “100%” category in 61% of responses, with the median per rule varying from 80% to 100% (range 0% to 100%). For the question of how much the rule is followed in practice, respondents chose the 100% category in 13% of responses, with the median per rule varying from 40% to 90% (range 0% to 100%). The median difference between the responses to these two questions (indicating a gap between how often the rule is followed and how often it should be followed) was 20%, with the median per rule varying from 0% to 30% (range -70% to 80%). There was no gap for 25% of responses, and a negative gap for 1% of responses (n = 5).

Feeling that the rule constitutes minimal care was positively associated with wanting support (OR=2.68, CI = 1.78–4.04, p < 0.0001, clustered by user), as was feeling that the rule should be followed (OR=10.3, CI = 3.53–29.9, p < 0.0001, clustered by user). Feeling that the rule is already followed (perceived current compliance) had a nonlinear relationship with choosing the rule for support (Figure 3.1). There was no significant linear relationship (aOR = 0.95, CI = 0.41–2.18, p = 0.91). The difference between how often the rule is followed and how often it should be followed was also very strongly associated with wanting support (OR=28.8, CI = 3.46–239.0, p = 0.002, clustered by user). None of these factors were associated with the selection of interruptive versus non-interruptive support (see Appendix 2 for quantitative results).

**Reasons for wanting support**

Of the rules where respondents indicated that they wanted support, respondents gave a median of 2 reasons, and 93% of responses included at least one reason (Figure 3.2). Responses that were chosen significantly more often were: a sense of responsibility, concern about forgetting to perform the action, and belief that failure to perform the action will harm the patient (Table 3.1). Selection of all responses differed significantly from chance (p < 0.01).

**Reasons for declining support**

Of the rules where respondents indicated that they did not want support, respondents gave a median of 2 reasons, and 95% of responses included at least one reason. Responses that were chosen significantly more often were: feeling that they would know when the action is needed, not forget to perform the action, concerns about interruption, and feeling that support could be useful for others rather than themselves (Table 3.2). Selection of all responses differed significantly from chance (p < 0.01).
Figure 3.1: Histogram of responses to the question, “This rule is followed in practice in —% of cases” for rules where support was wanted (left, \(n = 229\)) and declined (right, \(n = 140\)). The x-axis represents the response categories (0%, 10%, 20%,..., 100%) and the y-axis represents the percentage of responses in that category. Respondents tended to want support for rules when they estimated current compliance to be in the high-middle range, and decline support when they estimated current compliance to be low or very high.

Figure 3.2: Frequency of selection of reasons for wanting or declining support. Respondents could choose any number of reasons, no reasons, or fill in a free text field (“other”). Percentages are the percentage of responses which included this item. The full text of the reasons is given in Tables 3.1 and 3.2.
I am responsible for this action.
I might forget to perform this action.
Failure to perform this action can lead to harm for the patient.
- immediately
- after days
- after weeks
- after months
I often do not realize when a patient meets these conditions and needs this care.
This rule is relevant for performance indicators.
When this rule applies, rapid action is needed
free text comments

<table>
<thead>
<tr>
<th>answer</th>
<th>n (%, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I am responsible for this action.</td>
<td>176/238 (73%, CI 67% – 79%)</td>
</tr>
<tr>
<td>I might forget to perform this action.</td>
<td>143/238 (60%, CI 53% – 66%)</td>
</tr>
<tr>
<td>Failure to perform this action can lead to harm for the patient.</td>
<td>97/238 (41%, CI 34% – 47%)</td>
</tr>
<tr>
<td>immediately</td>
<td>17/238 (7%)</td>
</tr>
<tr>
<td>after days</td>
<td>28/238 (12%)</td>
</tr>
<tr>
<td>after weeks</td>
<td>45/238 (19%)</td>
</tr>
<tr>
<td>after months</td>
<td>31/238 (13%)</td>
</tr>
<tr>
<td>I often do not realize when a patient meets these conditions and needs this care.</td>
<td>82/238 (34%, CI 28% – 40%)</td>
</tr>
<tr>
<td>This rule is relevant for performance indicators.</td>
<td>33/238 (14%, CI 10% – 19%)</td>
</tr>
<tr>
<td>When this rule applies, rapid action is needed</td>
<td>25/238 (11%, CI 7% – 15%)</td>
</tr>
<tr>
<td>free text comments</td>
<td>19/238 (9%)</td>
</tr>
</tbody>
</table>

Table 3.1: Reasons for wanting support. n = total number of times this response was chosen; the percentage is the percentage of times this answer was chosen out of the times it was displayed, regardless of whether any reasons were given.

<table>
<thead>
<tr>
<th>answer</th>
<th>n (%, 95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I can easily recognize when this treatment is needed.</td>
<td>83/121 (60%, CI 50% - 67%)</td>
</tr>
<tr>
<td>I will not forget to perform this action.</td>
<td>44/121 (31%, CI 24% - 40%)</td>
</tr>
<tr>
<td>Decision support will interrupt my way of working.</td>
<td>43/121 (30%, CI 23% - 39%)</td>
</tr>
<tr>
<td>I don’t want support, but it could be useful for others.</td>
<td>40/121 (28%, CI 21% - 37%)</td>
</tr>
<tr>
<td>Failure to follow this rule will not result in unacceptable harm to the patient.</td>
<td>23/121 (16%, CI 11% - 24%)</td>
</tr>
<tr>
<td>No rapid action is needed (I can do it later)</td>
<td>15/121 (11%, CI 6% - 16%)</td>
</tr>
<tr>
<td>Decision support is frequently wrong.</td>
<td>10/121 (7%, CI 3% - 13%)</td>
</tr>
<tr>
<td>I am not responsible for this action.</td>
<td>6/121 (4%, CI 2% - 9%)</td>
</tr>
<tr>
<td>There are no performance indicators relevant to this rule.</td>
<td>0/121 (0%, CI 0% - 3%)</td>
</tr>
<tr>
<td>free text comments</td>
<td>22/121</td>
</tr>
</tbody>
</table>

Table 3.2: Reasons for declining support. n = total number of times this response was chosen; the percentage is the percentage of times this answer was chosen out of the times it was displayed, regardless of whether any reasons were given.

The two reviewers disagreed only as to whether three free-text comments constituted a new reason (Cohen’s $\kappa = 0.29$), which were then reviewed by the third reviewer. One comment about wanting support was interpreted as containing a new reason, namely, “I will answer yes if it is accepted policy of the NHG.” The NHG (College of General Practitioners) produces the national guidelines for general practice, thus this reason can be generalized as: “It supports our accepted guidelines.” None of the comments about declining support were interpreted as new reasons.
Discussion

A survey was developed to assess clinicians’ intention to accept decision support for 20 specific clinical rules, and their reasons for wanting or declining support, in a group of 43 general practitioners. The survey instrument consists of six questions covering whether the respondent agrees in principle with the need to improve performance on this clinical rule, alert design choices, and whether the respondent would personally want support for the rule and their reasons for that choice. Responses were received from 65%, and 47% completed the survey. Despite concerns about “too many alerts” and expressing concerns about interruption, the doctors preferred interruptive support (e.g. pop-ups) in 54% of responses, compared to 35% for less interruptive options. Feeling that the rule represents minimal care was associated with wanting support, as was feeling that the rule should be followed in a higher percentage of cases, and a larger perceived gap between how often the rule is followed and how often it should be followed in practice. The most common reasons given for wanting support were a sense of responsibility, concern about forgetting to perform the action, and belief that failure to perform the action will harm the patient. One additional reason was suggested in the comments, namely, that the support is in accordance with accepted guidelines. The most common reasons for declining support were feeling that they would know when action is needed, not forget to perform the action, concerns about interruption, and feeling that support could be useful for others rather than themselves.

To our knowledge, this study represents the first structured, prospective investigation of clinicians’ intention to accept decision support for specific clinical rules, and the reasons for those choices. An important strength of this study is the introduction of the survey instrument. We used both literature resources and interviews in the development of this survey to ensure content validity. Medical informatics experts were interviewed to contribute their broader experience with decision support implementations. The primary limitation is the small sample of doctors surveyed. However, we chose to limit the survey to doctors in the practices where a decision support intervention is planned, because the impending implementation makes the survey highly relevant for this population. This may have also contributed to our high response rate. It is possible that responses were affected by social desirability bias, although we tried to minimize this by ensuring the anonymity of all participants. However, this meant that we were unable to detect whether the eight doctors who participated in the focus group also filled in the online survey. Given that doctors probably filled in the online survey or participated in the focus group, and not both, it is likely that our response rate is even higher (80% rather than 65%). Social desirability bias was also mitigated by framing the question as a personal decision (“Would you turn support on or off?”) rather than something that affects the whole practice (e.g. “Should decision support be implemented for this rule?”). We chose to frame it as a yes/no question rather than asking participants to rank or rate the rules by importance because of the cognitive difficulty inherent in ranking many items. Finally, there is a possibility of participation bias, although the survey also gave a platform to those who might be opposed to the new decision support system, thus...
these doctors also had reason to participate.

Prior work in this field includes a qualitative investigation of expectations, barriers, and facilitators to implementing computerized decision support [66]. This study found that previous poor experiences with decision support, and concerns about harm to the doctor-patient relationship, obscured responsibilities, threats to autonomy, and potential extra workload were barriers to implementation. Controlling the frequency and content of alerts and the expectation that the support would help in practice were important facilitators. Several studies have retrospectively evaluated the reasons for alert override and acceptance [57, 78, 79]. A Delphi study of experts in computerized order entry found that clinical severity, clinical status, probability of occurrence, patient risk factors, strength of evidence, demographic data, class of drug, specialty of practitioner, type of alert, current task of user, and repetition of alert were the most important factors influencing acceptance [78]. Zheng et al. identified six constructs affecting acceptance: performance expectancy (whether the alerts are expected to help), ease of use, effort expectancy (to perform the recommended action), social influence, facilitating conditions, and perceived use of the alerts [79]. Seidling et al. conducted a retrospective analysis of drug-drug interaction alerts, and found that only interruptive alerts requiring a response were acknowledged. Within those alerts, knowledge quality, display characteristics, text, setting, patient age, dosing alerts, alert frequency, and severity level all impacted acceptance [57]. A common theme among these works and our study is that clinicians conceptually accept support if they perceive or anticipate that the alerts help them to provide better care.

There seemed to be a nonlinear relationship between wanting support and responses to the question, “This rule is followed for —% of patients.” Support was wanted for rules with a perceived current compliance in the high-middle range, and support was not wanted for rules with either a low or very high perceived current compliance. It may be that low perceived compliance implies that the doctor does not agree with the rule, and high perceived compliance implies that the doctor believes he can comply with the rule without needing support.

Selection of the reason “This rule is (not) relevant for performance indicators” was markedly lower than the other reasons, even though several interviewees suggested it as an important reason. This may be because at the time of our interviews (2009) a new national set of performance indicators were in the news, but were no longer a focus of attention by the time of our survey (2011). We considered “It supports our accepted guidelines,” given in the free text comments, to be a separate reason for wanting support. For our respondents “performance indicators” are publicly visible quality measures, where guidelines are standards used internally. Other reasons for wanting or not wanting support have some overlap with each other. For example, “I often do not realize when a patient meets these conditions and needs this care” is related to “I might forget to perform this action.” We considered them to be separate, because the first implies a need to facilitate case finding and the latter implies a need to facilitate the action. One of the more common reasons for declining support was, “Decision support could be useful for
others.” Although it is not by itself a reason to reject support, our interview subjects used it in two main contexts: “I always remember to do this, but I know that other doctors often forget, so I would turn it off for myself but I want it on for the practice,” or, “The nurse [or someone else] usually takes care of this.” Thus, there is some overlap with “I am not responsible for this action,” but in many cases the GP is ultimately responsible for the action, even though he is not the one who usually performs it. Further research is needed to determine an optimal set of questions with utility for determining when decision support is likely to work, and particularly whether questions such as these can help determine what kind of decision support will be most effective.

Although we encouraged our participants to “think outside the pop-up box” by describing both an interruptive alert and an alternative, most participants chose more interruptive alerts. The type of support chosen did not appear to be correlated with wanting support or any of the other factors measured in our survey. However, there could be other unmeasured attributes of our rules influencing this choice. Alternatively, this choice may be due to awareness of a higher response rate for alerts which require immediate attention [54, 57], or thinking about the alert in isolation rather than as part of a system with many pop-up alerts already present, or simply greater familiarity with this form of support. We know that too many alerts will lead to alert fatigue, but it is not currently known how many is “too many,” and what circumstances might mitigate this effect. The results of this survey suggest that simply having clinicians select the type of support from a multiple choice list will not by itself solve the issues of alert overload and alert fatigue: we must design alerts with an understanding of the clinical workflow, the needs of daily practice, and the capabilities of computers, and offer solutions that integrate with the care process [80]. Further research is needed in determining which rules justify interruptive forms of support, and for the others, what kind of support can be offered that is both less interruptive and still effective.

Acknowledgments

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Conflicts of Interest

The authors have no competing interests to declare.
Appendix 1: Survey instrument

Login page

introduction

part 1/3

Personal information:
age: (dropdown) <30, 30-40, 40-50, 50-60, >60
gender: (dropdown) male / female /other
Postcode of practice ___ (integer field)
Number of years experience as general practitioner: (dropdown) 0-5, 5-10, 10-15, 15-20, 25-30, >30
Employment status: (dropdown) self-employed / contract / group practice
Number of days worked per week (in 2010): (dropdown) 0, 1, 2, 3, 4, 5, 6
Number of patients in whole practice: (dropdown) <1000, <2000, <3000, <4000, <5000, <6000, <7000, <8000, <9000, <10000, >10000
Number of patients for which I am responsible: (dropdown) <100, <250, <500, <1000, <1500, <2000, <2500, <3000, <3500, <4000, >4000
Estimated percentage of patients over 65 years of age: (dropdown) <5%, 5-10%, 10-20%, 20-30%, 30-40%, 40-50%, >50%

part 2/3

Attitudes and Experiences Survey [A]

generic example
rule in the form of: IF condition THEN action

This rule should be followed for: [B] 
(dropdown) 100% (all), 90, 80, 70, 60, 50, 40, 30, 20, 10, 0% (none)
of my older patients that [condition]
of the cases in my practice
mouseover text: “patients that I am responsible for”

When this rule should be followed, I think it is actually followed in
(dropdown) n/a, 100% (all), 90, 80, 70, 60, 50, 40, 30, 20, 10, 0% (none)

This rule constitutes minimal care for elderly patients that every general practitioner should know. □ no □ yes [B]
What sort of support would you prefer: [C]

☐ example of an active system (e.g. a pop-up)
☐ example of a less interruptive system (e.g. a to-do list)

Please consider each rule by itself, as if it were the only rule being supported. Changes in the [specific changes to the details of the rule, e.g. the precise dose recommended or the specific blood tests recommended for medication monitoring] are allowed, but assume that the computer will not recognize any other changes or exceptions.

On my computer, I would turn support:

**ON**  **OFF**

[appears when ON is checked]**ON - because:**

Please check all that apply:

☐ I often don't recognize that the conditions apply to the patient:
   ☐ condition 1
   ☐ condition 2

☐ When the conditions apply, it is easy to forget to perform the action:
   ☐ action 1
   ☐ action 2

☐ Not following the rule (when it applies) can lead to serious harm to the patient: [D]
   ☐ immediately
   ☐ after days
   ☐ after weeks
   ☐ after months

☐ When the conditions apply, the action should be performed quickly [D]

☐ This rule is relevant for performance indicators [interviews]
   ☐ which I find important
   ☐ which I am obligated to follow

☐ I am responsible for performing this action:
   ☐ action 1
   ☐ action 2

☐ Other reason: ______ [free text field]

[appears when OFF is checked]**OFF - because:**

Please check all that apply:

☐ I do not want support, but it could be useful for:[interviews]
   ☐ full time doctors in my practice
☐ part time doctors in my practice
☐ new doctors in our practice
☐ supervisors
☐ junior/student doctors
☐ nurses

☐ I will easily recognize when the conditions apply to the patient:
  ☐ condition 1
  ☐ condition 2

☐ When the conditions apply, I won't forget to perform the action:
  ☐ action 1
  ☐ action 2

☐ Decision support would interrupt my manner of working [Varonen, Sim]
☐ Decision support would be wrong too often
☐ Not following this rule would not lead to any serious harm for the patient [D]
☐ The action does not need to be performed right away (it can be done later) [D]
☐ There are no performance indicators relevant to this rule [interviews]
☐ I am not responsible for performing this action:
  ☐ action 1
  ☐ action 2

☐ Other reason: _____ [free text field]

---

**specific example**

*IF a (vulnerable) elder is prescribed an NSAID, THEN the GP record should indicate whether or not s/he has a history of 1) gastrointestinal bleeding or ulcers and 2) renal insufficiency or 3) heart failure AND, if a history is present, the general practitioner should document justification of NSAID use.*

This rule should be followed for: (dropdown) 100% (all), 90, 80, 70, 60, 50, 40, 30, 20, 10, 0% (none) of my older patients that start therapy with an NSAID

When this rule should be followed, I think it is actually followed in: (dropdown) n/a, 100% (all), 90, 80, 70, 60, 50, 40, 30, 20, 10, 0% (none) of the cases in my practice

This rule constitutes minimal care for elderly patients that every general practitioner should know. ☐ no ☐ yes
What sort of support would you prefer:

- a pop-up by every new NSAID prescription
- a checklist to assist in documenting these items

Please consider each rule by itself, as if it were the only rule being supported. Changes in the specific things which should be documented are allowed, assume that the computer will not recognize any other changes or exceptions.

On my computer, I would turn support:

**ON OFF**

[appears when ON is checked] **ON – because:**

Please check all that apply:

- I often don’t recognize that the conditions (new NSAID prescription) apply to the patient
- When the conditions apply, it is easy to forget to perform the action:
  - reviewing the risk factors
  - recording the risk factors
  - recording justification
- Not following the rule (when it applies) can lead to serious harm to the patient:
  - immediately
  - after days
  - after weeks
  - after months
- When the conditions apply, the action should be performed quickly
- This rule is relevant for performance indicators:
  - which I find important
  - which I am obligated to follow
- I am responsible for performing this action:
  - reviewing the risk factors
  - recording the risk factors
  - recording justification
- Other reason: [free text field]

[appears when OFF is checked] **OFF – because:**

Please check all that apply:

- I do not want support, but it could be useful for:
  - full-time doctors in my practice
part time doctors in my practice
new doctors in our practice
supervisors
junior/student doctors
nurses

I will easily recognize when the conditions (new NSAID prescription) apply to the patient
When the conditions apply, I won’t forget to perform the action:
- reviewing the risk factors
- recording the risk factors
- recording justification

Decision support would interrupt my manner of working
Decision support would be wrong too often
Not following this rule would not lead to any serious harm for the patient
The action does not need to be performed right away (it can be done later)
There are no performance indicators relevant to this rule
I am not responsible for performing this action:
- reviewing the risk factors
- recording the risk factors
- recording justification

Other reason: [free text field]

Sources:


Other clinical rules used in this survey.
ALL (vulnerable) elders in stable health states should take 800 IU (or equivalent) of vitamin D supplementation daily.

IF a diabetic (vulnerable) elder has a persistent (on 2 consecutive visits) elevation of systolic BP >140 mm Hg, THEN the general practitioner should initiate an intervention (pharmacologic, lifestyle, compliance, etc.) or there should be documentation of a reversible cause/other justification for the elevation or a reason why an intervention was not done.

IF a (vulnerable) elder is started on an antipsychotic drug, THEN the general practitioner should document a first assessment of response within 1 week.

IF a (vulnerable) elder with metastatic cancer or oxygen dependent pulmonary disease has dyspnea refractory to non-opiate medications, THEN opiate medications should be offered.

IF a (vulnerable) elder is treated with daily NSAIDs (selective or nonselective) AND the (vulnerable) elder has risk factors for developing renal insufficiency, THEN serum creatinine should be assessed at baseline and at least once in the first year following the initiation of therapy.

IF a (vulnerable) elder has a diagnosis of depression for the first time and responds to the chosen therapy, THEN he or she should be continued on the same treatment for at least 6 months during which the general practitioner provides adequate monitoring.

IF a (vulnerable) elder is treated with a NSAID, THEN s/he should be treated concomitantly with either misoprostol or a proton pump inhibitor.

IF a (vulnerable) elder is prescribed chronic high-dose acetaminophen (≥ 3 grams/day) OR a (vulnerable) elder with liver disease is prescribed chronic acetaminophen THEN s/he should be advised on the risk of liver toxicity

IF a (vulnerable) elder tests positive for dementia, THEN the general practitioner should review the patient’s medications (including over-the-counter) for any that may be associated with mental status changes.

IF a (vulnerable) elder reports a history of ≥2 falls (or 1 fall for which the elder visits the general practitioner) in the past year and is taking a benzodiazepine, THEN the general practitioner should document a discussion of related risks and assistance offered to reduce/discontinue benzodiazepine use.

IF the general practitioner prescribes a (vulnerable) elder a new chronic disease medication, and s/he has a follow-up visit with this physician, THEN one of the following should be noted at the follow-up visit:

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1 Non-interruptive support preferred for this rule
• Medication is being taken;
• Patient was asked about the medication (e.g., side effects, adherence, availability);
• Medication was not started because it was not needed or it was changed.

13 IF a (vulnerable) elder is prescribed an ongoing medication for a chronic medical condition, THEN there should be a documentation of response to therapy.

14 IF a (vulnerable) elder reports a history of 2 falls (or 1 fall for which the elder visits the general practitioner) in the past year, THEN the general practitioner should document a basic fall history (including type and circumstances of the falls, and possible contributing factors like medication, chronic conditions, alcohol intake) within 3 months of the reported history (or within 4 weeks, if the most recent fall occurred in the past 4 weeks).

15 IF a (vulnerable) elder is prescribed a loop diuretic, THEN s/he should have electrolytes checked within 2 weeks after initiation and at least yearly thereafter.

16 ALL (vulnerable) elders should not be prescribed any medication with strong anticholinergic effects if alternatives are available.

17 IF a (vulnerable) elder is prescribed an ACE inhibitor, THEN s/he should have serum creatinine and potassium monitored within 2 weeks after initiation of therapy and at least yearly thereafter.

18 IF a (vulnerable) elder is prescribed a drug, THEN the (vulnerable) elder (or a caregiver) should receive appropriate education about its use.

19* IF a (vulnerable) elder is taking a benzodiazepine (>2 weeks), THEN the general practitioner should stop or taper this treatment, unless documented discussion with the patient provides counterarguments.

20* IF a (vulnerable) elder is prescribed low-dose (325 mg/day) aspirin, THEN the general practitioner should consider the associated gastrointestinal bleeding risks and advise the (vulnerable) elder accordingly.

Display again the **Attitudes and Experience Survey** with their previous answers:

Would you like to change any of your answers?

Record both the original answers and any changes.
Appendix 2: Additional analyses

OR = Odds Ratio, CI = Confidence Interval
Multivariate analysis was performed using logistic regression models. Adjusted odds ratios (aOR) are adjusted for all potential confounders, unless otherwise noted. Generalized estimating equations (GEE, package geepack) with logistic regression were used to account for the effect of clustering by user (results noted as “clustered by user”).

Association between selection of type of support (SI = selected an interruptive form of support, SN = selected a noninterruptive form of support) and indicating that the rule represents minimal care:
SI - minimal:
  OR = 1.37, CI = 0.608–3.09, p = 0.45
clustered by user:
  OR = 1.58, CI = 0.838–2.98, p = 0.16
SN - minimal:
  OR = 0.974, CI = 0.433–2.19, p = 0.95
clustered by user:
  OR = 0.785, CI = 0.41–1.5, p = 0.46

Association between selection of type of support and indicating that the rule is currently followed:
SI - isFollowed:
  OR = 0.993, CI = 0.791–1.25, p = 0.95
clustered by user:
  OR = 0.991, CI = 0.753–1.3, p = 0.95
SN - isFollowed:
  OR = 0.896, CI = 0.338–2.38, p = 0.82
clustered by user:
  OR = 1, CI = 0.756–1.32, p = 0.97211

Association between selection of type of support and indicating that the rule should be followed:
SI - shouldFollow:
  OR = 0.978, CI = 0.747–1.28, p = 0.87
clustered by user:
  OR = 1.06, CI = 0.872–1.28, p = 0.58
SN - shouldFollow:
  OR = 1.06, CI = 0.807–1.40, p = 0.6581
clustered by user:
  OR = 0.999, CI = 0.822–1.21, p = 0.99311

Association between selection of type of support and the difference between the amount the rule is (perceived to be) followed and the amount that it should be followed:
SI - difference:
  OR = 0.972, CI = 0.747–1.26, p = 0.83
clustered by user:
  OR = 1.03, CI = 0.754–1.41, p = 0.85
SN - difference:
  OR = 1.12, CI = 0.858–1.47, p = 0.4
clustered by user:
  OR = 1.03, CI = 0.767–1.38, p = 0.84