Author's response to reviews

Title: On the alert: future priorities for alerts in clinical decision support for computerized physician order entry identified from a European workshop

Authors:

Jamie J Coleman (jj.coleman@bham.ac.uk)
Heleen van der Sijs (i.vandersijs@erasmusmc.nl)
Walter E Haefeli (Walter.Emil.Haefeli@med.uni-heidelberg.de)
Sarah P Slight (Sarah.P.Slight@nottingham.ac.uk)
Sarah E McDowell (sarah.mcdowell@uhb.nhs.uk)
Hanna M Seidling (Hanna.Seidling@med.uni-heidelberg.de)
Birgit Eiermann (Birgit.Eiermann@ki.se)
Jos Aarts (aarts@bmg.eur.nl)
Elske Ammenwerth (Elske.Ammenwerth@umit.at)
Ann Slee (ann_slee@o2.co.uk)
Robin E Ferner (r.e.ferner@bham.ac.uk)

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Author's response to reviews: see over
Dear Dr Aldcroft

Thank you for the opportunity to revise and resubmit our manuscript. Both reviewers agree that the topic is very important and should be of high interest to the readers of BMC MI&DM.

We have, as a team, carefully considered this feedback and have revised our manuscript in the light of all the comments received. Below we provide a detailed response to each of the comments.

Reviewer 1

Overall: This is a very important topic and readers would be interested in hearing the opinions of experts from Europe. Overall this paper needs revision to improve clarity. Many of the statements need citations or should be clearly stated as opinion. Since much of this paper appears to be opinion, without strong actionable recommendations, it should be condensed. For example, the entire section on research methods to evaluate alerts provided little added value to the manuscript.

We are grateful to the reviewer for recognizing the importance of this topic. We’re sorry that Dr Hines found parts of the paper unclear, and have tried to clarify it. We contrast her view with that of Reviewer 2.

Major Compulsory Revisions

1. Please clarify, is the focus of paper on medication-related CDS (including alerts) or just alerts?

The workshop concentrated on alerts in CDS, and we have modified the title to make this explicit. Clearly, the alerts are the way in which active CDS is communicated to the user of prescribing systems. To this extent, the two are inseparable and the dichotomy suggested by the reviewer does not exist.

2a. The transition between the priorities and research methods to evaluate alerts is confusing. Is the section on research methods to evaluate alerts necessary?

We discussed research methods as part of the workshop. The design of studies to investigate the priorities is predicated on these methods, and thus we feel it helpful to include this section. We leave to the editor the decision whether this section is retained.
2a1. Many of the statements need citations or should be clearly stated as opinion.

We agree that if Dr Hines found this confusing, that other readers would do as well. Therefore we have amended the manuscript to indicate statements of opinion where workshop members reached consensus.

2b. Page 5 Alert specificity and sensitivity: Do you have a reference for your definition of specificity? This definition is awkward – perhaps clarification would be helpful. For example, the term “events” caught my eye. Please clarify.

We have clarified our description of specificity and incorporated this in our manuscript: “The specificity of the CDS system is a measure of its ability to distinguish between events that put an individual at risk of harm and non-events that will not: the more false positives, the lower the specificity.” (Altman DG, Bland JM. Diagnostic tests. 1: Sensitivity and specificity. BMJ 1994;11;308(6943):1552.)

3. Page 6 Knowledge of alert fatigue in CDS systems: In the first paragraph on this page you imply that overridden alerts results in alert fatigue. Please clarify.

We are grateful to the reviewer for identifying this. We have clarified the paragraph as: “In most, if not all, systems a large proportion of alerts generated by CDS is overridden (i.e. clinician chooses to proceed without adjusting or cancelling the prescription). This may be a symptom of ‘alert fatigue’,...”

4. Page 8 Priority #1 This whole paragraph/topic of sensitivity and specificity would benefit from clarification. Here it is stated that a research priority is to determine the ideal (do you mean realistic?) sensitivity and specificity, and then the ideal sensitivity and specificity are stated to be 100%. If ideal is 100%, then why should research be conducted to determine the obvious? Perhaps the research priority should be to determine how to improve sensitivity and specificity (and what is the impact of this improvement?) Or whether improving these factors improve alert fatigue?

We are grateful for the reviewer’s comments above and have re-written this section in our manuscript in light of them.

Minor Essential Revisions

5. Page 8 Priority #1 The sentence that starts, “However, this must be undertaken....” To what is “this” referring?

We have deleted this sentence to avoid any misunderstanding.

6. Page 8 Priority #1 Do you have an answer (or hypothesis) for the question you pose, “should we instead be looking for better specificity?”

We don’t have an answer: this is an important research question.

7. Page 8 Priority #1 Are you referring to drug interactions when you state “‘evidence-based information about drugs and their interactions’? So are you referring to a drug interaction knowledge base or a general drug knowledge base intended for medication-related CDS (allergies, disease interactions, dosing).
We have clarified this by writing: “It is important that the system is able to draw in additional information from beyond the knowledge base – by which we mean the collection of evidence-based information about drugs and their interactions”.

8. Page 9 top of the page: The first sentence is confusing regarding research showing that systems can be both sensitive and specific, or lack both qualities. Do you have a reference? The examples following this statement do not clearly relate.

We have added a reference to this statement.

9. Page 9 Priority #2 Do you have a reference for the statement saying that CDS alerts are often boring, difficult to see and understand, and thus frustrating to users?

We now indicate that this statement was the consensus reached by members of the workshop.

10. Page 10 Top of page: Do you have a reference for the statement about users having negative feelings.

We now indicate that this statement was the consensus reached by members of the workshop.

11. Page 10 Priority #3: Do you have evidence to support the statement that alerts should be displayed as early as possible in the prescribing process or no more than one alert for any prescription?

We now indicate that this statement was the consensus reached by members of the workshop.

12. Page 10 Priority 3. Can you clarify what you mean by a hierarchy of agreed alerts? Would lower levels not be displayed?

We have now clarified what we mean by a hierarchy of agreed alerts: “We discussed a hierarchy of agreed alerts, that is, a grading such as prescribing absolutely contraindicated, prescribe but only if certain conditions are met, and prescribe where benefit outweighs harm. Such a hierarchy would mitigate this conflict, since an alert at the highest level that interrupted the process could be displayed as soon as it was first encountered.”

13. Page 11 Table 2: How are synthetic quality measures different from other quality measures? i.e., What is a synthetic quality measure?

We have omitted the word synthetic to avoid any confusion.

14. Page 11: The correct balance (of what?) needs to be established?

We have moved this sentence to its correct position in the paragraph.

Discretionary Revisions

15. Page 8 Priority #1 I suggest that not all knowledge bases are “evidence-based,” at least in the strictest sense of term.

We understand the reviewer’s point that not all knowledge bases are evidence-based.
16. Page 11: Can you clarify what you mean by the need by consistent definitions of error and harm? Are you referring to medication errors? Some definitions have been proposed in the literature. Perhaps there is a need for adoption and consistent use of these safety-related terms? Perhaps you could propose some definitions? Or maybe just delete this statement.

We make reference to a paper where these definitions and the challenges associated with definitions are well discussed. We also have added a reference to a paper (Lisby et al 2010) that discusses the challenges of the comparability of studies due to the different definitions of medication error.

Reviewer 2

General comments

In this manuscript Coleman and other workshop participants provide a summary of a recent European workshop on computerized decision support (CDS). They particularly emphasize challenges related to finding the right balance between sensitivity and specificity that CDS-generated alerts must find in order to improve patient safety in clinical settings. Because the manuscript summarizes the discussions of a workshop, a reviewer can obviously not really suggest changes to the content of the manuscript. However, one can certainly state that the topic should be of high interest to the readership of BMC MI&DM and beyond, that the manuscript is overall well structured and well written, and that the discussions and results of this workshop presented here provide an up to date overview and (European) perspective of critical issues and challenges related to CDS. The manuscript therefore fulfills its primary mission, namely to provide a state of the art overview and guidance for future research and development related to CDS. Most specific thoughts and conclusions of the workshop can more or less also be found elsewhere in the (cited) literature, and it does not appear that a revolutionary new insight or future CDS concept emerged from the workshop. However, this cannot necessarily be expected and it also does not compromise the value of this comprehensive, clearly structured, well-balanced and clarifying overview on CDS for researchers in the field as well as any other interested reader.

With regard to Dr Russman’s comments, we are grateful for the positive comments on the comprehensiveness, clear structure, and balance of the review.

Major comments

1. The manuscript should state the date of the workshop

We have added the date of the workshop to the methods.

Minor comments

1. Page 8/9, section: it appears counter-intuitive that a sensitivity below 70% (or any other threshold value) of a CDS may result in a worse human performance compared to no use of a CDS. Furthermore, if sensitivities below 100% are referred to as risky, should one then also compare these to existing risks in today’s clinical practice where no CDS is used or oversensitive CDS can result in essentially complete alert fatigue? Maybe the authors can add some additional thoughts on those challenges.
We agree with the reviewer and have altered the last 3 sentences as follows: “This apparently counter-intuitive finding that poor CDS is worse than no CDS emphasizes the dangers of over-alerting.”

2. There is little information on studies that systematically evaluate(d) specific CDS, maybe due to limited time at the workshop. Nevertheless, I wondered whether this was also discussed at the workshop and, if so, could be briefly mentioned here.

We are not aware of work for medication CDS that specifically examines the specificity and sensitivity of alerts. There is a very general review of the benefits of CDS (Shojania KG, Jennings A, Mayhew A, Ramsay CR, Eccles MP, Grimshaw J. The effects of on-screen, point of care computer reminders on processes and outcomes of care. Cochrane Database of Systematic Reviews 2009, Issue 3.) We would of course add this reference if the editor felt it was appropriate.

3. The value of an alert may be limited for a clinician if there is no specific patient management implication / recommendation. Did the participants have any specific thoughts on this issue that could be presented here?

We agree with the reviewer. Alerts with no implications for management are unhelpful. We have added a section to the paper with this comment: “Alerts are only valuable in if they may change the patient’s clinical management. Those that are irrelevant to clinical management add to the alert burden without any clinical benefit. Studies to identify and refine management decision support will be important.”

4. Page 14, discussion: why should an alert hierarchy aim to generate one clinically relevant alert per prescription? Many prescriptions may have no relevant problem, whereas some may have more than one that would justify an alert.

We agree that many prescriptions may have no relevant problem. We have clarified this by saying that the alert hierarchy should be developed to generate at most one clinically relevant alert per prescription. The reviewer is correct in saying that some prescriptions may have many errors but the consensus was that the workflow should be interrupted at the first point at which an error occurs.

5. Are there any future workshops / follow-up meetings or further action planned by the organizers?

No further workshops have been planned but collaborative work has been initiated between the European collaborators.

Thank you again for the opportunity to revise and resubmit our paper.

Best wishes.

Yours sincerely,

Dr Jamie Coleman