Author’s response to reviews

Title: Representation and execution of clinical decision support using workflow engine technology (new title is: Implementation of workflow engine technology to deliver basic clinical decision support functionality)

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Author’s response to reviews: see over
October 9th, 2010

To the editor

Re: Manuscript: Ms. No.: JBI-08-233
Title: Representation and execution of clinical decision support using workflow engine technology
Corresponding Author: Dr. Vojtech Huser
Authors: J Starren, L. Rasmussen, R. Oberg

Dear Editor:

Thank you for reviewing our article and for providing the reviewers’ comments. We have revised our article using their suggestions. The changes made to our manuscript are listed below.

Reviewer 1

Major Compulsory Revisions
1. The authors focus much more on workflow than on decision support, particularly in the example use case the provide, in that the DSS components are considered in rather general terms, as a kind of plugin to the workflow architecture. This is not inappropriate of course, indeed it is conventional in the workflow community, but it is not what the title and discussion lead us to believe the paper is about.

Response:
We agree with the reviewer, and we changed the article to emphasize more the workflow engine technology implementation. The new title is: Implementation of workflow engine technology to deliver basic clinical decision support functionality.
In the discussion section of the article, we have also changed the initial paragraph and added a new section at the end of the discussion to better communicate the relationship we see between workflow engines and decision support engines.

2. To keep this title I believe that the authors should discuss in much more detail what they mean by decision support showing relevance of their approach to a range of different kinds of DSS (e.g. CPOE; Diagnosis; Prescribing; Treatment planning; Evidence based decision making) and explain how the proposed framework would support their deployment (e.g. how can it deal with semantic interoperability, cope with
clinical usability issues) or they should simply focus the discussion on dataflow and workflow.

Response:
We decided to change the title. The title now also includes the word basic. The reviewer has a valid point about complexity of the platform on the decision support. Equally challenging as generating the proper content is proper handling of the delivery of the content (proper clinician, proper EHR screen, multiple re-displaying if not reacted upon). We have added an additional clarification in the initial Methods section that our focus is mostly on generation rather then delivery. The revised text says:

Similarly to the event model, where HealthFlow EAs access EHR data, for final delivery of generated decision support content, it is important to provide similar interface via EAs to the host EHR system. Examples include the ability to modify or respond to action within EHR screens handling computerized order entry, problem list maintenance, results review, and treatment planning (referral and prescribing). In our work we focused mostly on generation of decision support content and non-standardized, basic delivery of this content at a single institution (e.g., daily batched delivery of generated content to a care coordinator role rather than scenarios with fully developed and sophisticated alert delivery and usability logic).

The main reason for this focus on mostly generation (rather then delivery) complexities is lack of any standards defining opportunities for decision support (a very useful SAGE format construct) within EHR systems and vendors’ resistance to such open EHR systems (vendor lock-in strategy, tight integration, ability to externalize decision support to third party systems). In terms of semantic interoperability, we stress at multiple places that an advantage of our platform is the fact that it is based on a cross-industry standard (semantic interoperability of the scenario itself). In terms of semantic interoperability of single steps (e.g., scenario trigger code), we have added additional clarification into the Ontology section.

3. The multiple complexity levels need to be justified more clearly - why are there three? and why does three actually become four later on in the paper. It might be better to be more explicit about the complexities considered in this work and then arbitrarily batch them up into levels for the purpose of the application.

Response:
We fully acknowledge this suggestion, and we have rewritten the appropriate section. We have changed the term for functionality covered by custom-programmed external applications to a better term (problem-specific external applications). We have also revised the section describing the usage levels and added additional historical and design specifications for them.

4. There is no discussion of uncertainty in process execution and clinical decision making – these are key are need to be commented on.

Response:
We agree with the criticism. In our current implementation, there is no built-in concept of uncertainty. We have added discussion of this and at the end of the new section ‘Comparison to other decision support formalisms’.
Finally, in contrast to numerous medicine-specific formats, the XPDL language and our HealthFlow workflow engine implementation does not include any built-in support for uncertainty. The existing implementation operates strictly on coded EHR concepts where all utilized facts are considered fully valid and only in cases where significant data unreliability is suspected by scenario authors, the scenario logic may include some additional information validation steps (e.g., minimum of two billing diagnostic codes). However, in some scenarios, we are considering inclusion of steps with natural language processing of free-text medical reports. Such scenarios would obviously have to deal with some uncertainty measure and the HealthFlow extensibility feature via new EAs or external engines would most likely be utilized where XPDL-based flowchart paradigm would be insufficient. However, some approach to uncertainty would also have to be adopted by the host EHR system and currently there is only limited support for this in our institution’s retrospective data or EHR system (e.g., uncertainty constructs within the problem list management or treatment planning).

5. Although the authors mention several approaches to providing decision support in the context of clinical guidelines (e.g. SAGE, GLIF, PROforma) they do not discuss them in any detail or give any references. They do not acknowledge that these approaches not only are focused on sophisticated decision support techniques (they are referred to vaguely as “knowledge representation standards) they do not comment on the fact that they all have considerable strengths in modeling workflow (e.g. see Mulyar et al in JAMIA). And these are not the only such approaches – a wider range can be reviewed at http://www.openclinical.org/gmmsummaries.html, for example.

Response:
The reviewer has a valid point. We have improved the references to clinical guidelines formalisms and added discussion which relates our approach to several guideline formats.

Despite existence of several, very sophisticated representation standards, none of them, however, reached a wide adoption and there is no great market of several possible execution engines for some group of “major” formats (with the exception Arden Syntax and ProForma) (see reference [2] of the article). The main point of our article is to demonstrate, that a limited decision support capability can be achieved with a cross-industry technology. A medicine-specific decision support formalism and engine will have, by definition (medicine-specific), several advantages compared with a generic workflow definition language and engine. Our report is not trying to establish superiority over existing guideline formats.

We have added a whole new section ‘Comparison to other decision support formalisms’ where we comment on some of relevant formats. (see the new section added: 23 lines of text with 14 new references)

A comprehensive review of guidelines formalism is a subject of many review papers and we provide reference to some of them (we consider the newest work by Peleg as the most current and relevant (in the book: Clinical Decision support: the road ahead). We think that a full and comprehensive comparison to all possible formats is out of scope of this software category paper. Direct download of an editor and engine for a given guideline
formalism is not available in many cases. It often requires a license and even close contact with the developer and in some cases, the website for some formats is not active any longer (e.g., glif.org).

On the point that several formalisms have considerable strengths in modeling workflow - we have added also additional statement of such fact and also a discussion relating to the fact that both workflow and decision support reasoning constructs are essential for full provision of decision support in medicine and a trend towards convergence of those two platforms (See also our response to a comment 1 of reviewer 2 and added section at the added discussion at the beginning of the section: ‘Future directions’).

Our first submission included a brief review of relevant implementation of workflow engine implementations in healthcare (see last paragraph of the original Background section) - since the paper’s scope is limited to describe a workflow engine implementation primarily (software article). However, we agree with the reviewer’s point and we have added the requested discussion.

Our initial submission did reference Mulyar’s team work in [old] reference #10 (Mulyar N at al.: Declarative and Procedural Approaches for Modelling Clinical Guidelines:Addressing Flexibility Issues, Proceedings of ProHealth Workshop (2007). This conference paper in fact states very similar facts as the JAMIA paper highlighted by the reviewer (table 1 of the conference paper is identical to JAMIA article’s table 2 and many sections present the same conclusions). We have now added also this JAMIA reference.

We are also aware of open clinical web site. We regard it as a great example of a research site focused on decision support. In fact, in September 2009 we communicated with the listed editor email for Open Clinical (Richard Thomson, openclinical@googlemail.com), received reply, submitted all requested information, but the site has not been updated. We revived this effort now.

**Minor essential revisions**

*Overall the presentation would benefit from tightening up some sections and extending others. Particular points include:*

1. *In the initial Background section, the first challenge is not described very well. The crux of this tool is the Extended Applications laid over the workflow framework. These are not described in any detail. Some description of the number of these and their use cases would be beneficial.*

Response:
This is a very good suggestion. Addressing the reviewer’s point emphasizing external applications, we have added a clarifying sentence into the “Overview of architecture” section putting more stress on the graphical flowchart representation, rather then external
applications. We also added additional points about “crux of this tool” into the conclusion section.

Addressing the EAs description suggestion, we have added several examples, classification and counts to EA section and also referenced our other, more detailed, published studies (including a published book containing the dissertation work of Vojtech Huser (available as a book at Amazon.com). Additional information, for interested readers, is now also available on the project blog (healthcareworkflow.wordpress.com). Also, as noted in the article, the levels and included EAs undergo some evolution, so capabilities and numbers of included EAs may change as the system evolves.

2. Three HealthFlow usage phases. This section is very useful. I would like to see more in this paper about stage 2 though which is highlighted in the abstract as one of the key findings, and not often discussed in the literature. However (a). what measures do you evaluate a RetroGuide performance on across a population. Perhaps in the example use case you could detail the kinds of changes that are made in the iterations before the RetroGuide scenario is considered finished.

Response:
This is a good point and we elaborated the stage two (RetroGuide) description using the suggested points (a) and (b). We added references to concrete published case studies. (a): We added several evaluations aspects for the retrospective testing (RetroGuide) phase. An additional paragraph explaining this was inserted into the HealthFlow usage phases section.

(b). The claim that it’s generally difficult to go from phase 1 and 2 to phase 3 needs to be justified. Other, healthcare specific knowledge representation standards tend not to dwell on this issue.

Response:
The article does not mention that it is difficult to go from retrospective (phase 2) to prospective mode (phase 3). On the contrary, we describe how conclusion steps used during retrospective testing are translated into action steps and communicate how the event representation model used in both modes is the same. In the final part of the phase 3 description, we only state that it is not possible to test some prospective decision support scenarios which rely on new types of human actions (e.g., new type of data being collected or acceptance or rejection some prior alerts) for which there are no retrospective sample data to test against.

3. Healthflow external applications section
a. What is a “small” number of parameters?

Response:
We have clarified the number of input parameters to be one or two and one output parameter. We have also added names of the input parameters in the provided examples.
b. Why can you only export data in the advanced usage level?

Response:
This comment has been addressed by a response to a previous comment. We added explanation and rationale for the division into usage levels and mentioned that it is somewhat arbitrary and additional functionalities may be added to any of the three layers. The division into usage levels stems from our past experience with different scenarios and different HealthFlow users and also facilitates stratified training for early adopter and more advanced users. The ability to export data does require some experience with scenario creation and execution and report review, and it also requires training and understanding the HealthFlow event representation model. In this case, the ability to export is included in the advanced level mainly due to training purposes.

4. Figure 6 is not useful without further detailed explanation. It should at least be linked to table 2 but I would prefer some description of the number of events and their hierarchy.

Response:
We have linked table 2 (examples of events) more closely with figure 6 (database schema) by adding database column names to table 2 and also extended the description for table 2. Correspondingly, the figure 6 description was extended with reference to table 2 for event examples.

5. The notion of GUI-unrestricted creativity in the discussion is pretty weak - both SQL query building tools and Workflow building tools can employ the same dual gui / code views and in both cases the gui widgets are likely not to provide full coverage. Perhaps the point is that workflow tools are conceptually driven from the flowchart gui representation and SQL query tools are conceptually driven from the code so the workflow GUI coverage of allowed concepts is likely to be more thorough. Needs clarification

Response:
We agree with the reviewer’s point about a possible dual view. However, (and we have added this to the discussion section), it is not always possible to translate changes bi-directionally.

Added text:
In many tools there is an option for dual or combined interface for query authoring, so the difference may not be apparent in basic query tasks. However, the advanced nature of some tasks created via direct code authorship often breaks the link between these two corresponding representations (graphical and code representation) paradigms. Whereas it is almost always possible to transform GUI-authored changes into the code form, the tool (e.g., business intelligence tools) may not always support the ability to transform changes made directly in the code back to the graphical user interface representation form.

We tried to clarify this point when we get back in the discussion to commenting on HealthFlow with added text to the revised article. We, however, do believe that there is a difference when a programmer opens a “notepad-like” editor and starts to code in a Touring-complete language (blank-sheet-of-paper type of screen), versus a non-expert
authoring a query in a more restricted GUI-based tool translating into a higher level language (e.g., SQL). We believe that graphic-based workflow process authoring within an XPDL workflow standard (not in other workflow standards, such as BPEL which lacks the flowchart layer) is offering a hybrid solution which: (1) retains the blank-sheet-of-paper paradigm (user can create any sequence of “solution” steps (alone or aided by collaborating)) knowledge engineer; while also keeping a (2) user-friendly, step-based, flowchart layer (which can be even simplified with hierarchical sub-flows which expand more complex steps into a sub-flowchart).

6. Future directions - which problems were fixed by the upgrade from 2 to 3?
Response:
We added enumeration of some display disadvantages addressed in version 3: direct display of transition conditions in the flowchart, improved storage of flowchart layout and interface customizations.

There is also a more detailed significance explanation behind the version 3 upgrade - which is out of scope of the article, but we include it in this response letter: Our group, in fact, used an older version 1.4 of the editor until the release of version 3, since some features were removed in version 2-community-edition. The major change with version 3 was making the whole editor more license friendly - advertising splash for professional version (every 5 minutes) was removed, and all professional features are now fully included in the community edition.

7. open MDR - This is mentioned in the Methods section as a medical record modality but I have no idea what it is
Response:
We have corrected a single letter type to openMRS and added a reference.
This direction of our work hopes to have an additional test-bed EHR platform (openMRS) to experiment with workflow engine integration. We looked at number of similar platforms (e.g., openEMR, openVista (Medsphere), Tolven) and find openMRS easy to download and free of other licensing restrictions, documented, and with simple database schema and solid and varied user base.

Minor discretionary revisions

With respect to the questions we are asked to consider by the Journal ...
1. Does the software address a novel task? Probably but please clarify.
Response:
We have added an additional sentence describing the aim of the article. In terms of addressing what additional input our article presents compared with other workflow technology implementations, there is a section at the end of the fourth paragraph of the Background section.
The text of the article says:
The implementation presented in this article extends this prior work and proposes a prospective as well as retrospective operation mode of utilizing a workflow engine. Unlike previous implementation, it is also a solution which relies on established workflow technology standards rather then proprietary process definition languages.
2. Is it easy to use? Probably, since it has been deployed, but could be clearer
   
   **Response:**
   We have modified the “Availability and requirements” section to improve clarity of this issue.

   The main argument for ease of use is the formal evaluation study with 18 participants (referenced and described in the article) which utilized a technology acceptance model (UTAUT model) and its measure of effort expectancy (EE), with questions such as (EE1): I find the tool easy to use. The EE values were all above 3.5 on a 5-point Likert scale. In addition to this qualitative result, the follow-up qualitative evaluation’s leading category was ‘easy to learn/use/understand’ (9 subjects).

3. Does it satisfactorily address the task or application the authors intend? Apparently.

4. Is the software freely available for non-commercial use (note that this is a condition of publication)? And is the availability of the software and any restrictions on use clearly stated in the manuscript? It appears to be freeware/open source but needs clarification.
   
   **Response:**
   We have re-written the “availability and requirements” section to better indicate that the software is freely available for non-commercial use. Restrictions are clearly defined by standard GNU GPL license which is widely used.

5. Does the manuscript clearly describe the problem the software is designed to address?
   Yes, except where noted above
   
   **Response:** addressed in prior responses

6. Does the manuscript clearly describe how the software is implemented? At a sufficient level but figures need better explanations.
   
   **Response:**
   Figure 6 description was modified because of prior comment. Additionally, explanations of figures 1, 2, and 7 were expanded.

7. Does the manuscript clearly describe how the software performs and its advantages / limitations over existing applications? No – see above remarks
   
   **Response:**
   We have addressed, to the best of our ability, all of the above noted remarks. There are clear sections explaining strengths and limitations of our architecture and the workflow suite. The revised manuscript now also includes a new section on relationship to other decision support platforms.

8. Does the manuscript state the software’s operating requirements? More please.
   
   **Response:**
   We have revised the “availability and requirements” section and included more details.

9. Are the discussion and conclusions of the manuscript well balanced and adequately
supported by the data? Reasonably so except where indicated above.

**Response:** addressed in prior responses

10. Do the title and abstract of the manuscript accurately convey what has been found?

No, as explained above.

**Response:**
The title has been changed. A revised abstract clarifies already at the beginning that the article’s focus is on describing a workflow technology implementation.

11. Is the writing acceptable? Needs work in places as detailed.

**Response:** addressed in prior responses.

The article underwent a review by Marshfield Clinic Writing Center staff member before original submission. A second Writing Center review was done for this revised version (English native speaker with journal text reviewing experience)

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**Reviewer 2**

**Discretionary Revisions**

1. Contemporary decision support system frameworks incorporate event buses, workflow engines, and production rules systems. There is convergence between production rules systems and workflow engines—workflow engines incorporate or may be based on production rules systems; ‘rule flows’ allow representation of flowchart-like logic. Given this convergence, the use of a particular CDS representation does not dictate a particular implementation framework.

**Response:**
We fully agree with the reviewer’s observation about a convergence trend. This comment is also related to comment 1 of Reviewer 1, and we have included a discussion of this issue in a revised discussion section.

2. Contemporary workflow engines typically allow rules tasks implemented as rete-trees. It would be interesting to know whether there were tasks in the implemented decision support that would have benefited from a rules representation

**Response:**
This is a good point. The current version of the employed workflow suite does not directly support such integration, but it would be possible to provide this representation paradigm by calling an external service. It would have to also include a display plug-in or extension within the workflow editor to display such trees or structures. As far as inclusion of such logic in some of our scenarios, it is an initial design decision whether such representation paradigm would be used. However, the users would have to be able to review it and understand it (Would it be as intuitive for the user as reviewing a flowchart?). In some cases, it definitely would be advantageous. We have added two sentences in the discussion section which reflects on this comment and states that in most
cases we wanted to represent as much logic as possible within the flowchart paradigm utilizing all possible XPDL constructs prior resorting to externalizing the problem or creating a problem-specific external application.

3. Similarly, it would be interesting to identify the characteristics of complexity that make the flowchart metaphor difficult to apply.

**Response:**
The original article did describe one limitation (which can be considered as a case addressing this comment) where a complex problem results in very large flowcharts which are not easy to review. In the revised version, we have added one additional description of a case where the flowchart representation was cumbersome. (new multiple-trigger-steps example at the end of the section: ‘Strengths and limitations of currently used workflow suite’)

4. Scenario testing is a critical part of CDS testing and may take 4-5 times longer than rules creation. It is not clear from the description how complete scenario testing is. Retrospective execution will identify available cohorts in the database, but the database may not provide an exhaustive set of scenarios to execute all branches of the logic.

**Response:**
This is a very good point and similar to point 2a of reviewer 1. We have added additional description of the retrospective testing (RetroGuide phase section).

We describe also a possibility where the scenario creation/modification (phase 1) almost merges with the scenario retrospective testing (phase 2) because there are tens of iterations between those two phases.

As for the exhaustiveness of the retrospective data, if the scenario does not include a novel drug or diagnostic test, a large retrospective data should technically include most of the possible data patterns (e.g., 3 years worth of retrospective data should have more exhaustive variability set than, for example, 6 months of prospective module evaluation). However, we have added a statement which admits that retrospective testing is not 100% exhaustive and only complements prospective scenario evaluation.

5. The terms for complexity—simple, advanced, and ultimate—are arbitrary and unlikely to be readily adopted. It would be useful if the authors could elaborate more technical characteristics that differentiate these levels.

**Response:**
This is a valid point. In a response to a similar comment by Reviewer 1, we have extended the description of the rationale for the division. We again want to acknowledge, that the division is based on our local experience and mostly for stratified training purposes. We do not expect adopters of workflow technology at different instructions to use the same division, although we see the ability a layered approach to model complexity as a significant advantage.
Reviewer 3

1. The main problem I have with this paper is that it is not focused on the main concepts (as described in the title) but probably tries to do too much and included too much detail about the technical bases. It needs to be very specific about the objectives and include more details about the evaluation methodology. As this is a research methodology journal, the focus should be on the methodology for a cost-effective evaluation of the implementation. In fact, the excessive technical details have detracted from the research methodology approach and IMRAD format.

Response:
The reviewer brings up a good point about the breadth, aim, and scope of the paper. We have clarified in the modified introduction (4th paragraph) the overall character of the paper as a software article type as defined by the journal. See also our response to a later point #5 of Reviewer 3. We have looked at several examples of a software article from BMC Med Res Methodol (http://www.biomedcentral.com/1471-2288/7/20 ; http://www.biomedcentral.com/1471-2288/8/65 ; http://www.biomedcentral.com/1471-2288/9/80). We have also seen an article initially started as software article be converted into a research article during the review process (http://www.biomedcentral.com/1471-2288/9/70), but keeping the structure of the software article (Background, Methods, Results, Discussion, Conclusion, Availability and requirements) with some evaluation sections added. Our goal is to publish a description of a workflow engine implementation because we believe this is an important contribution to the healthcare research community. There are several implementation of a workflow engine in routine use (e.g., Siemens Soarian EHR system with workflow engine integrated directly by the system vendor and tens of customers of such system), but there is not enough published research reporting such implementations in detail. Our article tries to fill that gap. We view our evaluation sections as useful additional content to the software article aim, and see a software category article as a very fitting way of publishing our experience with an open source workflow engine technology.

2. In addition, there were many unexplained acronyms and assumptions about the technical aspects of the implementation. For example, the i2b2 should be better described and should have been earlier in the paper. The paper should be re-written in a style that is understandable by the clinical end-user or clinical researcher. It is paradoxical that a paper that describes user-friendly scenario-based modelling is so technically dense. The other aspect is the rather lax referencing e.g. reference #14 in paragraph 4 of the Methods section.

Response:
The reviewer brings up several valid points and we have made appropriate corrections to the best of our ability.

I2b2 is an important emerging platform which uses population execution approach (query translated into SQL language) and focuses on cohort size estimation. I2b2 search capabilities are limited (http://www.biomedcentral.com/1471-2288/9/70, ref [22]) and are also commented in our publication which is referenced (reference [6]). I2b2 query
capabilities should, however, greatly improve in future version 1.6. It is not, however an execution platform for prospective decision support and the authors (Shawn Murphy) repeatedly stress (at an i2b2 workshop where the authors were present) that it is a cohort size estimation tool. Our platform includes search capabilities, but tries to achieve much more then just i2b2’s retrospective search scope (dual mode with real time execution, live link to EHR system and/or data warehouse), and we think the discussion in the later section of the article is appropriate. We have improved the initial description of i2b2 and acronym explanation and linked the later discussion to the first occurrence of i2b2 in the article.

We have clarified in a re-stated aim of the paper, in a revised Background section, to be targeted at informaticians and champion clinicians at institutions considering a workflow engine adoption rather then an end-user clinician (also in response to other comments from reviewers). We plan to write future papers which will focus on individual clinical domain (e.g., primary care, rheumatology) and one particular clinical problem, and such reports will be meant for a clinician audience.

In addressing several other reviewers’ comments, there have been significant revisions made in the manuscript. We have also improved the description and references of several acronyms (e.g., i2b2, Tibco, BPEL, BPMN, OpenMRS, vMR, SANDS, STRIDE, LDAP).

3. The use of examples with clear explanations e.g., in the section on “relationship to query systems”.

Response:
The original submitted version contained three examples (fracture, PHQ-9 and bone density); the revised version now has two additional examples added (LDL cholesterol and TSH screening).

4. The instruments used to evaluate the “user-friendly scenario-based modelling”(A) and implementation of the CDSS (B) should also be described in greater detail and made available for scrutiny.

Response:
We acknowledge the reviewer’s concerns about the evaluation. There are two aspects of our response.
(A) As for the evaluation of scenario modeling, this work was done as part of a PhD research (Vojtech Huser). It underwent considerable scrutiny of a PhD committee and has been published as a separate peer reviewed article, and this article was referenced in the original text. To address this comment, we have extended the description of this evaluation with additional details and examples of tested problem task in the revised version.
(B) As for the second point (implementation of the CDSS), we have improved the article text to better reflect our overall aim and target audience and made changes to the best of our ability to provide a clear basic description of our workflow engine implementation. Delivery of clinical decision support, integration of this functionality into an EHR
5. I could not assess the software directly because installation was a fairly complex process requiring many separate downloads. In summary, this is important work and should be reported. However, the paper needs to be focused and explicit with the aims and research questions (and therefore explicit with the paper). My recommendation is “to decide on acceptance or rejection after the authors have responded to the major compulsory revisions” On the other hand, this “technical” paper may be better received in a more technical software development journal.

Response:
We agree with the reviewer that a research article category of submission would normally contain Aims and Research question, however the paper we wanted to write was a software article (link describing the sections of a software article type: http://www.biomedcentral.com/bmcmedresmethodol/ifora/?txt_jou_id=2006&txt_mst_id=1009). We have published a previous research article type of paper, which focuses on evaluation of a sub-component of the HealthFlow system (RetroGuide). We agree that a research paper published around our implementation would be beneficial, and we hope to write such a paper after we collect more implementation results from our pilot deployment in the domains of rheumatology, cholesterol management, and two medical home rules, where we have concrete aims at improving the quality of care provided and will assess how the workflow engine-based implementation was able or not able to achieve them. The aim of this software article was per article category guidelines: “we encourage authors of software applications, tools or algorithm implementations to publish descriptions of their code using the Software article type”). In our case, we hope to provide a description of a tool implementation - a use of a workflow engine tool in healthcare settings. This was reflected by the last sentence in the introductory paragraph which states: ”We present our implementation of a workflow engine technology which addresses two current challenges of DSSs.” However, we also added additional clarification of the paper aim in the fourth paragraph which spells out the purpose of the paper and clarifies the intended audience (informaticians and champion clinicians).

We agree with the reviewer that the installation of the system with full integration into a local EHR is a fairly complex task; however, an interested institution experimenting with
workflow engine implementation may be willing to invest more effort into the installation. For purposes of a review of this technology, we suggest that a reviewer who wants to have a better understanding of the flowchart-based modeling paradigm within a few minutes, install the workflow editor only and then open and browse through several provided examples (XPDL file(s)). We have made changes to the Google code HealthFlow site, so that these two downloads (editor and examples) show up as featured downloads at the initial page.

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All correspondence regarding this manuscript should be sent to Dr. Vojtech Huser. Thank you for considering my article for publication and I look forward to hearing from you.

Sincerely,

Vojtech Huser, M.D., Ph.D.