Author's response to reviews

Title: Validation of the Work Observation Method By Activity Timing (WOMBAT) method of conducting time-motion observations in critical care settings: an observational study

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Author's response to reviews: see over
To the editor:

We would like to thank both reviewers for their very detailed and constructive comments regarding our manuscript. We think the comments regarding the central focus of the manuscript have been helpful and we have included changes to ensure that it is clear that the central focus of the paper is to provide evidence that the results provided by this methodology are reliable and that where they differ from previously reported findings are intuitive based on the care provided in intensive care units. We extended the method in several ways and we have reorganized the results and discussion in an attempt to make this clear. We address the reviewers' individual points below – reviewer’s comments are italicized, our return comments are regular font and quotes from the manuscript are indented:

Reviewer’s report

Title: Interruptions and time spent on continuity of information tasks by critical care providers prior to the introduction of a critical care clinical information system: an observational study

Version: 1 Date: 15 January 2011

Reviewer: Maria Högglund

Reviewer’s report: The paper describes an observation study performed at two ICUs at Canadian hospitals using the WOMBAT method. Unfortunately the objectives of the paper have not been clarified and the paper lacks focus. Is the main focus of the paper interruptions, continuity of information (or both?) or is it a validation of the method used for the observations?

The validation of the method within the ICU as a research setting is the primary focus of the paper. We have made rather extensive changes to the abstract, introduction, and discussion to address this concern.

Major Compulsory Revisions

In general, there are some major issues with the paper. It is clear that it is part of a larger study, yet it is unclear how this paper relates to previously published results (for instance:


We have now cited appropriate articles and abstracts and have added these to the discussion to clarify where this paper fits within the larger study. We disagree that there is overlap between this paper and the others. We have included references throughout the manuscript to other reports that make it more clear how this manuscript fits in with the other publications in this study.
Abstract

1. There is no clearly stated purpose or objective in the abstract; is it to present results from the observational study or to present a validation of the methods used?

We have included the following statement of the objective in the abstract:

Objective: To evaluate a previously described method of quantifying amounts of time spent and interruptions encountered by HCPs working in two ICUs.

2. In the results section of the abstract you also state that “interdisciplinary information sharing and communication in ICUs explain higher proportions of time spent on professional communication and documentation by HCPs, as well as more frequent interruptions...”. Compared to what?

We have reworded the sentence to state:

Compared with previously published data from Australian hospital wards, interdisciplinary information sharing and communication in ICUs explain higher proportions of time spent on professional communication and documentation by nurses and physicians, as well as more frequent interruptions which are often followed by professional communication tasks.

3. The conclusions in the abstract are very vague... please rewrite so that they reflect the actual conclusions! Again, what is the actual purpose that your conclusions are related to? Is it the validation of the WOMBAT method (which has not been mentioned earlier in the abstract!), or is it to describe requirements for accurate timely information sharing and communication?

We have revised the conclusions to support the focus of the paper – the WOMBAT method - which is now mentioned in the Methods section of the Abstract. The conclusion section now reads:

Critical care workloads include requirements for timely information sharing and communication and explain the differences we observe. The data presented here further validate the WOMBAT method, and demonstrate its utility in comparing workflows before and after the introduction of electronic documentation methods in ICUs.

Background

4. It is unclear what the focus of this particular paper is. First you discuss continuity of care and how CCIS could improve it. Then you discuss HOW to study work in ICU environments, and finally you introduce medication errors and state that “A clear picture of how HCPs working in ICUs manage interruptive communications is needed to better understand the relationship between interruptions and errors”. Please clarify your focus!

On the "background", we have left the first two paragraphs largely unchanged as we think the reader will benefit from understanding the larger goal behind the applying this method in ICUs. The "rationale"
now provides a more effective linkage between the larger study and the purpose of this particular paper, which is more clearly stated in the "objective" section.

5. In background, 3rd paragraph you say “Furthermore, comparisons between ICUs and general hospital wards have shown there are higher rates of adverse medical events”. Where? In ICUs or general hospital wards?

We have revised this sentence to state: “Furthermore, comparisons between ICUs and general hospital wards have shown there are higher rates of adverse medical events in ICUs.”

6. In the Rationale section it is stated that this paper provides part of a methodological foundation for a larger mixed-methods study assessing the impact of a CCIS – so is it the METHOD that is actually the focus of the paper? In that case rewrite title, abstract etc.

We agree and have revised the abstract and title, as described above, to clarify the focus of the paper.

7. When you refer to “our study” in the background, it is difficult to judge whether it is the larger study or the study in this paper you are referring to. Please focus on the objectives, method, results of the part presented in this paper to avoid confusion.

We have modified the rationale and background sections to more clearly state the goals of the larger study of which the present paper.

8. The objective section of the background needs to be rewritten. As it is now, it is a description of the method you’ve used to perform the observations, but you do not say what the objective of the study presented in this paper is. This makes it very difficult to judge the rest of the paper!

We agree and have modified the objective section of the paper to state: "In this paper we compare our time-motion baseline results with those previously published to provide evidence supporting that the WOMBAT method provides valid results when quantifying amounts of time spent on different tasks and interruptions encountered by critical care providers. We discuss differences observed between the reported data and previously published results from Australian general hospital wards, based on the nature of critical care."

Method

9. There is a lot of focus on interruptions in the results section. In the background and title you discuss continuity of care and continuity of information, yet you have no results on HOW information is actually transferred within the ICU ward (what type of information has to be transferred? When? Between which HCPs?)

We have revised the title and abstract to avoid any confusion about the primary goal of the manuscript. The large amounts of time spent on documentation tasks and professional communication tasks when compared with the previously reported data from Australian general hospital wards demonstrate the
needs for critical care providers to access and disseminate information about patient care plans and status. This is summarized in the conclusion:

Critical care providers spend greater proportions of time communicating with each other than do physicians and nurses working in Australian general hospital wards. This is consistent with specialized, coordinated, team based care. These results help to validate the previously published findings of the WOMBAT method on hospital wards as well as demonstrating the amounts of time front line critical care providers spend accessing and disseminating information for patient care.

10. The work definitions presented in table 1 and 2 are problematic. They are highly detailed regarding medication (which suggests they might be useful when looking at medication errors), but they provide very little information on continuity of information – how is information actually shared within the team? In the professional communication – what do they actually discuss? Which information is it they need that they do not have access to?

We agree that the work definitions would benefit from more detail in terms of the content being discussed by different HCPs, and to a limited extent this is captured in the field notes accompanying the data generated by the PDA software. The data definitions are customized to be used with the software, which was originally designed for studying medication tasks in detail. At the outset of this study we decided to use this method as it represented a vast improvement over other paper approaches that would not allow the simultaneous capture of interruption data. We think that publishing these complete definitions will assist other investigators in improving future tools (tablets etc) to collect richer time-motion records of work observations in health care settings, and especially to develop methods whose data are more comparable across studies. To assist future investigators in this endeavour, we have included sections in the discussion aimed at limitations within our data definitions. One of these sections deals with the category of indirect patient care tasks. We have added to this section of the discussion as follows:

In addition, other categories could be enhanced to collect more detailed information about the tasks being performed, such as what information is being discussed during professional communication tasks.

11. In the results section (and later on in discussion as well), there is a lot of focus on interruptions. If this is the main focus of this paper, how does this study relate to the previously published paper Interruptions in workflow prior to the implementation of a Critical Care Information System (CCIS) in two intensive care settings in which abstract you state: As part of a longitudinal study, results of the frequency and nature of interruptions in workflow before the implementation of a CCIS will be reported. There appears to be a large overlap between these studies!

Interruptions are a focus (but not the primary focus) due to hypothesized links amongst interruptions, cognitive shifts as care providers switch tasks, and medical error. During the data collection, we can make the best use of our resources (i.e., research observer’s time) by collecting these data alongside the time spent data. This provides the additional benefit of allowing us to see which tasks tend to form
interrupted (or primary) and interrupting (or secondary) tasks during interruptions. The goal of much research is aimed at preventing medical error, but a better understanding of the reasons why interruptions are so difficult to avoid might help to mitigate the risks of adverse events in ICUs. The comparison between the previously reported data from Australian hospital wards and this paper (Westbrook et al, 2008, 2009) is that maintaining informational continuity is a necessary driver behind interruptions and that the secondary tasks (or interrupting) tasks tend to be professional (verbal) communication about 1/2 the time when care providers are interrupted in these ICUs. The results are compared with general hospital ward data to provide more evidence of the validity of this method, thus strengthening the central point of the paper, the validity of the WOMBAT method in this setting.

Secondly, regarding the Mador et al paper, this is a preliminary paper of the initial design of the larger study. The sentence cited by the reviewer is written in the future tense - no results were reported in Mador et al. To ensure the best transparency regarding these publications we have included references throughout the manuscript to other reports that make it more clear how this manuscript fits in with the other publications in this study.

Discussion

12. There is a lot of mentioning of other work/results performed as part of your larger study in the discussion, but you never reference these results. If the results are unpublished you have to state this, but it makes it difficult for us as readers to confirm your results. If it is published you should reference accordingly!

The only mention of other work was a preliminary qualitative analysis of interview data of critical care providers. An abstract was published and is now cited in the manuscript.

13. In the first paragraph of the discussion you state that “the present results demonstrate the information needs of critical care providers working to address the needs of highly complex and acute patients”. I do not agree. In fact, you show that perhaps they need information, but we knew this already, and you do not specify which information they need or where they get it from today! It is therefore impossible to judge whether the conclusions you draw that a CCIS could meet these needs is valid.

Conclusions

14. Again, I do not believe that this study actually presents the information needs of the HCPs. In fact, it is difficult to connect the objectives (which are hardly specified at all), to the methods, results, discussion and finally conclusions. The paper is fragmented and will need extensive rewriting to clarify its focus and the relationship to other publications made relating to the larger study.

Regarding points 13 and 14: We agree that the previously made statements need better support, and future publications related to the larger study should address the point of whether the CCIS assists HCPs in meeting their information needs. Within this paper, the changes made to the title, abstract, initial paragraphs of the discussion, and the conclusion have, in our opinion, clarified the focus of the
manuscript. We would like to thank the reviewer for their comments that we think have helped to enhance the readability of the manuscript and we hope also its future impact.

**Level of interest:** An article whose findings are important to those with closely related research interests

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:** I declare that I have no competing interests

Reviewer's report #2

**Title:** Interruptions and time spent on continuity of information tasks by critical care providers prior to the introduction of a critical care clinical information system: an observational study

**Version:** 1 Date: 16 January 2011

**Reviewer:** Phillip Asaro

**Reviewer's report:** This is an observational study of the activities of health care providers in the setting of intensive care unit using a continuous observation methodology. Time-motion study has been used extensively in health care settings to study workflow and changes in workflow due to various interventions including introduction of electronic medical record systems. This study was performed to collect pre-implementation (baseline) data for later comparison to data after the implementation of an electronic medical record in an ICU.

**Major Compulsory Revisions:** none

**Minor Essential Revisions**

1) It seems to this reviewer that the statement “the data presented here ...suggest that these patterns of work may be improved by enhanced information sharing in ICU’s” may be stretching the science a little. This type of data rather crudely describes workflow and allows some inferencing regarding information flows. One might hypothesize that information sharing may be enhanced by some intervention such as an introduction of an electronic information system, and the time observation studies provide a means to measure the effects. However, it seems a stretch to assert that “these data suggest” that information sharing could be improved without describing in what way the data suggest this. For example, if the authors mean to say that they have uncovered deficits in information sharing that might be improved through some intervention, then they should point out those deficits.

We agree that our previous suggestion that the CCIS may improve information sharing is premature. We have clarified the focus of the objective and especially the initial paragraphs of the discussion. Future work within the larger study will address the question of whether the CCIS supports information sharing in ICUs.
2) In the 3rd paragraph of the background section, it is said that work sampling methods may systematically neglect tasks performed during busy periods and that observational techniques reduce concerns about incomplete data. These statements seem to confuse terms describing studies of workflow and tasks. It might well be said that the continuous sampling of time-motion studies such as described in this study provide a richer data set than intermittent work sampling methods. However, intermittent work sampling methods are not necessarily self-reported; they can be performed with data capture by observers and thus provide accurate and statistically valid data. Decisions regarding how and by whom data are collected are separate and different from decisions of whether to use an intermittent vs. continuous sampling approach.

This reviewer comments that the use of observers vs self report data is a separate issue from whether continuous or intermittent sampling approaches are used. A practical reason to utilize an intermittent sampling approach is that continuous sampling cannot be accomplished by the participants themselves alongside their normal workloads, thus avoiding the formidable cost of employing outside observers, in addition to other reasons well addressed by Ampt et al., 2007. We have modified the pertinent sections to clarify this distinction:

"Observational and self-reporting techniques have been used to study work in hospitals and other settings [1]. A practical advantage of self report studies is the lower cost resulting from participants recording their own activities when they are prompted by a reminder device [1]. However, participants giving self reports may ignore the prompts during busy work periods, which can result in incomplete data [1]."

3) The ability to describe periods of time using multiple task descriptions is useful and has been used in other studies. For example, it has previously been found in the emergency department setting that physicians frequently access results in the patient’s record during discussions with consultants, either by phone or face-to-face. However, when time is attributed to multiple tasks, the analysis of the results is complicated. Since the time attributed to tasks is not mutually exclusive, care must be given to comparisons of time spent at aggregate levels. This will likely become of greater concern in the reports of future work when pre and post-implementation comparisons are performed.

We agree with the reviewers comments. The analysis of time spent on multiple simultaneous tasks is complex. We have described one comparison where the amount of multi-tasking decreased for ICU physicians, nurses, and respiratory therapists after the CCIS was introduced (Ballermann et al., 2010, Ref #23 in the manuscript).

4) In reporting the results in this study, time percentages and interruption rates are reported without confidence intervals, although there appear to be unlabeled and undefined error bars in the bar graphs. Confidence intervals or other certainty measures become more important when the results are compared to similar results from other settings or after intervention. In this manuscript, we really have no idea whether the difference between 3.8 interruptions per hour in this study and 2.9 per hour in a previous study on hospital wards is significant.
The unlabeled error bars within the graphs represent 95% confidence intervals, and we have revised the figure captions to state this. Although we agree that it would be valuable to have directly compared the general and ICU data interruption rate to determine if a statistically significant difference exists, without having adequately controlled for outside variables (different wards, similar yet different healthcare systems), the interpretation of a comparison between papers would be a problematic endeavor.

5) In the Discussion under the sub-heading “Participant reactivity”, the first paragraph does not appear to be about participant reactivity at all. Perhaps a little reorganization is in order.

We have altered the section of the discussion to clarify the relationship between the analysis reported in the results section and the interpretation of those data.

6) While I can appreciate that the authors view this study as a precursor to further studies and that the results are just part of a larger picture, the framing of this study within that larger picture seems out of place in the Results section of the Abstract. Something on this might well fit in the Background section of the Abstract.

We agree with the comment and have revised the Background section of the Abstract to read:

Electronic documentation handling may facilitate information flows in health care settings to support better coordination of care among Health Care Providers (HCPs), but evidence is limited. Methods that accurately depict changes to the workflows of HCPs are needed to assess whether the introduction of a Critical Care clinical Information System (CCIS) to two Intensive Care Units (ICUs) represents a positive step for patient care. We used a previously described method to quantify amounts of time spent and interruptions encountered by HCPs working in two ICUs, to compare how critical care changes after a CCIS was introduced.

Discretionary Revisions

1) The authors compare the activity patterns found in this study with those found in other studies, particularly their own studies performed on non-ICU hospital wards. They aptly note differences in activities related to the critical, time-sensitive nature of information flows in the ICU. It might also be of interest to compare their finding to those of published time-motion studies performed in the emergency department, another clinical setting with critical, time-sensitive information flows. The differences between task categorizations are a barrier to comparison, but at some level of aggregation of categories, meaningful comparison should be possible.

We agree with the reviewer and have added comparisons to a paper using the WOMBAT method in EDs that has been published since this manuscript was first submitted for publications:

As the reports from this paper are directly comparable to our physician data, we have superimposed the percentages of time spent in Figure 1 to facilitate comparisons between the ICU and ED observational data.

2) There are several typographical/editing errors in the paper - a close reading by someone different that the primary author should uncover these.

We have located and corrected several typographical and editing errors, and we are hopeful that we have eliminated all those seen by the reviewer.

*Level of interest: An article whose findings are important to those with closely related research interests*