Author's response to reviews

Title: An empirically-derived approach for investigating Health Information Technology: the Elementally Entangled Organisational Communication (EEOC) framework

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Version: 2 Date: 18 May 2012

Author's response to reviews: see over
18 May 2012

BioMed Central Editorial

Dear Editors,

MS: 1646190243680155
An empirically-derived approach for investigating Health Information Technology: the Elementally Entangled Organisational Communication (EEOC) framework

Thank you for the opportunity to revise and update our document in line with the constructive comments and suggestions provided by our reviewers. In the following pages you will find a point by point response to each of the reviewers’ points.

Yours faithfully,

Dr Andrew Georgiou
Senior Research Fellow
**Editorial requests**

Informed consent must be documented. Manuscripts may be rejected if the editorial office considers that the research has not been carried out within an ethical framework, e.g., if the severity of the experimental procedure is not justified by the value of the knowledge gained.

**Authors’ response**

We draw attention to the following sections in the manuscript:

Page 8 (paragraph 1):

Ethics approval to study the HIT implementation (Project No. 2005/058 and Project No. 2007/077), was provided by the relevant Health Service Research Ethics (HREC) committees.

Page 8 (paragraph 2):

The research study conducted 16 focus groups (involving 68 participants) and 141 interviews (75 participants) and 43 hours of observation. All participants provided their informed consent.

**Reviewer 1 comments**

The article suggests that there is a paucity of health information technology (HIT) systems research that employs an explicit approach centered on organizational communication. The authors then suggest an elementally entangled organizational communication (EEOC) framework to frame and guide future HIT research. Three case studies involving the deployment of computerized provider order entry (CPOE) are used to illustrate the dimensions of the proposed framework.

While the article builds a solid case that HIT systems impact organizational communication, which is a key factor implicated in the safety, efficiency and quality of care delivery, the EEOC framework is unclear and, in its present state, insufficient for use by other HIT researchers. Therefore the following suggestions are provided to help the authors enhance the submitted

**Reviewer 1’s suggestions for enhancing our paper are valuable and much appreciated. We have dealt with them in the following ways:**

i) We have incorporated recent articles discussing the paucity of studies examining organisational communication, highlighting some existing limitations of current research literature and drawing attention to the value of a theoretical framework to meet this challenge. See page 5 (paragraph 3):

Organisational communication approaches in the way described have yet to be widely utilised by the health informatics community, at least explicitly[29]. Giuse and Kuhn’s outline of the challenges identified by the Heidelberg Health Information Systems Working Group conference in 2002 drew attention to an apparent disregard for communication among clinical users[30]. Moreover, as Kuziemsky et al. highlight, existing research often fails to consider the role of communication in the context of specific team structures, processes and outcomes[31]. Communication failures, problems or misalignments are widely seen to be a central reason for poor quality health care today, but understanding the dynamics of these failures and their complex
**Major Compulsory Revisions**

1. **The most pressing issue for the authors to address is the need for a framework to study organizational communication in HIT system development and/or deployment.** Several recent articles in the literature have discussed the paucity of studies that explicitly examine organizational communication, and these articles call for greater attention to organizational communication in future health care and HIT studies. While this point is well taken, why does the HIT community need a framework to explicitly examine organizational communication? Why not simply examine organizational communication as a phenomenon without a framework? What value does the EEOC framework provide other than a new label to previously describe challenge in HIT system implementation?

   Reviewer 1 asks for clarification about the intention and focus of the EEOC framework relative to other theoretical perspectives. In addition to the points addressed in point 1 above, we have revised the following section beginning on Page 6 (paragraph 2):

   Previous research approaches have tended to describe organisations as fixed entities or containers through which information is transmitted and communicated to internal and external audiences[33]. However, as per Weick, organisations are more than this: they are dynamic entities comprising people enmeshed in the processes of sense making, organising and interpreting their environment[34, 35]. Communication process are therefore an essential part of the process of establishing and maintaining the ongoing, interconnected behaviours that contribute to the makeup of an organisation[33]. This is...
enhancements that Kuziemsky et al make to Donabedian’s structure, process, outcomes framework) or whether the EEOC framework should stand on its own, independent of other theoretical frameworks used in HIT research.

particularly relevant for research involving health information systems which have a disruptive ability to change the role communication plays in organisationally linking people and activities across space and time[35]. In this way we believe that organisational communications perspectives can complement, underpin and build on some of the better known approaches such as socio-technical[36, 37], workflow [38, 39] and system approaches[40-42].

We have also added the following section to Page 6 (paragraph 3) to proceed our explanation of the reasons for the use of EEOC in HIT research:

EEOC draws on rich sources of organisational communication scholarship which have been iteratively assessed and applied to empirical data to establish a novel innovative theoretical tool to inform future research. There are compelling reasons for the development of EEOC as a theoretical lens for HIT research.

Other aspects of the Reviewer 1’s points are also addressed in Point 1 above, particular as regards the utilisation of the EEOC framework.

3. The framework as described is of little utility to other HIT researchers. While interesting, the article does not provide guidance on the application of the framework to broader organizational communications elements and components beyond those discussed in the first two case studies. Figure 1 is a bit abstract, and the article lacks a sufficient explanation of the various components of the overall framework depicted in the figure. More detail is necessary not only when the Figure is introduced but also the Discussion section to provide advice for others seeking to leverage the framework for their HIT evaluation efforts. Again, the article emphasizes (correctly) that organizational communications can advance HIT innovation and research, but it remains unclear how the framework can

We have revised sections of the paper to deal with this comment.

i) The following sentence has been added to Page 10 (paragraph 1) to guide the reader about how the framework (depicted in Figure 1) can be applied:

These components of the framework highlight a number of guiding themes which are then used to interrogate the findings and orient the analysis and understanding of the results. For instance, some of the guiding themes for the communication environment may include considerations about what type of information is exchanged and how it is communicated and processed. Alternatively, key themes for the temporal environment may consider the role of information and communication in the allocation of work, the time taken for it to be carried out and how it is allocated. For the organisational environment, the key considerations may turn on how work is planned, organised or coordinated.

ii) Figure 1 has also been reworked to provide more information about temporal,
support this aim. Organisational and communications environments along with detail about the role and contribution that EEOC makes to the way that organisations respond to, and deal with these environments.

iii) The Discussion section of the paper has also been revised to provide more details about the components of the framework and to explain how the framework can be used to guide analysis and as an aid for HIT research and innovation. This includes the addition of a new Table (now appears as Table 1) which is used to connect the findings to the EEOC framework. The changes appear on page 16 (paragraph 2):

Table 1 outlines key guiding themes from the EEOC framework alongside findings from each of the case studies. The case studies highlight not only the pre-existing communication infrastructures (e.g., the essential collaboration involved between the Blood Bank and the ward in coordinating safe and timely blood products to patients, particularly related to how information is processed) but also the way organisations go about addressing their requirements (e.g., the Clinical Chemistry and Haematology departments attempt to organise, synchronise and control the tracking and monitoring of specimens as part of how work is controlled). A realist analysis would consider these as part of the context setting of the pathology service. In order to comprehend the innovative capacity of new technology there needs to be an assessment of its impact on the temporal makeup of the organisation and the entangled material objects, equipment and spaces through which humans are required to act and interact[82]. These factors have an impact on the allocation and synchronisation of work activities. These findings identify some of the mechanisms that trigger different outcomes. Our findings revealed a number of outcomes as illustrated by the temporal transformation in the way that blood collection processes within the Central Specimen Reception area were carried out, affecting not only the way that work was undertaken but also how it was sequenced and distributed within a socio-material space that extended from the department across to the whole hospital.

| 4. The three case studies in the Results section contain excellent detail on the setting and the | Our reply to point 3 above addresses a number of the points raised here by Reviewer 1. These include the addition of a table which connects the key findings with sections |
intervention. However, the case studies lack detail when describing the CPOE outcomes and the relationship between the findings and the EEOC framework. Given that this journal does not restrict on page length, the authors should expand their discussion of the case studies, offering the reader more detail on the findings from the CPOE implementation and describing the link between outcomes and components of the framework. Specifically,

a) The authors assert that Blood Bank employee concerns about the safety and adequacy of the system’s warning and notifications mechanisms (4th paragraph of Results) led to the non-utilization of the CPOE. Describe how the CPOE warning and notifications interrupted existing communication patterns on prevented “normal” communication from effectively passing along critical information to Blood Bank or other hospital personnel.

b) Provide more detail on the “the experience” involving the LIS interface with the CPOE system. It would appear that the vendor developed an interface to replace the existing homegrown connection. Did the interface not work as desired? Describe the explicit linkage between the interface and existing organizational communications.

Page 11 (paragraph 3)

Prior to the introduction of CPOE, the method that hospital staff used to communicate orders to the Blood Bank was predominantly synchronous, using the telephone or the fax machine which triggered an alarm system to notify Blood Bank staff of the presence of a request. The switch from a synchronous exchange to an asynchronous one (which involved posting a message on the system) implied a major change in the collaborative relationship between the hospital ward and the Blood Bank and was a cause of some concern. This is because of the fear that the department may fail to notice or not be adequately notified of the existence of an electronic request which may sit unnoticed in system. This trepidation led to the indefinite postponement of electronic requests for blood products.

Page 13 (paragraph 3)

Before the implementation of the new LIS/CPOE both Clinical Chemistry and Haematology operated middleware systems which added functionality to their existing LIS and helped facilitate result handling, tracking specimens and storage[73]. Clinical Chemistry utilised middleware for result interpretation, tracking and handling of test specimens. The department has to keep control of its specimens and aliquots (daughter tubes) and be able to locate them when needed. The existing homegrown system allowed the laboratory to identify the processes that a specimen had been through, and to ascertain what processes were still required. It also provided the laboratory with a designated position where the specimen was to be stored. The new system did not replicate this process, requiring the laboratory to manually allocate a rack and storage position.

For Haematology, middleware played an autoverification role which incorporated checks on reference ranges, quality control, critical values, delta
checks, dilution needs, instrument flags and laboratory review policies[73]. The new Cerner Pathnet LIS did not replicate this role[74]. This situation required the laboratories to undertake a complex set of negotiations with the software vendor to compensate for these missing functionalities and to devise a system to replicate the tracking and monitoring functions of the previous middleware system. This led to the development and introduction of a new “Specimen Orderable Status” (SOS) program which read specimen barcodes and indicated whether results had been validated or not, identifying those results that needed to be manually validated[74].

The experiences of the Clinical Chemistry and Haematology departments highlight how each new technology needs to be implemented in the context of existing infrastructures and social practices[75]. It also shows how the pre-existing organisational and communication environment can affect the way that work is allocated, organised and controlled and how information is communicated.

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<th>Reviewer 2 comments</th>
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<td>Overall this is a well written paper introducing a much needed approach to the understanding and evaluating HIT as an embedded part of a broader sociotechnical system. My suggestions for revision are few and minor. I admit that while the approach does not seem very profound to me, it is probably novel to many and is therefore of potential importance to the field. My suggestions therefore focus chiefly on adding value to readers who may be less familiar with or have not “brought into” this type of approach.</td>
<td>Our response to Reviewer 1 above (particularly points 1 – 3) provide greater emphasis on the importance and significance of the framework and provide more information about its utility for researchers and HIT designers.</td>
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<th>Minor essential revisions</th>
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<td>1. Methods, para starting with “Field materials...”, it is not clear who did this analysis, if there were multiple analysts (and if so, how they worked together),</td>
<td>We have made the following revision to the Analysis section on Page 8 (paragraph 3) to deal with the point raised:</td>
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|                         | }
Field materials were analysed in order to relate data and concepts, building a viable real world narrative, synthesising participants’ behaviours, attitudes and discourse, and mapped to their situation[58, 59]. This was achieved by a team of research experts in areas of qualitative data analysis and involved a process of constant comparison of data for similarities and differences[60]. NVivo software was used by AG to undertake an initial open coding of all interview and focus group transcriptions[61]. Axial coding (involving the whole research team) was performed whereby initial codes, indicators and concepts were exposed to more and more data, and then elaborated on, and transformed into robust categories leading to more refined analytical levels relevant to the topic under investigation[62].

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<th>2. On p.8, the authors state that “In this study the realistic evaluation” framework, e.g., Pawson &amp; Tilley’s, or that the authors conducted an evaluation/analysis from a realist perspective as stated at the start of the paragraph? I realize the overlap between the framework and perspective, but the analytic language that is not represented in this paper (e.g., there’s no formal talk of triggered mechanisms in the results and discussion similar to other RE studies, if they did not use realistic evaluation but identify as realists, they should consider rewording the above quoted sentence.</th>
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<td>We have made a slight revision to the paragraph (see Page 9, paragraph 2) to indicate our use of the Pawson and Tilley’s framework.</td>
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<td>This work initially adopted a realist approach to achieve its research aim, drawing on Pawson and Tilley’s context-mechanism-outcome framework[18].</td>
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<td>In line with Reviewer 1’s point 3 above, we have also added a Table and revised Page 16 (paragraph 2) to incorporate the analytical language relevant to the utilisation of the context-mechanism-outcome framework.</td>
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<th>3. The authors introduce a new framework but there are similar HIT-specific frameworks that have been proposed or are being used, including Harrison et al.’s IASTE framework, Carayon et al.’s AHRQ Workflow Toolkit, and Unertl et al.’s Workflow Elements Framework/Model. Readers may wonder how these models or approaches overlap, how EEOC is different or preferable to the others (e.g., for addressing</th>
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<td>Reviewer 2 makes some valuable suggestions that correspond with comments by Reviewer 1 addressed in Reviewer points 1-3 above, including references to important research cited by the Reviewer. In addition to these points we have made the following revision that now appears on Page 18 (paragraph 2):</td>
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<td>The adoption and successful implementation of HIT is not simply a matter of matching new technology to organisational need[75] and then proceeding to “roll-out” or “diffuse” the new system[88]. Such approaches ignore the mutual transformation of the organisation by the technology, and of the HIT system</td>
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communication-specific questions), and how EEOC might apply to the kind of cases that the other models have been applied. Related to this last issue of applying EEOC to familiar cases beyond the LIS and CPOE applications described by the authors in this and other papers, I think it would be of tremendous interest to readers to know how EEOC might help us understand health information exchange (by itself or compared to Unert et al.’s application of their Workflow Elements Framework), the Han et al. “CPOE increases mortality” case, or the “unintended consequences” from Joan Ash’s studies of CPOE. These are cases with which many readers will be familiar that EEOC can address from a novel perspective.

As per Reviewer 1 (point 3) above, Figure 1 has also been reworked to provide more information about temporal, organisational and communications environments along with detail about the role and contribution that EEOC makes to the way that organisations respond to, and deal with these environments.

**Discretionary revisions**

4. The authors use “communication” in the name of their framework but discuss a number of actions and interaction that are more than communication, for example, coordination, forecasting, temporal issues related to workflow, etc. I understand some of the reasons behind focusing on communication, but I wonder whether there is too narrow, especially for introducing the framework to unfamiliar readers. The authors may wish to explicitly address in what way communication might be an umbrella term for these phenomena or how communication is a part of a larger constellation of organizational phenomena, all of which must be considered.

5. P.2, “The HIT challenge underscores the

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<th>The authors use “communication” in the name of their framework but discuss a number of actions and interaction that are more than communication, for example, coordination, forecasting, temporal issues related to workflow, etc. I understand some of the reasons behind focusing on communication, but I wonder whether there is too narrow, especially for introducing the framework to unfamiliar readers. The authors may wish to explicitly address in what way communication might be an umbrella term for these phenomena or how communication is a part of a larger constellation of organizational phenomena, all of which must be considered.</th>
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<td>5.</td>
<td>P.2, “The HIT challenge underscores the</td>
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| 4. | We have taken on board Reviewer 2’s suggestion to explicitly address the role of communication as part of organisation. In addition to the points outlined in response to Reviewer 1 (see points 1-3 above) we can also draw attention to the following section (Page 5, paragraph 2):

> From this perspective, communication processes can be seen as part of the *social glue* facilitating organisational functioning[26, 27]. These processes are *elemental* because they undergird the way that organisations operate, but also deeply *entangled* as interrelated components of the way that organisations make sense of their environment, coordinate their activities and make decisions about their future. In essence, communication processes need to be studied because they are the sociological and organisational DNA that make things work[28]. We label initiatives which attempt to investigate this phenomenon the *Elementally Entangled Organisation Communication (EEOC)* approach. |
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<td>5.</td>
<td>We thank Reviewer 2 for this suggestion and have revised the section accordingly</td>
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importance of employing theory-based approaches..”:
the authors may be interested in another paper (Holden & Karsh, 2009) whose argument is the need for theory-based approaches to HIT, attached.

(see Page 4 paragraph 2):
The HIT challenge underscores the importance of employing theory-based approaches that can help to integrate and highlight the significance of findings and improve our understanding of how and why things happen[10-13]. As an example of this, consider the results of studies suggesting that a Computerised Provider Order Entry (CPOE) system has attained its goal and is deemed to be working successfully[14-16].

6. Table 1: As an undifferentiated list, I’m not sure what this adds. Perhaps the authors have a way of labelling or categorizing these communication events (e.g., one-way vs. Two-way: request vs. Provision of information; order vs. Consultation; etc) in a way that extracts meaning out of them? Otherwise, not sure a table is necessary to get the points across.

We agree with the Reviewer’s point and have deleted the table.

7. Related to the comment above, on p.10, the authors refer to “a two-way process of message reinforcement” but it is not clear which or how many of the transactions are actually two-way (e.g., are orders two-way or one-way transactions or does it depend?) and it is also not clear whether Blood Bank ever initiates, follows-up on, or circumvents any of these transactions (e.g., Blood Bank sends receipt confirmation to ward? Blood Bank anticipates need to tube product and does so with a phone call?). In a nutshell, if there is more complexity to the communication than evident in Table 1, it would be consistent with EEOC to detail some of it.

As per the above point we have deleted the table. We have also added more explanation to this section (see Reviewer 1 point 4) to highlight elements of the complexity of the process and its relationship to synchronous/asynchronous communication.

8. The PDF version of Figure 1 did not appear to come out properly. Are there supposed to be arrows or is the arrow floating mid-page a PDF conversion

From the Reviewer’s points it seems that there has been some corruption in the PDF. We have reworked the Figure to improve its quality and (as per Reviewer 1 point 3 above) to provide more information about temporal, organisational and
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<td>artefact? I am confused about how “role”, as advertised in the figure caption, is depicted in the figure. I am also having difficulty extracting meaning from the figure beyond “these things are important and interrelated.” This be because I am missing part of the figure (arrows? text?) or perhaps that is all the meaning the authors intended to impart (which is fine, though I would have liked more). Finally, why is “staffing” not part of the “organisational environment”?</td>
<td>communications environments along with detail about the role and contribution that EEOC makes to the way that organisations respond to, and deal with these environments. Reviewer 2’s point about the misleading caption is well taken. We have now changed it to read: Figure 1: A conceptual depiction of the components and interconnections of the EEOC framework. As suggested we have inserted “staffing” to the “organisational environment” section. We have also added a new table to the document (now identified as Table 1) which (as per our response to Reviewer 1 point 3) above, provides greater detail about the structure of the EEOC framework and its connection to the empirical findings.</td>
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<td>9. Figure 2 isn’t strictly necessary: the concept is clearly enough described in the text.</td>
<td>We agree and have removed the figure.</td>
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<td>10. If the intent of the paper is to convince potential evaluators of the importance of the EEOC approach relative to other, e.g., technology-focused, approaches, the authors may wish to illustrate this by showing how an alternative approach(es) might have provided an incorrect, less actionable, or otherwise less desirable evaluation of the three presented cases.</td>
<td>Reviewer 2’s points are valuable. In the course of responding to our reviews and revising the paper we have made a number of changes which deal with the points raised: a) As per point 9 above we have added a new Table which highlights the component parts of the EEOC framework and how it was used to identify key issues. b) We have added additional points (see Reviewer 1 point 3) which broaden the explanation of the framework. c) Our response to Reviewer 2 (point 3) also adds more detail to the potential value of the framework particularly regarding issues of unintended consequences, safety and innovation.</td>
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