Author's response to reviews

Title: Successful implementation of new technologies in nursing care: a questionnaire survey among nurse-users

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Author's response to reviews: see over
Successful implementation of new technologies in nursing care: a questionnaire survey of nurse-users

Dear Mr. Aldcroft,

Thank you for the comments on our manuscript submitted to BMC Medical Informatics and Decision Making. We have revised the manuscript in response to the comments by the two reviewers. In the next pages we give a detailed point-by-point response, indicating where and how the manuscript has been revised.

We have submitted two versions of the manuscript. One version shows the changes that have been made in the original manuscript in response to the comments of the reviewers. The second version is the revised version. One of the reviewers has pointed out that some further language revision is required. We have (for the second time) asked a native English-speaking professional reviser to correct this revised manuscript.

At the editor’s request we have added a statement of ethical approval to the Methods section.

The editor requests that a copy of the questionnaire be included as an additional file. The original questionnaire is lengthy and also addresses other aspects of technology in nursing care. Besides, the questions are in Dutch. Because we don't think it would be useful to include the questionnaire, we have stated in an additional sentence that the questionnaire is available on request from the first author.

In the annex we indicate where and how the manuscript has been revised. Reviewer 2 has major concerns about the model we used to underpin our study. In our responses we therefore first address this general and rather fundamental observation. Then, we give a point-by-point response to the comments of both reviewers.

Thank you in advance for reconsidering our manuscript for publication. We look forward to receiving your comments on the revised manuscript.

With best wishes, also on behalf of the other co-authors,

Anke de Veer and Margot Fleuren
ANNEX

The authors’ reply to the reviewers’ report regarding the manuscript ‘Successful implementation of new technologies in nursing care: a questionnaire survey of nurse-users’

In general: The innovation model we used

Re-reading our article and the way we explained the model we used, we understand the reviewer’s concerns about the model. By ‘just’ referring to Roger’s Diffusion of Innovation theory, we may have put the reviewers on the wrong foot. As is the case with many models or frameworks – as well as UTAUT – our model is traced back to earlier work by Rogers. Over the years, the model of Rogers has evolved and has been refined, based on research findings.

In short: the original model of Rogers stems from research on the diffusion and adoption of agricultural products (seeds) in the 1950s. It was a rather top-down model. The model was then widely used in the U.S. for introducing educational innovations. However, the results were rather disappointing. Research showed that teachers widely embraced the curriculum innovations – and so adopted them – but did not use them, or only in part. The main criticism of the model of Rogers was:
- adoption versus implementation – these are different concepts;
- agricultural products differ in many respects from educational innovations (and health care innovations).

As opposed to the top-down approach, a bottom-up approach was introduced in the field of education. Teachers were given financial resources to develop their own curriculum innovations. Michael Fullan was one of the first researchers to show that this bottom-up approach did not work either (e.g. M. Fullan, The new meaning of educational change. NY: Teachers College Press, 2001 (3rd ed.).

It then became clear that innovations (curriculum or health care innovations) cannot be conceived of as just a single event in time, rather they should be viewed as a developmental process involving four main stages: dissemination, adoption, implementation and continuation. Adoption refers to the intention to use an innovation. Implementation refers to the process of actual use. Both are elements of the total innovation process.

In social sciences and health care, several models and frameworks exist on how to implement innovations effectively (e.g. Grol, 2005; Greenhalgh et al., 2004; Fleuren et al., 2004; Bartholomew et al., 2006; Glasgow et al., 1999; www.re-aim.org), all derived from the original Diffusion of Innovation Theory (Rogers), the Theory of Planned Behavior (Azjen, 1991) or the Social Cognitive Theory (Bandura, 1986). Despite some differences, these models follow a similar planning sequence: (1) the innovations should be introduced systematically to maximise success, and (2) a planned innovation strategy should be tailored to the determinants that facilitate or impede the intended innovation process.

Our model, developed by TNO (Fleuren et al., 2004), has been used for a number of years in health care and has proved to be useful (e.g. Wiefferink et al., 2005; Crone et al., 2006; Fleuren et al., 2010; Vlemmix et al., 2010). Since 1999, one of the research programs at TNO has focused on determinants of innovations in health care (prevention, cure and care) and in schools. TNO developed a generic and short measurement instrument for determinants of implementation, using empirical data. The instrument can be used during the very first stage of the innovation design and in the subsequent further refinement of the technology and implementation activities.

As the models of Venkatesh (TAM and UTAUT) are well known and have proved to be useful in the
field of Information Technology (IT), the same is true for our model – and similar models – in health care. Therefore, the model described in our article is in line with models used by many researchers and agents of change in health care.

**In response to Reviewer 1 (M. Koivunen)**

1. **Explanation for authors’ selection of the model. More earlier studies where the model was used.**
   
   We have explained above why we have chosen our model, which is quite well known in health care. In the Background (first section) of the manuscript we have explained why we referred to other, similar models, in health care, as well as to the models of Venkatesh. We have also added some references to studies in which (elements of) Rogers’ theory is used in technology within health care settings.

2. **Ethical statement related to the participants is missing**
   
   We have added a statement of ethical approval in the methods section.

3. **Are text paragraphs based on separate tables?**
   
   We have added extra references to tables. If the results in the text are not represented in a table we now explicitly mention this.

4. **Results Table 3 not clear: how sets the percentages in the table?**
   
   The total number of observations (n) used to calculate the percentages has been added to the title. Also we reformulated the text of the footnote.

5. **Add more about reliability of open questions in Discussion**
   
   For the open questions concerning the determinants we used the existing system of TNO which has already been successfully applied in several studies. In our study one of the TNO researchers (MF) coded the answers together with another researcher (AdV) until 100% reliability was approached. Then, AdV coded the other answers but in case of doubt consulted MF. Reliability is therefore high. We added some extra text about this procedure in the “coding and analyses” paragraph.

6. **Is figure 1 from Fleuren et al.?**
   
   Figure 1 is derived from Fleuren et al. In the original manuscript a reference was made by using only the number [3] of the article in the reference list. Perhaps using only a number in the title of a figure is not clear enough. Therefore we now explicitly mention the authors in the title of the figure.

7. **Ambiguities in division into paragraphs**
   
   We found ambiguities in the discussion paragraph and changed the headings.

8. **Reference list is not completely based on journals requirements.**
   
   The reference list has been adapted in accordance with the journal requirements.
In response to Reviewer 2 (J. Aarts)

We addressed the main comments of the reviewer by outlining the model we used (see above). We will now respond to more detailed elements of the reviewer’s comments.

1. The reviewer “read the paper as trying to find out how a group of professionals perceive adoption of a new technology invented by someone else.”
   Apparently the article suggests that the research concerns technologies that are already technically ‘ready’ and, in the next phase, have to be implemented. This is certainly not what we intend to say. As we conclude in the discussion, in practice this is one of the pitfalls. Development of a technology without involving the potential users is mentioned as one of the determinants influencing the implementation of the technology.

2. Rogers talks about diffusion of innovation and not about the process of innovation itself.
   As we stated above, the original model of Rogers has been refined over the years. Many authors refer to innovation processes, involving four main stages: dissemination, adoption, implementation and continuation. It is useful to distinguish these four stages – especially in daily practice – as different determinants may play a role in these several stages. Determinants influencing the adoption are to some extent different from those influencing the continuation (Fleuren et al., 2004).

3. The question is whether implementation is similar to innovation.
   We are not sure whether we fully understand the reviewer’s comment. Our assumption is that innovation and implementation are not similar. By innovation, we mean, for example, technologies, guidelines, interventions or programs that are perceived as new by an individual or other unit of adoption (Rogers, 2003). So, in our article innovation refers to the technology itself. By implementation we mean the stage of the innovation process in which the professional tries to use the innovation in daily practice and experiences what working with the innovation means in daily practice (Rogers, 2003). In the Background part of the manuscript we explain these stages in more detail.

4. Technology, people and organizational context are closely intertwined. Different technologies cannot be lumped together.
   We fully agree with the reviewer. That is exactly why our model looks at determinants at all levels (innovation, user, organization and context). We added this to the Background part of the manuscript. We also agree that determinants are dependent on the innovation and the context is which the innovation is introduced. We therefore carefully categorised the technologies, so as to avoid comparing ‘apples and oranges’. In the methods section (Coding and Analyses) we added a description of the way the clustering of technologies has been carried out.

5. Authors claim that they are experts in the field of nursing care, but experts in the field of health IT were clearly not present.
   We assume that by outlining the model we used (see above) we convinced the reviewer of our expertise in the field of health care as well as implementation. In our organisations – especially at TNO – many well functioning technological innovations have been developed, for example a smart virtual and personal assistant that helps people to interact with the technology around them.
5. VNV-038/085.11/AdV/DS

(Ashley), or detection systems for fall prevention of frail elderly. Yet, professionals / patients / clients do not automatically use these technologies. Our model has been shown to be useful in explaining why technological innovations are not used and, moreover, what should be done so that they will be used.

6. List of references suggests old and questionable theories (especially Lee).

Much research has been done concerning the uptake of new technologies but often this research concerns other types of professionals and sectors. The research of Lee that we used concerns qualitative studies on how nurses perceive the use of technologies (e.g. a new computerized care plan system). In our article we used the references to her research only to illustrate (1) that central themes in the experience of nurses concerning adoption and use relate to Rogers’ innovation characteristics and (2) that other authors also stress the importance of involving nurses in early system design and the design of implementation strategies.

7. Authors conclude that users should be more involved. But how should that happen?

What we mean is that users should be involved in the first place so as to understand whether the technology has any relevance for the user or the end-user (patient/client), before it is developed. This is a condition sine qua non, but is mainly overlooked by scientists and producers of technology. Secondly, technologies should be pilot-implemented in daily practice. This is the standard procedure for many clinical guidelines. A determinant analysis is performed with the final draft of the guideline by asking the potential users for example to “test” the final draft in daily practice for a brief period of time. The guidelines are adapted to the results and the results show what innovation strategies should be developed for national dissemination, adoption and implementation. In the Discussion paragraph we have added some extra text on this topic.