Author's response to reviews

Title: Discriminant content validity of a Theoretical Domains Framework questionnaire for use in implementation research

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Version: 6 Date: 6 November 2013

Author's response to reviews: see over
Professor S. Michie

Editor, Implementation Science

Subject: Revisions manuscript

Dear professor Michie,

We would like to thank you for the opportunity to revise our manuscript ‘Discriminant content validity of a Theoretical Domains Framework questionnaire for use in implementation science’, for resubmission to *Implementation Science*.

The suggestions of the first reviewer were excellent ideas to improve the manuscript, for which we would like to express our gratitude. Furthermore, we would like to thank all reviewers for their positive feedback and their careful reading. Below we address their comments and describe in detail which changes have been made to the original manuscript.

Looking forward to your reply,

On behalf of the co-authors,

Yours sincerely,

Johanna M. Huijg

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Revisions

Reviewer 1

Methods:
1. The authors provide details about the information that informed the development of the questionnaire items, but the process for item generation is not described. Were themes from the previous interview studies mapped onto the domains and, if so, who did this job. Did the items go through an initial filtering, face validity, sense-check? The development process is not sufficiently specified and, as the basis for the DCV, the item generation process is critical.

We thank the reviewer for this excellent suggestion and in line with it we have now provided a more detailed description of the development of the questionnaire in general and the item generation process specifically. First, we have extended our description on how constructs within domains were selected, see tracked changes on page 7/8:

“We developed a questionnaire that initially included 79 items assessing each of the domains through their related key constructs (see Additional file 1). Constructs within domains were selected based on a. conceptual relatedness to the content of the domain (i.e., Knowledge, Procedural knowledge, Skills, Professional role, and Memory), b. inclusion in relevant theories frequently used in the field of behavior change (and thus ready access to existing theories): the Theory of Planned Behavior [40] (i.e., Perceived behavioral control, Attitudes, Subjective norm, and Intention) and Social Cognitive Theory [41] (i.e., Self-efficacy, Outcome expectancies, and Social support), c. existence of validated scales (i.e., Optimism, Pessimism, Action planning, Attention, Affect, Stress, Automaticity, and Self-monitoring), and/or d. relevance to the implementation of PA interventions in routine health care by mapping factors resulting from previous research [42,43] onto the TDF domains. JP and JMH independently identified that the constructs Reinforcement, Priority, Resources/materials, and Descriptive norm were salient in the previous PA-based research and thus these constructs were also included as construct-indicators of their respective domains.”

Second, we have now provided a more detailed description of how items measuring constructs within the domains were developed, page 8 second paragraph:

“Items measuring constructs within the domains Knowledge, Beliefs about capabilities, Optimism, Beliefs about consequences, Intentions, Social influences, Emotion, and Behavioral regulation were adapted from previously published questionnaires (i.e., [34,35,40,41,44–52]). Given lack of available questionnaires in the literature for some domains, new items were created for the domains Skills, Social/professional role and identity, Reinforcement, and Environmental context and resources. With regard to the domain Goals, items were newly developed for the construct Priority (as none could be located in the literature), while items measuring the construct Action planning were adapted from a previously published questionnaire [45]. With regard to the domain Memory, attention, and decision making, items measuring the construct Attention were adapted from a previously published questionnaire [50] and items measuring the construct Memory were newly developed. New items were developed based on discussions between JP and JMH. These discussions were informed by the academic literature on the concept and definition of
specific domains and constructs, questions to identify behavior change processes as formulated by Michie et al. [31], and themes emerging from interviews on the implementation of PA interventions [42]. WAG and MRC supervised the development of the questionnaire and reviewed items’ face validity.”

Discussion:
2. The second point is related to the first. In the discussion, the authors touch on issues with trying ‘to balance representation of the constructs within the domains with a parsimonious questionnaire that could be feasibly used in the field’. The academic judges might have been able to help here by offering a view on the extent to which they agreed that the items actually measured the constructs. I set myself this task and, for the most part, I felt the balance had been achieved. However, there are two areas in particular where I feel more concerned that the items do not address the construct. The first is emotion. Here the authors ask generally about how the person has been feeling. For example, ‘have you recently, during the past two weeks been able to enjoy your normal day-to-day activities?’ Thus, the emotion items are not target specific and yet the emotions associated with performing a behaviour are known to influence whether or not that behaviour is enacted. For example if GPs feel embarrassed about discussing PA or nervous about raising the issue with the client, they are less likely to do so perhaps. Whilst, if they feel comfortable, they might. In our work in hospitals, we found these and anticipated emotions (i.e., guilt, regret, pride etc.) were important influences on behaviour. I am concerned that if people adopt this questionnaire as a template they may miss these critical behavioural determinants. With this in mind, I would ask you to highlight this limitation in the discussion section.

In line with the reviewer’s comment we have now addressed this issue in the discussion of the revised manuscript, see tracked changes page 25/26:

“In the initial questionnaire, items measuring the domain Emotion were adapted from previously published questionnaires. Specifically, items measuring the construct Affect were based on the Positive and Negative Affect Schedule [48] and Stress items were based on the General Health Questionnaire [47]. Items measuring the construct Stress demonstrated to be able to discriminately assess the domain Emotions, while Affect items did not. Therefore, the final questionnaire includes items concerning health care professionals’ general feelings (i.e., Stress) instead of their emotions related to performing a specific behavior (i.e., Affect). Yet, when investigating determinants of health care professionals’ implementation behaviors, items assessing emotions in relation to performing a specific behavior should also be taken into account as these have been found to be linked to implementation behaviors in previous research [62–64]. Although initial TACT-specific items assessing the construct Affect were not judged to discriminately assess the domain Emotions, potential users of the final questionnaire may want to consider using such items by including other emotions such as pride, empathy [64], fear [62–64], and embarrassment [63].”

3. The other area where I feel the authors may need to do further work is in adequately representing the construct of environment and resources. Environment and resources is framed entirely in terms of the socio-political context in the final version of the questionnaire. However, from my experience, and based on the definition of this construct that is provided in the paper, the influences in this category are much more varied - do people have access to the supplies and equipment they need, is the time available to do the task sufficient, is the supervision or monitoring appropriate and do the processes e.g. for
referral, for transfer, for communication support the behaviour and so on. I wonder whether the limited perspective on this construct has arisen because the authors have attempted to develop a generic questionnaire, but from interviews about a specific behaviour. It seems likely that this narrow focus has led to a restricted range of items. I think this needs to be acknowledged in the discussion section as an area for further work. It might be more appropriate to conceive of environment and resources as a higher order factor which influences the social, cognitive and emotional factors that are the more proximal determinants of behaviour.

We agree with the reviewer that the domain Environmental context and resources cannot be sufficiently assessed by items solely related to the socio-political context. We have addressed this issue in the discussion, see tracked changes page 24/25:

“Lastly, the findings indicate that further refinement of the final questionnaire is required. In general, the amount of items measuring most of the domains could be increased to at least three items for each domain (at least three items with a loading above .80 will give a reliable component [61]). With regard to the specific domains, the final items measuring the domain Environmental context and resources are framed entirely in terms of the socio-political context, while there may be additional environmental and resources influences that remain unmeasured. The initial version of the questionnaire included items related to characteristics of the innovation, organization, socio-political context, and innovation strategies [16–20], however, only the items assessing the socio-political context were judged to discriminately assess this domain. Lack of discriminant content validity of items measuring characteristics of the innovation, organization, and innovation strategies might be due to our method of developing a generic questionnaire based on factors related to a specific implementation behavior (i.e., the implementation of PA interventions). Moreover, the domain Environmental context and resources is arguably among the least well conceptualized domains of the TDF, which may partly explain challenges that judges faced in allocating items to this domain. Nevertheless, potential users of the final questionnaire may wish to incorporate additional more contextually sensitive items focusing on the environment and resources whilst recognizing that their discriminant content validity has not yet been demonstrated.”

Furthermore, in the revised manuscript, we have now also suggested that the assessment of the domain Knowledge could be improved by adding items testing knowledge, see tracked changes page 26 first paragraph:

“Furthermore, the assessment of the domain Knowledge could be improved by adding items to test health care professionals’ knowledge on a certain implementation behavior [63,65].”

Reviewer 2

Comment:
The authors have addressed the issues raised in my first review.

We would like to thank the reviewer for providing us with positive feedback regarding the revised version of the manuscript.
Reviewer 3

Comments:
I raised two main issues in my previous review of this paper.

1. The level at which the definitions for the task were provided, i.e. domain level definitions, rather than construct definitions

2. Whether the full breadth of each theoretical domain was covered by the items

My overall evaluation of the paper was that it would make an excellent contribution to the development of theory based measures within the field. I still hold that view. I believe the authors have adequately addressed both issues in the revised discussion and have progressed this work since their original submission by testing the questionnaire in a sample of health professionals (paper referenced in submission).

I recommend the paper be accepted for publication as is.

We are very grateful for the reviewer’s very positive evaluation of the revised manuscript.