Author's response to reviews

Title: Patients' functioning as predictor of nursing workload in acute hospital units providing rehabilitation care: a multi-centre cohort study

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Author's response to reviews: see over
Dear editors of BMC Health Services Research,

Thank you very much for your and the reviewer’s comments on our manuscript "Patients’ functioning as predictor of nursing workload in the acute hospital: a multi-centre cohort study " and for giving us the opportunity to revise our paper again. Please find enclosed our detailed answers and changes to your and the reviewer’s comments. We have revised the manuscript accordingly and we hope that the paper is now acceptable for publication. All authors have been involved in the revision of the manuscript and agree to be co-authors of the revised manuscript.

Sincerely,

Martin Mueller
Answers to Reviewer 2 (Caitlin Brennan)

Minor Essential Revisions

1. Figures 2, 3, & 4 need to be labeled with more specific information about what the authors are trying to convey to the reader.

Figures 2-4 show accuracy of fit of the models. This was a suggestion in the first review. From our point of view, it is beyond the scope of the paper to explain model fit in detail.

Major Compulsory Revisions

1. It is concerning that a large number of ICF categories were excluded because of too little variation. Given the exclusion of so many of the ICF categories, I question whether the ICF is an appropriate tool to predict workload.

Variation in independent variables is a prerequisite of robust estimation in regression analysis methods. Our model selection procedure aimed to eliminate variables with little variation since they do not add information. The ICF categories were excluded to enhance the performance of the model. You are definitely right when stating that the ICF – and even the ICF Core Sets – as a whole is not a practical tool to predict nursing workload. This is not only due to the issue of little variation in some categories but mainly due to the comprehensiveness of the ICF. Thus, the aim of our study was to select those categories that have sufficient power to explain nursing workload.

2. In aim 3, the authors’ goal was to validate the ICF Core Sets by demonstrating their ability to predict workload. Predictive validity is a necessary, but not sufficient aspect of validating an instrument.

We totally agree with the statement that the assessment of predictive validity is only one aspect (out of several others) when exploring validity of an instrument. From our point of view, we have mentioned this adequately with the sentence in the discussion:

*We also found that the use of selected ICF Core Set categories was equally predictive than the conventional Barthel Index, thus demonstrating the predictive validity of the ICF Core Sets*

3. It remains unclear whether the setting is acute care or rehabilitation and what the difference between these two settings might be in the hospitals where the study took place.

We apologize for not being absolutely clear about that. Setting of research was the acute hospital situation. A main inclusion criterion – besides patients’ characteristics - was that the wards provided rehabilitation interventions coordinated by a rehabilitation physician. This follows the concept of rehabilitation in the context of acute hospital care as detailed by Stucki et al. (2005,
Rationale and principles of early rehabilitation care after an acute injury or illness. Disabil Rehabil 2005 7/8). To underscore this, we added the reference [22] to the respective sentence:

Patients were included if they were at least 18 years old and received coordinated rehabilitation interventions for treatment of any acute musculoskeletal, neurological or cardiopulmonary injury or disease [22].


In addition, we suggest to change the title to:

Patients’ functioning as predictor of nursing workload in acute hospital units providing rehabilitation care: a multi-centre cohort study

4. The small sample size for each population remains a concern, especially given that the data come from multiple sites. It is unclear if the demographics of patients at each site are significantly different from each other. The authors address this in the limitations section by stating that “the KFJS is certainly comparable to the other two study centres with respect of nursing skills and patient characteristics…” However, the authors do not include any data on nursing skills and patient characteristics to demonstrate that there were no statistically significant differences between study sites.

We apologize for the unclear and misleading wording which was due to a transcription error at an earlier phase of manuscript preparation. The legal situation in Austria, Switzerland and Germany allows but a small proportion of unlicensed staff in acute hospital nursing services. Thus, basic nursing education and nursing skills are comparable across German speaking countries, as is nursing education and hospital reimbursement for nursing services. Effectively, the main outcome of our study, i.e. nursing workload, arguably is comparable across countries. We acknowledge that there are differences in patient characteristics between study sites, e.g. as regarding age or diagnoses. However, those differences are accounted for in the multivariable models. We modified the respective paragraph which now reads as:

“Since the legal situation in Austria, Switzerland and Germany allows but a small proportion of unlicensed staff in acute hospital nursing services, the KFJS is certainly comparable to the other two study centres with respect to nursing skills. In addition, clinical nursing education is basically comparable in the three countries [51].”


5. In the initial sections of the background, the authors make the case that managers need better data with regard to nursing workload, in order to make sound staffing decisions. How will the ICF assist managers in making staffing
decisions? Are the authors recommending that the ICF data be used on the hospital level, in order to make decisions about the number of full-time equivalents that are needed? Or are the authors suggesting that the ICF could be used on the unit level for staffing decisions each shift?

Our apologies for not being absolutely clear in this argument. Please refer to response to 6 where we displayed all changes in the conclusions.

6. Although this area of study is very important, this secondary analysis seems to be missing key components:

a. There is a great deal of missing data due to doubts about the quality of data collection and due to a lack of variability in the ICF categories.

b. The Barthel Index performed quite well, in terms of the variance in workload explained by the items, for all 3 condition groups. The ICF seems quite labor intensive, in terms of the number of categories that are included in each rating, and it is unclear how the ICF results in a more parsimonious measure of workload than the Barthel.

First of all, we would like to underscore that this is not a secondary analysis but an integral part of the project to validate the Acute ICF Core Sets. In our study, we were confronted with missing data as most observational studies are. Since we assumed noninformative missingness we took the approach of multiple imputation which is the preferred method in literature for the problem of missing data. This has been referred to in the ‘Methods’ section.

We do agree that the ICF as a whole is burdensome to use in clinical practice and shorter instruments like the BI are more handy. However, there is great interest (supported by WHO) to implement the ICF into practice since it is the reference terminology for outcomes across professional borders. Our idea was to explore to what extent – if the ICF or the ICF Core Sets will ever be used in clinical practice – information collected with the ICF can be used for other applications than clinical assessment. Specifically, we wanted to explore if ICF information explains resource utilization, specifically nursing workload. It was not our primary goal to compete with established instruments like the BI. Nevertheless, especially the frequently used BI has some limitations (see our ‘Background’ section).

To underscore our primary intention, we have added a paragraph to the ‘Background’ section:

Moreover, the implementation of the ICF in clinical applications -assessment and outcome evaluation - by developing ICF Core Sets is a major endeavour of WHO [22]. Therefore it should be explored, to what extent ICF Core Set data is useful in further applications, such as predicting resource utilization.

To underscore that we do not want to compete against the BI as a primary goal, we deleted “but more efficient” from the first paragraph of the ‘Discussion’. The respective sentence now reads as follows:

*We also found that the use of selected ICF Core Set categories was equally predictive as the Barthel Index, thus demonstrating the predictive validity of the ICF Core Sets.*

We also rewrote the ‘Conclusions’ as follows:

*A substantial fraction of the variation in patient-related nursing workload in patients with rehabilitation needs in the acute care situation can be predicted by a highly selected group of categories of the Acute International Classification of Functioning, Disability and Health Core Sets. Incorporating ICF Core Set-based data in nursing management decisions, particularly staffing decisions, may be beneficial. Considering patients functioning based on specific categories of the ICF may be an option for the unit-level to guide staffing decisions as well as for the hospital-level to estimate full-time equivalents more precisely. The result of our study may be extendable for identifying the predictors relevant for all health professionals involved in acute patient care. As such, this study represents the first step towards establishing a general approach enabling the entire interdisciplinary team to plan the patient-specific workload in a common language.*

We also rewrote the Background and conclusions of the abstract accordingly:

**Background**

*Management decisions regarding quality and quantity of nurse staffing have important consequences for hospital budgets. Furthermore, these management decisions must address the nursing care requirements of the particular patients within an organizational unit. In order to determine optimal nurse staffing needs, the extent of nursing workload must first be known. Nursing workload is largely function of the composite of the patients’ individual health status, particularly with respect to functioning status, individual need for nursing care, and severity of symptoms. The International Classification of Functioning, Disability and Health (ICF) and the derived subsets, the so-called ICF Core Sets, are a standardized approach to describe patients’ functioning status. The objectives of this study were to (1) examine the association between patients’ functioning, as encoded by categories of the Acute ICF Core Sets, and nursing workload in patients in the acute care situation, (2) compare the variance in nursing workload explained by the ICF Core Set categories and with the Barthel Index, and (3) validate the Acute ICF Core Sets by their ability to predict nursing workload.*

**Conclusions**

*A substantial fraction of the variance in nursing workload in patients with rehabilitation needs in the acute hospital could be predicted by selected categories of the Acute ICF Core Sets, or by the Barthel Index score. Incorporating ICF Core Set-based data in nursing management decisions, particularly staffing decisions, may be beneficial.*