

Feb 15, 2011

RE: NRES-D-10-00263, titled "Nurse Dose: Linking Staffing Variables to Adverse Patient Outcomes"

Dear Dr. Manojlovich,

Recently you sent your manuscript for consideration by Nursing Research. The review of your manuscript is complete and the comments of the reviewers are listed below along with a checklist for style. You may revise your manuscript based on the reviews and resubmit the manuscript to Nursing Research for further consideration. I will verify that this has been done upon receipt of the revised manuscript.

Please make note of the following information as you revise your manuscript: Use this opportunity to ensure that your manuscript is prepared in accordance with the Publication Manual of the American Psychological Association (6th ed.; 2010). The Background should include a discussion of the literature; a scholarly review of the literature establishes the priority of others' work and develops the continuity between earlier work and yours. The Discussion is reserved for evaluation and interpretation of the results. Similarities and differences between your results and the work of others should be used to clarify and confirm your conclusions. You may refer to the literature presented in the Background but literature should not be introduced in the Discussion. Please turn to Chapter 2 in the Publication Manual for a more complete discussion of the parts of a manuscript and what they should contain.

Please include with your revised submission an itemized, point-by-point response to the comments of the reviewers. The location (section title, paragraph #, & line #) of each response can be included in a simple table. It is helpful to identify the changes in your revised manuscript with a contrasting font color or highlighting, if possible. The revisions should be completed by April 2, 2010 to avoid being considered as a new submission.

Also, at this time you will be required to upload a signed copyright release form via Editorial Manager. Remember to clearly indicate on the copyright release form and the manuscript if any funding is received. Posting of the paper to PubMed is based on this information. The form can be found at <http://edmgr.ovid.com/nres/accounts/copyrightTransfer.pdf> .

To submit a revision, go to <http://nres.edmgr.com/> and log in as an Author. You will see a menu item called "Submission Needing Revision." Please click on this item to obtain your submission record and begin the revision process.

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Reviewer Comments:

Reviewer #1: I found this paper to be interesting and timely. Please correct APA and minor grammatical errors. On pg 2 you state that a large body of research has attempted to link staffing variables to pt. outcomes, using staffing variables as proxies; however no citations were provided and if the amount of literature is extensive then perhaps a table of evidence would be helpful in this paper. I believe a strength of this paper is the previous work conducted by the research team concerning concept validation and development of a theoretical structure.

In the abstract it was stated that nurse dose describes the influence of "all" variables on outcomes (pg 1, line 5). I recommend that "all" be changed to "numerous or many" variables because it may be premature to say "all." On pg 5 lines 17-19 you indicated that high FTEs and High RN-HPPD creates low nurse-patient ratios?it actually creates high "nurse" to patient ratios, therefore lower pt loads per nurse. On pg 7 you indicated that 4 categories were created for each variables?because these supposedly corresponded to the distribution were they just quartiles or was the decision based on some other mathematical decision, or was it arbitrary?

(Pg 7 Line 10) Although I believe it might be too simplistic to construct the active ingredient from average "categorized" scores, I believe I understand why you are choosing to take that approach at this time. However, this may be a limitation and further sophistication would be needed as this work progresses. Perhaps discussing this in the limitations section would be helpful.

Pg 8 Line 4-please change analysis to analyses. Some of the data on pg 8 reflected large ranges?in those cases it would be nice to provide the median as well as the mean. As hospitals in the United States and Canada work toward reducing patients falls and MRSA rates?it may be difficult to accurately ascertain the relationships with nurse dose--you alluded to this in your limitations section, so it was unclear to me how active ingredient and intensity were "practically identical contributors to MRSA"?more explanation may be needed for clarity (pg 10 lines 1-2)

Pg 9?at the top of page 9 the correlations indicate that approximately 20% of the variance is accounted for by the relationship between active ingredient and the outcomes. Certainly the relationship between MRSA and intensity is interesting because 49% of the variance is accounted for in this case, but again only 19% of the variance was accounted for between falls and intensity. To me this indicates that more nursing "presence/time" with patients results in less MRSA and I

expected to see some discussion about that. Although the regression results were significant for both attributes they also were small.

Pg 9?Discussion section?lines 14-16. There were no hypotheses stated in this paper, so if the results showed associations in the direction "hypothesized," the hypotheses should have been clearly stated earlier in the paper.

This paper is timely because, while I do not agree with all the conceptualizations, I believe this work is important to open the dialogue about how to tie complex nursing concepts to outcomes. Nurse dose may need some refinement because a dose of a medication is simply the amount of the drug?not the actual amount necessarily needed to achieve improvement. For example, I may need 3 doses of antibiotic over 10 days to achieve the outcome of no infection. It appears that your conceptualization of dose is the level of nurse provided, not how much of that level is needed.

Also, discussion about these concepts within the literature is needed to insure that the correct variables can be easily located and integrated across hospital databases and clinical information systems.

I applaud you in conducting research in this complex and important area. No one study will serve to move the science forward in this area, but you are demonstrating a sequential and well-thought out approach to the problem of quantifying nursing care to outcome at the "nurse" level.

Reviewer #2: Manuscript Number: NRES-D-10-00263

Title: Nurse Dose: Linking Staffing Variables to Adverse Patient Outcomes

Article Type: Brief Report

Let me begin this review by pointing out that I am a nurse and the manager of an Ambulatory Surgery Center (ASC), and thus this topic is of vital interest to me.

Daily I struggle to balance the economic necessities of my business with the requirements of quality care and improved patient outcomes. Nurses play a central role in that struggle, and thus I welcome research such as this which attempts to elucidate the parameters and variables of nurse staffing that affect these outcomes.

This brief report attempts to test the quantitative validity of a measure of nurse staffing - "nurse dose". In the introduction, they explain the problems to date of linking patient outcomes to staffing, and point out that perhaps the greatest barrier has been lack of a consistent theoretical construct that encompasses the most important dimensions of nurse staffing. The concept of "nurse dose" at first caught me by surprise, as this was the first I had heard of it, but as I read on I became

convinced that the authors are on to something.

In reading some of the references, and comparing, for example, the preliminary description of Brooten and Youngblut (2006) with the authors' more nuanced and developed concept, I get the sense of an improving technology, as we slowly approach a better vocabulary and more useful descriptions of the variables. In particular I am appreciative of their statement that the version of the concept that they are pursuing is a "unit level variable". I am a believer in the "Clinical Microsystems" approach, and thus supportive of attempts to look at effects taking place at the level where patient care is made.

The introduction very clearly addresses the need to define a single measure, nurse dose, that can be consistently applied to staffing data to return important insights into what constitutes safe and appropriate RN staffing. This is of tremendous importance to the hospital industry, where RN staffing has become a regulatory issue (see California) and threatens to strangle innovation and cost containment efforts. One theoretical question the authors don't address very well is that of compounding error. If we find that these individual variables do not accurately predict patient outcomes, why then should we think that combining them makes them better predictors?

I liked that they changed "purity" to "active ingredient". To me the connotations are much better and clearer. And the combining of Amount and Frequency into the single measure, Intensity, was also well described and made sense. Thus we end up with two attributes: Active Ingredient and Intensity. Marvelous! As opposed to so many "theoretical constructs", to me as a nurse manager these words seem to carry cash value.

Page 6, lines 17 - 22: Kudos on use of productive hours vs. hours - as the authors point out, a real problem in comparing different countries, or even parts of the country, where vacation and sick policies may make use of simple hours ineffective. 1768 in the US vs. 1527 in Canada - a 14% difference! It demonstrates practical knowledge on the part of the authors - I have come to use this measure in my own benchmarking, and I note the Ambulatory Surgery Center industry is moving in that direction as well. In my industry, this helps remove a real confounding variable: the number of years that a facility has been open. The amount of vacation time earned by staff will be significantly greater in an ASC that has been open for 20 years vs. 5 years, and thus comparisons will be unfair (my facility is 24 years old).

Pg 7 lines 10-15. Since factor analysis revealed that unit skill mix had a much more profound correlation (I am not sure I am interpreting this correctly, but here is the question that rose in my mind), why didn't you account for that in your score

for Intensity, where it appears you give each factor equal weight? It appears from the factor analysis that you could double the effect of unit skill mix. Again, I am unsophisticated in statistics, so this may be an easy answer, but as a reader, it was something that struck me. The factors involved in the Intensity variable did not seem to be significantly different and thus the need for weighting didn't seem as important to me.

Pg 8 lines 1-2: What does this statement mean, in practical terms, and why is it important for you to make it: "Both outcomes' distributions 1 clustered around zero with a positive skew, resembling a Poisson distribution." I read up on Poisson distributions and Poisson regression, so I now think I know the answer (you were justifying the use of Poisson regression in your analysis), but you might want to make that point a bit clearer for a reader like me.

Given that the purpose of the study was to determine if combining variables gives a clearer picture of the effects of RN staffing on outcomes, it would be interesting to hear a bit of discussion about whether the regression results for the component variables were consistent with those for the combined variable. In other words, looking at the regression analysis for just education, just experience, and just skill level and then comparing those three with the result for the combination of the three. When we look at the results for the single variables, is it still apparent that combining them is a good thing? For example, if unit skill mix shows a positive effect (meaning it was associated with a greater number of falls or infections), but education and experience show enough negative effect to drag the combined regression over to the negative side, that would be something to ponder and discuss.

Overall, this is an excellent paper, and I can already see applications in my work place- in particular, adding weight to my point of using productive hours as the measure of hours. In my facility, I am struggling with the proper use of assistive personnel, and the benchmark I would use, rather than falls or infections, would be medication errors. It seems to me that the number of medication errors I see is positively correlated with the use of greater amounts of assistive personnel, and the concepts presented here will help me properly analyze the problem. After reading the paper, I realize that I will have to include more variables than simply the number of FTE RNs or Assistive personnel (in my state, they are called Health Care Assistants, or HCAs).

Reviewer #3: NRES-D-10-00263

In this manuscript, the authors report findings from a study to investigate

relationship among a unit level measure of nurse dose (active ingredients and intensity) and patient outcomes (MRSA rate and falls) using data from 24 adult medical and/or surgical units in two health care systems. This manuscript addresses a challenging but much needed area of research that has great potential to contribute to the nurse staffing-outcomes literature. As noted in the literature review, there are numerous factors that have contributed to inconsistent findings in the staffing research that has been done to date. The authors are to be commended for moving beyond a narrow conceptualization of nurse staffing to a broader perspective of staffing that is based on the idea of nurse dose. This broader perspective has strong potential in terms of better understanding the components of staffing that have the greatest potential to yield optimal patient outcomes.

Although the literature review captures the state of the knowledge with respect to nurse staffing and patient outcomes, both the introduction and the literature review jump back and forth between conceptual and methodological issues that have limited previous research in this area. It would be helpful to better organize this content as well as elaborate more fully on some of these issues. For example, the reader is told at the start of the literature review that much of the staffing research has been atheoretical but no information is given to explain this statement. In the introduction, however, the reader is told that staffing variables are used as proxies for actual nursing care and then, at the end of the literature review, the reader is told that specific staffing variables have been assumed to be equally associated with all outcomes. It seems to me that both of these statements identify areas of conceptual weakness that could be grouped into a single section of the literature review focused on the atheoretical nature of this research and then elaborated on more fully. In particular, the point needs to be made that staffing is a necessary but not sufficient condition for "good" nursing care and thus, in itself, is not a proxy for good nursing care. This point is never clearly argued in the manuscript and, in fact, it is unclear that nurse dose per se actually does or does not provide a measure of "good" nursing care. Similarly, characteristics of RNs as a potentially relevant component of nurse staffing seems to be another conceptual issue that could be addressed in this section and discussed in a way that supports the use of RN characteristics as part of the conceptualization of nurse dose. Finally, methodological issues could be grouped into a single section and then discussed more fully. For example, the reader is told that methodological issues include differences in the construction of FTE, HPPD, and RNHPPD. Yet, these differences are not described. While unit of analysis is mentioned as a methodological issue, this section should be expanded to provide a rationale for why the decision was made to construct the nurse dose variable at the unit level.

There are several questions that are not well addressed in terms of the methods for this study.

1. Were the nurse dose variables constructed using data that were limited to

unit-level RNs who provide direct patient care or all RNs assigned to a unit including those who function in non-patient care roles?

2. Data were collected from nursing units nested in two hospitals. No information was given about the potential design effect associated with using nested data. What is the relative contribution of hospital membership to variance in nurse dose and patient outcomes? To what extent are the two hospital systems comparable in terms of average patient acuity, length of stay, range of services provided, etc?

3. The authors report that a factor analysis was done in which two nurse dose factors were identified. Is the reader to assume that none of six indicators had dual loadings and this is why the loadings for each indicator were reported only for one of the two factors? It seems that indicators often load on more than one factor, especially when the loadings are borderline low.

4. The approach used to construct the composite variables seems less than optimal. Insufficient information is given to explain why the decision was made to reduce the level of measurement of the staffing indicators from the ratio to the quasi-interval level. In addition, skill mix, for example, had a much stronger loading as an indicator of active ingredient than did RN education or RN experience. Assigning an equal weight to each indicator ignores the relative contribution of each indicator to the composite variable. Assigning an equal weight to each indicator also can mean that the same value can be obtained for a composite variable even though there may be differences in the actual number assigned to each indicator. Would it not be appropriate to use factor scores to construct the composite variables instead of assigning a single number from 1-4 to each indicator? According to the authors, the approach used to construct the composite variables was chosen because it is simple to use and easy to interpret. This argument does not provide adequate justification.

5. As noted in the manuscript, higher FTEs and higher RNHPPD tend to be associated with lower nurse-patient ratios. It seems probable that several of the six staffing indicators used in this study are likely to be highly correlated, raising questions about redundancy among the indicators which could result in overly inflated correlations between the composite variables and the outcomes. Yet, no information is given about the intercorrelations among the staffing indicators. Finally, the discussion needs to be strengthened, especially in terms of acknowledging that staffing variables really give no information about what nurses actually do to achieve optimal patient outcomes. Also, the authors suggest that future studies should be done to examine the relationship between nurse dose and other outcomes that are "more sensitive to variations in staffing." However, patient falls are identified by NDNQI and NQF as a nurse sensitive indicator.

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CHECKLIST FOR STYLE

TEXT --

Reduce # of pages (e.g., Brief Report article is 6-8 pages, there are currently 10 pages).

REFERENCES --

Clarify the Hutchinson ref/citation (or Hutchinson & Holtman, 2005).

TABLES -- Format tables according to APA 6th Ed: Define all abbreviations used in the tables in a note below each table.