Author's response to reviews

Title: Practice Change Toward Better Adherence to Evidence-Based Treatment of Early Dental Decay in the National Dental PBRN

Authors:

D B Rindal (donald.b.rindal@healthpartners.com)
Thomas J Flottemesch (thomas.j.flottemesch@healthpartners.com)
Emily U Durand (emily.c.durand@healthpartners.com)
Olga V Godlevsky (olga.v.godlevsky@healthpartners.com)
Andrew M Schmidt (andrew.m.schmidt@healthpartners.com)
Gregg H Gilbert (ghg@uab.edu)

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Author's response to reviews: see over
Dear Editor:

We are submitting a revised version of MS: 6877870041265731 now entitled “Practice Change Toward Better Adherence to Evidence-Based Treatment of Early Dental Decay in the National Dental PBRN” based on the second review of the manuscript. In retrospect, we agree that our first responses were not sufficient and appreciate the opportunity to address the remaining concerns of the reviewers. In addition to highlighting major changes in gray, we also labeled and referenced the lines of the manuscript so that the review is less burdensome for the reviewers.

We choose to combine reviewer comments from both reviews because that allows us to provide additional details not provided in our first response. Our intent is to minimize documents and simplify the process for a second review. Responses from the first review were either unchanged or further detailed and/or line numbers were added. Comments and responses from the second review are identified and bolded.

Reviewer 1:
First of all, this research is of importance as an innovation in dental clinical research, so the authors should be complimented with their research work in PBRN. Given the contemporary standards of reporting in implementation research substantial improvements should be made. In general these improvements focus on more specific description of the intervention, more clarity in method text, also in tables and figures, more insight in statistical procedures and the motivation of the sequence in which the multilevel analysis were carried out.

Please see our revisions to the manuscript, additions to the tables and the new appendix.

The title could probably more focus on practice change and knowledge translation regarding adherence towards CPG on early dental decay clinical performance in relation to PBRN.S

The title has been revised to “Practice Change Toward Better Adherence to Evidence-Based Treatment of Early Dental Decay in the National Dental PBRN”

Second Review: Abstract: some data presented with p--#values, and others with OR, more consistent reporting. The abstract needs further improvement regarding the precise description of the research question.

We agree with the reviewer that we sacrificed clarity in a pursuit of economy. We have re-written the objectives portion of the abstract and have added test values and point estimates along with the p-values.


Thank you. We have discussed and referenced this work. See lines 89-103.

Second Review: my suggestion to use more recent dental research on implementation of CPGs in oral care instead of only an extensive description retrieved from medical research. By simply describing the dental research in the background section without focusing on the impact of the results and conclusion, which are relevant for CPG implementation research in dental practice (guideline implementation tools, multifaceted interventions in knowledge translation) is useless. If references are used in the text, they should also be described in the reference list.

Thank you. We have discussed and referenced this work. See lines 89-103. The missing reference was an oversight we have corrected.

Extensive description again on PBRN in medical care regarding professional behavior and PBRN. Is there any additional research on networks in dental care in US or Europe?

We have added the following reference and related text on lines 103-106: Botello-Harbaum MT, Curro FA, Rindal DB, Gilbert GH, Hilton TJ, Collie D, Craig RG, Lehman M, McBride R, Vena DA, Thompson V, Lindblad A for the CONDOR Collaborative Group. Information-seeking behaviors of

Paragraph sentence: ‘this current study’ employed etc. regarding ‘the diagnosis and treatment of early carious lesions’. Next sentence: to study the impact on practice patterns or provider patterns or both? We have revised the language to improve clarity. See lines 127-130.

Next sentence: Evidence supports….could you report how conclusive this evidence is? And more specific: what was the specific CPG-recommendation to adhere to in this study? Which specific professional tasks/performance acts are behind the different diagnostic codes? Two systematic reviews have been added as references. See lines 131-134. An additional reference was added in the discussion regarding this issue. See lines 376-379.

Methods are in general appropriate described, improvements are needed regarding the description of inclusion and exclusion criteria, regarding the used levels analysis, especially for care providers which have not been explicitly described (provider characteristics). We have re-written the methods section to include better descriptions of how we identified our provider group and identified the final analytic samples. See lines 146-188.

Second Review: Explain further the meaning of ‘large integrated, multi--clinic dental group’? page 9. A group of the same GDPs working in one clinic or working in clinics in different locations? Integrated in what sense? We made additional changes on lines 146-149 to address this comment from the second review.

Second Review: The reliability of the data collection could be questioned; there is a substantial loss of data i.e. as mentioned on page 15 under results. The quality of data recording by providers as mentioned before has not been addressed properly. We cannot quantify the quality of the data recorded in the dental record by the dentist. We can say that Standardization was done via training at staff meetings. The caries depth measure is also addressed in the HealthPartners caries guideline providing a description of the specific caries diagnosis codes. We address this issue in the method section, lines 153-157. We also address this in the discussion section under limitations, lines 441-442.

Second Review: Moreover, as mentioned in the discussion section there have been changes in the electronic dental record over time in the research period (page 22), which could have influence on the results. We have provided more detail of those changes and made a revision to the last sentence of that paragraph to provide more-appropriate conclusions for the reader, see lines 431-432.

More explicit: reporting intraclass correlations and explained variance of different applied levels? What is missing is a clear overview of the variables applied in the multilevel analysis and the results of each step should be documented for the reader…” We appreciate this thorough review and appreciate the criticisms outlined. We have re-written the methods section to clarify inclusion criteria applied to the providers. We have also included an Appendix that lists the diagnostic and treatment codes used to identify and classify dental findings.

The data described are sometimes confusing, especially regarding the counting of the diagnostic codes on page 9 and 10 showing substantially differences (errors in calculation). Numbers described in the text are not always in with the total numbers described in Table 1. We thank the reviewer for his or her patience. Our initial submission failed to clearly illustrate how the final analysis dataset was identified. We have re-written and added a section to the RESULTS section. Hopefully, this clarifies how this was done. In addition, we have provided an appendix that details our data development and model development. We believe this improves the accessibility of our findings.
More clarity (relevant information) is needed to improve readability. Text and tables should speak for themselves. Tables need consistent improvement according to the current standards of reporting.

We have made several modifications to the text and to the tables provided in the text in an attempt to improve clarity. Particular additions have been made to Table 2.

More elaboration on social theory-driven behavior and the confounding influence of an alternative intervention during the time period (financial incentive) clinical performance of the three groups? An a priori reliance on a theoretical framework would have improved our understanding of factors that influenced our observed results. However, the study design was not prospective and therefore relied on a data-driven approach because data already existed in the electronic dental record and basic PBRN enrollment data.

It would be preferable to describe this section of data collection with explicit inclusion and exclusion criteria for the two sources. We thank the reviewer for the helpful comments regarding clarification. We have made several edits to this end. See lines 162-188.

Furthermore, method of collection data and results should be fully separated here. The results (number of identified codes found) should be described in the result section. We agree that our initial submission mixed Methods and Results. These two sections have been clearly delimited in the revised manuscript.

Elaborate on the three possible reasons why 95,531 codes were missing is interesting but not relevant to describe in the method section. Discussion section would be more appropriate perhaps with some thoughts on the quality of record keeping in dental care? We agree. We have moved this into a new section, Development of analytic dataset that now leads the RESULTS SECTION.

What should be more explicitly described here is an overview of provider characteristic (table) as important part of the multilevel analysis (yet described as ‘demographic data’ in the text). The patient demographics table also raises questions: what is meant by ‘number of findings’ and ‘co-occurring findings’. It would preferable to describe in more detail results of provider demographics (characteristics) to give insight in the group of professionals.

We have modified Table 1 of the paper to include a section summarizing the provider characteristics by PBRN engagement level. Although the impact of provider-level factors was considered in model development, none of these met our stated a priori criteria of significance at the 10% level.

Lines 239-241 now read: “Fourth, provider demographics were screened and incorporated with factors significant at the 0.10 level and/or significantly contributing to model fit (likelihood-ratio test<=.05) retained”.

We apologize for the lack of clarity of terms used by dentists. They may not be well-known elsewhere. We have added parentheticals to the text to clarify their meaning (see lines 243-252). “The first logistic, mixed-effects regression used data from all HPDG providers meeting the three inclusion criteria. The final model included provider level cross-level random effects and the following patient-level factors: age, Number of other Enamel Findings (the number of other Enamel findings diagnosed at the same index visit), Number of other Dentin Findings (the number of other Dentin caries diagnosed at the index visit), and Number of Sealants with Damage (the number of teeth previously treated with a sealant that were found to have damage during the visit). No provider factors were found significant at the 10% level and were not retained (see appendix results from other model runs). This final model was used to examine our first two research questions. The key variables of interest were provider level of PBRN engagement (Q 1) and provider attendance at the 2008 PBRN meeting (Q 2). “

We have also included in the new appendix results from baseline model runs (i.e. those not incorporating our effects of interest) that show these estimated effects.
What is missing is a clear overview of the variables applied in the multilevel analysis and the results of each step should be documented for the reader.

We have addressed this comment in two ways. First, we have included an appendix outlining our model development. Second, we have re-written both the methods and results sections to clarify our modeling approach, development of the analytic dataset, and our steps of model development.

It would preferable to describe in more detail results of provider demographics (characteristics) in order to give insight in the group of professionals.

Table 1 has been modified to include these data. However, as noted in Lines 308-313 of the revised manuscript, these factors were not significant at the 10% level and were not retained in our final models.

**Second review**: "Explain the combination of the 5 levels of PBRN involvement (page 14), in higher and lower levels by combining 1 and 2 and 3 and 4, what happened to level 5?"

We apologize to the reviewer for our presentation's lack of clarity. We combined levels of engagement to arrive at three final levels: Low Involvement, Surveys and Studies, and Studies, Meetings, and Presentations. Our intent was to distinguish those with only cursory engagement (Low), those who-at a minimum-attended a PBRN meeting, and those who actively participated and presented PBRN-related research. This is now noted in Lines 268-274, which read:"In subsequent analyses to better distinguish lower and higher levels of PBRN engagement, we combined levels 1 and 2 and levels 3 and 4 (Figure 1) leaving three final levels of PBRN engagement: Low Involvement (levels 1 and 2), Surveys and Studies (levels 3 and 4), and Studies, Meetings & Presentations (level 5). These levels distinguish cursory engagement (Low), those who-at a minimum-attended at PBRN meeting, and those who actively participated and presented PBRN-related research."

We have also made appropriate changes to tables and in the text.

**Second review**: "The counting of the diagnostic coding was incorrect in the first review manuscript and the corrected counting of diagnostic coding is still incorrect on page 14 and 15. Based on the numbers in the text, the remaining findings should be 103,235 instead of 107,581."

We thank the reviewer for pointing out this error within the manuscript. The values have been changed to reflect the correct numbers that appear in Table 1 and lines 290 and 295.

**Second review**: "The stepwise statistic procedure in the model seems to be correct, but the results of the analysis depend for the greater part on the quality of the collected variables (data) that were put into the model, so there exist serious doubts about the quality of the data used."

We agree with the reviewer's insightful comment. Any empirical study is only as good as the data available to the proper analysis supplied. We have re-written the limitations of the study (Lines 440-459) to now read:

"Limitations of this study include the retrospective design and our reliance on data entered into a clinical record. Clinical data in the electronic health record have not been fully validated and may not accurately reflect the actual clinical condition. The issue of missing data is also of concern. While uniformly distributed across all provider groups, missing treatment plan data may have impacted results. As with any study, findings are only as strong as the data that underlie them. In this study, there were missing data across all of our provider groups. This limited our ability to adjust for demographic factors in multivariate analysis and may have impacted results in an unforeseen way. Further, we only examined the practice patterns of 35 providers; however, we were able to have a large number of observations for each provider. These providers practice in a large staff model setting that may not be representative of other practice settings. For these reasons, we consider these findings supportive of additional investigation but not conclusive on their own. Ideally, we would like to replicate these findings in other settings, but currently dentistry lacks standardized electronic clinical data that includes universally accepted diagnosis
codes. A randomized trial of providers is a stronger study design but has several limitations, including feasibility and the inability to identify the components of PBRN participation that are most predictive of practice change.”

DISCUSSION
Some discussion on what could be seen as a relevant change in provider behavior from a clinical perspective?

Text was added on line 377-380 discussing the improved health of a tooth avoiding the long term impact of the initial restoration.

How consistent and solid was the evidence in the CPG referred to in this study?
In case a small evidence base adherence by providers could be questioned?

References have been added to the appropriate text summarizing the current evidence. See lines 131 and additional reference in the discussion section in line 379.

Evidence based decision making relies on scientific evidence, clinical expertise and context as well as on patient preferences. Is something known about these patient preferences regarding the restoration decisions in this study?

We did not capture patient preference information. The prior regional Dental PBRN did conduct a study that examined patient satisfaction with a restoration visit. It found that patients frequently would have liked additional information about the restoration choices, suggesting that less-than-optimal information was provided on their treatment options. The following reference and related discussion was added on lines 453-457. Riley JL III, Gordan VV, Rindal DB, Fellows JL, Qvist V, Sager P, Foy P, Williams OD, Gilbert GH for the National Dental PBRN Collaborative Group. Components of patient satisfaction with a dental restorative visit: results from The Dental Practice-Based Research Network. Journal of the American Dental Association 2012; 143(9):1002-1010.

Changing professional behavior is complex and substantial research has been conducted over the past decades. Theory-driven approaches to professional behavior change and current knowledge extends Friedson reference (1971) in the text. A review from Eccles et al., 2005 Journal of Clinical Epidemiology could be helpful to elaborate on this important topic.

Thank you; this reference has been added as well as two additional references. We expanded the discussion section to include a better discussion of the topic; see lines 388.

Second review: I disagree with the authors when they stated: ‘this study does not use a theoretical framework because it was not prospective’. My previous comment was focused on a broader discussion on the current knowledge of behavior change and implementation based on more than one study from decades ago (Friedson 1971).

Thank you for the additional clarification. We have added to the discussion to address this useful suggestion. See lines 388-405.

The dissemination of best evidence in groups (social environment of peers): exploring some possible others determinants or factors than mentioned (PBRN) here could be interesting.

See response to the prior comment for the reviewer. We added text and a reference to enhance the discussion.

The role of opinion leaders, competent peers and experts in transfer of knowledge has been discussed in this section. A reference to research evidence is preferable.

The relevant reference has been added to that text, lines 402-404.

A main confounding problem is the additional intervention (2010-2011), mentioned in the discussion section. As described ‘pay-for-performance’ incentives could be effective in changing professional behavior. In what way could this financial intervention affect the results in this study? And should ‘this intervention’ not be adjusted for in the analysis? Or could you looking at Figure 1 (blue line) give an
explanation why this group of practitioners, in contrast with both other groups did not change performance more?

The practice change we observed in 2010-2011 impacted practitioners who had not changed practice patterns due to PBRN activities. The actual amount of the incentive was very small.

The impact of the national meeting: is this implementation tool cost effective given the small improvement overall?

We concurred that the national meeting was expensive and may not be cost effective. It just happened to be the network meeting where caries treatment was the main topic.

Second review: Moreover, as mentioned in the discussion section there has been changes in the electronic dental record over time in the research period (page 21), which could have influence on the results.

We added a description of changes that occurred; see lines 430-432.

Reviewer 2:

In general, the work is original, important and in most parts well defined. Presentation and writing are good. However, I feel that the conditions under which the diagnostic codes were obtained need further clarification, and that the abstract does not adequately capture the objective or the limitations of the work.

Major Compulsory Revisions:
It should be mentioned in the text whether caries diagnosis was set after clinical examination only or radiographic control was performed as well. Proper early caries diagnosis cannot be performed and evidence based treatment cannot be implemented unless x-rays have been used for the interproximal areas.

See updated response below.

The abstract should be changed to capture the exact objective of the present work. Moreover, the limitations of the current work should be further discussed in case of lack of radiographic assessment, as well as, in the light of the practice guidelines, that appear to have been released in 2008 also (2008 Mar 31-www.guideline.gov), the same year as the NDPBRN meeting. How was the presentation of these practice guidelines made to the practice dentists?

The caries guideline has been in place for several years. In 2008 the guideline was updated to reflect any new evidence. The changes did not include a change in the treatment of early caries.

Minor essential revisions:
Explanations for the codes F83, F84, F892 & F893 should be provided as well.

See the response above to reviewer 1.

Second review:

a. It should be clarified in the text whether caries diagnosis was set after clinical examination only or radiographic control was performed as well. In case of lack of concurrent radiographic control, the limitations of the current work should be discussed and the exact background of the intervention should be reflected in both title and abstract. For example, under such conditions of data gathering, one cannot talk about “Adherence to Evidence-Based Treatment of Early Dental Decay”. Evidence based treatment can be based only on an as possible accurate diagnosis of each condition.

We agree; more detail should be provided for the reader. We addressed this issue in the method section, lines 154-157 and again in the discussion section under limitations, lines 431-432.

b. Furthermore, I would suggest that the term “pre-curious” is changed to “early caries” in the text.

This suggestion is welcomed and has been made throughout the text.
c. After inspecting the Supplement 2 Table A1 Codes, I noticed that sealants were categorized in the restoration group of codes. Sealants are primarily used for prevention. Under which conditions were sealants used for treatment?

For the analysis sealants were considered a non-restorative treatment of the early caries that was utilized to arrest the lesion.

D. Brad Rindal, DDS
HealthPartners Institute for Education and Research
PO Box 1524, MS 21111R
Minneapolis, MN 55440-1524
952-967-5026
Fax 952-967-5022