PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Prevalence of and factors associated with fewer than 20 remaining teeth in Taiwanese adults with disabilities: A community-based cross-sectional study
AUTHORS	Pan, Mei-Yu; Hsieh, Tsung-Cheng; Tai, Hung-Cheng; Lin, Ming-shyan; Lin, Yu-Chen;Chen, Mei-Yen

VERSION 1 – REVIEW

REVIEWER	Jose Leopoldo Ferreira Antunes University of Sao Paulo, School of Public Health Brazil
REVIEW RETURNED	16-Feb-2017

GENERAL COMMENTS	This study assessed dental loss in adults affected by disabilities. This objective is certainly relevant to health research, notwithstanding having been scarcely studied. The study included a relatively large number of participants. Having gathered this sample is also a scarce characteristic in studies about this theme. The text is well organized and can be read smoothly. The Introduction poses well the problem to be studied. This reviewer agrees with the main methodological options, and considers them to have been appropriately described in Methods. Results have been objectively described and the Discussion makes a strong case to the report of conclusions, in addition to have made a fair acknowledgment of study limitations. I consider this manuscript to be a nice documentation of the oral health of people with different types of disability.

REVIEWER	Paula M. Minihan Tufts University School of Medicine USA
REVIEW RETURNED	15-Mar-2017

GENERAL COMMENTS	Data analysis and presentation: -Recommend stratifying some data by 'edentulous' and 'dentate'. The prevalence of certain oral health behaviors reported in Table 2 (i.e., times brushing per day, brushing teeth after meals, using dental floss) should be reported for dentate subjects only. When I hand-calculated the prevalence of these behaviors using # of dentate subjects as the denominator (vs. all subjects - edentulous and dentate), the results were, more or less, in line with prevalence figures reported in other studies involving adults with disabilities, so this might alter the Discussion.

Some guidelines recommend that people who are edentulous need only visit a dentist once a year (or a primary care provider annually for an oral check), so perhaps this variable should be reported differently for edentulous subjects. Also, in addition to reporting the average NRT, suggest either: reporting the median NRT to acknowledge the possibility that the 13.7% of edentulous subjects may skew the mean towards zero; or 2) reporting the mean NRT among dentate subjects only.

-Note the n= in the title line for each table (to account for the presence or absence of 18 subjects who failed to complete the NRT assessment).

Clarification of several issues:

-The authors note that the study provides new information about the oral health needs of adults with disabilities in rural communities (in Abtract), but it's unclear the degree to which the study population represents a rural population.

-Under inclusion criteria, 'mental illness' is one of four disabilities listed. Elsewhere in the manuscript, however, the term 'intellectual disability" is used. Is intellectual disability a sub-category of mental illness? Please clarify. This is important because 'intellectual disability' was found to be associated with NRT. Also, did the four disability groups represent the primary disability? It's not unusual for adults with disabilities to have one or more different disabilities; these individuals are typically placed in a separate additional category. Finally, some subjects were said to receive assistance with the interview from caregivers and others; more information about the nature and degree of this assistance would be helpful

-'Less' compared to 'more' years of education was found to be associated with NRT. It's unclear the degree to which the presence of a sizable group of adults with intellectual disabilities – who, by definition, find it difficult to learn and may not attend a regular school - would affect this measure. Please clarify.

Limitations:

Additional limitations include self-reported health behaviors and the potential for bias in the direction of socially desirable behaviors. Also, the oral health assessments were made by community health workers (albeit trained), and not by dental professionals.

Some statements did not appear to be supported by data in the manuscript:

"Moreover poor oral health behaviors received limited attention from healthcare providers." (in Abstract)

". . . the sub-group of individuals with intellectual disabilities was found to be afflicted with severe oral diseases more commonly than the other sub-groups." (in Discussion)

Reference list:

-The Reference list should include more epidemiologic profiles of the oral health of adults with disabilities, particularly those based on clinical examinations (UK and US).

-Members of the disability community may consider Reference #32 offensive and suggest it be removed and/or replaced by a paper focused on human medicine.

REVIEWER	Kristine Harrsen Bachkati, PhD fellow University of Southern Denmark Department of Epidemiology, Biostatistics and Biodemography. Denmark
REVIEW RETURNED	31-Mar-2017

| GENERAL COMMENTS | Major revisions
1 Research question
a. Please clarify in the research question (p. 5, lines 22-23) that the population is non-institutionalized.

b. The authors could specify factors to e.g. selected health behaviors etc. and various disabilities by writing physical and intellectual disabilities or even write the four specific disabilities.

2 Introduction
a. Please elaborate on the kind of impact on 'individuals' health' (p.4 line 14)

3 Design, sample, and setting /Measurements
a. The authors should specify in the section design, sample, and setting how many participants was invited for the study and what the response rate was.

b. Please specify where the demographic data where obtained from.

c. Disability related data should not be categorized as/put under the heading 'demographic characteristics'.

4 Cross sectional study
a. The authors should consider the limitations regarding the cross sectional design and elaborate on these.

5 Analyses and results
a. The presentation of findings in table 3 and 4 give rise to a great deal of confusion. The authors aim to investigate the prevalence of and factors associated with NRT among adults with various disabilities in Taiwan. The disability measure is presented on the same level as exposures and confounders. Since the focus is on prevalence and factors among adults with various disabilities, the univariate analyses and regression analyses should be made and presented within the four different disability groups so each group is treated as a separate population.

b. Table 3: It is not clear who the reference group is (who is disabled and who is not). Please specify this. Please argue why percentages on columns have been used. To examine the outcome distribution in relation to the exposure it is more informative to present row percentages so please consider this instead of a share of NRT (in two categories).

c. Table 3 reveals that only the vision impaired participants has a slightly higher possibility of having less than 20 remaining teeth (5% vs. 3.5% in row percentages). Hearing impaired, physically and intellectually disabled participants are more likely to have 20 or more remaining teeth. This indicates that these disabilities should have a protective effect against loosing teeth. The results are conflicting in relation to the findings in table 4 where only intellectual disability has a significant OR on 2.30. |

	Further elaborations on these findings are needed.
	d. Table 4: In table 4 it seems like disability is the exposure. Either change table or the aim.
	e. Please argue why physical disability has been chosen as the reference in the regressions analyses.
	f. Information on the stepwise analysis in the regression analyses is very relevant in terms of understanding and interpretation of the findings. Please expand the table with additional analyses on e.g.: First column: Unadjusted analyses on the associations between exposures and NRT in the four categories of disabled. Second column: Exposures and NRT in the four categories of disabled adjusted for age, sex, and education Third column: Fully adjusted model.
	6 Discussion a. Under four key findings, the authors write that there were a higher prevalence of NRT<20 among disabled participants. On what ground can this be concluded? It is rather problematic to conclude on disabled as one group, when analyses are done on four subgroups. Table 3 reveals that only the vision impaired had a higher prevalence of NRT<20 teeth. Furthermore the p-value for the disability classification is not significant.
	b. The authors should briefly give a description on how the dental health care system works in Taiwan. For instance: Is it free of charge (for a selected group)? Is there any reimbursement possibilities? Or other relevant issues.
	c. Further reflection on the association between education and NRT is recommendable.
	d. The authors do not at any time reflect on the importance of socio economic position. Please elaborate on this in the discussion. Where there any information on this in the questionnaire?
	Minor revisions a. Page 6 line 9: Please correct of 2013 to in 2013 b. Page 6 line 24: please correct viz., to viz.: c. Page 13: Table text: correct analysis to analyses d. Page 19 line 3: Please add the reference again to the 8020 campaign

VERSION 1 – AUTHOR RESPONSE

For reviewer 1:
Thank you for your support and appreciation that this paper is important in this field.

For reviewer 2:
Thank you for your comments, especially for the appreciation that this paper is important in this field, as well as the recognition of study design.
1. Regarding the suggestion of stratifying data by "edentulous" and "dentate"…
Ans. As we asked the participants to recall their oral health behaviors back to a year and/or were dentate during data collection, the stratification may not be applicable in our research context.

However, we have still tried to analyze the data and showed the similar results in the discussion on p16 with red font.

2. Regarding reporting the median NRT.

Ans. We have reedited the median NRT on Table 2 and its footnote and in result section with red font.

3. Regarding the number of participants "n" in the title line for each table.

Ans. We have reedited the number in the title line and excluded the subjects of missing data in the footnote for each table with red font.

4. Regarding the unclear wording about "rural" communities (in abstract).

Ans. We have reedited on p3 with red font.

5. Regarding the inclusion criteria of "mental illness" were unclear…

Ans. We have reedited the term "mental illness" and "adults with more than one different disabilities" on p6 with red font.

6. Regarding information about the nature and degree of the caregivers' assistance.

Ans. We have provided more information on the section of "procedures and ethical considerations" as most of the caregivers were their family members living together. Please see p9 with red font.

7. Regarding unclear the degree of intellectual disability subjects and the further reflection on the association between education and NRT.

Ans. Sorry about the confusion, as education has been defined as a confounder that is similar to the unmodifiable variables like age and gender, its effect has been adjusted in the further stepwise analysis in the regression analyses. Issues around education and school years have been removed from the manuscript to focus on the modifiable variables. We have reedited the result, discussion, and conclusion on p16, 18, 21 with red font.

8. Regarding the additional limitations of the self-reported health behaviors, and the assessment done by the assistant…

Ans. We have reedited the section of limitation on p21 with red font.

9. Regarding the statements did not appear to be supported by data…

9.1 … poor oral health behaviors…in the section of strength and limitations of this study in abstract…

Ans. We have reedited the section of strengths and limitations on p3 with red font.

9.2 …the sub-group of individuals with intellectual…than the other sub-groups…

Ans. We have reedited the statement on p17 with red font.

10. Regarding references-
10.1 Regarding more literatures in epidemiologic profiles of the oral health…

Ans. We have reedited the reference. Please see the reference #20, 21, 23.

10.2 The reference #32 that may be offensive.

Ans. Thank you so much. We've removed it from the list.

For reviewer 3:
Thank you for your comments and especially for the appreciation on the paper with interesting and help us to modify the stepwise analyses in the regression analyses.

1. Research question-
1.1 Regarding the clarification of the research question that the population is "non-institutionalized".

Ans. We have reedited the research questions on p5-6 with red font.

1.2 Regarding the research purpose relating to the discussion of various disabilities.

Ans. We apologize for the misleading in the previous manuscript. In this study, the categories of disabilities were analyzed and demonstrated as a "factor/exposure" rather than a separate research question (please see p5-6, in the last section of introduction). We will take this issue in mind and do further research in the future.

2. Introduction-
Regarding the further explanation about the "impact on individuals' health".

Ans. We have reedited the mentioned issue on individuals' health in more detail on p4 with red font.

3. Design, sample, and setting /Measurements-
3.1 Regarding how many participants was invited and the response rate was…

Ans. We have provided more information on p10 with red font.

3.2 Regarding the collection of demographic data and the categorization...

Ans. We have reedited the background information and contains three parts. Please see p8 with red font.

4. Analyses and results-
4.1 Regarding Table 3-4, and some statements with confusion in terms of the categories of disabilities, and consequent comments/questions based on the concern of this issue hereafter.

Ans. Sorry about the confusion. We have reedited the stepwise analysis in the regression analyses has been conducted to develop 3 steps of models. The tables were then redesigned and presented as shown in Table3. As the category of disabilities could be an "exposure and confounder" in this model, the presentation and discussion of each group with various disabilities as a separate population would not be the main focus of this paper. Therefore, the clarifications and explanations through the research purpose to the end were reedited on p5, 10, 13-16 with red font.

4.2 Regarding the selection of physical disability as a reference group in regression analyses.

Ans. Based on previous studies (we provided the citations as follows) showed that the dental status and oral prophylaxis behaviors in the physical disability individuals are better than intellectual disability (Leroy & Declerck, 2013; Lai, et al., 2014), thus we selected the physical disability as a reference group in regression analyses.
Leroy, R., & Declerck, D. (2013). Objective and subjective oral health care needs among adults with various disabilities. Clin Oral Investig, 17(8), 1869-1878.
Lai, H.-T., Kung, P.-T., Su, H.-P., & Tsai, W.-C. (2014). Examining related influential factors for dental calculus scaling utilization among people with disabilities in Taiwan, a nationwide population-based study. Research in Developmental Disabilities, 35(9), 2231-2240.

5. Discussion-
5.1 Regarding the four key findings that conclude the prevalence of one group while showing analysis based on four groups.

Ans. We have redesigned the tables and showed a stepwise model that define the subgroups of disabilities as the exposure. Additionally, we appreciate your valuable insight that inspires another interesting topic to be explored in the future study.

5.2 Regarding the dental health care system in Taiwan.

Ans. Taiwan government provides additional oral health services such as the use of fluoride gel/varnishes and more frequent dental scaling, etc. (p5, "…These premium subsidies funded by the NHI…"). Besides, under the normal NHS system, no extra charge in addition to the registration fee and copayment fee on p17 with red font.

5.3 Regarding the association between education and NRT...

Ans. Although previous studies have pointed out that education is related to tooth loss, education has been defined as a confounder in this study that is similar to the unmodifiable variables like age and gender, its effect has been adjusted in the further stepwise analysis in the regression analyses. Issues around education and school years have been removed from the manuscript to concentrate on the modifiable variables.

5.4 Regarding the socio-economic position of the participants.

Ans. In the questionnaire, we only collected the data regarding education, which is seen as an important indicator for the socio-economic status (Winkleby, et al., 1992). However, since education is an unmodifiable variable like age and gender, we saw it as a confounder without further discussion and adjusted it in the stepwise models on p10, 16 (in statistical analyses and results) with red font.

5.5 Regarding the limitations of the cross-sectional design.

Ans. We have added a limitation in the relevant section on p21 with red font.
6. Regarding the comments on minor revisions…

Ans. Thank you. We have reedited them in the manuscript with red font.

REVIEWER	Paula M. Minihan
	Tufts University School of Medicine USA
REVIEW RETURNED	06-Jun-2017

GENERAL COMMENTS	The authors devoted considerable effort to revising this manuscript, and they paid careful attention to the reviewers' comments. Thank you for your hard work. The original manuscript had many strengths, and they have been retained in the revision. These include the following.
	• The study was well-designed:
	o inclusion/exclusion criteria were clear;
	o strategies designed to recruit the convenience sample resulted in a robust sample size;
	o the outcome and independent variables were clearly defined; several variables were measured using physiological bio-markers, medical histories diagnosed by physicians, and public health department socio-demographic data; and
	o the data analysis was appropriate.
	• From all appearances, the study was implemented with great care.
	The authors also clarified several issues which were unclear in the original submission.
	• The study population represents adults with disabilities who live in community settings and were recruited from a specific geographic entity.
	• A subset of the study population had 'intellectual disability' and not 'mental illness.'
	• Some subjects with intellectual disability and hearing impairment required assistance with the self-interview survey, and the source and level of assistance were made clear.
	• Table headings were edited to note the n's.
	• The authors provided more information about the instructions for the self-interview survey; specifically, study subjects were told to recall their health behaviors (e.g., tooth brushing) up to a year previously and/or when they were dentate. [Suggest adding an asterisk to Table 3, independent variables requiring teeth and, in a footnote, explain that the variable data reflects subjects' recollection of their behaviors when they were dentate.]
	• The authors noted concerns about shortcomings regarding self- and/or caregiver-reported behaviors, and the potential for recall and social desirability biases in the Discussion section. [Suggest noting these limitations in the Abstract too.]
	Continuing concern about outcome measures.
	The outcome of interest was 'Fewer than 20 Remaining Teeth' (Yes or No) (measured by prevalence/proportion). The authors also calculated the mean (SD) Number of Remaining Teeth. Studies with this outcome (Number of Remaining Teeth) generally also include edentulism as an outcome. Edentulism is a standard measure of oral health status in population-based surveys in the USA, UK and Canada.
	For this reason, I recommended, in my original review, that the authors consider adding 'edentulism' as an outcome, and specifically suggested they consider stratifying some descriptive data by 'edentulous' vs. dentate status. The authors did add some text

about edentulism status (towards the end of the Discussion section) and also reported median # of remaining teeth to account for potential skewing due to the 13.7% of subjects who were edentulous, but otherwise chose not to consider edentulism as an outcome of interest.

I was unsure personally of what I thought about this issue, and spent some time today researching it in more depth. Based on this research, I've concluded that the paper would be stronger – particularly for those with an interest in the oral health status of adults with intellectual disability - if the authors provided some descriptive information stratified by dentate vs. edentulous status.

I defer to the editor with respect to the final decision. Nonetheless, I would like to present the rationale behind my recommendation.

•   It's important that the authors provide the framework/rationale behind the "< 20 remaining teeth" outcome – regardless of what they decide to do about the subjects who are edentulous. The framework is based on the concept of Functional Dentition (a.k.a., Functional Natural Dentition). This refers to the belief that individuals who have approximately 20/21 teeth (exact number said to be somewhat arbitrary) have 'enough' teeth to be able to chew their food and eat without it being onerous. This is referred to as the Functional Dentition Threshold.

•   The outcome "Number of Remaining Teeth' has emerged because patterns of tooth loss and tooth retention are changing for the better. Fewer people in the general population are losing their teeth as they age and fewer people are losing all their teeth. This is a great achievement and this trend is expected to continue.

•   This quote captures what I'm trying to articulate:

"Although it is a crude measure of oral health, the proportion who have no natural teeth is both clear cut and important. However, as fewer people lose all their teeth, its usefulness reduces, and other measures (such as the number of teeth and the proportion with a 'functional natural dentition') may be necessary if an accurate indication of oral health to be obtained from all patient groups." (Steele et al., 2000, British Dental Journal, 598-603).

•   Oral health data with respect to adults with disabilities, particularly adults with intellectual disability (ID), are limited. What data there are, however, suggest that edentulism remains highly prevalent among adults with ID. Furthermore, there is no information at present to suggest that the prevalence of edentulism in this group is dropping.

•   FYI – I googled 'Number of Remaining Teeth (albeit not very scientific but still potentially informative). It may be relevant that the first seven citations that appeared referenced oral health studies conducted in Asian countries (Japan, Korea, Taiwan). Perhaps there is regional variation in the selection of oral health outcomes.

•   This is a strong paper and contains important information for those working to improve the oral health outcomes of adults with disabilities, including adults with ID. If the paper does not include basic information about risk factors for edentulism – a standard oral health measure – it will to be difficult to compare and contrast the findings from this study with the findings from other studies and populations.

Other concerns:

•   Age is among the strongest predictors of tooth loss in every population, and it was found to have a statistically significant association with '<20 remaining teeth' in the original submission.

	Age does not appear to be a significant risk factor, however, in the revised document. I don't see any information about the statistical significance of age in the revised table. • The revised manuscript includes a new exclusion criteria: having more than one category of disability. Many individuals with intellectual disability have multiple disabilities and associated medical and behavioral conditions. The authors may want to consider using the term 'primary disability' when describing the characteristics of the study population.

VERSION 2 – AUTHOR RESPONSE

For reviewer 2:

Thank you so much for your efforts and comments, especially for the appreciation of many strengths, including the significance of the issue as well as the recognition of study design, are retained both in the original manuscript and in the revision. Your comment that the clarification of several issues that were unclear in the original submission is highly appreciated, too.

1. Regarding the suggestion of considering adding 'edentulism' as an outcome, and specifically suggested we consider stratifying some descriptive data by 'edentulous' vs. dentate status.

Ans. The figure of the edentulism in the current study is 73 (13.7%) that is a bit higher than some previous research. We understand that edentulism is another crucial indicator of oral health adopted in the US, UK, and Canada. To demonstrate the importance of the indicator, we stratified some descriptive data by "edentulous" vs. "dentate" status, whilst divided the dentate into NRT 1-19 and NRT≥20 to match the original design. Further statistical analyses of χ2 tests were then conducted as an univariate analysis to compare differences between the three groups. The results indicated a consistence of the findings between edentulism and an NRT<20. We have reedited the measurements, statistical analyses, result, discussion, and conclusion on p7, 10, 11, 12, 13, 15, 16, 17, and 20 with red font.

2. Regarding the suggestion that oral health data with respect to adults with disabilities, particularly adults with intellectual disability (ID), are limited. What data there are, however, suggest that edentulism remains highly prevalent among adults with ID. Furthermore, there is no information at present to suggest that the prevalence of edentulism in this group is dropping.

Ans. We appreciate the insightful comments on the prevalence of edentulism among the ID group. However, since the ID group emerged as results and findings of the current survey, the focus of this paper was not on the prevalence of edentulism among the ID group. Please allow us to conduct further research in the near future.

3. Regarding the suggest of adding an asterisk to Table 3, independent variables requiring teeth and, in a footnote, explain that the variable data reflects subjects' recollection of their behaviors when they were dentate.

Ans. We have reedited and added the information about data collection in the footnotes in Table 2, 3 with red font.

4. Regarding noting of the limitations in the Abstract that self- and/or caregiver-reported behaviors, and the potential for recall and social desirability biases mentioned in the Discussion section.

Ans. We have reedited and added a limitation on p3 line 13-15 with red font.

5. Regarding the age is among the strongest predictors of tooth loss in every population, but it does not appear to be a significant risk factor, however, in the revised document.

Ans. Although previous studies have pointed out that age is a strong predictor of tooth loss, it is defined as a confounder that is similar to the unmodifiable variables like education and gender in this study. Issues around age were demonstrated in Table 3 without much explanation. In the manuscript, we only focus on those modifiable variables that can be further intervened or improved. We have reedited the Table 3, on p14 with red font.

6. Regarding the revised manuscript includes a new exclusion criteria: having more than one category of disability. Many individuals with intellectual disability have multiple disabilities and associated medical and behavioral conditions. The authors may want to consider using the term 'primary disability' when describing the characteristics of the study population.

Ans. We have reedited the inclusion criteria by using the term of 'primary disability' in inclusion criteria (1) on p.6, line 14-15 with red font; and removed the wordings of exclusion criteria "(2) having more than one category of disability".

For reviewer 3:
Thank you for your comments and careful proofread into details.

1. Regarding move the information of the column 'prevalence of NRT<20 on Table 3 to the descriptive columns on Tables 1 and 2.

Ans. Thank you for the comments that we have reedited the Tables 1, 2, and 3, on p12, 13, and 14 with red font. However, according to another reviewer's suggestions that we have substituted the data of NRT<20 with number (percentages) and chi-square tests. All findings and results remain the same.

2. Regarding the tests on how correlated are the variables e.g. hypertension, diabetes mellitus, hyperlipidemia to avoid the risk of over adjustment.

Ans. Thank you for the comments that we have checked the correlations between the three diseases (see table below). It seems the correlations were minor and they did not influence the results and findings.
The Phi coefficient of correlation between Hypertension, Diabetes, and Hyperlipidemia

Variable	Hypertension	Diabetes	Hyperlipidemia
Hypertension	-		
Diabetes	0.147*	-	
Hyperlipidemia	0.164*	0.108*	-

* P value < 0.05.

3. Regarding consider to present only confidence intervals.

Ans. Thank you for the comments that we have reedited the Table 3, on p14 with red font.

4. Regarding other minor revisions include the wordings of "acceleration", model numbering, and typo error in Table 3.

Ans. Thank you for the careful proofread that we have reedited the manuscripts per suggestions. We have reedited the wording on p4, line 16 and Table 3 on p14 with red font.

REVIEWER	Kristine Harrsen Bachkati University of Copenhagen Department of Public Health, Section of Social Medicine CSS, Øster Farimagsgade 5 DK-1014 Copenhagen K E-mail krba@sund.ku.dk And University of Southern Denmark Epidemiology, Biostatistics and Biodemography J. B. Winsløws Vej 9 5000 Odense C www.sdu.dk
REVIEW RETURNED	07-Aug-2017

GENERAL COMMENTS	Thank you for your revised paper. It would be a strength to write that you checked the correlation and there were none.

VERSION 3 – AUTHOR RESPONSE

For reviewer 3:
Thank you for your suggestion.

1. Regarding to that "it would be a strength to write that you checked the correlation and there were none".

Ans. We have reedited the relevant sections to demonstrate our efforts on checking the correlations between the three diseases of hypertension, diabetes mellitus, and hyperlipidemia on p13-14 with red font.