



# Self-report oral health and disease experience among adults in China and NZ

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## Abstract

**Objectives** Differences in oral health perceptions complicate comparisons of self-reported oral health in countries with considerably different cultures, traditions, and dental care. We compared it in China and New Zealand (NZ), to determine whether adults in those countries differ in how self-report oral health item responses distinguish those with different clinical oral disease states.

**Materials and methods** Analysis of representative data on dentate 35–44-year-olds and 65–74-year-olds from the 3rd National Oral Health Survey of China in 2005 (for Sichuan province) and the NZ Oral Health Survey in 2009. Self-rated oral health in the Chinese survey was assessed by asking “Overall, how would you rate your oral health?” (responses: “Very poor,” “Poor,” “Fair,” “Good,” and “Very good”). The NZ survey asked “How would you describe the health of your teeth or mouth?” (responses: “Excellent,” “Very good,” “Good,” “Fair,” or “Poor”). To enable comparability, these were combined to create a four-category ordinal measure of self-reported oral health. The slope index of inequality (SII) and the relative index of inequality (RII) determined the extent to which the four-category self-report item distinguished those with better or poorer oral status.

**Results** A higher proportion of Chinese than NZ 35–44-year-olds rated their oral health as poor or fair, and the NZ proportion rating their oral health as very good was four times that observed among Chinese. The 65–74-year-olds differed even more in their overall responses. For most aspects of clinical disease experience, the two populations were responding similarly to the self-reported oral health item, although the SII and RII values were more pronounced among 35–44-year-olds in NZ than in China; among 65–74-year-olds, both countries were more similar.

**Conclusions** Chinese and NZ adults’ self-ratings reflect their oral disease experience in largely similar ways, despite considerable absolute differences.

**Clinical relevance** These findings support the cross-cultural applicability of self-report oral health measures.

**Keywords** Self-report · Dental caries · Periodontal diseases · Oral health · China · New Zealand

## Introduction

Global (single-item) health measures summarize the informant’s subjective perceptions and more objective observations of his/her health [1]. Their use has increased in

recent years, partly because they are easier to use and interpret than multi-item scales. The most commonly used one in oral health research is the question “How would you describe the health of your teeth or mouth?” which uses the ordinal response options “Excellent,” “Very

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good,” “Good,” “Fair,” or “Poor” [2]. It can be used as an outcome measure in its own right [3, 4] or as a “gold standard” against which to validate multi-item scales [5]. It has also been validated against clinical disease measures in representative samples of Australian and New Zealand adults [6].

Notwithstanding the clinical validation of measures for it, self-reported oral health is known to be influenced by contextual determinants such as stress or socio-economic position [7] and, at the individual level, by particular personality characteristics [8]. It is also likely that there are wider cultural influences on how people perceive their oral health [9], so comparisons of self-reported oral health in different countries can be challenging. Differences in reporting style may also contribute to observed inter-country differences, a phenomenon known as reporting heterogeneity [10]. Moreover, as pointed out by Sen [11], someone from a community with high morbidity levels and relatively ineffective (or scarce) health facilities may view particular symptoms or disease states as normal, whereas those in more affluent and healthy communities may regard even minor disruption as deviating from health. That the former have a low perception of illness does not mean that there is little or none in that community; it may simply reflect different frames of reference. Such a phenomenon has been observed in respect of sex differences in self-reported health observed in surveys (whereby women usually report poorer health than men [12]). These may be at least partly due to differences in interpretation of the ordinal response categories, with women “setting the bar higher” for considering someone healthy.

Such influences complicate comparisons of self-reported oral health in different countries, particularly those with considerably different cultures, traditions, and dental care systems. For example, comparing self-reported oral health in a Western society (such as New Zealand) and one rooted in the Confucian tradition (such as China) would assist in understanding the sociocultural influences on oral health. Confucian values emphasize inter-relatedness, mutuality, responsibility, obligation, and reciprocity, whereas contemporary Western societies value autonomy, independence, and competition. We recently described marked differences in tooth retention and in oral disease levels between Chinese and New Zealand adults [13]. Given the abovementioned wider influences on people’s self-reported health, a comparison of the degree to which self-reported oral health reflects clinically determined oral disease experience would enhance our understanding of how people in two very different societies perceive their oral health. The aims of this study were to compare self-reported oral health in China and New Zealand and to determine whether adults in those countries differ in the degree to which responses to a single-item self-report oral health item discriminate among those with different clinical oral disease states.

## Methods and materials

Our analysis was based on the nationally representative data from the 3rd National Oral Health Survey of China in 2005 [14] and the New Zealand Oral Health Survey (NZOHS) in 2009 [15]. Both surveys had detailed demographic data and carried out an oral examination, and reporting of the study conforms to STROBE guidelines.

Unit-record data were used. Conducted in 2005, the Sichuan province component of the 3rd National Oral Health Survey of China [14] examined adults in the 35–44 and 65–74 age groups. Sichuan is the fifth largest province in China and has a population of over 80 million people; Han Chinese comprise 95% of those. Participants were selected using multistage stratified cluster sampling. First, the province was divided into urban and rural areas; the former were then classified into three strata by population size, while rural areas were classified by gross domestic product (GDP). One city or county was randomly selected from each stratum, giving three cities from urban areas and three counties from rural areas. For the next level, three townships or streets were randomly selected from each county or city (respectively), and two residents’ committees in these streets (or two villages in townships) were randomly chosen as survey stations. At each survey station, 20 adults and 20 senior adults were recruited randomly from each residents’ committee’s list, with the aim of recruiting a target sample of 720 participants in each age group. Since weights were not initially available for the Chinese data, we computed survey weights based on a comparison of the samples’ age and sex proportions and those observed for Sichuan in a national census which had been conducted prior to the oral health survey.

The New Zealand Oral Health Survey (NZOHS [15]) was conducted from February to December 2009, examining 3196 children and adults. Participants in the NZOHS were individuals who had participated in the previous New Zealand 2006/2007 health survey and agreed to be contacted for future surveys. We weighted the data to account for the complex survey design. For the periodontal data, we computed CPI-equivalent measures from attachment-loss data (an approach we have used successfully before, but with index teeth only [16]) using the pocket probing depths on all teeth, excluding the third molars. This enabled direct comparison with the Chinese data.

## Measurement of self-rated oral health

Self-rated oral health in the Chinese survey was assessed by the single-item global question: “Overall, how would you rate your oral health?” Responses were divided into “Very poor,” “Poor,” “Fair,” “Good,” and “Very good.” In the New Zealand survey, self-rated oral health was measured using Locker’s global item “How would you describe the health of your teeth

or mouth?” with response options of “Excellent,” “Very good,” “Good,” “Fair,” or “Poor” [2]. To enable comparability in the findings of the two surveys, these items were combined (Table 1) to produce a four-category ordinal measure of self-reported oral health.

## Statistical analyses

Analyses were conducted using Stata Intercooled 13.1 for Windows (Stata Corp, College Station, TX). Observed differences in means or proportions were tested for statistical significance using (respectively) ANOVA or chi-square tests.

To determine the extent to which the four-category ordinal self-reported oral health item discriminated those with better or poorer clinical oral status, we used the slope index of inequality (SII) and the relative index of inequality (RII) respectively [17, 18]. These are regression-based measures of inequality that take into account the entire distribution of the “exposure” variable being used. To calculate the SII, the self-rated oral health groups were ranked from lowest to highest, with each category then given a score based on the midpoint of its weighted cumulative distribution. Each outcome was then regressed against the midpoint of its cumulative distribution, and the coefficient on the midpoint is the SII. The RII (ratio) was calculated by dividing the predicted coefficient of the clinical oral health measure for the poorest self-rated oral health group by the predicted value for the best self-rated oral health group [19]. We adjusted for age and education when estimating the SII and RII. In respect of social inequalities, a higher SII or RII is undesirable, because it confirms the existence of marked inequalities across the entire distribution of the socio-economic position marker being used. By contrast, we interpreted our data as a higher SII or RII reflecting better discrimination by the self-rated oral health measure.

## Results

Among the dentate 35–44-year-olds, a higher proportion of Chinese than New Zealanders rated their oral health as poor or fair (Appendix Table 1), and the proportion of New Zealanders rating their oral health as very good was four times that observed among Chinese. There were largely consistent gradients in dentition status and dental caries experience observed in each country, with the most worst self-reported oral health people having

the greatest disease experience, but those in China were not as pronounced as those in New Zealand. There were inconsistencies in the proportion with 1+FT across the self-reported oral health responses. Periodontal disease experience showed consistent gradients, although the extent of BOP did not.

Summary data on dentate 65–74-year-olds’ clinical oral status by responses to the self-reported oral health item (Appendix Table 2) show that, again, the two populations differed in their overall responses, with the difference between the Chinese and New Zealanders being even more pronounced than that observed in the 35–44-year-olds. There were largely consistent gradients in dental caries experience across the self-reported oral health item responses in both countries. It is noteworthy that there were no gradients observed in periodontal diseases in each country, other than with 6+mm AL among the Chinese.

Data on the indices of inequality are presented by age group and country in Table 2. The positive SII for mean DMFT among the 35–44-year-olds means that those rating their oral health more poorly had higher DMFT scores, and this is reflected in the RII being considerably greater than 1.00. When “moving down” the scale from “Very good/Excellent” to “Poor/Very poor” self-rated oral health, there was an absolute “increase” of 3.3 in the DMFT score in the Chinese population, whereas it was 7.4 for the New Zealanders. By contrast, the negative SII value and the RII value < 1.00 for the mean number of teeth reflect the lower number of teeth among those rating their oral health more poorly. For most aspects of clinical disease experience, the two populations were responding similarly to the self-reported oral health item, although the SII and RII values were more pronounced among 35–44-year-olds in New Zealand than in China; among the 65–74-year-olds, both countries were more similar. A notable exception was the extent of BOP in both age groups, where Chinese rating their oral health more poorly had less gingival bleeding, whereas New Zealanders had more. There was also a notable age group difference: there was a negative SII and RII < 0.00 for the number of filled teeth (and the % with 1+FT) observed for older people in both countries, whereas the SII was positive and the RII > 0.00 for 35–44-year-olds in both countries. Finally, in order to examine the robustness of the findings, we undertook a sensitivity analysis using each scale’s original five categories (as seen in Table 1). The data are presented in Appendix Table 3. The estimates were similar, with no marked divergences from those in Table 2.

**Table 1** Overview of the creation of the self-reported oral health variable

	Very poor	Poor	Fair	Good	Very good	Excellent
China	✓	✓	✓	✓	✓	
New Zealand		✓	✓	✓	✓	✓
New variable	Poor/Very poor		Fair	Good	Very good/Excellent	

## Discussion

We investigated the association between self-reported oral health and clinical oral disease among two key age groups in China and New Zealand. Despite considerable absolute

**Table 2** Indices of inequality in relation to dentate persons' self-reported oral health responses, by country and age group (data adjusted for age and education; brackets contain 95%CI)

	Slope index of inequality (SII)		Relative index of inequality (RII)	
	China	New Zealand	China	New Zealand
<b>35–44-year-olds</b>				
Dentition status				
% Functional dent. <sup>a</sup>	— <sup>b</sup>	− 6.60 (− 12.55, − 0.65)	— <sup>b</sup>	0.93 (0.87, 0.99)
Mean no of teeth	− 1.39 (− 2.03, − 0.75)	− 1.62 (− 2.75, − 0.49)	0.95 (0.93, 0.98)	0.94 (0.90, 0.98)
Dental caries				
Mean DMFT	3.30 (2.33, 4.27)	7.43 (5.01, 9.85)	2.68 (2.01, 3.36)	2.08 (1.57, 2.60)
Mean DT	1.47 (0.90, 2.04)	2.61 (1.74, 3.48)	3.69 (2.09, 5.28)	14.38 (5.41, 23.35)
Mean MT	1.41 (0.78, 2.04)	2.41 (1.21, 3.62)	2.05 (1.45, 2.65)	4.05 (1.29, 6.81)
Mean FT	0.31 (0.04, 0.58)	2.68 (0.85, 4.52)	5.15 (− 0.98, 11.27)	1.46 (1.08, 1.85)
% with 1+DT	38.85 (26.72, 50.98)	52.67 (36.20, 69.15)	2.45 (1.70, 3.20)	4.52 (1.69, 7.35)
% with 1+MT	20.67 (8.55, 32.79)	31.84 (11.51, 52.16)	1.37 (1.11, 1.63)	2.09 (0.99, 3.19)
% with 1+FT	15.74 (4.95, 26.52)	9.72 (− 2.23, 21.68)	4.21 (0.48, 7.94)	1.11 (0.96, 1.26)
Periodontal disease				
% with AL 4–5 mm	21.67 (9.62, 33.73)	30.56 (10.66, 50.45)	2.20 (1.25, 3.15)	2.04 (0.99, 3.08)
% with AL 6+ mm	5.42 (− 0.24, 11.09)	14.96 (6.33, 23.59)	5.40 (− 1.30, 12.10)	7.68 (− 0.87, 16.23)
Extent of BOP	− 5.43 (− 14.63, 3.77)	17.44 (9.10, 25.79)	0.90 (0.73, 1.06)	2.43 (1.45, 3.42)
<b>65–74-year-olds</b>				
Dentition status				
% Functional dent. <sup>a</sup>	− 36.52 (− 50.12, − 22.93)	− 34.07 (− 65.25, − 2.88)	0.60 (0.46, 0.73)	0.52 (0.17, 0.87)
Mean no of teeth	− 8.36 (− 11.23, − 5.49)	− 4.02 (− 8.86, 0.82)	0.71 (0.62, 0.79)	0.81 (0.62, 1.01)
Dental caries				
Mean DMFT	9.84 (7.12, 12.57)	4.02 (1.32, 6.72)	2.47 (1.82, 3.12)	1.17 (1.05, 1.30)
Mean DT	3.20 (1.73, 4.67)	1.75 (0.07, 3.42)	3.09 (1.46, 4.72)	5.51 (− 1.73, 12.75)
Mean MT	6.49 (4.23, 8.76)	4.59 (− 0.41, 9.60)	2.39 (1.63, 3.15)	1.45 (0.85, 2.05)
Mean FT	− 0.33 (− 0.80, 0.15)	− 2.98 (− 7.86, 1.90)	0.45 (− 0.01, 0.91)	0.77 (0.43, 1.10)
% with 1+DT	48.70 (31.10, 66.29)	48.37 (22.63, 74.10)	2.26 (1.35, 3.17)	4.25 (0.23, 8.27)
% with 1+MT	7.88 (− 4.54, 20.30)	— <sup>c</sup>	1.09 (0.94, 1.23)	— <sup>c</sup>
% with 1+FT	− 15.00 (− 35.57, 5.58)	− 8.89 (− 26.42, 8.64)	0.49 (0.04, 0.93)	0.91 (0.73, 1.08)
Periodontal disease				
% with AL 4–5 mm	7.62 (− 11.29, 26.53)	2.59 (− 31.35, 36.53)	1.11 (0.81, 1.41)	1.04 (0.46, 1.62)
% with AL 6+ mm	6.25 (− 12.55, 25.04)	12.05 (− 11.36, 35.46)	1.18 (0.58, 1.78)	1.90 (− 0.54, 4.34)
Extent of BOP	− 11.07 (− 24.20, 2.07)	1.94 (− 11.91, 15.78)	0.78 (0.56, 1.00)	1.11 (0.25, 1.97)

<sup>a</sup> Functional dentition; having 21 or more natural teeth<sup>b</sup> Error was encountered when running the models because no-one in the tertiary education category did not have a functional dentition<sup>c</sup> Error was encountered when running the models because there were only 4 people who had not lost a tooth (and they all reported very good oral health)

differences between the two populations in their self-reported oral health, the associations with self-reported oral health were largely similar. Before discussing the findings, it is appropriate to consider the methodological aspects of the study.

One issue with our approach is how we combined the SROH data from the two different surveys (as shown in Table 1). Each country used a five category self-reported oral health variable, but the different category labels for those meant that they had to be collapsed into a four-category

measure. This will have reduced some of the observed variance for each country, but a key assumption for the current analysis was that the direct comparison of the responses in the two populations was valid. The validity of that assumption could be challenged, given (a) the difference in the covered range, with more positive response options (states) in the NZ survey than in the Chinese one, and (b) the possibility of end-aversion bias, whereby the reluctance of some respondents to use a scale's extreme categories compromises sensitivity and



reliability [17]. Another potentially contentious aspect of this study is our use of regression-based measures of inequality—the SII and RII—for a purpose which is outside their original scope. We are unaware of any such uses of these measures previously, but contend that this is a better method than comparing the populations in terms of the ratio of the proportion reporting the best oral health to that reporting the worst. The latter approach has the problem of ignoring the intermediate ratings and disregarding the proportion of the population giving each response [18]; by contrast, the SII and RII take those into account and enable a direct comparison of the two populations [19, 20]. The data in Appendix Tables 1 and 2 clearly show that there were marked differences between Chinese and New Zealanders in the proportions in each category, with, for example, almost half of the Chinese 65- to 74-year-olds—but a very small minority of their New Zealand counterparts—reporting poor oral health. There were similar but less marked differences among the 35- to 44-year-olds. In allowing for those differences, the regression-based measures permit direct comparisons.

We investigated whether the association between self-reported oral health and clinical oral disease differed substantially in two quite different populations. The data show that, for most aspects of clinical oral disease, the two populations are reporting similarly, despite some marked differences in both self-report oral health (Appendix Tables 1 and 2) and in clinical oral disease [13]. The exception to this was the extent of gingival bleeding, whereby Chinese rating their oral health more poorly had less gingival bleeding, whereas New Zealanders doing so had more. The reasons for this are unclear, but the difference may be a result of differing constructs of what constitutes acceptable oral health. Qualitative investigation of this difference would be informative and useful but is beyond the scope of the current study.

There was a noteworthy age difference (regardless of country) in the association of filled teeth with self-reported oral health: for the younger age group, those with fewer filled teeth rated their oral health as better, while the converse applied for older people. This most likely reflects the different life course dental caries experience of two groups, with greater overall caries experience in the older group and a considerably higher proportion of that manifesting as missing teeth. In such circumstances, having more filled teeth would be regarded as perhaps the lesser of the two evils, so this is an understandable difference.

In conclusion, Chinese and New Zealand adults' self-ratings of their oral health reflect their clinical oral disease in largely similar ways, despite considerable differences in absolute terms. These findings provide further evidence for the utility and cross-cultural applicability of self-report oral health measures.

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## Compliance with ethical standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical approval** All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed consent** Informed consent was obtained from all individual participants included in the study.

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